Vancouver Building By-law 2025

Book I: General (Volume 1)

Bylaw #14343

Amended by By-laws 14414 up to 14820

Consolidated to September 30, 2026 (v4.01)

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CITY OF VANCOUVER

Preface

The 2025 Building By-law (hereinafter the "Building By-law") is an objective-based code which identifies the minimum standard in the City of Vancouver for buildings to which this By-law applies. These address the same objectives of the Building By-law's parent codes.

The Building By-law establishes standards for building materials, products and assemblies. Some standards are explicitly provided in the Building By-law while others are incorporated by reference to existing standards for materials, products and assemblies which are developed and published by specialist organizations.

The Building By-law is substantially based on Book I (General) and Book II (Plumbing Systems) of the 2024 British Columbia Building Code, which in turn is substantially based on the model National Building Code of Canada 2020 and the model National Plumbing Code of Canada 2020. This model of adoption of national model codes helps promote consistency among building codes.

This Building By-law replaces the 2019 Building By-law and also contains certain transition provisions which apply to permits issued under the 2019 Building By-law. The Building By-law is regularly updated and users should ensure that the By-law is current.

Codes Development

National Codes

The CCBFC, an independent committee established by the National Research Council of Canada (NRC), is responsible for the content of the National Model Codes. The CCBFC is made up of volunteers from across the country and from all facets of the Codes-user

community. Members of the CCBFC and its standing committees include builders, engineers, skilled trade workers, architects, building owners, building operators, fire and building officials, manufacturers, and representatives of general interests.

Codes Canada staff within the Construction Research Centre at the NRC provide technical and administrative support to the CCBFC and its standing committees, and coordinate the provision of evidence-based research to inform Codes development. The NRC publishes the National Model Codes and periodic revisions to the Codes to address pressing issues, and like the Codes themselves, such periodic revisions do not have legal effect until adopted into law by the City of Vancouver.

British Columbia Building Code

In British Columbia, the 2024 Building Code is the legal adoption of National Model Building and Plumbing Codes under the authority of the government of the Province of British Columbia. This includes much of the National Model Codes as amended from time to time, but also includes provincially applicable requirements to address provincial priorities and concerns.

Vancouver Building By-law

This By-law consists of two Books, that set out the minimum standard for the design and construction of new buildings as applicable. It also applies to the alteration, change of use and demolition of existing buildings. The By-law is substantially based upon the British Columbia Building Code and establishes requirements to address five objectives, which are fully described in Division A of the By-law.

General Requirements

The Building By-law sets out technical provisions for the design and construction of new buildings. It also applies to the alteration, change of use and demolition of existing buildings.

The Building By-law establishes requirements to address the following five objectives:

(a) safety

(b) health

(c) accessibility

(d) fire and structural protection of buildings

(e) environment

The design of a technically sound building depends upon many factors beyond compliance with building regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who are familiar with the principles of good building practice and experience using reference manuals and technical guides.

Additional Information

Numbering System

A consistent numbering system has been used throughout the National Model Codes. The first number indicates the Part of the Code; the second, the Section in the Part; the third, the Subsection; and the fourth, the Article in the Subsection. The detailed provisions are found at the Sentence level (indicated by numbers in brackets), and Sentences may be broken down into Clauses and Subclauses. This structure is illustrated as follows:

B	Division
3.	Part
3.5.	Section
3.5.2.	Subsection
3.5.2.1.	Article
3.5.2.1.(2)	Sentence
3.5.2.1.(2)(a)	Clause
3.5.2.1.(2)(a)(i)	Subclause

Use of the term “Reserved”

The term “reserved” is included in place of certain deleted National Codes content which has not been adopted. The term “reserved” is generally used so that the numbering structure of the BCBC is aligned with the model National Codes, easing comparability and possible future harmonization.

Unique to Vancouver Indication

All text in the By-law that is Unique to Vancouver (UTV) is provided with a grey background wherever practical. This identifier was utilized to provide the user of the By-law with a means by which to differentiate the Vancouver provisions of this By-law from those of the 2024 British Columbia Building and Plumbing Codes. Where the provisions of Vancouver have required the deletion of the 2024 British Columbia Building and Plumbing Code text, and no Vancouver text has replaced the deleted text, the word “deleted” has been used to alert the user that a deletion has been made and that there is a difference from the 2024 British Columbia Building and Plumbing Codes text.

Revision Indication

From time to time, the provisions of the Building By-law may be amended. Where this occurs, updated text is marked by a sidebar with text in brackets indicating the Revision. In some cases, text that was originally included as part of the Building By-law is amended and would result in substantial renumbering of associated portions of the Building By-law.

Meaning of the Words “And” and “Or” between the Clauses and Subclauses of a Sentence

Multiple Clauses and Subclauses are connected by the word “and” or “or” at the end of the second last Clause or Subclause in the series. Although this connecting word appears only once, it is meant to apply to all the preceding Clauses or Subclauses within that series.

For example, in a series of five Clauses—(a) to (e)—in a Sentence, the appearance of the word “and” at the end of Clause (d) means that all Clauses in the Sentence are connected to each other with the word “and.” Similarly, in a series of five Clauses—(a) to (e)—in a Sentence, the appearance of the word “or” at the end of Clause (d) means that all Clauses in the Sentence are connected to each other with the word “or.”

In all cases, it is important to note that a Clause (and its Subclauses, if any) must always be read in conjunction with its introductory text appearing at the beginning of the Sentence. Moreover, the connecting words “and” and “or” must be read in the context of the Sentence. In particular, the use of the word “and” as a connecting word does not necessarily mean that all Clauses (or Subclauses) are applicable for compliance with the Sentence.

Units

All values in the NBC are given in metric units. Some of the metric values in the Code have been converted and rounded from imperial values. A conversion table of imperial equivalents for the most common units used in building design and construction is located at the end of the Code.

Complementary Publications

The following publications are referenced in the NBC 2020 or facilitate the application of its requirements:

National Energy Code of Canada for Buildings 2020 National Farm Building Code of Canada 1995 National Fire Code of Canada 2020

National Plumbing Code of Canada 2020

Illustrated User's Guide – NBC 2020: Part 9 of Division B, Housing and Small Buildings Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)

Supplement to the NBC 2020: Intent Statements

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Relationship of the Building By-law to Standards Development and Conformity Assessment

The development of many provisions in this By-law and the assessment of conformity to those provisions are supported by several of the member organizations of Canada's National Standards System (NSS).

The NSS is a network of accredited organizations concerned with standards development, certification, testing and inspection that is established under the auspices of the Standards Council of Canada Act. Activities of the NSS are coordinated by the Standards Council of Canada (SCC), which accredits standards development organizations, certification bodies, testing and calibration laboratories, and inspection bodies, among others.

The SCC is a non-profit federal Crown corporation responsible for the coordination of voluntary standardization in Canada. It also coordinates Canadian participation in voluntary international standardization activities.

Canadian Standards

Many of the standards referenced in the NBC are published by standards development organizations accredited in Canada. As part of the accreditation requirements, these organizations adhere to the principle of consensus, which generally means substantial majority agreement of a committee comprising a balance of producer, user and general interest members, and the consideration of all negative comments. The standards development organizations also have formal procedures for the balloting and second-level review of standards prepared under their oversight.

The following organizations are accredited as standards development organizations in Canada:

- Air-Conditioning, Heating and Refrigeration Institute (AHRI)
- ASTM International

- Bureau de normalisation du Québec (BNQ)
- Canadian General Standards Board (CGSB)
- CSA Group
- International Association of Plumbing and Mechanical Officials (IAPMO)
- ULC Standards
- Underwriters' Laboratories Inc. (UL)

Tables 1.3.1.2. and D-1.1.2. of Division B list the standards referenced in the NBC. Standards proposed to be referenced in the NBC are reviewed to ensure that their content is compatible with the Code. Thereafter, referenced standards are reviewed as needed during each Code cycle. Standards development organizations are asked to provide information on any changes in the status of their standards referenced in the NBC—withdrawals, amendments, new editions, etc. This information is passed on to the CCBFC, its standing committees, the provinces and territories, and interested stakeholders, all of whom are given the opportunity to identify any problems associated with the changes. These bodies do not necessarily review in detail the revised standards; rather, the approach relies on the consensus process involved in the maintenance of the standards and on the extensive knowledge and experience of committee members, provincial or territorial staff, NRC staff, and consulted stakeholders to identify changes in the standards that might create problems in the Code.

Non-Canadian Standards

A number of subject areas for which the standards development organizations accredited in Canada have not developed standards are covered in the NBC. In these cases, the Code often references standards developed by organizations in other countries, such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the National Fire Protection Association (NFPA). These standards are developed using processes that may differ from those used by the standards development organizations accredited in Canada; nevertheless, the standards have been reviewed by the relevant standing committees and found to be acceptable.

Conformity Assessment

The NBC establishes minimum measures, which are set out within its own text or within referenced standards. However, the NBC does not set out who is responsible for assessing conformity to the measures or how those with this responsibility might carry it out. This responsibility is usually established by the governing legislation of the adopting provinces and territories. Provincial or territorial authorities should be consulted to determine who is responsible for conformity assessment within their jurisdiction.

In Vancouver, the Chief Building Official is authorized to regulate construction and to enforce the requirements of the Building By-law.

Those persons responsible for ensuring that materials, appliances, systems and equipment meet the requirements of this Code have several means available to assist them, ranging from on-site inspection to the use of certification services provided by accredited third-party organizations. Test reports or mill certificates provided by manufacturers or suppliers can also assist in the acceptance of products. Engineering reports may be required for more complex products. Requirements for Registered Professionals are located in Division C of this By-law.

Testing

The SCC accredits testing and calibration laboratories that are capable of reliably testing products to specified standards. The test results produced by these organizations can be used in the certification, evaluation and qualification of products for compliance with Code provisions. The SCC's website (www.scc.ca) lists accredited testing and calibration laboratories, along with their scope of accreditation.

Certification

Certification is the confirmation by an independent organization that a product, process, service or system meets a requirement. Certification may entail physical examination, testing as specified in appropriate standards, an initial plant inspection, and/or follow-up unannounced plant inspections. This procedure leads to the issuing of a formal assurance or declaration, by means of a certification mark or certificate, that the product, process, service or system is in full conformity with specified provisions.

In some cases, a product for which no standard exists can be certified using procedures and criteria developed by an accredited certification body and specifically designed to measure the performance of that product.

Certification bodies publish lists of certified products and companies. The SCC's website (www.scc.ca) lists accredited certification bodies, along with their scope of accreditation. Several organizations, including the Canadian Construction Materials Centre (CCMC) at the NRC, offer product certification services.

Evaluation

An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of a Code requirement. Follow-up plant inspections are not normally part of the evaluation process. While the development of such an evaluation is useful to establish a basis for acceptance, this does not mean that there will be an automatic assumption of By-law compliance by the Chief Building Official for any given material, product or assembly covered by this evaluation or that will necessarily be deemed applicable in every situation.

Qualification

Qualification evaluates the ability of a product to perform its intended function by verifying that it meets the requirements of a standard. Qualification normally includes some follow-up plant inspection. Some organizations publish lists of qualified products that meet the specified requirements. Some organizations qualify product manufacturing and/or testing facilities for compliance with the Building By-law and relevant standards.

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BOOK I (GENERAL) - DIVISION A

Part 1
Compliance

Section 1.1. General

1.1.1. Application of this By-law

1.1.1.1. Application of this By-law

1) This By-law applies to any one or more of the following:

a) the design and construction of a new *building*,

b) the *occupancy* of any *building*,

c) a change in *occupancy* of any *building*,

d) an *alteration* of any *building*,

e) an addition to any *building*,

f) the *demolition* of any *building*,

g) the reconstruction of any *building* that has been damaged by fire, earthquake or other cause,

h) the correction of an *unsafe condition* in or about any *building*,

i) all parts of any *building* that are affected by a change in *occupancy*,

j) the work necessary to ensure safety in parts of a *building*

  i) that remain after a *demolition*,

  ii) that are affected by, but that are not directly involved in, *alterations*, or

  iii) that are affected by, but not directly involved in, *additions*,

k) except as permitted by the Fire By-law, the installation, replacement, or *alteration* of materials or equipment regulated by this By-law,

l) the work necessary to ensure safety in a relocated or removed *building* during and after relocation or removal,

m) safety during *construction* of a *building*, including protection of the public,

n) the design, installation, extension, *alteration*, renewal or repair of *plumbing systems*, and

o) the *alteration*, renovation and change of *occupancy* of *heritage buildings*.

p) the design and *construction* of a *marina*,

q) the *alteration* of a *marina*, and

r) retaining structures greater than 1.2 m in height.

2) This By-law does not apply to the following:

a) *sewage*, water, electrical, telephone, rail or similar public infrastructure systems located on, or in a *street* or a public transit right of way,

b) utility towers and poles, and television, radio and other communication aerials and towers, except for loads resulting from their being located on or attached to *buildings*,

c) mechanical or other equipment and *appliances* not specifically regulated in these regulations,

d) flood control and hydro electric dams and structures,

e) accessory *buildings* less than 10 m^2 in *building area* that do not create a hazard,

f) with the permission of the *Chief Building Official*, temporary *buildings* including

  i) construction site offices,

  ii) seasonal storage *buildings*,

  iii) deleted,

  iv) emergency facilities, and

  v) similar structures with the permission of the *Chief Building Official*,

g) factory built housing and components complying with CSA-Z240 MH Series standard, but this exemption does not extend to on site preparations (siting, foundations, mountings), connection to services and installation of *appliances*, and

h) areas that are specifically exempted from provincial *building* regulations by provincial or federal enactments.

i) an existing residential *building* with not more than two *dwelling units* located on a parcel which is the subject of an application for a *building permit* to construct a laneway house if there is no renovation or change in use of the existing *building*,

j) a *noncombustible container* used only for storage of emergency supplies and required by the City's Emergency Social Services Program if

  i) the *building area* of the *container* is no more than 15 m^2,

  ii) the *container* is located at least 3 m from any *building*, and

  iii) the location of the *container* does not obstruct the *exit* path of an *existing building* and the firefighter's access path to an *existing building*,

k) structures necessary for the operation of a *public bike share station* if the *public bike share station*

  i) does not interfere with any public works, public facilities or public amenities,

  ii) does not include any enclosed structures,

  iii) is located at least 3 m from any *building*,

  iv) does not obstruct the *exit* path of an *existing building* and the firefighter's access path to an *existing building*., and

l) structures necessary for the operation of an *e-scooter* station if the *e-scooter station*

  i) does not interfere with any public works, public facilities or public amenities,

  ii) does not include any enclosed structures,

  iii) does not obstruct the *exit* path of an *existing building* and the firefighter's access path to an *existing building*.

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3) This By-law applies to both site-built and factory-constructed *buildings*.

(See Note A-1.1.1.1.(3).)

4) *Farm buildings* shall conform to the requirements in the National Farm Building Code of Canada 1995.

5) Deleted.

6) Temporary *buildings* and *existing buildings* that are occupied on a temporary basis shall conform to the requirements of this By-law.

1.1.1.2. Application to Existing Buildings

1) Where a *building* is altered, renovated or repaired, or there is a change in *major occupancy*, the *building* shall also upgrade in accordance with Part 11 of Division B. (See Note A-1.1.1.2.(1).)

2) Alternative compliance measures to assist in the renovation or conversion of *existing buildings* in Sections 11.2. though 11.4. of Division B may be substituted for the requirements contained elsewhere in this By-law if the conditions for using the alternatives have been met.

1.1.2. Internal References to this By-law

1.1.2.1. Book I (General) and Book II (Plumbing Systems) of the By-law

1) This is the first of the two Books, Book I (General) and Book II (Plumbing Systems), that together form the Building By-law.

1.1.2.2. Internal References to the By-law

1) Unless a Book is specified, references to "the Vancouver Building By-law," "the By-law," "this By-law" and the like shall be read as references to the Book in which they appear.

1.1.3. Appendices, Notes and Annotations

1.1.3.1. Appendices, Notes and References to Appendices and Notes have No Legal Effect

1) The Appendices and Notes of this By-law have no legal effect, except for the Appendices and Notes that are directly referenced in a Part of this By-law, being the following Notes:

a) A-1.4.1.2.(1) Designated flood plain of Division A, including Figures A-1.4.1.2.(1)-C, D and E,

b) A-1.4.1.2.(1) Flood construction level requirements of Division A,

c) A-1.4.1.2.(1) Groundwater protection area of Division A, including Figure A-1.4.1.2.(1)-F, #14603

d) A-Table 9.23.3.5.-B of Division B, and

e) A-9.23.13. of Division B, including Table A-9.23.13.

Section 1.2. Compliance

1.2.1. Compliance with this By-law

1.2.1.1. Compliance with this By-law

1) Compliance with this By-law shall be achieved by

a) complying with the applicable acceptable solutions in Division B (see Note A-1.2.1.1.(1)(a)), or

b) except as required by Sentence (3), using alternative solutions, accepted by the *Chief Building Official* under Section 2.3 of Division C, that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Note A-1.2.1.1.(1)(b)). #14488

2) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.

3) An alternative solution shall not be used in place of an acceptable solution if the acceptable solution expressly requires conformance to a provincial enactment other than Book I (General) or Book II (Plumbing Systems) of the Vancouver Building By-law.

1.2.1.2. Responsibility of Owner

1) Unless otherwise specified in this By-law, the *owner* of a *building* shall be the person responsible for carrying out the provisions of this By-law in relation to that *building.*

2) The *owner* of a *building* is in no way relieved of full responsibility for complying with this By-law by the *Chief Building Official*

a) granting a *building permit*,

b) approving drawings or specifications, or

c) carrying out inspections.

1.2.2. Materials, Appliances, Systems and Equipment

1.2.2.1. Characteristics of Materials, Appliances, Systems and Equipment

1) All materials, appliances, systems and equipment installed to meet the requirements of this By-law shall possess the necessary characteristics to perform their intended functions when installed in a *building*.

1.2.2.2. Storage on the Building Site

1) All building materials, appliances and equipment on the building site shall be stored in such a way as to prevent the deterioration or impairment of their essential properties.

1.2.2.3. Used Materials, Appliances and Equipment

1) Unless otherwise specified, used materials, appliances and equipment are permitted to be reused when they meet the requirements of this By-law for new materials and are satisfactory for the intended use.

1.2.2.3. Storage on the Building Site

1) All *building* materials, appliances and equipment on the *building* site shall be stored in such a way as to prevent the deterioration or impairment of their essential properties.

1.2.3. Installation of Plumbing Systems

1.2.3.1. Personnel Performing Plumbing Work

1) Personnel performing the installation, *alteration*, renewal or repair of a *plumbing system* shall

a) possess a Canadian tradesperson's qualification certification as a plumber,

b) be an indentured apprentice supervised by a journeyperson who meets the criteria set out in Clause (a), or

c) be the registered *owner* and occupant or intended occupant of the single detached dwelling in which plumbing work will occur.

1.2.3.2. Personnel Performing Sprinkler System Work

1) Persons performing installation, *alteration* or repair on a *sprinkler system* shall

a) possess a British Columbia industry training credential as a *sprinkler system installer*, or

b) be a trainee supervised by a s*prinkler system installer* qualified under the Industry Training Authority Act.

Section 1.3. Divisions A, B and C of this By-law

1.3.1. General

1.3.1.1. Scope of Division A

1) Division A contains the compliance and application provisions, objectives and functional statements of this By-law.

1.3.1.2. Scope of Division B

1) Division B contains the acceptable solutions of this By-law.

1.3.1.3. Scope of Division C

1) Division C contains the administrative provisions of this By-law.

1.3.1.4. Internal Cross-references

1) Where the Division of a referenced provision is not specified in this By-law, it shall mean that the referenced provision is in the same Division as the referencing provision.

1.3.2. Application of Division A

1.3.2.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division A apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

1.3.3. Application of Division B

1.3.3.1. Application of Parts 1, 7, 8 and 10

1) Parts 1, 7, 8 and 10 of Division B apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

1.3.3.2. Application of Parts 3, 4, 5 and 6

1) Parts 3, 4, 5, and 6 of Division B apply to all buildings described in Article 1.1.1.1. and

a) classified as *post-disaster buildings*,

b) used for *major occupancies* classified as

i) Group A, *assembly occupancies*,

ii) Group B, *care, treatment or detention occupancies*, or

iii) Group F, Division 1, high-hazard industrial occupancies, or

c) exceeding 600 m^2 in *building area* or exceeding 3 storeys in *building height* used for major occupancies classified as

i) Group C, *residential occupancies*,

ii) Group D, *business and personal services occupancies*,

iii) Group E, *mercantile occupancies*, or

iv) Group F, Divisions 2 and 3, medium- and *low-hazard industrial occupancies*.

2) Parts 3, 4, 5 and 6 of Division B apply to *buildings* designed and constructed in accordance with Subsection 3.2.10. of Division B.

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3) Part 4 applies to all *buildings* except *buildings* containing not more than two principal *dwelling units* and their *ancillary residential units* and accessory *buildings*.

4) Part 5 applies to all Group C *multi-family buildings* and *Artist Live/Work Studios* that are

a) more than 2 *storeys* in *building height*, or

b) more than 600 m^2 in *building area* excluding *firewalls*.

5) Notwithstanding Sentence (1), Section 3.8 applies to all Part 9 *buildings*.

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1.3.3.3. Application of Part 9, 11, 12, and 13

1) Except as provided in Sentences 1.3.3.2.(2) and (3), Part 9 of Division B applies to all *buildings* described in Article 1.1.1.1. of 3 storeys or less in *building height*, having a *building area* not exceeding 600 m^2, and used for *major occupancies* classified as

a) reserved,

b) Group C, *residential occupancies* (see Note A-9.1.1.1.(1) of Division B),

c) Group D, *business and personal services occupancies*,

d) Group E, *mercantile occupancies*, or

e) Group F, Divisions 2 and 3, *medium-* and *low-hazard industrial occupancies*.

2) Part 9 of Division B does not apply to *buildings* designed and constructed in accordance with Subsection 3.2.10. of Division B

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3) Part 11 applies to the *alteration*, renovation, repair, *addition* or change of *major occupancy* of an *existing building* and as defined in Subsection 11.1.4. of Division B.

4) Part 12 applies to the design and *construction* of all new *marinas* and *float homes*; and to existing *marinas* and existing *float homes* as defined in Subsection 11.1.4. of Division B.

5) Part 13 applies to the design and *construction* of temporary *buildings*, and the occupancy of *existing buildings* on a temporary basis.

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1.3.3.4. Building Size Determination

1) Where a *firewall* divides a *building*, each portion of the *building* so divided shall be considered as a separate *building*, except when this requirement is specifically modified in other parts of this By-law. (See Note A-1.3.3.4.(1).)

2) Except as permitted in Sentence (3) and (4), where portions of a *building* are completely separated by a vertical *fire separation* that has a *fire-resistance rating* of not less than 1 h and extends through all *storeys* and service spaces of the separated portions, each separated portion is permitted to be considered as a separate *building* for the purpose of determining *building height*, provided

a) each separated portion is not more than 4 storeys in *building height* and is used only for *assembly*, *residential*, *and business and personal services occupancies*, and

b) the unobstructed path of travel for a firefighter from the nearest *street* to one entrance of each separated portion is not more than 45 m.

(See Note A-1.3.3.4.(2) and (3).)

3) Except as permitted in Sentence (4), where portions of a *building* are completely separated by a distance of at least 3 m, each separated portion is permitted to be considered as a separate *building* for the purpose of determining *building height*, provided

a) each separated portion complies with the requirements of Subsection 3.2.3. of Division B,

b) all connecting construction is

i) of *noncombustible construction*, and

ii) contains only F3 occupancies, or uses and occupancies subsidiary to the remainder of the building,

c) a vertical *fire separation* that has a *fire-resistance rati*ng of not less than 2 h and extends through all *storeys* and *service spaces* of the connecting construction and superimposed portions of the *building area* above the connecting construction, and

d) the unobstructed path of travel for a firefighter from the nearest *street* to one entrance of each separated portion is not more than 45 m.

(See Note A-1.3.3.4.(2) & (3).)

4) The vertical fire separation referred to in Sentence (2) and (3) may terminate at the floor assembly immediately above a *basement*

a) provided the *basement* conforms to Article 3.2.1.2. of Division B~~.~~, and

b) where any of the separated portions exceed 4 *storeys* in *building height* and measures to prevent the movement of contaminated air are provided in accordance with Article 3.2.6.3. of Division B.

1.3.3.5. Air Space Subdivision

1) Where a subdivision of land creates an *air space parcel* boundary in or through a *building*, which otherwise complies with this By-law, such *building* or a portion of the *building* may, at the discretion of the *Chief Building Official*, be considered as a single *building* not requiring internal *firewalls* or *party walls* along *air space parcel* boundaries if legal agreements are registered against title to all *air space parcels* and the remainder whereby

a) all relevant *owners* grant easements necessary to ensure common access to the fire and life safety systems and *exits* required for the *building* to function as a single *building* and to allow the *owners* to operate and maintain the *building* and its common systems, and

b) all owners grant a covenant to the *City* on terms acceptable to its Director of Legal Services and the *Chief Building Official* whereby the owners

i) acknowledge and agree that they have requested the *Chief Building Official* to treat the building as a single *building*,

ii) release and indemnify the *City* and the *Chief Building Official* for, without limitation, all liability arising from the *Chief Building Official* agreeing to treat the *building* or a portion of the *building* as a single *building* for the purposes of this By-law, and

iii) agree to inspect, test and keep in good repair and good working order all common fire and life safety systems, common utilities and shared *exits* located on their parcel and, to the extent necessary, use the easements referred to in Clause (1)(a) for that purpose.

1.3.3.6. Automatic Sprinkler Systems

1) Except for *buildings* described in Sentence (2), all newly constructed *buildings* shall be provided with an automatic *sprinkler system* designed and installed in accordance with Article 3.2.5.12. of Division B.

2) The following *buildings* are not required to be *sprinklered*

a) temporary *buildings* conforming to Subsection 1.6.8. of Division C, and tents and *air-supported structures* conforming to Subsection 3.1.6. of Division B,

b) one *storey* non-residential storage *buildings* less than 100 m2 in *building area*, and having a *limiting distance* on all sides of not less than 15 m,

c) one *storey* detached residential garages and carports,

d) one *storey* detached *buildings* which are accessory to a residential *building* containing not more than two *dwelling units*, and which are less than 50 m^2 in *building area*,

e) *industrial* or *hazardous occupancies* where the *Chief Building Official* accepts that the installation of an automatic *sprinkler system* would represent a hazard to the occupants or would be incompatible with the use of the *building*,

f) public concession stands and changing room buildings less than 100 m^2 in *building area* and having a *limiting distance* on all sides of not less than 15 m,

g) ticket kiosks,

h) bleachers which do not contain roofed *occupancies*,

i) farm *buildings*, except farm *buildings* with caretaker residential *suites*,

j) greenhouses used solely for the growing of plants where no public admittance is permitted, and

k) one storey portable classroom *buildings* of less than 100 m² in *building area* with an *occupancy* classification of Group A Division 2 or Group D. (See Note A-1.3.3.6.(2)(k).)

1.3.4. Application of Division C

1.3.4.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division C apply to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

Section 1.4. Terms and Abbreviations

1.4.1. Definitions of Words and Phrases

1.4.1.1. Non-defined Terms

1) Words and phrases used in this By-law that are not included in the list of definitions in Article 1.4.1.2. shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in this By-law, they shall be the objectives and functional statements described in Parts 2 and 3.

3) Where acceptable solutions are referred to in this By-law, they shall be the provisions stated in Parts 2 to 9 of Division B.

4) Where alternative solutions are referred to in this By-law, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b).

1.4.1.2. Defined Terms

1) The words and terms in italics in this By-law shall have the following meanings:

Acceptable means acceptable to the *Chief Building Official*.

Accepted means accepted by the *Chief Building Official*.

Access or ***Accessible*** means an area and its facilities, or both, as required by this By-law, which is easy to approach, enter, exit, operate, participate in, pass to and from, and use safely and independently by *persons with disabilities*.

Access to exit means that part of a *means of egress* within a *floor area* that provides access to an *exit* serving the *floor area*.

Adaptable dwelling unit means a *dwelling unit* designed and constructed with some *accessible* features and which accommodates the future modification to provide more *accessible* features.

Addition means an *alteration* to any *building* which will increase the total aggregate area of *floor area* or the *building height* (in *storeys*).

Adfreezing means the adhesion of soil to a foundation unit resulting from the freezing of soil water. (Also referred to as "frost grip.")

Air barrier system means the assembly installed to provide a continuous barrier to the movement of air.

Air space parcel has the meaning assigned to it by the Land Title Act of British Columbia.

Air-supported structure means a structure consisting of a pliable membrane that achieves and maintains its shape and support by internal air pressure.

Alarm signal means an audible signal transmitted throughout a zone or zones or throughout a *building* to advise occupants that a fire emergency exists.

Alert signal means an audible signal to advise designated persons of a fire emergency.

Alteration means a change or extension to any matter or thing or to any *occupancy* regulated by this By-law.

Ancillary residential building meaning a *building* entirely of *residential occupancy*, constructed on the same parcel and smaller than the primary *residential building* and containing not more than one *dwelling unit* and its subsidiary uses, such as a laneway house

Ancillary residential unit means a self-contained *dwelling unit* that:

• with its primary *dwelling unit* constitute a single real estate entity,

• is smaller than the principal *dwelling unit*, and

• is located in: - a *building* of only *residential occupancy*, or - that portion of a *building* which is *row housing* and is completely separated from all other parts of the *building* by a continuous vertical *fire separation* that has a fire-resistance rating of no less than 1 h.

Apparent sound transmission class *(ASTC)* means a single number rating of the airborne sound attenuation of *building* assemblies separating two adjoining spaces, taking into account both the direct and flanking sound transmission paths. (See Note A-1.4.1.2.(1).) (See also Note A-9.11. of Division B.)

Appliance means a device to convert fuel into energy or using electricity to carry out a process supporting *building* services, and includes all components, controls, wiring and piping required to be part of the device by the applicable standard referred to in this By-law.

Apprentice means a regularly indentured apprentice under the provisions of the Industry Training Authority Act of British Columbia.

Area of refuge means a space that facilitates a safe delay in egress, is sufficiently protected from fire conditions developing in the *floor area*, and provides direct access to an exit or firefighters' elevator.

Artesian groundwater means a confined body of water under pressure in the ground.

Artist Live/Work Studio means an Artist Studio and a Residential Unit associated with and forming an integral part of an Artist Studio, as defined in the Zoning and Development By-law.

Artist studio — Class A means Artist studio-Class A as defined in the Zoning and Development Bylaw.

Artist studio — Class B means Artist studio-Class B as defined in the Zoning and Development Bylaw.

Assembly occupancy (Group A) means the *occupancy* or the use of a *building* or part thereof by a gathering of persons for civic, political, travel, religious, social, educational, recreational or like purposes, or for the consumption of food or drink.

Attic *or* ***roof space*** means the space between the roof and the ceiling of the top *storey* or between a dwarf wall and a sloping roof.

Basement means a *storey* or *storeys* of a *building* located below the *first storey*.

Bearing surface means the contact surface between a foundation unit and the soil or rock upon which it bears.

Boiler means an *appliance* intended to supply hot water or steam for space heating, processing or power purposes.

Braced wall band means an imaginary continuous straight band extending vertically and horizontally through the *building* or part of the *building*, within which braced wall panels are constructed.

Braced wall panel means a portion of a wood-frame wall where bracing, sheathing, cladding or interior finish is designed and installed to provide the required resistance to lateral loads due to wind or earthquake.

Breeching means a flue pipe or chamber for receiving flue gases from one or more flue connections and for discharging these gases through a single flue connection.

Building means any structure used or intended for supporting or sheltering any use or *occupancy*, including any *float home* or *marina* and any retaining structures greater than 1.2 m in height.

Building area means the greatest horizontal area of a *building* above *grade* within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of *firewalls*.

Building drain means the lowest horizontal piping, including any vertical *offset*, that conducts *sewage*, *clear-water waste* or *storm water* by gravity to a *building sewer*. (See Book II, Division A, Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Building Envelope Professional means a *registered professional* who is:

• a member or licensee of the Architectural Institute of British Columbia, or

• a member or licensee of the Association of Professional Engineers and Geoscientists of British Columbia qualified by virtue of training or experience to provide building enclosure services.

Building height (in *storeys*) means the number of *storeys* contained between the roof and the floor of the *first storey*.

Business and personal services occupancy (Group D) means the *occupancy* or use of a *building* or part thereof for the transaction of business or the rendering or receiving of professional or personal services.

Building sewer means a pipe that is connected to a *building drain* 1 m outside a wall of a *building* and that leads to a public sewer or *private sewage disposal system*.

Caisson (see Pile).

Care means the provision of services other than *treatment* by or through care facility management to residents who require these services because of cognitive, physical or behavioural limitations.

Care occupancy (Group B, Division 3) means the *occupancy* or use of a *building* or part thereof, other than a home-type *care occupancy*, where care is provided to residents. (See Note A-1.4.1.2.(1).)

Cavity wall means a construction of masonry units laid with a cavity between the wythes. The wythes are tied together with metal ties or bonding units, and are relied on to act together in resisting lateral loads.

Certified Professional means a Certified Professional as defined in the Certification of Professionals By-law.

Chief Building Official means the *City Building Inspector*, and any person authorized to act on behalf of the *City Building Inspector*.

Children means persons under the age of 13 years.

Chimney means a primarily vertical shaft enclosing at least one flue for conducting flue gases to the outdoors.

Chimney liner means a conduit containing a *chimney* flue used as a lining of a masonry or concrete *chimney*.

City means the City of Vancouver.

City Building Inspector means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

City Engineer means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.

Clear-water waste means waste water with impurity levels that will not be harmful to health and may include cooling water and condensate drainage from refrigeration and air-conditioning equipment and cooled condensate from steam heating systems, but does not include *storm water*. (See Book II, Division A, Note A-1.4.1.2.(1).)

Closure means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, a damper, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible means that a material fails to meet the acceptance criteria of CAN/ULC-S114, “Standard Method of Test for Determination of Non-Combustibility in Building Materials.”

Combustible construction means that type of *construction* that does not meet the requirements for *noncombustible construction* or *encapsulated mass timber construction*.

Combustible dusts means dusts and particles that are ignitable and liable to produce an explosion.

Combustible fibres means finely divided, combustible vegetable or animal fibres and thin sheets or flakes of such materials which, in a loose, unbaled condition, present a flash fire hazard, including cotton, wool, hemp, sisal, jute, kapok, paper and cloth.

Combustible liquid means a liquid having a flash point at or above 37.8°C and below 93.3°C.

Community Care Facility means Community Care Facility as defined in the Zoning & Development By-law.

Commissioning means a process by which a *building's* operating systems are verified to meet the basis of design as stated in the design documents submitted for *building permit*.

Commissioning Provider means an individual identified by an *owner* to lead the planning and implementation of the *commissioning* process as defined in ASHRAE Standard 202, or CSA Z320 and CSA Z5000.

Conditioned space means any space within a building, the temperature of which is controlled to limit variation in response to the exterior ambient temperature by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

Construction means, with respect to a *building*: erection, repair, *alteration*, enlargement, *addition*, *demolition*, *deconstruction*, removal and excavation.

Construction Safety Officer means a person who has been trained specifically to understand and apply safe *construction* practice as it relates to the worksite and as it affects the public, neighbouring properties and utilities, and who has been retained by the *owner*, or the *owner's* principal *contractor* or *project* manager, to coordinate all sub trade supervisors relating to *construction* safety at the *project* site.

Construction Safety Plan means a plan containing *construction* procedures and fire safety measures designed to protect workers on a project, neighbouring private property, public property, and members of the general public.

Constructor or ***Contractor*** means a person who contracts with an *owner* or their authorized agent of an *owner* to undertake a *project*, and includes an *owner* who contracts with more than one person for the work on a *project* or undertakes the work on a *project* or any part thereof.

Contained use area means a supervised area containing one or more rooms in which occupant movement is restricted to a single room by security measures not under the control of the occupant.

Container means a metal transportable structure designed for the storage and transport of goods, the typical dimensions of which are 2.44 m in width, 2.59 m in height, and 6.1 m in length.

Cooktop means a cooking surface having one or more burners or heating elements.

Dangerous goods means products, materials or substances that are

(a) regulated by TC SOR/2001-286, "Transportation of Dangerous Goods Regulations (TDGR)" (see Table 3.2.7.1. of Division B of the NFC), or

(b) classified as controlled products under HC SOR/2015-17, "Hazardous Products Regulations" (see Note A-Table 3.2.7.1. of Division B of the NFC).

(See Note A-1.4.1.2.(1).)

Dead load means the weight of all permanent structural and non-structural components of a *building*.

Deconstruction means demolition by systematic disassembly of a *building* resulting in the reuse, recycling or recovery of not less than 75% of all building materials, excluding materials which are hazardous or banned from landfill.

Deep foundation means a *foundation unit* that provides support for a *building* by transferring loads either by end-bearing to soil or rock at considerable depth below the *building*, or by adhesion or friction, or both, in the soil or rock in which it is placed. Piles are the most common type of *deep foundation*.

Demolition means the action or process of demolishing a *building*, and includes *deconstruction*.

Designated flood means a flood which may occur in any given year, of such magnitude as to equal a flood having a 200 year return period.

Designated flood plain means those lands in the *City* which are hereby designated, for the purposes of section 306(1)(cc) of the Vancouver Charter, as flood plains susceptible to flooding and subject to *flood construction level requirements*, and those lands so designated include:

(a) lands located in the proximity to the *natural boundary* of the Burrard Inlet, English Bay, False Creek and the Fraser River, which are located within the areas shown shaded or crosshatched on the maps attached to this Bylaw as

Diagrams A1 and A2. (See Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River flood plains and Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain, wave effect zone.); and

(b) lands located in the areas shown crosshatched on the map attached to this By-law as Diagram B.

(See Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

Designated Structural Engineer (Struct. Eng.) means a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Regulations pursuant to the Professional Governance Act of British Columbia, and a person who is designated by the Association of Professional Engineers and Geoscientists of British Columbia as a Designated Structural Engineer.

Designer means the person responsible for the design.

Detention occupancy (Group B, Division 1) means the *occupancy* by persons who are restrained from or are incapable of evacuating to a safe location without the assistance of another person because of security measures not under their control.

Direct-vented (as applying to a fuel-fired space- or water-heating appliance) means an *appliance* and its venting system in which all the combustion air is supplied directly from the outdoors and the products of combustion are vented directly to the outdoors via independent, totally enclosed passageways connected directly to the *appliance*.

Drainage system means an assembly of pipes, fittings, *fixtures*, *traps* and appurtenances that is used to convey *sewage*, *clear-water waste* or *storm water* to a public *sewer* or a *private sewage disposal system*, but does not include *subsoil drainage pipes*. (See Book II, Division A, Figure A-1.4.1.2.(1)-F in Note A-1.4.1.2.(1).)

Distilled beverage alcohol means a beverage that is produced by fermentation and contains more than 20% by volume of water-miscible alcohol.

Distillery means a process plant where distilled beverage alcohols are produced, concentrated or otherwise processed, and includes facilities on the same site where the concentrated products may be blended, mixed, stored or packaged.

Dwelling unit means a *suite* operated as a housekeeping unit, used or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Emergency once through cooling equipment means *once through cooling equipment* that is not normally operated and is only activated in the event of a sudden, unforeseen failure of an otherwise properly designed, operated and maintained primary cooling system.

Encapsulated mass timber construction means that type of *construction* in which a degree of fire safety is attained by the use of encapsulated mass timber elements with an *encapsulation rating* and minimum dimensions for structural members and other *building* assemblies.

Encapsulation rating means the time in minutes that a material or assembly of materials will delay the ignition and combustion of encapsulated mass timber elements when it is exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed by this By-law.

E-scooter station means an e-scooter sharing facility where e-scooters are stored and from which the general public may rent and return e-scooters and other objects or equipment necessary for the operation of an e-scooter system.

E-scooter system means a service that provides the general public with an opportunity to rent e-scooters through an automated system, on a short-term basis for use within the city as part of a network comprised of no fewer than 50 e-scooter stations located on separate sites on streets, and public and private real property. #14688

Excavation means the space created by the removal of soil, rock or fill for the purposes of *construction*.

Exhaust duct means a duct through which air is conveyed from a room or space to the outdoors.

Existing building means a *building* lawfully constructed and completed under a permit before submission of the current *permit* application.

Exit means that part of a *means of egress*, including doorways, that leads from the floor area it serves to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare. (See Note A-1.4.1.2.(1).)

Exit level means the level of an *exit* stairway at which an exterior *exit* door or *exit* passageway leads to the exterior.

Exit storey (as applying to Subsection 3.2.6. of Division B) means a storey having an exterior *exit* door.

Exposing building face means that part of the exterior wall of a *building* that faces one direction and is located between ground level and the ceiling of its top *storey* or, where a building is divided into *fire compartments*, the exterior wall of a *fire compartment* that faces one direction.

Factory-built chimney means a *chimney* consisting entirely of factory-made parts, each designed to be assembled with the other without requiring fabrication on site.

Farm building means a *building* or part thereof that contains an agricultural occupancy. (See Note A-1.4.1.2.(1).)

Field *review* means a review of the work

- at a *building* site, and
- where applicable, at locations where *building* components are fabricated for use at the *building* site

that a *registered professional* in their professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by a *registered professional*.

Fill means soil, rock, rubble, industrial waste such as slag, organic material or a combination of these that is transported and placed on the natural surface of soil or rock or organic terrain. It may or may not be compacted.

Fire block means a material, component or system that restricts the spread of fire within a concealed space or from a concealed space to an adjacent space.

Fire compartment means an enclosed space in a building that is separated from all other parts of the building by enclosing construction providing a fire separation having a required fire-resistance rating.

Fire damper means a closure consisting of a damper that is installed in an air distribution system or a wall or floor assembly and that is normally held open but designed to close automatically in the event of a fire in order to maintain the integrity of the fire separation.

Fire detector means a device that detects a fire condition and automatically initiates an electrical signal to actuate an alert signal or alarm signal and includes heat detectors and smoke detectors.

Fire load (as applying to an occupancy) means the combustible contents of a room or *floor area* expressed in terms of the average weight of combustible materials per unit area, from which the potential heat liberation may be calculated based on the calorific value of the materials, and includes the furnishings, finished floor, wall and ceiling finishes, trim and temporary and movable partitions.

Fire-protection rating means the time in minutes or hours that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this By-law.

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived therefrom as prescribed in this By-law. (See Sentence D-1.2.1.(2) in Appendix D of Division B.)

Fire-retardant-treated wood means wood or a wood product that has had its surface-burning characteristics, such as flame spread, rate of fuel contribution and density of smoke developed, reduced by impregnation with fire-retardant chemicals.

Fire separation means a construction assembly that acts as a barrier against the spread of fire. (See Note A-1.4.1.2.(1).)

Firestop means a system consisting of a material, component and means of support used to fill gaps between *fire separations* or between *fire separations* and other assemblies, or used around items that wholly or partially penetrate a *fire separation*.

Fire stop flap means a device intended for use in horizontal assemblies required to have a *fire-resistance rating* and incorporating protective ceiling membranes that operates to close off a duct opening through the membrane in the event of a fire.

Firewall means a type of fire separation of *noncombustible construction* that subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and that has a *fire-resistance rating* as prescribed in this By-law and has structural stability to remain intact under fire conditions for the required fire-rated time.

First storey means the uppermost *storey* having its floor level not more than 2 m above *grade*.

Fixture (as applying to plumbing) means a receptacle, appliance, apparatus or other device that discharges *sewage* or *clear-water waste*, and includes a floor drain.

Fixture outlet pipe means a pipe that connects the waste opening of a *fixture* to the *trap* serving the *fixture*. (See Book II, Division A, Figure A-1.4.1.2.(1)-H in Note A-1.4.1.2.(1).)

Flame-spread rating means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in this By-law.

Flammable liquid means a liquid having a flash point below 37.8°C and having a vapour pressure not more than 275.8 kPa (absolute) at 37.8°C as determined by ASTM D323, "Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)."

Flash point means the minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Flight means a series of steps between landings. (See Note A-1.4.1.2.(1).)

Float home means any structure incorporating a floatation system, intended for use or *occupancy* or being used or occupied for residential purposes, containing one *dwelling unit* only, and not primarily intended for, or useable in, navigation, but does not include any *water craft* designed or intended for navigation.

Flood construction level means the minimum elevation of the underside of a floor system, or of the top of a concrete slab, of a *building* which is used or may be used for habitation, business, or for the storage of goods which may be damaged by flood water.

Flood construction level requirements means

(a) on the Burrard Inlet, English Bay, False Creek and Fraser River flood plains:

(i) for *buildings* located within the areas shown shaded or crosshatched on the map attached to this By-law, the underside of a floor system or the top of a concrete slab of a *buildings* used for habitation, business or storage of goods, shall not be lower than 4.6m Greater Vancouver Regional District datum. (See Figure A-1.4.1.2.(1)-C for Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River flood plains); and

(ii) for *buildings* located in the areas shown shaded or crosshatched on the map attached to this Bylaw, an additional elevation allowance above 4.6 m may be required for wave run-up, at a level as determined by a Professional Engineer and to the satisfaction of the *Chief Building Official*. (See Figure A-1.4.1.2.(1)-D for Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River flood plain wave effect zone); and

(b) on the Still Creek flood plain:

(i) the underside of a floor system or the top of a concrete slab of any *buildings* used for habitation, business or storage of goods shall not be lower than the applicable elevation shown on the map attached to this By-law. (See Figure A-1.4.1.2.(1)-E for Diagram B: Still Creek flood plain and *flood construction levels*.)

Floor area means the space on any *storey* of a *building* between exterior walls and required *firewalls*, including the space occupied by interior walls and partitions, but not including *exits*, vertical *service spaces*, and their enclosing assemblies.

Flue means an enclosed passageway for conveying flue gases.

Flue collar means the portion of a fuel-fired *appliance* designed for the attachment of the flue pipe or breeching.

Flue pipe means the pipe connecting the flue collar of an *appliance* to a *chimney*.

Forced-air furnace means a furnace equipped with a fan that provides the primary means for the circulation of air.

Foundation means a system or arrangement of *foundation units* through which the loads from a *building* are transferred to supporting soil or rock.

Foundation unit means one of the structural members of the foundation of a *building* such as a footing, raft or pile.

Frost action means the phenomenon that occurs when water in soil is subjected to freezing which, because of the water/ice phase change or ice lens growth, results in a total volume increase or the build-up of expansive forces under confined conditions or both, and the subsequent thawing that leads to loss of soil strength and increased compressibility.

Furnace means a space-heating *appliance* using warm air as the heating medium and usually having provision for the attachment of ducts.

Gas contractor means a person licensed as a gas *contractor* pursuant to the License By-law, and who is either a gas fitter or a person who employs a gas fitter on a full-time basis.

Gas vent means that portion of a venting system designed to convey vent gases to the outdoors from the vent connector of a gas-fired *appliance* or directly from the *appliance* when a vent connector is not used.

General Manager, Park Board means the person appointed as such by the Park Board.

General Manager, Real Estate and Facilities Management means the person appointed as such by City Council.

Grade means the lowest of the average levels of finished ground adjoining each exterior wall of a *building*, except that localized depressions need not be considered in the determination of average levels of finished ground. (See First storey and Note A-1.4.1.2.(1).)

Greenhouse gases has the meaning attributed to it in section 559 of the Vancouver Charter. #14688

Groundwater means a free standing body of water in the ground.

Groundwater protection area means those lands in the *City* which are located in the areas shown shaded on the map attached to this By-law as Diagram C. (See Figure A-1.4.1.2.(1)-F for Diagram C: Groundwater Protection Area.) #14603

Groundwater level (groundwater table) means the top surface of a free standing body of water in the ground.

Group Residence means Group Residence as defined in the Zoning & Development By-law.

Guard means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, *mezzanines*, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such a barrier may or may not have openings through it.

Heat detector means a *fire detector* designed to operate at a predetermined temperature or rate of temperature rise.

Heat loss calculation means a calculation according to the methodology of CSA F280-12, "*Determining the required capacity of residential space heating and cooling appliances*".

Heat pump means equipment that transfers heat from one location to another using a refrigeration cycle. When used for space heating, this equipment may function to provide both heating and cooling.

Heavy timber construction means that type of *combustible construction* in which a degree of fire safety is attained by placing limitations on the sizes of wood structural members and on the thickness and composition of wood floors and roofs and by the avoidance of concealed spaces under floors and roofs.

Heritage building is a *building* which is legally protected or officially recognized as a heritage property by the Provincial government, the City, or a *building* that in the opinion of the City Building Inspector, has sufficient heritage value or heritage character to justify its conservation. (See Note A-1.1.1.1.(5).)

High-hazard agricultural occupancy (Group G, Division 1) means an agricultural occupancy containing sufficient quantities of highly *combustible* and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

High-hazard industrial occupancy (Group F, Division 1) means an *industrial occupancy* containing sufficient quantities of highly *combustible* and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

Horizontal exit means an exit from one building to another by means of a doorway, vestibule, walkway, bridge or balcony.

Horizontal service space means a space such as an attic, duct, ceiling, roof or crawl space oriented essentially in a horizontal plane, concealed and generally inaccessible, through which *building* service facilities such as pipes, ducts and wiring may pass.

Impeded egress zone means a supervised area in which occupants have free movement but require the release, by security personnel, of security doors at the boundary before they are able to leave the area, but does not include a *contained use area*.

Indirect service water heater means a *service water heater* that derives its heat from a heating medium such as warm air, steam or hot water.

Industrial flex space means an industrial use which is located in a new *building* containing Group C *major occupancies*.

Industrial occupancy (Group F) means the *occupancy* or use of a *building* or part thereof for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Interconnected floor space means superimposed *floor areas* or parts of *floor areas* in which floor assemblies that are required to be *fire separations* are penetrated by openings that are not provided with closures.

Journeyperson plumber means a person, other than an *apprentice*, who holds a certificate issued pursuant to the provisions of the Industry Training Authority Act of British Columbia authorizing the person to engage in the plumbing trade.

Lane means a public thoroughfare or way not more than 10.1 m in width which affords only a secondary means of access to a site, at the side or rear.

Leader means a pipe that is installed to carry *storm water* from a roof to a *storm building drain* or *sewer* or other place of disposal.

Limiting distance means the distance from an *exposing building face* to a property line, the centre line of a street, lane or public thoroughfare, or to an imaginary line between 2 *buildings* or *fire compartments* on the same property, measured at right angles to the *exposing building face*.

Live load means a variable load due to the intended use and *occupancy* that is to be assumed in the design of the structural members of a *building*. It includes loads due to cranes and the pressure of liquids in containers.

Liveaboard vessel means any *water craft* intended primarily for use in navigation and used for residential purposes.

Loadbearing (as applying to a *building* element) means subjected to or designed to carry loads in addition to its own *dead load*, excepting a wall element subjected only to wind or earthquake loads in addition to its own *dead load*.

Low carbon energy system means a professionally operated and maintained district-scale or on-site system that supplies heat energy, primarily derived from highly efficient and renewable sources, in order to provide space heating and conditioned ventilation air for buildings, and may also provide domestic hot water and cooling service.

Low-hazard industrial occupancy (Group F, Division 3) means an *industrial occupancy* in which the *combustible* content is not more than 50 kg/m^2 or 1 200 MJ/m^2 of *floor area*.

Maintenance once through cooling equipment means *once through cooling equipment* that is not normally operated and is only activated to temporarily supplement or replace the primary cooling system during scheduled maintenance on the primary cooling system.

Major occupancy means the principal *occupancy* for which a *building* or part thereof is used or intended to be used, and shall be deemed to include the subsidiary *occupancies* that are an integral part of the principal occupancy. The *major occupancy* classifications used in this By-law are as follows:

A1 – *Assembly occupancies* intended for the production and viewing of the performing arts

A2 – *Assembly occupancies* not elsewhere classified in Group A

A3 – *Assembly occupancies* of the arena type

A4 – Assembly occupancies in which the occupants are gathered in the open air

B1 – *Detention occupancies* in which persons are under restraint or are incapable of self-preservation because of security measures not under their control

B2 – *Treatment occupancies*

B3 – *Care occupancies*

C – *Residential occupancies*

D – *Business and personal services occupancies*

E – Mercantile occupancies

F1 – *High-hazard industrial occupancies*

F2 – *Medium-hazard industrial occupancies*

F3 – *Low-hazard industrial occupancies*

Marina means any structure or installation, including *marina walkways*, which provides moorage space for *water craft.*

Marina walkway means any surface extending over navigable water used to accommodate pedestrian traffic, and used so that *water craft* and *float homes* may lie alongside to receive and discharge cargo and passengers.

Marine toilet means any toilet on or within a *water craft.*

Masonry *or* ***concrete chimney*** means a *chimney* of brick, stone, concrete or masonry units constructed on site.

Means of egress means a continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare. *Means of egress* includes *exits* and *access to exits*.

Mechanically vented (as applying to a fuel-fired space- or water-heating *appliance*) means an *appliance* and its combustion venting system in which the products of combustion are entirely exhausted to the outdoors by a mechanical device, such as a fan, blower or aspirator, upstream or downstream from the combustion zone of the *appliance*, and the portion of the combustion venting system that is downstream of the fan, blower or aspirator is sealed and does not include draft hoods or draft control devices. (See Note A-1.4.1.2.(1).)

Mechanical system means a heating or cooling system and includes all components, controls, wiring and any piping associated with the system.

Medium-hazard industrial occupancy (Group F, Division 2) means an *industrial occupancy* in which the *combustible* content is more than 50 kg/m^2 or 1 200 MJ/m^2 of *floor area* and not classified as a high-hazard industrial occupancy.

Mercantile occupancy (Group E) means the *occupancy* or use of a *building* or part thereof for the displaying or selling of retail goods, wares or merchandise.

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or *storey* and includes an interior balcony.

Multi-family means a *residential occupancy* with more than two principal *dwelling units*.

Municipal Heat Pump Certification means a certification issued to a person who has completed the Municipal Heat Pump Certification training.

Natural boundary means the visible high water mark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself.

Noncombustible means that a material meets the acceptance criteria of CAN/ULC-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials."

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of *noncombustible materials* for structural members and other *building* assemblies.

Occupancy means the use or intended use of a *building* or part thereof for the shelter or support of persons, animals or property.

Occupant load means the number of persons for which a *building* or part thereof is designed.

Offset means the piping that connects the ends of 2 pipes that are parallel. (See Book II, Division A, Figure A-1.4.1.2.(1)-K in Note A-1.4.1.2.(1).)

Once through cooling equipment means equipment that produces a cooling effect by transfer of heat to water that is only circulated once through the equipment and is then discharged, and includes but is not limited to commercial and industrial air conditioners, refrigerators, freezers, coolers and ice machines.

Open-air storey means a *storey* in which at least 25% of the total area of its perimeter walls is open to the outdoors in a manner that will provide cross-ventilation to the entire *storey*.

Operating permit means permission or authorization in writing by the *Chief Building Official* to install or retain existing equipment or systems for which an operating permit is required under this By-law.

Owner means a registered owner, a holder of an agreement for sale and purchase and, in the case of Crown-owned lands, owner shall mean the occupier.

Partition means an interior wall 1 *storey* or part-*storey* in height that is not loadbearing.

Party wall means a wall jointly owned and jointly used by 2 parties under easement agreement or by right in law, and erected at or upon a line separating 2 parcels of land each of which is, or is capable of being, a separate real-estate entity.

Perched groundwater means a free standing body of water in the ground extending to a limited depth.

Permit means permission or authorization in writing by the *Chief Building Official* to perform work regulated by this By-law and, in the case of an *occupancy permit*, to occupy any *building* or part thereof, but does not include an *operating permit*.

Persons with disabilities means persons who have a permanent or temporary physical, mental, intellectual or sensory impairment which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others.

Pile means a slender deep *foundation unit* made of materials such as wood, steel or concrete or a combination thereof, that is either premanufactured and placed by driving, jacking, jetting or screwing, or cast-in-place in a hole formed by driving, excavating or boring. (Cast-in-place bored piles are often referred to as caissons in Canada.)

Plenum means a chamber forming part of an air duct system.

Plumbing contractor means a person licensed as a *contractor* pursuant to the License By-law and who is either a *journeyperson plumber* or a person who employs a *journeyperson plumber* on a full time basis.

Plumbing system means a *drainage system*, a *venting system* and a *water system* or parts thereof. (See Book II, Division A, Figure A-1.4.1.2.(1)-L in Note A-1.4.1.2.(1).)

Post-disaster building means a *building* that the *Chief Building Official* has determined is necessary for the provision of essential services to the general public in the event of a disaster and includes *buildings* meeting these criteria but not limited to

- hospitals, emergency treatment facilities and blood banks,
- telephone exchanges,
- power generating stations and electrical substations,
- control centres for natural gas distribution,
- control centres for air, land and marine transportation,
- water treatment facilities,
- water storage facilities,
- water and sewage pumping stations,
- *sewage* treatment facilities,
- *buildings* having critical national defence functions, and
- *buildings* of the following types, unless exempted from this designation by the *Chief Building Official*:
    - emergency response facilities,

- fire, rescue and police stations and housing for vehicles, aircraft or boats used for such purposes, and
- communications facilities, including radio and television stations.

(See Note A-1.4.1.2.(1).)

Private sewage disposal system means a privately owned plant for the treatment and disposal of *sewage* (such as a septic tank with an absorption field).

Private water supply system means an assembly of pipes, fittings, valves, equipment and appurtenances that supplies water from a private source to a *water distribution system*.

Process plant means an *industrial occupancy* where materials, including flammable liquids, combustible liquids or gases, are produced or used in a process. (See Table 3.2.7.1. of Division B of the Fire By-law.)

Project means any *construction*, *alteration* or *demolition* operation.

Protected floor space means that part of a floor area protected from the effects of fire and used as part of a *means of egress* from an *interconnected floor space*.

Public bike share means a service that provides the general public with an opportunity to rent bicycles through an automated system, on a short term basis for use within the *City* as part of a network comprised of no fewer than 50 *public bike share stations* located on separate sites on streets, and public and private real property.

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Public bike share station means a bicycle sharing facility where bicycles are stored and from which the general public may rent and return bicycles and other objects or equipment necessary for or appurtenant to the operation of a *public bike share*.

Public corridor means a corridor that provides *access to exit* from more than one *suite*. (See Note A-1.4.1.2.(1).)

Public way means a sidewalk, *street*, highway, square or other open space to which the public has access, as of right or by invitation, expressed or implied.

Pump-out facility means a device or method for the removal of *sewage* from a holding tank connected to a *marine toilet* or from a self-contained *marine toilet*.

Ramp means a path of travel having a slope steeper than 1 in 20.

Recommissioning means to commission a building using the documentation created during the previous commissioning process.

***Registered professional* means**

- a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
- a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Registered professional of record means a *registered professional* retained to undertake design work and *field review* in accordance with Subsection 2.2.7. of Division C.

Re-occupancy permit means permission or authorization in writing by the *Chief Building Official* to re-occupy any *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy*.

Repair garage means a *building* or part thereof where facilities are provided for the repair or servicing of motor vehicles.

Residential occupancy (Group C) means the *occupancy* or use of a *building* or part thereof by persons for whom sleeping accommodation is provided but who are not harboured for the purpose of receiving care or treatment and are not involuntarily detained.

Recommissioning means to commission a *building* using the documentation created during the previous commissioning process.

Retro-commissioning means to commission an *existing building* when *commissioning* has never been carried out or documentation does not exist.

Return duct means a duct for conveying air from a space being heated, ventilated or air-conditioned back to the heating, ventilating or air-conditioning appliance.

Rim joist means the outermost member in floor framing, other than blocking, be it parallel, perpendicular or on an angle to the floor joists. (See Note A-1.4.1.2.(1).)

Rock means that portion of the earth's crust that is consolidated, coherent and relatively hard and is a naturally formed, solidly bonded, mass of mineral matter that cannot readily be broken by hand.

Roof drain means a fitting or device that is installed in the roof to permit *storm water* to discharge into a *leader*.

Row housing means a *building* or portion of a *building* of *residential occupancy* where no *dwelling unit* is located above another principal *dwelling unit* or its *ancillary residential unit*, and there is no common interior or exterior *means of egress*.

Run means the horizontal distance between two adjacent tread nosings on a stair. (See Figure A-9.8.4.-B in Note A-9.8.4. of Division B.)

Sanitary drainage system means a drainage system that conducts *sewage*.

Service room means a room provided in a *building* to contain equipment associated with *building* services. (See Note A-1.4.1.2.(1).)

Service space means space provided in a *building* to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Service water heater means a device for heating water for plumbing services.

Sewage means any liquid waste other than *clear-water waste* or *storm water*.

Shallow foundation means a *foundation unit* that derives its support from soil or rock located close to the lowest part of the *building* that it supports.

Single room accommodation means a room designated as accommodation pursuant to the Single Room Accommodation By-law.

Smoke alarm means a combined *smoke detector* and audible alarm device designed to sound an alarm within the room or *suite* in which it is located upon the detection of smoke within that room or *suite*.

Smoke detector means a *fire detector* designed to operate when the concentration of airborne combustion products exceeds a predetermined level.

Soil means that portion of the earth's crust that is fragmentary, or such that some individual particles of a dried sample may be readily separated by agitation in water; it includes boulders, cobbles, gravel, sand, silt, clay and organic matter.

Solid masonry means a single wythe or multi-wythe construction made of solid masonry units or semi-solid, cored, or hollow masonry units, the cells of which may or may not be filled with mortar or grout. In multi-wythe masonry construction, the space between the wythes consists of a mortar-filled collar joint or grout-filled space and the wythes may or may not be constructed of the same masonry materials.

Solid masonry unit means a concrete block or brick unit, a clay brick unit, or calcium silicate brick unit whose net solid area is at least 75% of its gross area. (See Note A-1.4.1.2.(1).)

Sound transmission class *(STC)* means a single number rating of the airborne sound attenuation of a *building* assembly separating two adjoining spaces, taking into account the direct sound transmission path. (See Note A-1.4.1.2.(1).) (See also Note A-9.11. of Division B.)

Space heater means a *space-heating appliance* for heating the room or space within which it is located, without the use of ducts.

Space-heating appliance means an *appliance* intended for the supplying of heat to a room or space directly, such as a *space heater*, fireplace or unit heater, or to rooms or spaces of a *building* through a heating system such as a central furnace or *boiler*.

Sprinkler contractor means a person licensed as a *contractor* pursuant to the License Bylaw and who is either a *sprinkler system installer* or a person who employs a *sprinkler system installer* on a full-time basis.

Sprinkler system means an automatic fire extinguishing system designed to the National Fire Protection Association 13, 13D or 13R standard and all applicable associated sprinkler standards, and which consists of a system of devices and equipment designed to automatically detect a fire and discharge water or another approved fire extinguishing agent in the area of or onto a fire.

Sprinkler system installer means a person who has successfully completed an accredited program as a *Sprinkler System Installer* under the Industry Training Authority Act and Industry Training Regulation of British Columbia.

Sprinklered (as applying to a building or part thereof) means that the *building* or part thereof is equipped with a system of automatic sprinklers.

Stage means a space that is designed primarily for theatrical performances with provision for quick change scenery and overhead lighting, including environmental control for a wide range of lighting and sound effects and that is traditionally, but not necessarily, separated from the audience by a proscenium wall and curtain opening.

Storage garage means a *building* or part thereof intended for the storage or parking of motor vehicles and containing no provision for the repair or servicing of such vehicles. (See Note A-1.4.1.2.(1).)

Storage-type service water heater means a *service water heater* with an integral hot water storage tank.

Storey means that portion of a *building* that is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

Storm building drain means a *building drain* that conducts *storm water* and is connected at its upstream end to a *leader*, sump or catch basin, and at its downstream end to a *building sewer* or a designated *storm water* disposal location.

Storm drainage system means a *drainage system* that conveys *storm water*.

Storm water means water that is discharged from a surface as a result of rainfall or snowfall.

Stove means an appliance intended for cooking and space heating.

Street means a public road, highway, bridge, viaduct, *lane*, and sidewalk, and any other way normally open to the use of the public, but does not include a private right-of-way on private property and, for the purposes only of Part 3 and Part 9 of this Bylaw, a street which is less than 9 m in width or a *lane* or sidewalk.

Subsoil drainage pipe means a pipe that is installed underground to intercept and convey subsurface water.

Subsurface investigation means the appraisal of the general subsurface conditions at a *building* site by analysis of information gained by such methods as geological surveys, in situ testing, sampling, visual inspection, laboratory testing of samples of the subsurface materials and *groundwater* observations and measurements.

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes *dwelling units*, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for *business and personal services occupancies*. (See Note A-1.4.1.2.(1).)

Supervisory staff means those occupants of a *building* who have some delegated responsibility for the fire safety of other occupants under the fire safety plan.

Supply duct means a duct for conveying air from a heating, ventilating or air-conditioning appliance to a space to be heated, ventilated or air-conditioned.

Tapered tread means a tread with non-parallel edges that increases or decreases its run uniformly over its width.

Theatre means a place of public assembly intended for the production and viewing of the performing arts or the screening and viewing of motion pictures, and consisting of an auditorium with permanently fixed seats intended solely for a viewing audience.

Trades safety coordinator means an agent, employee or officer of a company supplying, installing or using materials at a *construction* site who has been trained to understand and apply safe *construction*, installation or *demolition* techniques, as applicable, respecting those materials and their relationship to the worksite, neighbouring property, public utilities and the general public.

Training school means a School-Arts or Self-Improvement, School —Business, or School - Vocational or Trade, as defined in the Zoning & Development By-law.

Trap means a fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid.

Treatment means the provision of medical or other health-related intervention to persons, where the administration or lack of administration of these interventions may render them incapable of evacuating to a safe location without the assistance of another person. (See Note A-1.4.1.2.(1).)

Treatment occupancy (Group B, Division 2) means the *occupancy* or use of a *building* or part thereof for the provision of treatment, and where overnight accommodation is available to facilitate the treatment. (See Note A-1.4.1.2.(1).)

Unit heater means a suspended space heater with an integral air-circulating fan.

Unprotected opening (as applying to *exposing building face*) means a doorway, window or opening other than one equipped with a closure having the required *fire-protection rating*, or any part of a wall forming part of the *exposing building face* that has a *fire-resistance rating* less than that required for the *exposing building face*.

Unsafe condition means any condition that could cause undue hazard to the life, limb or health of any person authorized, expected or anticipated to be on or about the premises, *building* or *construction*.

Unstable liquid means a liquid, including flammable liquids and combustible liquids, that is chemically reactive to the extent that it will vigorously react or decompose at or near normal temperature and pressure conditions or that is chemically unstable when subjected to impact.

Vapour barrier means the elements installed to control the diffusion of water vapour. (See Note A-1.4.1.2.(1).)

Vegetated roof assembly ("green roof") means a vegetated roof system (a functional arrangement of interacting components, inclusive of vegetation) that is combined with a roof assembly, is intended to both grow and flourish, and may be installed on a roof to control the rate of rainwater discharged through a storm drainage system. (See Note A-1.4.1.1.)

Vent connector (as applying to heating or cooling systems) means the part of a venting system that conducts the flue gases or vent gases from the flue collar of a gas *appliance* to the chimney or gas vent, and may include a draft control device.

Venting system means an assembly of pipes and fittings that connects a *drainage system* with outside air for circulation of air and the protection of trap seals in the *drainage system*. (See Book II, Division A, Figures A-1.4.1.2.(1)-F and A-1.4.1.2.(1)-G in Note A-1.4.1.2.(1).)

Vertical service space means a shaft oriented essentially vertically that is provided in a *building* to facilitate the installation of *building* services including mechanical, electrical and plumbing installations and facilities such as elevators, refuse chutes and linen chutes.

Walkway means a covered or roofed pedestrian thoroughfare used to connect 2 or more *buildings*.

Water craft means any boat, hull, barge, or houseboat which is afloat, whether self-propelled or not, and includes pleasure and commercial craft.

Water distribution system means an assembly of pipes, fittings, valves and appurtenances that conveys water from the *water service pipe* or *private water supply system* to water supply outlets, *fixtures*, appliances and devices.

Water service pipe means a pipe that conveys water from a public water main or private water source to the inside of the *building*.

Water system means a *private water supply system*, a *water service pipe*, a *water distribution system* or parts thereof.

1.4.2. Symbols and Other Abbreviations

1.4.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in this Code shall have the meanings assigned to them in this Article and Article 1.3.2.1. of Division B.

1 in 2 slope of 1 vertical to 2 horizontal

cm centimetre(s)

CRP coordinating registered professional

° degree(s)

°C degree(s) Celsius

dBA A-weighted sound level

diam diameter

ERV energy recovery ventilator

g gram(s)

GHG greenhouse gas

h hour(s)

HDD heating degree-day(s)

HRV Heat Recovery Ventilator

HVAC heating, ventilating and air-conditioning

Hz hertz

Inc. Incorporated

J joule(s)

K degree(s) Kelvin

kg kilogram(s)

kN kilonewton(s)

kPa kilopascal(s)

kW kilowatt(s)

kWh kilowatt hour(s)

L litre(s)

lx lux

m metre(s)

M metric nomenclature for reinforcing bars

max. maximum

min. minimum

min minute(s)

MJ megajoule(s)

mm millimetre(s)

MPa megapascal(s)

N newton

n/a not applicable

ng nanogram(s)

No. number(s)

o.c. on centre

OSB oriented strandboard

Pa pascal(s)

PM particulate matter

ppb part(s) per billion

ppm part(s) per million

R thermal resistance value (imperial unit)

RP registered professional

RSI thermal resistance value (metric unit)

s second(s)

W watt(s)

% percent

µg microgram(s)

µm micrometre(s)

U-value overall thermal transmittance

Section 1.5. Referenced Documents and Organizations

1.5.1. Referenced Documents

1.5.1.1. Application of Referenced Documents

1) Except as provided in Sentence (2), the provisions of documents referenced in this By-law, and of any documents referenced within those documents, apply only to the extent that they relate to

a) *buildings*, and

b) the objectives and functional statements attributed to the applicable acceptable solutions in Division B where the documents are referenced.

(See Note A-1.5.1.1.(1).)

2) Where a provision of this By-law references the Vancouver Fire By-law, the NECB, or Book II (Plumbing Systems) of this By-law the applicable objectives and functional statements shall include those found in that referenced document. (See Note A-2.1.1.2.(6).)

1.5.1.2. Conflicting Requirements

1) In case of conflict between the provisions of this By-law and those of a referenced document, the provisions of this By-law shall govern.

1.5.1.3. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions designated in Subsection 1.3.1. of Division B.

1.5.2. Organizations

1.5.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in Article 1.3.2.1. of Division B.

Notes to Part 1
Compliance

A-1.1.1.1.(3) Factory-Constructed Buildings. The Building By-law applies the same requirements to site-built and factory-constructed buildings. However, it can often be difficult to determine whether a factory-constructed building complies with the By-law once it has been delivered to the construction site because many of the wall, roof and floor assemblies are closed in and so their components cannot be inspected. CSA A277, "Procedure for certification of prefabricated buildings, modules, and panels" was developed to address this problem with regard to residential, commercial and industrial buildings. This standard describes a procedure whereby an independent certification agency can review the quality control procedures of a factory and make periodic unannounced inspections of its products. The standard is not a building code, only a procedure for certifying compliance of factory-constructed components with a building code or other standard. If a factory-constructed building bears the label of an accredited certification agency indicating that compliance with the National Building Code has been certified using the CSA A277 procedure, the accepting authority will have some assurance that the concealed components do not require re-inspection on site.

On the other hand, standards in the CSA Z240 MH Series, "Manufactured homes," do resemble a building code. Most of the individual standards in the series contain requirements regarding many issues also covered in this By-law. Some of these Z240 MH Series provisions are performance requirements with no quantitative criteria, some simply reference the applicable Building By-law requirements, while others contain requirements that differ from those in the Building By-law. One of the individual standards in the Z240 MH Series deals with special requirements for manufactured homes related to the fact that these houses must be moved over roads, which is an issue the Building By-law does not address. Therefore, labeling that indicates that a factory-constructed house complies with the Z240 MH Series standards can NOT be taken as an indication that the house necessarily complies with the building code in effect for the location where the house will be sited.

The Building By-law does reference CSA Z240.10.1, "Site preparation, foundation, and installation of buildings," which is not actually part of the CSA Z240 MH Series. This standard contains requirements for surface foundations where buildings—not just houses—comply with the deformation resistance test provided in CSA Z240.2.1, "Structural requirements for manufactured homes."

A-1.1.1.2.(1) Application to Existing Buildings. This By-law is most often applied to existing or relocated buildings when an owner wishes to renovate a building, change its use, or build an addition, or when an enforcement authority decrees that a building or class of buildings be altered for reasons of public safety. It is not intended that the Building By-law be used to enforce the retrospective application of new requirements to existing buildings or existing portions of relocated buildings, unless specifically required by local regulations or bylaws. For example, although the Fire By-law could be interpreted to require the installation of fire alarm, standpipe and hose, and automatic sprinkler systems in an existing building for which there were no requirements at the time of construction, it is not intended that the Fire By-law be applied in this manner to these buildings unless the Chief Building Official has determined that there is an inherent threat to occupant safety and has issued an order to eliminate the unsafe condition, or where substantial changes or additions are being made to an existing building or the occupancy has been changed. (See also Note A-1.1.1.1.(1) of Division A of the Fire By-law.)

Relocated buildings that have been in use in another location for a number of years can be considered as existing buildings, in part, and the same analytical process can be applied as for existing buildings. It should be noted, however, that a change in occupancy may affect some requirements (e.g. loads and fire separations) and relocation to an area with different wind, snow or earthquake loads will require the application of current By-law requirements. Depending on the construction of the building and the changes in load, structural modifications may be required. Similarly, parts of a relocated or existing building that are re-constructed, such as foundations and basements, or parts being modified are required to be built to current codes.

Whatever the reason, By-law application to existing or relocated buildings requires careful consideration of the level of safety needed for that building. This consideration involves an analytical process similar to that required to assess alternative design proposals for new construction. See Clause 1.2.1.1.(1)(b) for information on achieving compliance with the By-law using alternative solutions.

In developing By-law requirements for new buildings, consideration has been given to the cost they impose on a design in relation to the perceived benefits in terms of safety. The former is definable; the latter difficult to establish on a quantitative basis. In applying the By-law requirements to an existing building, the benefits derived are the same as in new buildings. On the other hand, the increased cost of implementing in an existing building a design solution that would normally be intended for a new building may be prohibitive.

The successful application of By-law requirements to existing construction becomes a matter of balancing the cost of implementing a requirement with the relative importance of that requirement to the overall By-law objectives. The degree to which any particular requirement can be relaxed without affecting the intended level of safety of the Code By-law requires considerable judgment on the part of both the designer and the Chief Building Official.

Further information on the application of By-law requirements to existing or relocated buildings can be found in the following publications:

- "User's Guide – NBC 1995 Fire Protection, Occupant Safety and Accessibility (Part 3)"
- "Guidelines for Application of Part 3 of the National Building Code of Canada to Existing Buildings"
- Commentary entitled "Application of NBC Part 4 of Division B for the Structural Evaluation and Upgrading of Existing Buildings" of the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)"
- "User's Guide – NBC 1995, Application of Part 9 to Existing Buildings"
- CBD 230, "Applying building codes to existing buildings"

These publications can be accessed ordered through the NRC's Web site.

A-1.2.1.1.(1)(a) By-law Compliance via Acceptable Solutions. If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable acceptable solutions in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the By-law. In fact, if it can be determined that a design meets all the applicable acceptable solutions in Division B, there is no need to consult the objectives and functional statements in Division A to determine its compliance.

A-1.2.1.1.(1)(b) By-law Compliance via Alternative Solutions. Where a design differs from the acceptable solutions in Division B, then it should be treated as an "alternative solution." A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions—certainly far less precisely than would be the case with a true performance code, which would have quantitative performance targets and prescribed methods of performance measurement for all aspects of building performance. Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B—not "well enough" but "as well as."

In this sense, it is Division B that defines the boundaries between acceptable risks and the "unacceptable" risks referred to in the statements of the By-law's objectives, i.e. the risk remaining once the applicable acceptable solutions in Division B have been implemented represents the residual level of risk deemed to be acceptable by the broad base of Canadians who have taken part in the consensus process used to develop the By-law.

Level of Performance

Where Division B offers a choice between several possible designs, it is likely that these designs may not all provide exactly the same level of performance. Among a number of possible designs satisfying acceptable solutions in Division B, the design providing the lowest level of performance should generally be considered to establish the minimum acceptable level of performance to be used in evaluating alternative solutions for compliance with the By-law

Sometimes a single design will be used as an alternative solution to several sets of acceptable solutions in Division B. In this case, the level of performance required of the alternative solution should be at least equivalent to the overall level of performance established by all the applicable sets of acceptable solutions taken as a whole.

Each provision in Division B has been analyzed to determine what it is intended to achieve. The resultant intent statements clarify what undesirable results each provision seeks to preclude. These statements are not a legal component of the By-law, but are advisory in nature, and can help By-law users establish performance targets for alternative solutions. They are published as a separate electronic document entitled "Supplement to the NBC 2020: Intent Statements," which is available on the NRC's website. These intent statements should be cross referenced with the associated requirements of the Building By-law.

Areas of Performance

A subset of the acceptable solutions in Division B may establish criteria for particular types of designs (e.g. certain types of materials, components, assemblies, or systems). Often such subsets of acceptable solutions are all attributed to the same objective: Fire Safety, for example. In some cases, the designs that are normally used to satisfy this subset of acceptable solutions might also provide some benefits that could be related to some other objective: Fire Protection of the Building, for example. However, if none of the applicable acceptable solutions are linked to Objective OP1, Fire Protection of the Building, it is not necessary that alternative solutions proposed to replace these acceptable solutions provide a similar benefit related to Fire Protection of the Building. In other words, the acceptable solutions in Division B establish acceptable levels of performance for compliance with the By-law only in those areas defined by the objectives and functional statements attributed to the acceptable solutions.

Applicable Acceptable Solutions

In demonstrating that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B, its evaluation should not be limited to comparison with the acceptable solutions to which an alternative is proposed. It is possible that acceptable solutions elsewhere in the By-law also apply. The proposed alternative solution may be shown to perform as well as the most apparent acceptable solution which it is replacing but may not perform as well as other relevant acceptable solutions. For example, an innovative sheathing material may perform adequately as sheathing in a wall system that is braced by other means but may not perform adequately as sheathing in a wall system where the sheathing must provide the structural bracing. All applicable acceptable solutions should be taken into consideration in demonstrating the compliance of an alternative solution.

A-1.2.1.2.(1) Responsibility of Owner. Sentence 1.1.1.1.(1) is not intended to imply that a person who becomes the owner of a building must bring the entire building into compliance with the By-law. The By-law applies only in the cases and to the extent specified by Article 1.1.1.1., and the owner of a building is therefore made responsible for ensuring the building complies with the By-law by Sentence 1.2.1.2.(1) only in the cases and to the extent specified by Article 1.1.1.1 and Part 11. If none of the provisions in Sentence 1.1.1.1.(1) and Part 11 apply to the building, the owner is not required to make any changes to the building.

A-1.3.3.4.(1) Buildings Divided by Firewalls. This concept relates to the provisions directly regulated by this By-law and does not apply to electrical service entrance requirements, which are regulated by other documents.

A-1.3.3.4.(2) Buildings on Sloping Sites. Application of the definition of grade to stepped buildings on sloping sites often results in such buildings being designated as being greater than 4 storeys in building height even though there may be only 2, 3 or 4 storeys at any one location. Figure A-1.3.3.4.(2)-A illustrates this application compared to a similar building on a flat site.

Under Sentence 1.3.3.4.(2), Building A can be considered as being 4 storeys in building height instead of 7 storeys in building height. Both Building A and B are comparable with regard to fire safety and egress.

This relaxation applies to the determination of building height only. All other requirements continue to apply as appropriate.

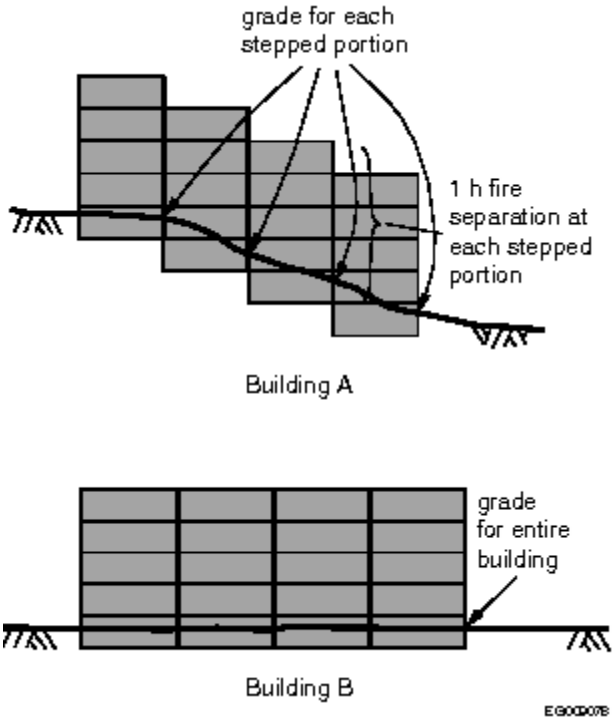


Figure A-1.3.3.4.(2)-A
Application of the definition of grade

Larger buildings also have significant challenges due to sloping sites

Figure A-1.3.3.4.(2)-B illustrates this application of Sentence (3). Under Sentence 1.3.3.4.(2), Building A and B can be considered separately as these would have a level of fire safety and egress comparable with buildings constructed as separate entities.

As with the 4 storey case, this relaxation applies to the determination of building height only. All other requirements continue to apply as appropriate.

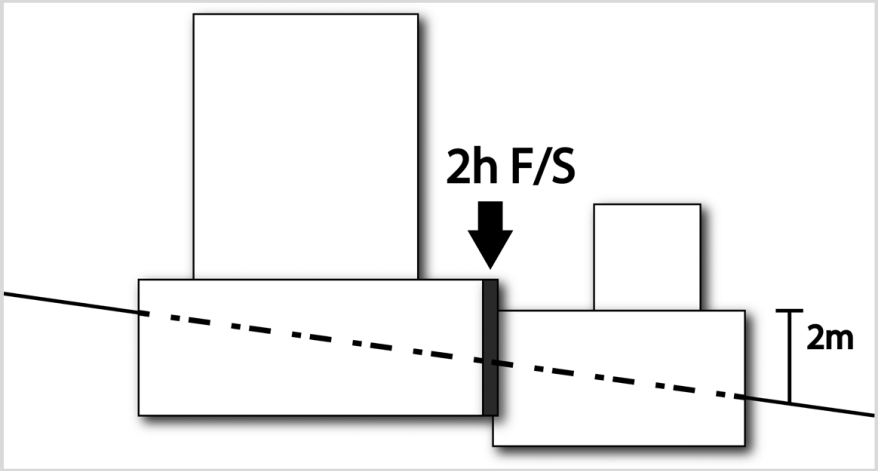


Figure A-1.3.3.4.(2)-B

Application of the definition of grade for physically separate components

A-1.3.3.6.(2)(k) Portable Classroom Exemption. This exemption is based on the following considerations

• the building area is less than 100 m^2 in building area and each unit is provided with exiting directly to the exterior,

• the building is constructed with smoke detection in all major rooms and with adequate portable fire extinguishers,

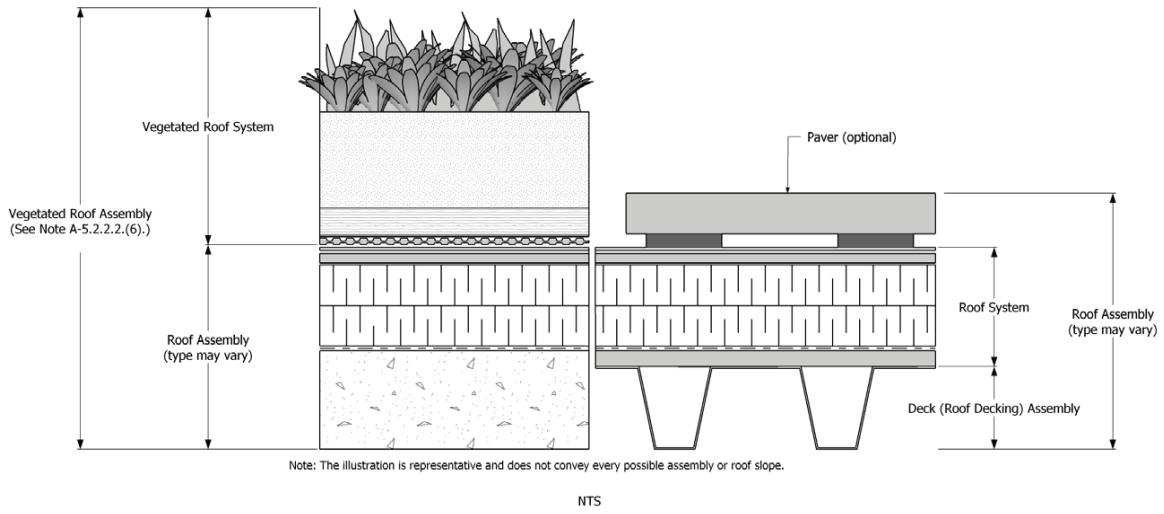
• the building is properly supervised with a practised and drilled fire safety plan and with supervisory staff fully trained in securing the rapid evacuation of the facilities upon initiation of any alarm device, and

• the building, its construction type and any required fire ratings are otherwise in full conformance with the requirements of the By-law.

A-1.4.1.1. Non-defined Terms

Roof terminology

Where the By-law addresses the separation of environments (Part 5 and Part 9), various terms refer to the assembly on top of a building that protects the building interior from the weather. In general terms, that assembly is called a “roof assembly” (or more simply, a “roof”) A roof comprises two integrated parts: the “deck assembly” (a structural element of a building, also referred to as the “roof decking assembly”), and the “roof assembly” and not the “roof system”; example, the “roof assembly” must resist wind load (see Article 5.2.2.2. of Divison B).



Note: The illustration is representative and does not convey every possible assembly or roof slope. Not to scale. Image created by Roofing Contractors Association of British Columbia and is reproduced here with its consent.

Figure A-1.4.1.1.

Roof terminology

When materials that seal the roof to resist the transmission of liquid water into a building are constructed on a roof deck — including water under some hydrostatic pressure — they form a waterproofing roof assembly. Waterproofing materials are usually manufactured as rolled sheet goods or as liquids; installation methods are specified by the manufacturer and often governed by published standards (for example, standards by ASTM and the Roofing Contractors Association of British Columbia). Waterproofing roof assemblies can be constructed on any slope but are generally intended for horizontal or near-horizontal applications. Roofs constructed with rolled sheet membranes are those referred to in Sentence 5.2.2.2.(4) of Division B.

Generally, waterproofing roof assemblies can be configured in one of two ways. “Conventionally insulated” roof assemblies (also referred to as “compact roofs”) are constructed with the weatherproofing material (membrane) on top of the assembly. The membrane therefore shields the insulation and all other assembly components from the weather. In “protected” roof assemblies, the membrane is located immediately above the roof deck and is therefore protected by insulation and other roofing components that are made to be exposed to weather. The configuration of the roof assembly determines the appropriate selection of its

materials, including the membrane. A third, “hybrid configuration” (sometimes called a “modified protected” roof assembly) is less common and combines a protected system on top of a conventional assembly, to utilize the benefits of each.

Many waterproofing roof assemblies provide a suitable platform for rooftop amenities, a vegetated roof system, or other types of overburdens. Careful consideration must be given to superimposed loads, to avoid compression and distortion of the roofing materials, which can compromise the waterproofing. Where any overburden is intended for sloped applications, the design must incorporate anti-shear measures. Water-shedding roof assemblies are typically constructed with a slope equal to or greater than 1:4 (3” in 12”), include curved or barreled forms, and are designed and constructed with weatherproofing materials that interlock or overlap, relying on gravity and slope to shed water away from a building, usually into an arrangement of gutters. These assemblies may be insulated, when configured appropriately for ventilation. In Vancouver, most water-shedding roofs are built with asphalt shingles, cedar shingles or shakes, or metal panels.

More information on roofing materials, installation, and maintenance is available through the Roofing Contractors Association of British Columbia, including the “Roofing Practices Manual.”

A-1.4.1.2.(1) Defined Terms.

Access or Accessible and Persons with Disabilities

The terms “access” or “accessible” and the term “persons with disabilities” are revised in this edition of the By-law for greater alignment with the United Nations (UN) Convention on the Rights of Persons with Disabilities. This does not alter the objectives and functional statements attributed to the provisions of this By-law regarding access for persons with disabilities. The revised definitions are to provide greater clarity as to why the By-law applies requirements the way it does.

Ancillary Residential Unit

An ancillary residential unit is a self-contained dwelling unit that together with a larger principal dwelling unit forms a single real-estate entity. Ancillary residential units are typically created within an existing single dwelling building (house) either constructed as an addition or an alteration to an existing house or incorporated during the construction of a new house. An ancillary residential unit may have more than one storey and may be on the same level as the principal dwelling unit or be above or below it.

In a building with more than one ancillary residential unit, the principal dwelling unit along with its associated ancillary residential unit, must be either be vertically separated from all other portions of a the building that is of residential occupancy by a vertical fire separation that extends continuously through all crawlspaces, storeys and attic spaces of the vertically separate portions of a building or provided with enhanced fire protection (see Article 9.37.2.24.) Neither the ancillary residential unit nor any other dwelling unit subordinate to a principal dwelling unit can be strata-titled or otherwise subdivided from the remainder of the principal dwelling unit under provincial legislation. This means that the principal dwelling unit and all subordinate dwelling units are registered under the same title.

ASTC and STC

The higher the ASTC or STC rating, the more the assembly or the system of assemblies protects occupants from noise in adjacent spaces.

These ratings, which are determined in accordance with ASTM E413, “Classification for Rating Sound Insulation,” roughly describe the noise reduction provided by the separating floor or wall, or in the case of the ASTC rating, by the system of separating and adjoining walls and floors.

Care Occupancy

Support services rendered by or through care facility management refer to services provided by the organization that is responsible for the care for a period exceeding 24 consecutive hours. They do not refer to services provided by residents of dwelling units or suites, or to services arranged directly by residents of dwelling units or suites with outside agencies.

In the context of care occupancies, these services may include a daily assessment of the resident's functioning, awareness of their whereabouts, the making of appointments for residents and reminding them of those appointments, the ability and readiness to intervene if a crisis arises for a resident, supervision in areas of nutrition or medication, and provision of transient medical services. Services may also include activities of daily living such as bathing, dressing, feeding, and assistance in the use of washroom facilities, etc. No actual treatment is provided by or through care facility management.

Dangerous Goods

In previous editions of the Building By-law, the terminology used to identify dangerous goods came from TC SOR/2008-34, "Transportation of Dangerous Goods Regulations (TDGR)." The TDGR apply solely to the adequate identification of hazards related to dangerous goods in the contexts of transportation and emergency response.

Dangerous goods in the workplace are identified in accordance with the "Workplace Hazardous Materials Information System (WHMIS)," established in accordance with the "*Hazardous Products Act*." The WHMIS identification system is specifically designed with the users of the product in mind.

This edition of the Building By-law identifies dangerous goods as products regulated by the TDGR or classified under the WHMIS. In order to harmonize these two nomenclatures for dangerous goods, class descriptors were developed taking into consideration both the TDGR and WHMIS classification systems. The proposed ~~The NBC~~ nomenclature ~~uses~~ introduces a descriptive approach to classifying dangerous goods, which is similar to the one used by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) developed by the United Nations (UN). Canada has actively participated in the development of the GHS and has committed to its implementation through the TDGR and WHMIS regulations.

The Building By-law nomenclature takes a common sense approach that corresponds more closely to how people refer to dangerous goods on a daily basis, blending TDGR and WHMIS terminology without using nondescript numbers and letters as previously found in the Building By-law, TDGR and WHMIS.

Table A-1.4.1.2.(1)
TDGR, WHMIS and Building By-law Class Descriptors for Dangerous Goods

TDGR		**WHMIS**	**Building By-law**
Class	Descriptor		
1	Explosives	Explosives	Explosives
2	Gases	Gases under pressure	Compressed gases
2.1	Flammable gases	Flammable gases; Flammable aerosols	Flammable gases; Flammable aerosols
2.2	Non-flammable, non-toxic gases	Gases under pressure	Non-flammable, non-toxic gases
2.2 (5.1)	—	Oxidizing gases	Oxidizing gases
2.3	Toxic gases	—	Toxic gases
3	Flammable liquids	Flammable liquids	Flammable liquids
4.1	Flammable solids	Flammable solids	Flammable solids
4.2	Substances liable to spontaneous combustion	Pyrophoric liquids; pyrophoric solids	Pyrophoric materials
4.3	Water-reactive substances	Substances and mixtures which, in contact with water, emit flammable gases	Water-reactive substances
5.1	Oxidizing substances	Oxidizing liquids; oxidizing solids	Oxidizers
5.2	Organic peroxides	Organic peroxides	Organic peroxides
6.1	Toxic substances	(1)	Toxic substances
6.2	Infectious substances	(1)	Infectious materials
7	Radioactive materials	Not covered by WHMIS	Radioactive materials
8	Corrosives	(2)	Corrosives
9	Miscellaneous products, substances, or organisms	(2)	Miscellaneous dangerous goods
—	—	Previously Class F	Dangerously reactive materials

Notes to Table A-1.4.1.2.(1):

(1) The WHMIS has various descriptors for this Class of products based on their toxicity.
(2) The WHMIS has various descriptors for this Class of products based on the nature of the danger presented by the product.

Designated Flood Plain

The Burrard Inlet, English Bay, False Creek and Fraser River flood plains are illustrated on Diagram A1 and the wave effect zones are illustrated on Diagram A2. See Figure A-1.4.1.2.(1)-C and Figure A-1.4.1.2.(1)-D. The Still Creek flood plain is illustrated on Figure A-1.4.1.2.(1)-E.

Exit

Exits include doors or doorways leading directly into an exit stair or directly to the outside. In the case of an exit leading to a separate building, exits also include vestibules, walkways, bridges or balconies.

Farm Building

Farm buildings as defined in Article 1.4.1.2. include, but are not limited to, produce storage and packing facilities, livestock and poultry housing, milking centres, manure storage facilities, grain bins, silos, feed preparation centres, farm workshops, greenhouses, farm retail centres, and horse riding, exercise and training facilities. Farm buildings may be classified as low or high human occupancy, depending on the occupant load.

Examples of farm buildings likely to be classed as low human occupancy as defined in Article 1.2.1.2. of the National Farm Building code of Canada are livestock and poultry housing, manure and machinery storage facilities and horse exercise and training facilities where no bleachers or viewing area are provided.

Examples of farm buildings that would be classified as other than low human occupancy include farm retail centres for feeds, horticultural and livestock produce, auction barns and show areas where bleachers or other public facilities are provided. Farm work centres where the number of workers frequently exceeds the limit for low human occupancy will also be in this category.

It is possible to have areas of both high and low human occupancy in the same building provided that the structural safety and fire separation requirements for high human occupancy are met in the part thus designated.

Fire Separation

It is generally understood that the term “fire” refers to all products of combustion, including heat and smoke. Although a fire separation is not always required to have a fire-resistance rating, it should act as a barrier to the spread of smoke and fire until some type of response is initiated. If the fire-resistance rating of a fire separation is permitted to be waived on the basis of the presence of an automatic sprinkler system, it is nonetheless the intent of the By-law that the fire separation be constructed so that it will remain in place and act as a barrier against the spread of smoke until the sprinklers have actuated.

Flight

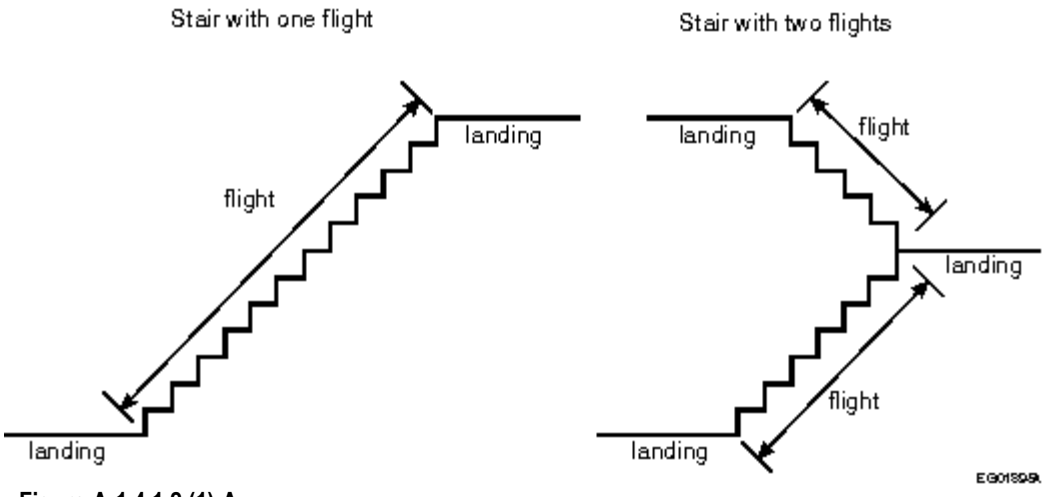


Figure A-1.4.1.2.(1)-A
Flight

Flood Construction Level Requirements

The Burrard Inlet, English Bay, False Creek and Fraser River flood plains are illustrated on Diagram A1 and the wave effect zones are illustrated on Diagram A2. See Figure A-1.4.1.2.(1)-C and Figure A-1.4.1.2.(1)-D. The Still Creek flood construction levels are illustrated on Figure A-1.4.1.2.(1)-E.

Grade

Localized depressions that need not be considered in the determination of the elevation of grade include such features as vehicle and pedestrian entrances and other minor depressions that do not affect accessibility for firefighting or evacuation.

Groundwater Protection Area. The Groundwater Protection Area is illustrated on Diagram C. see Figure A-1.4.1.2.(1)-F.

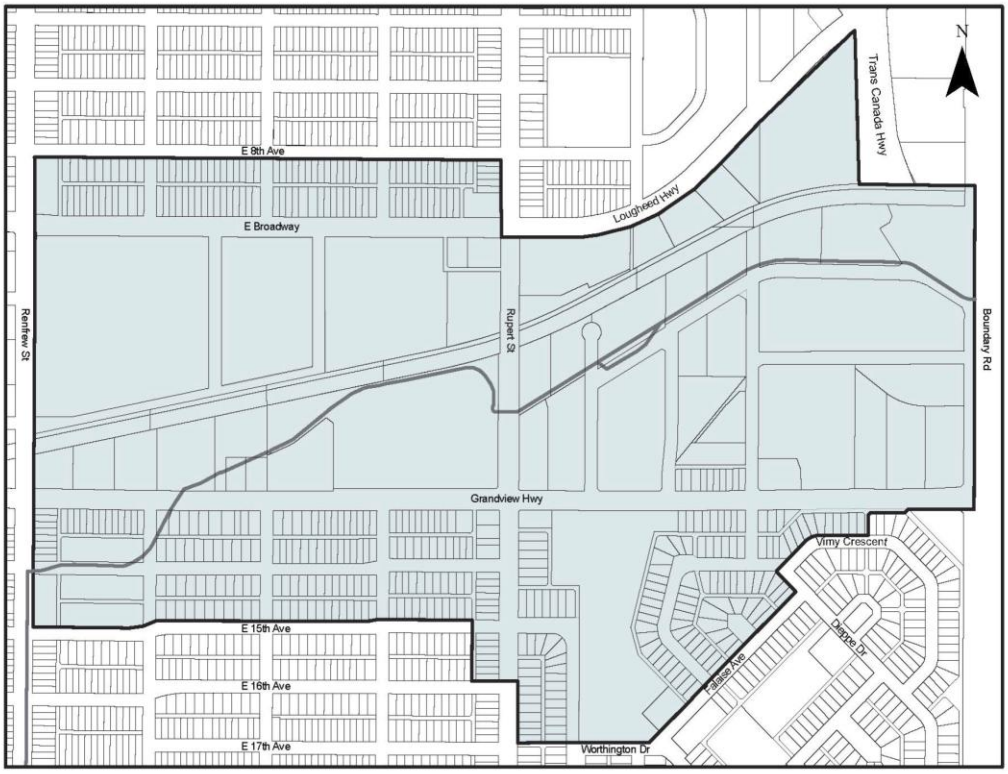


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Figure A-1.4.1.2.(1)-F Diagram C: Groundwater Protection Area.

Heritage Building

Heritage buildings are buildings that are legally recognized by the Province or the City as having historic, architectural or cultural value to the community. To qualify as a heritage building under the Vancouver Building By-law, a building must be:

- protected as heritage property by the Province under the Heritage Conservation Act or the Park Act;
- subject to a heritage designation bylaw pursuant to the Municipal Act or Vancouver Charter;
- listed in the Provincial heritage register or in an inventory of heritage buildings maintained for this purpose under section 20(1)(h) of the Heritage Conservation Act.

Despite this definition of Heritage Buildings, the Chief Building Official may accept a lesser standard.

Mechanically Vented

The definition of this term is intended to include all types of appliances and venting systems that rely entirely on fans to evacuate the products of combustion. Systems variously referred to as “forced draft,” “power vented” and “induced draft” in standards and industry terminology may be covered by this definition. The key characteristic of such systems is that they are more resistant to depressurization-induced spillage of combustion products into the building in which they are housed because the combustion venting system downstream of the fan is “sealed,” i.e. includes no draft hood or draft control device.

Post-Disaster Building

There may be circumstances where the Chief Building Official would choose to exempt certain types of buildings or parts thereof from being designated as post-disaster buildings. Such is the case in the following examples: an example that is stored at a volunteer’s residence or a police station that is housed in a small shopping mall or residential complex.

Some municipalities have emergency management plans that specify which buildings are to be used for the provision of essential services after a disaster. Municipalities normally coordinate their requirements with provincial or territorial emergency management protocols, which may or may not be mandatory. If in doubt about whether a building should be designated as a post-disaster building, designers should consult with the Chief Building Official.

The inclusion of control centres for natural gas distribution as examples of post-disaster buildings is intended to ensure that, following a disaster, control is maintained over large fuel distribution networks that supply a commodity essential to the health and safety of a significant proportion of the Canadian population. In contrast, the localized failure of a single fuel supply point does not jeopardize the entire fuel distribution system.

Buildings with rooftop telecommunication or cellular network equipment need not be designated as post-disaster buildings.

Public Corridor

A covered mall is considered to be a public corridor and, as such, is subject to the same requirements as a public corridor.

Rim Joist

In the field, rim joists may also be referred to as rim boards, headers or header joists.

Service Room

Typical examples of service rooms include boiler rooms, furnace rooms, incinerator rooms, garbage handling rooms and rooms to accommodate air-conditioning or heating appliances, pumps, compressors and electrical equipment. Rooms such as elevator machine rooms and common laundry rooms are not considered to be service rooms.

Solid Masonry Units

The net solid area of a masonry unit is calculated by determining the gross area of the bed face of the unit (L × T) and subtracting the cumulative areas of the hollow portions. As long as the total area of the hollow portions is 25% or less of the gross area, the unit is considered to be a solid masonry unit.

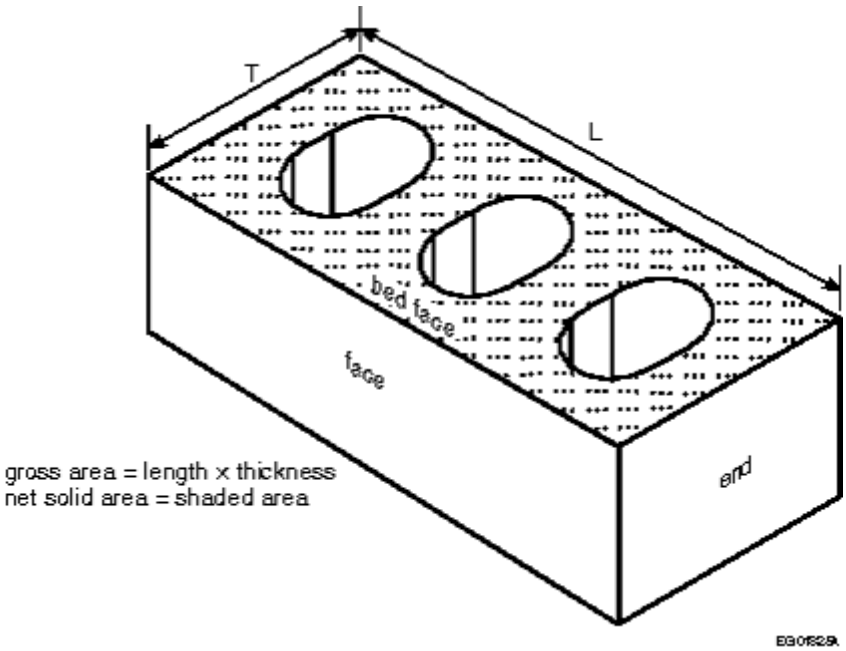

Figure A-1.4.1.2.(1)-B
Net solid area of masonry unit

Storage Garage

Entrances at which vehicles stop for a short time beneath an unenclosed canopy to pick up and drop off passengers are not considered as storage garages. As a subsidiary use, storage garages may also contain space for parking or storing other vehicles (bicycles, boat, etc.).

Suite

Tenancy in the context of the term “suite” applies to both rental and ownership tenure. In a condominium arrangement, for example, dwelling units are considered separate suites even though they are individually owned. In order to be of complementary use, a series of rooms that constitute a suite must be in reasonably close proximity to each other and have access to each other either directly by means of a common doorway or indirectly by a corridor, vestibule or other similar arrangement.

The term “suite” does not apply to rooms such as service rooms, common laundry rooms and common recreational rooms that are not leased or under a separate tenure in the context of the By-law. Similarly, the term “suite” is not normally applied in the context of buildings such as schools and hospitals, since the entire building is under a single tenure. However, a room that is individually rented is considered a suite. A warehousing unit in a mini-warehouse is a suite. A rented room in a nursing home could be considered as a suite if the room was under a separate tenure. A hospital bedroom on the other hand is not considered to be under a separate tenure, since the patient has little control of that space, even though he pays the hospital a per diem rate for the privilege of using the hospital facilities, which include the sleeping areas.

For certain requirements in the By-law, the expression “room or suite” is used (e.g., travel distance). This means that the requirement applies within the rooms of suites as well as to the suite itself and to rooms that may be located outside the suite. In other places the expression “suite, and rooms not located within a suite” is used (e.g., for the installation of smoke and heat detectors). This means that the requirement applies to individual suites as defined, but not to each room within the suite. The rooms “not within a suite” would include common laundry rooms, common recreational rooms and service rooms, which are not considered as tenant-occupied space.

Tapered Tread

The definition of tapered tread includes treads in curved stairs and treads in winder stairs, However, requirements for winders differ from those for other tapered treads. Requirements for tapered treads are found in Articles 3.3.1.16., 3.4.6.9., and 9.8.4.3. of Division B. Requirements for winders are found in Article 9.8.4.6. of Division B.

Treatment

The ability to evacuate unassisted implies that a person is capable of recognizing and responding to an emergency given their physical, cognitive and behavioural abilities, and able to move to a safe location without the assistance of another person. For example, such persons must be able to arise and walk, or transfer from a bed or chair to a means of mobility, and leave the building or move to a safe location on their own.

Treatment Occupancy

"Treatments" may include such things as surgery, intensive care, and emergency medical intervention. Treatment services differ from the services provided by care occupancies like personal care assistance or the administration of medication, and from those provided by business and personal services occupancies like dentistry or day procedures.

Illustrations for Defined Terms

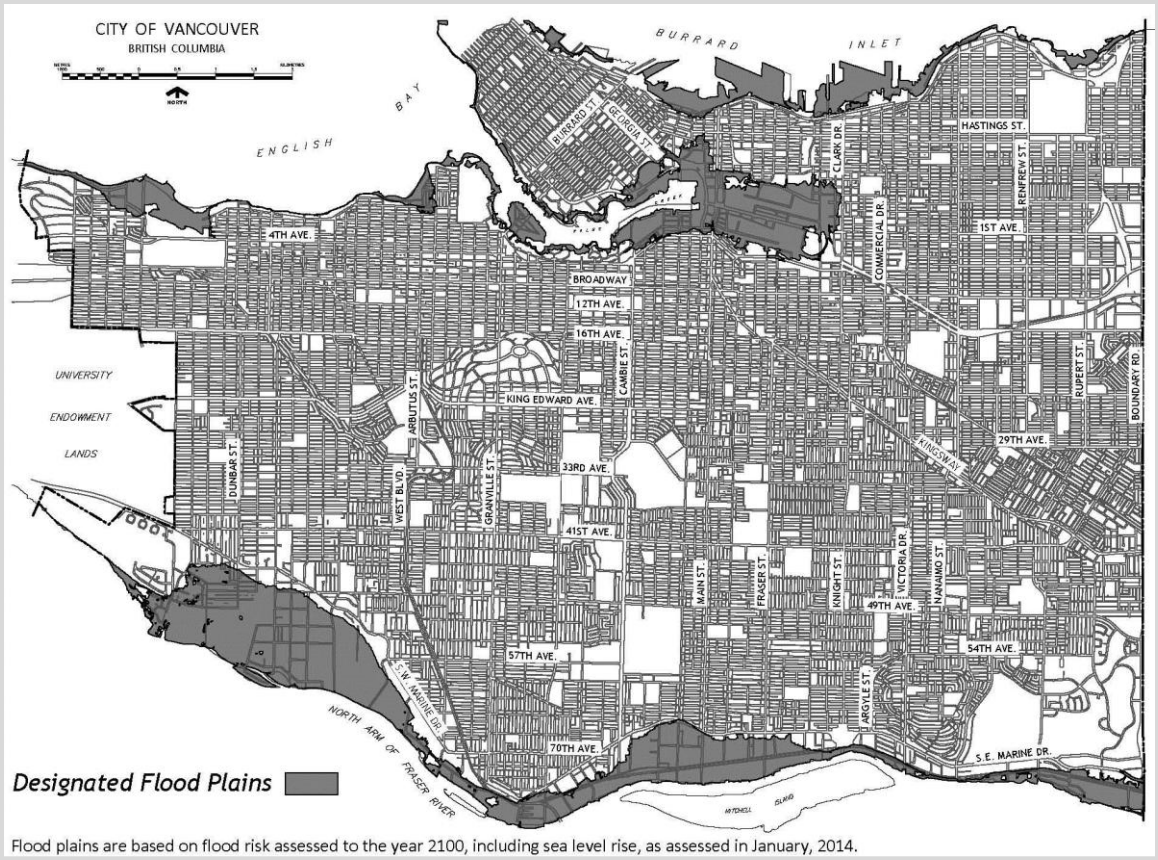

Figure A-1.4.1.2.(1)-C

Diagram A1: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plains

Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plain Wave Effect Zone

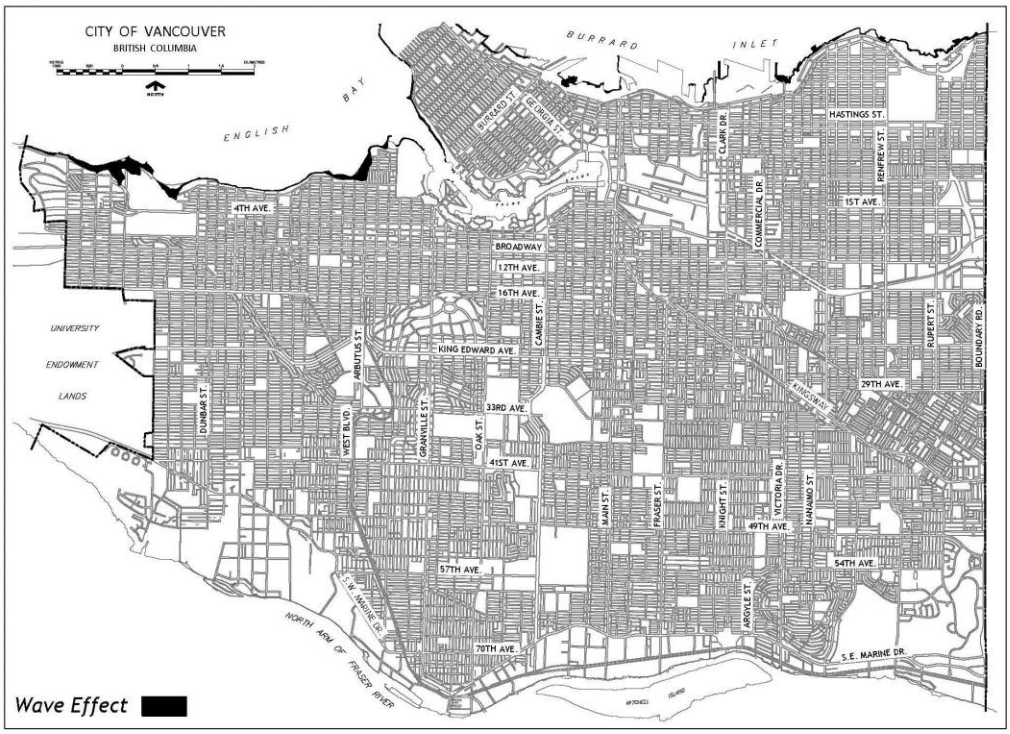

Figure A-1.4.1.2.(1)-D

Diagram A2: Burrard Inlet, English Bay, False Creek and Fraser River Flood Plain Wave Effect Zone

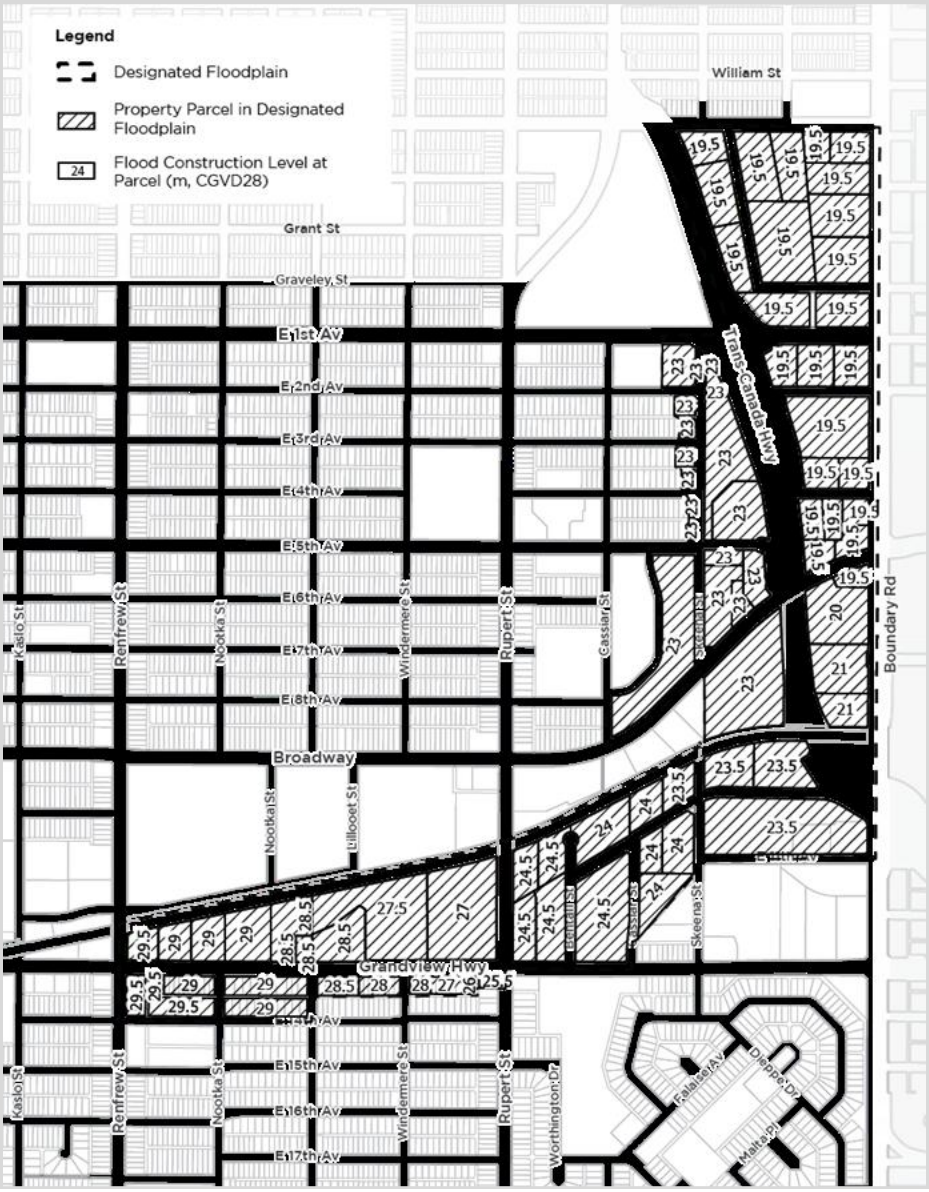

Figure A-1.4.1.2.(1)-E

Diagram B: Still Creek Flood Plain and Flood Construction Levels

A-1.5.1.1.(1) Application of Referenced Documents. Documents referenced in the Building By-law may contain provisions covering a wide range of issues, including issues that are unrelated to the objectives and functional statements stated in Parts 2 and 3 of Division A respectively; e.g. aesthetic issues such as colour-fastness or uniformity. Sentence 1.5.1.1.(1) is intended to make it clear that, whereas referencing a document in the By-law generally has the effect of making the provisions of that document part of the By-law, provisions that are unrelated to buildings or to the objectives and functional statements attributed to the provisions in Division B where the document is referenced are excluded.

Furthermore, many documents referenced in the By-law contain references to other documents, which may also, in turn, refer to other documents. These secondary and tertiary referenced documents may contain provisions that are unrelated to buildings or to the objectives and functional statements of the By-law: such provisions—no matter how far down the chain of references they occur—are not included in the intent of Sentence 1.5.1.1.(1).

Part 2
Objectives

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law except for *existing buildings*. (See Article 1.1.1.1.)

2.1.1.2. Application of Objectives

(See Note A-2.2.1.1.(1).)

1) Except as provided in Sentences (2) to (6), the objectives described in this Part apply

a) to all *buildings* covered in this By-law (see Article 1.1.1.1.), and

b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

2) Objective OS4, Resistance to Unwanted Entry, applies only to *dwelling units* or commonly accessible facilities serving multifamily *buildings* and publicly accessible spaces. (See Article 1.3.3.3.)

3) Objective OH3, Noise Protection, applies only to *dwelling units*.

4) Objective OH5, Hazardous Substances Containment, applies only to the extent defined in

a) Book II (Plumbing Systems) of this By-law, and

b) the Fire By-law.

5) Objective OA, Accessibility (including Objectives OA1, Accessible Path of Travel, and OA2, Accessible Facilities), does not apply to

a) detached houses, semi-detached houses, houses with *ancillary residential units*, duplexes, triplexes, townhouses, *row housing* and boarding houses,

b) *buildings* of Group F, Division 1 major occupancy, and

c) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

6) Objective OE, Environment, applies only to

a) *buildings* of *residential occupancy* to which Part 9 of Division B applies,

b) buildings containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 of Division B applies whose combined total *floor area* does not exceed 300 m^2, and

c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

(See Note A-2.1.1.2.(6).) (See also Article 1.3.3.3.)

Section 2.2. Objectives

2.2.1. Objectives

2.2.1.1. Objectives

1) The objectives of this By-law are as follows (see Note A-2.2.1.1.(1)):

OS Safety

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury.

OS1 Fire Safety

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire. The risks of injury due to fire addressed in this By-law are those caused by—

OS1.1 – fire or explosion occurring

OS1.2 – fire or explosion impacting areas beyond its point of origin

OS1.3 – collapse of physical elements due to a fire or explosion

OS1.4 – fire safety systems failing to function as expected

OS1.5 – persons being delayed in or impeded from moving to a safe place during a fire emergency

OS2 Structural Safety

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to structural failure. The risks of injury due to structural failure addressed in this By-law are those caused by—

OS2.1 – loads bearing on the building elements that exceed their loadbearing capacity

OS2.2 – loads bearing on the building that exceed the loadbearing properties of the supporting medium

OS2.3 – damage to or deterioration of building elements

OS2.4 – vibration or deflection of building elements

OS2.5 – instability of the building or part thereof

OS2.6 – collapse of the excavation

OS3 Safety in Use

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards. The risks of injury due to hazards addressed in this By-law are those caused by—

OS3.1 – tripping, slipping, falling, contact, drowning or collision

OS3.2 – contact with hot surfaces or substances

OS3.3 – contact with energized equipment

OS3.4 – exposure to hazardous substances

OS3.5 – exposure to high levels of sound from fire alarm systems

OS3.6 – persons becoming trapped in confined spaces

OS3.7 – persons being delayed in or impeded from moving to a safe place during an emergency (see Note A-2.2.1.1.(1))

OS4 Resistance to Unwanted Entry

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in the building will be exposed to an unacceptable risk of injury due to the building's low level of resistance to unwanted entry (see Sentence 2.1.1.2.(2) for application limitation). The risks of injury due to unwanted entry addressed in this By-law are those caused by—

OS4.1 – intruders being able to force their way through locked doors or windows

OS4.2 – occupants being unable to identify potential intruders as such

OS4.3 – intruders being able to force their way through physical security feature

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OS5 Safety at Construction and Demolition Sites

An objective of this By-law is to limit the probability that, as a result of the construction or demolition of the building, the public adjacent to a construction or demolition site will be exposed to an unacceptable risk of injury due to hazards. The risks of injury due to construction and demolition hazards addressed in this By-law are those caused by—

OS5.1 – objects projected onto public ways

OS5.2 – vehicular accidents on public ways

OS5.3 – damage to or obstruction of public ways

OS5.4 – water accumulated in excavations

OS5.5 – entry into the site

OS5.6 – exposure to hazardous substances and activities

OS5.7 – loads bearing on a covered way that exceed its loadbearing capacity

OS5.8 – collapse of the excavation

OS5.9 – persons being delayed in or impeded from moving to a safe place during an emergency (see Note A-2.2.1.1.(1))

OH Health

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person will be exposed to an unacceptable risk of illness.

OH1 Indoor Conditions

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in the building will be exposed to an unacceptable risk of illness due to indoor conditions. The risks of illness due to indoor conditions addressed in this By-law are those caused by—

OH1.1 – inadequate indoor air quality

OH1.2 – inadequate thermal comfort

OH1.3 – contact with moisture

OH2 Sanitation

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in the building will be exposed to an unacceptable risk of illness due to unsanitary conditions. The risks of illness due to unsanitary conditions addressed in this By-law are those caused by—

OH2.1 – exposure to human or domestic waste

OH2.2 – consumption of contaminated water

OH2.3 – inadequate facilities for personal hygiene

OH2.4 – contact with contaminated surfaces

OH2.5 – contact with vermin and insects

OH3 Noise Protection

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in the building will be exposed to an unacceptable risk of illness due to high levels of sound originating in adjacent spaces in the building (see Sentence 2.1.1.2.(3) for application limitation). The risks of illness due to high levels of sound addressed in this By-law are those caused by—

OH3.1 – exposure to airborne sound transmitted through assemblies separating dwelling units from adjacent spaces in the building

OH4 Vibration and Deflection Limitation

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, a person in the building will be exposed to an unacceptable risk of illness due to high levels of vibration or deflection of building elements.

OH5 Hazardous Substances Containment

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, the public will be exposed to an unacceptable risk of illness due to the release of hazardous substances from the building (see Sentence 2.1.1.2.(4) for application limitation).

OA Accessibility

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, *persons with disabilities* will be unacceptably impeded from accessing or using the building or its facilities (see Sentence 2.1.1.2.(5) for application limitations).

OA1 Accessible Path of Travel

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, *persons with disabilities* will be unacceptably impeded from accessing the building or circulating within it (see Sentence 2.1.1.2.(5) for application limitations).

OA2 Accessible Facilities

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, *persons with disabilities* will be unacceptably impeded from using the building's facilities (see Sentence 2.1.1.2.(5) for application limitations).

OP Fire and Structural Protection of Buildings

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the building, the building or adjacent buildings will be exposed to an unacceptable risk of damage due to fire or structural insufficiency, or the building or part thereof will be exposed to an unacceptable risk of loss of use also due to structural insufficiency.

OP1 Fire Protection of the Building

An objective of this By-law is to limit the probability that, as a result of its design or construction, the building will be exposed to an unacceptable risk of damage due to fire. The risks of damage due to fire addressed in this By-law are those caused by—

OP1.1 – fire or explosion occurring

OP1.2 – fire or explosion impacting areas beyond its point of origin

OP1.3 – collapse of physical elements due to a fire or explosion

OP1.4 – fire safety systems failing to function as expected

OP2 Structural Sufficiency of the Building

An objective of this Code is to limit the probability that, as a result of its design or construction, the building or part thereof will be exposed to an unacceptable risk of damage or loss of use due to structural failure or lack of structural

serviceability. The risks of damage and of loss of use due to structural failure or lack of structural serviceability addressed in this Code are those caused by—

OP2.1 – loads bearing on the building elements that exceed their loadbearing capacity

OP2.2 – loads bearing on the building that exceed the loadbearing properties of the supporting medium

OP2.3 – damage to or deterioration of building elements

OP2.4 – vibration or deflection of building elements

OP2.5 – instability of the building or part thereof

OP2.6 – instability or movement of the supporting medium

OP3 Protection of Adjacent Buildings from Fire

An objective of this By-law is to limit the probability that, as a result of the design or construction of the building, adjacent buildings will be exposed to an unacceptable risk of damage due to fire. The risks of damage to adjacent buildings due to fire addressed in this By-law are those caused by—

OP3.1 – fire or explosion impacting areas beyond the building of origin

OP4 Protection of Adjacent Buildings from Structural Damage

An objective of this By-law is to limit the probability that, as a result of the design, construction or demolition of the building, adjacent buildings will be exposed to an unacceptable risk of structural damage. The risks of structural damage to adjacent buildings addressed in this By-law are those caused by—

OP4.1 – settlement of the medium supporting adjacent buildings

OP4.2 – collapse of the building or portion thereof onto adjacent buildings

OP4.3 – impact of the building on adjacent buildings

OP4.4 – collapse of the excavation

OE Environment

An objective of this By-law is to limit the probability that, as a result of the design, construction or renovation of the building or of the *plumbing system*, the environment will be affected in an unacceptable manner.

OE1 Energy Efficiency and Water Use

An objective of this By-law is to limit the probability that, as a result of the design, construction or renovation of the building, the use of energy will be inefficient or the use of water will be excessive. The risks of inefficient energy use or excessive water use addressed in this By-law are those caused by –

OE1.1 – inefficient energy performance of *buildings* or *building* components

OE2 Greenhouse Gases

An objective of this By-law is to limit the probability that, as a result of design and construction of the *building*, including the *building's* systems, and the energy consumed in the operation of those systems, the production of greenhouse gases will be excessive. The risks of excessive greenhouse gas emissions addressed in this By-law are those caused by-

OE2.1 – excessive emissions as a result of the design and construction of the *building*, including the *building's* systems, and the energy consumed in the operation of those systems

OE2.2 – excessive greenhouse gas emissions associated with building materials and construction processes throughout the lifecycle of a *building*, except emissions from building energy use. These include emissions from extraction, manufacture, transportation, construction, replacement, refurbishment, demolition, removal, and other processes.

Notes to Part 2
Objectives

A-2.1.1.2.(6) Application of Environment Objective. Objective OE, Environment (including its sub-objectives), is attributed to the requirements in Section 9.36. of Division B, which address energy efficiency for small residential buildings and certain small non-residential and mixed-use buildings (see Article 9.36.1.3. of Division B). The objectives, functional statements and energy efficiency requirements for larger Part 9 residential buildings as well as for non-residential buildings whose combined total floor area exceeds 300 m^2 and some mixed-use buildings are addressed in the National Energy Code for Buildings.

A-2.2.1.1.(1) Objectives.

Listing of objectives

Any gaps in the numbering sequence of the objectives are due to the fact that there is a master list of objectives covering the principal Code Documents — but not all objectives are pertinent to all Codes.

The building

Where the term "the building" is used in the wording of the objectives, it refers to the building for which compliance with the Building By-law is being assessed.

Emergency

The term "emergency"—in the context of safety in buildings—is often equated to the term "fire emergency;" however, the wording of objectives OS3.7 and OS5.9 makes it clear that the By-law addresses any type of emergency that would require the rapid evacuation of the building, such as a bomb threat or the presence of intruders.

Fire Safety

In the definition of Objective OS1, Fire Safety, the term "person" refers to any individual in or adjacent to the building, including the occupants, the public, and emergency responders including firefighters when performing their duties.

Certain technical requirements in the By-law are intended to address the safety of emergency responders, including firefighters, when performing their duties.

Part 3
Functional Statements

Section 3.1. Application

3.1.1. Application

3.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1.)

3.1.1.2. Application of Functional Statements

1) Except as provided in Sentences (2) to (4), the functional statements described in this Part apply

a) to all *buildings* covered in this By-law (see Article 1.1.1.1.), and

b) only to the extent that they relate to compliance with this By-law as required in Article 1.2.1.1.

2) Functional Statement F56 applies only to *dwelling units*.

3) Functional Statements F73 and F74 do not apply to

a) detached houses, semi-detached houses, houses with *ancillary residential units*, duplexes, triplexes, townhouses, *row housing* and boarding houses,

b) buildings of Group F, Division 1 major occupancy, and

c) buildings that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

4) Functional Statement F75 applies only to *adaptable dwelling units*.

Section 3.2. Functional Statements

3.2.1. Functional Statements

3.2.1.1. Functional Statements

1) The objectives of this By-law are achieved by measures, such as those described in the acceptable solutions in Division B, that are intended to allow the building or its elements to perform the following functions (see Note A-3.2.1.1.(1)):

F01 To minimize the risk of accidental ignition.

F02 To limit the severity and effects of fire or explosions.

F03 To retard the effects of fire on areas beyond its point of origin.

F04 To retard failure or collapse due to the effects of fire.

F05 To retard the effects of fire on emergency egress facilities.

F06 To retard the effects of fire on facilities for notification, suppression and emergency response.

F10 To facilitate the timely movement of persons to a safe place in an emergency.

F11 To notify persons, in a timely manner, of the need to take action in an emergency.

F12 To facilitate emergency response.

F13 To notify emergency responders, in a timely manner, of the need to take action in an emergency.

F20 To support and withstand expected loads and forces.

F21 To limit or accommodate dimensional change.

F22 To limit movement under expected loads and forces.

F23 To maintain equipment in place during structural movement.

F30 To minimize the risk of injury to persons as a result of tripping, slipping, falling, contact, assault, drowning or collision.

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F31 To minimize the risk of injury to persons as a result of contact with hot surfaces or substances.

F32 To minimize the risk of injury to persons as a result of contact with energized equipment.

F33 To limit the level of sound of a fire alarm system.

F34 To resist or discourage unwanted access or entry.

F35 To facilitate the identification of potential intruders.

F36 To minimize the risk that persons will be trapped in confined spaces.

F40 To limit the level of contaminants.

F41 To minimize the risk of generation of contaminants.

F42 To resist the entry of vermin and insects.

F43 To minimize the risk of release of hazardous substances.

F44 To limit the spread of hazardous substances beyond their point of release.

F46 To minimize the risk of contamination of potable water.

F50 To provide air suitable for breathing.

F51 To maintain appropriate air and surface temperatures.

F52 To maintain appropriate relative humidity.

F53 To maintain appropriate indoor/outdoor air pressure differences.

F54 To limit drafts.

F55 To resist the transfer of air through environmental separators.

F56 To limit the transmission of airborne sound into a dwelling unit from spaces elsewhere in the building (see Sentence 3.1.1.2.(2) for application limitation).

F60 To control the accumulation and pressure of water on and in the ground.

F61 To resist the ingress of precipitation, water or moisture from the exterior or from the ground.

F62 To facilitate the dissipation of water and moisture from the building.

F63 To limit moisture condensation.

F70 To provide potable water.

F71 To provide facilities for personal hygiene.

F72 To provide facilities for the sanitary disposal of human and domestic wastes.

F73 To facilitate *access* to and circulation in the building and its facilities by *persons with disabilities* (see Sentence 3.1.1.2.(3) for application limitation).

F74 To facilitate the use of the building's facilities by *persons with disabilities* (see Sentence 3.1.1.2.(3) for application limitation).

F75 To minimize obstacles for future modification to provide *access* (see Sentence 3.1.1.2.(4) for application limitation).

F80 To resist deterioration resulting from expected service conditions.

F81 To minimize the risk of malfunction, interference, damage, tampering, lack of use or misuse.

F82 To minimize the risk of inadequate performance due to improper maintenance or lack of maintenance.

F90 To limit the amount of uncontrolled air leakage through the building envelope.

F91 To limit the amount of uncontrolled air leakage through system components.

F92 To limit the amount of uncontrolled thermal transfer through the building envelope.

F93 To limit the amount of uncontrolled thermal transfer through system components.

F95 To limit the unnecessary demand and/or consumption of energy for heating and cooling.

F96 To limit the unnecessary demand and/or consumption of energy for service water heating.

F98 To limit the inefficiency of equipment.

F99 To limit the inefficiency of systems.

F100 To limit the unnecessary rejection of reusable waste energy.

F101 To limit excessive emission of greenhouse gases into the environment.

Notes to Part 3
Functional Statements

A-3.2.1.1.(1) Listing of Functional Statements. The numbered functional statements are grouped according to functions that deal with closely related subjects. For example, the first group deals with fire risks, the second group deals with emergency egress and response, etc. There may be gaps in the numbering sequence for the following reasons:

- Each group has unused numbers which allows for the possible future creation of additional functional statements within any one group.
- There is a master list of functional statements covering the principal Code Documents—the British Columbia Building Code Book I: General, British Columbia Building Code Book II: Plumbing Systems, and the British Columbia Fire Code—but not all functional statements are pertinent to all Codes.

BOOK I (GENERAL) - DIVISION B

Part 1
General

Section 1.1. General

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)

2) When an *existing building* is altered and the *alteration* triggers upgrading as determined by this By-law, alternative provisions in Part 11 of Division B may be used instead of the requirements of this Part. (See Article1.1.1.2. of Division A.)

1.1.2. Objectives and Functional Statements

1.1.2.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements identified in Sections 2.5., 3.10., 4.5., 5.10., 6.10., 7.2., 8.3., 9.38, and 10.5. (See Note A-1.1.2.1.(1).)

1.1.3. Climatic and Seismic Data

1.1.3.1. Climatic and Seismic Values

1) Except as provided in Sentences (2) and (4) and as required by Sentence 9.7.4.3.(2), the climatic and seismic values required for the design of *buildings* under this By-law shall be in conformance with the values established by the *Chief Building Official*.

2) Where they have not been established by the *Chief Building Official*, the climatic values required for the design of *buildings* shall be in conformance with Sentence (3) and the values listed in Appendix C. (See Note A-1.1.3.1.(2).)

3) The outside winter design temperatures determined from Appendix C shall be those listed for the January 2.5% values. (See Note A-1.1.3.1.(3).)

4) Where they have not been established by the *Chief Building Official*, the seismic values required for the design of *buildings* under Part 4 and Part 9 shall be in conformance with Appendix C. (See Note A-1.1.3.1.(4).)

5) The outside summer design temperatures determined from Appendix C shall be those listed for the July 2.5% dry values.

1.1.3.2. Depth of Frost Penetration

1) Depth of frost penetration shall be no less than 450 mm.

1.1.4. Fire Safety Plan

1.1.4.1. Fire Safety Plan

1) Where a fire safety plan is required, it shall conform to Section 2.8. of Division B of the Fire By-law.

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division B that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division B, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division B, they shall be the provisions stated in Parts 3 to 10, and 12.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division B shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division B shall have the meanings assigned to them in Article 1.4.2.1. of Division A and Article 1.3.2.1.

Section 1.3. Referenced Documents and Organizations

1.3.1. Referenced Documents

1.3.1.1. Effective Date

1) Unless otherwise specified herein, the documents referenced in this By-law shall include all amendments, revisions, reaffirmations, reapprovals, addenda and supplements effective to April 15, 2025.

1.3.1.2. Applicable Editions

1) Where documents are referenced in this By-law, they shall be the editions designated in Table 1.3.1.2.

Table 1.3.1.2.
Documents Referenced in Book I (General) of the Building By-law(1)(2)
Forming Part of Sentence 1.3.1.2.(1)

Issuing Agency	Document Number(3)	Title of Document	Code Reference
AAMA	501-05	Methods of Test for Exterior Walls	A-5.9.3.
AAMA	501.1-05	Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure	A-5.9.3.
AAMA	501.2-09	Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems	A-5.9.3.

AAMA	501.4-09	Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drifts	A-5.9.3.
AAMA	501.5-07	Test Method for Thermal Cycling of Exterior Walls	A-5.9.3. A-5.9.3.3.(1)
AAMA	501.6-09	Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System	A-4.1.8.18.(14) and (15) A-5.9.3.
AAMA	1304-02	Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems	9.7.5.2.(2)
ACGIH	28th Edition	Industrial Ventilation: A Manual of Recommended Practice for Design	6.2.1.1.(1) 6.3.2.14.(2) A-6.3.1.5.
ACI	355.2-19	Qualification of Post-Installed Mechanical Anchors in Concrete (ACI 355.2-19) and Commentary	4.1.8.18.(7)
ACI	355.4M-19	Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4M-19) and Commentary	4.1.8.18.(7)
AISI	S201-12	North American Standard for Cold-Formed Steel Framing - Product Data 2012 Edition	9.24.1.2.(1)
ANSI	A135.6-2012	Engineered Wood Siding	Table 5.9.1.1. 9.27.9.1.(1)
ANSI	A208.1-2009	Particleboard	9.23.15.2.(3) 9.29.9.1.(1) 9.30.2.2.(1)
ANSI/APA	PRG 320-2018	Standard for Performance-Rated Cross-Laminated Timber	3.1.18.3.(3)
ANSI/ASHRAE	52.2-2017	Method of Testing General Ventilation Air-Cleaning Devices	6.3.2.14.(1)
ANSI/ASHRAE	55-2010	Thermal Environment Conditions for Human Occupancy	6.6.2.1.(1)
ANSI/ASHRAE	188-2018	Legionellosis: Risk Management for Building Water Systems	A-6.2.1.1.
ANSI/CSA	ANSI Z21.10.3-2017/CSA 4.3-2017	Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous	10.2.2.12.(1)(d)
ANSI/CSA	ANSI Z83.8-2016/CSA 2.6-2016	Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces	10.2.2.14.(1)

APA	ANSI/APA PRG 320-2018	Standard for Performance-Rated Cross-Laminated Timber	3.1.6.3.(3)	
ASCE	ASCE/SEI (7-10)	Minimum Design Loads for Buildings and Other Structures	A-4.1.8.18.(14) and (15) A-9.4.2.1. and 9.4.2.2.	
ASCE	ASCE/SEI (8-02)	Specification for the Design of Cold-Formed Stainless Steel Structural Members	A-4.3.4.2.(1)	
ASCE	ASCE/SEI (49-12)	Wind Tunnel Testing for Buildings and Other Structures	4.1.7.14.(1)	
ASHRAE	1997	ASHRAE Handbook – Fundamentals	A-9.32.3.11.	
ASHRAE	2011	ASHRAE Handbook – HVAC Applications	A-2.4.2.1.(1)	
ASHRAE	Guideline 12-2023	Minimizing the Risk of Legionellosis Associated with Building Water Systems	6.2.1.1.(1) 6.3.2.15.(9) 6.3.2.16.(1)	
ASHRAE	ANSI/ASHRAE 62-2001 (except addendum n)	Ventilation for Acceptable Indoor Air Quality (except Addendum n)	6.3.1.1.(2) 6.3.1.1.(3) 10.2.2.3.(1) A-9.25.5.2.	
ASHRAE	ANSI/ASHRAE 62.1-2016	Ventilation for Acceptable Indoor Air Quality	6.3.2.2.(1)	#14688
ASHRAE	ANSI/ASHRAE/IES 90.1-2019[9]	Energy Standard for Buildings Except Low-Rise Residential Buildings	10.2.2.1.(1) A-10.2.2.2.	#14688
ASHRAE	ANSI/ASHRAE 188-2015	Legionellosis: Risk Management for Building Water Systems	A-6.2.1.1.	
ASME	B18.6.1-1981	Wood Screws (Inch Series)	Table 5.9.1.1. 9.23.3.1.(3) A-9.23.3.1.(3)	
ASME/CSA	ASME A17.1-2016/CSA B44-16	Safety Code for Elevators and Escalators	3.2.6.7.(2) 3.5.2.1.(1) 3.5.2.1.(2) 3.5.2.1.(3) 3.5.4.1.(2) 3.5.4.2.(1) 3.8.3.7.(1) A-3.5.2.1.(1) Table 4.1.5.11. Table 4.1.8.18.	
ASSE/ IAPMO/ANSI	12080-2020	Professional Qualifications Standard for Legionella Water Safety and Management Personnel	A-1.6.9.4.(1) of Division C	
ASTM	A123/A123M-17	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	Table 5.9.1.1. Table 9.20.16.1.	

ASTM	A153/A153M-16a	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware	Table 5.9.1.1. Table 9.20.16.1. 9.23.2.4.(2)
ASTM	A252-10	Standard Specification for Welded and Seamless Steel Pipe Piles	4.2.3.8.(1)
ASTM	A283/A283M-18	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	4.2.3.8.(1)
ASTM	A390-06	Standard Specification for Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)	Table 9.10.3.1.-B
ASTM	A653/A653M-18	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process	Table 5.9.1.1. 9.3.3.2.(1) 9.23.2.4.(1)
ASTM	A792/A792M-10	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process	9.3.3.2.(1)
ASTM	A1008/A1008M-18	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable	4.2.3.8.(1)
ASTM	A1011/A1011M-18a	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength	4.2.3.8.(1)
ASTM	C4-04	Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C27-98	Standard Classification of Fireclay and High-Alumina Refractory Brick	9.21.3.4.(1)
ASTM	C73-17	Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C126-13	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C212-17	Standard Specification for Structural Clay Facing Tile	Table 5.9.1.1. 9.20.2.1.(1)
ASTM	C260/C260M-10a	Standard Specification for Air-Entraining Admixtures for Concrete	9.3.1.8.(1)

ASTM	C411-19	Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation	3.6.5.4.(4) 3.6.5.5.(1) 9.33.6.4.(4) 9.33.8.2.(2)
ASTM	C412M-15	Standard Specification for Concrete Drain Tile	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C444M-17	Standard Specification for Perforated Concrete Pipe	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C494/C494M-17	Standard Specification for Chemical Admixtures for Concrete	9.3.1.8.(1)
ASTM	C516-08e1	Standard Specification for Vermiculite Loose Fill Thermal Insulation	A-9.25.2.4.(5)
ASTM	C553-13	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications	Table 5.9.1.1.
ASTM	C612-14	Standard Specification for Mineral Fiber Block and Board Thermal Insulation	Table 5.9.1.1.
ASTM	C700-18	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	Table 5.9.1.1. 9.14.3.1.(1)
ASTM	C726-17	Standard Specification for Mineral Wool Roof Insulation Board	Table 5.9.1.1. 9.25.2.2.(1)
ASTM	C754-18	Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products	Table A-9.11.1.4.-A Table A-9.11.1.4.-B Table A-9.11.1.4.-C Table A-9.11.1.4.-D
ASTM	C834-17	Standard Specification for Latex Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C840-18b	Standard Specification for Application and Finishing of Gypsum Board	3.1.6.6.(2) Table 5.9.1.1. 9.29.5.1.(3) A-9.29.5.1.(3)
ASTM	C920-18	Standard Specification for Elastomeric Joint Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C954-18	Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness	9.24.1.4.(1)
ASTM	C991-16	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings	Table 5.9.1.1.

ASTM	C1002-07	Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	Table 5.9.1.1. 9.24.1.4.(1) 9.29.5.7.(1)
ASTM	C1055-03	Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries	A-6.5.1.1.(3)
ASTM	C1177/C1177M-17	Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. Table 9.23.17.2.-A A-9.27.14.2.(2)(a)
ASTM	C1178/C1178M-18	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel	3.1.5.14.(6) 3.1.5.15.(4) Table 5.9.1.1. 9.29.5.2.(1)
ASTM	C1184-18e1	Standard Specification for Structural Silicone Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C1193-16	Standard Specification for Use of Joint Sealants	A-Table 5.9.1.1. A-9.27.4.2.(1)
ASTM	C1280-13	Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing	Table 5.9.1.1.
ASTM	C1299-03	Standard Guide for Use in Selection of Liquid-Applied Sealants	A-9.27.4.2.(1)
ASTM	C1311-14	Standard Specification for Solvent Release Sealants	Table 5.9.1.1. 9.27.4.2.(2)
ASTM	C1330-18	Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants	Table 5.9.1.1. 9.27.4.2.(3)
ASTM	C1363-11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	A-5.9.4.1.(1)
ASTM	C1396/C1396M-17	Standard Specification for Gypsum Board	3.1.5.14.(6) 3.1.5.15.(4) 3.1.6.6.(2) 3.1.6.15.(1) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1) Table 9.29.5.3.
ASTM	C1472-16	Standard Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width	A-Table 5.9.1.1. A-9.27.4.2.(1)

ASTM	C1658/C1658M-18	Standard Specification for Glass Mat Gypsum Panels	3.1.5.14.(6) Table 5.9.1.1.
ASTM	D323-15a	Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)	1.4.1.2.(1)(4)
ASTM	D1037-12	Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials	A-9.23.15.2.(4)
ASTM	D1143/D1143M-07	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load	A-4.2.7.2.(2)
ASTM	D1227/D1227M-13	Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing	Table 5.9.1.1. 9.13.2.2.(2) 9.13.3.2.(2)
ASTM	D1761-12	Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials	A-9.27.5.4.(2)
ASTM	D2178/D2178M-13a	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	Table 5.9.1.1.
ASTM	D2898-10	Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	3.1.4.8.(3) 3.1.5.5.(3) 3.1.5.24.(1) 3.1.6.9.(6) 3.2.3.7.(4) 9.10.14.5.(3) 9.10.15.5.(3)
ASTM	D3019/D3019M-17	Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D3679-17	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	9.27.12.1.(1)
ASTM	D4477-16	Standard Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit	9.27.12.1.(3)
ASTM	D4479/D4479M-07e1	Standard Specification for Asphalt Roof Coatings – Asbestos-Free	Table 5.9.1.1. 9.13.2.2.(2) 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D4637/D4637M-15	Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D4811/D4811M-16	Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B

ASTM	D5456-19	Standard Specification for Evaluation of Structural Composite Lumber Products	3.1.11.7.(5)
ASTM	D6878/D6878M-11a	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing	Table 5.9.1.1. 9.13.3.2.(2) Table 9.26.2.1.-B
ASTM	D7254-17	Standard Specification for Polypropylene (PP) Siding	9.27.13.1.(1)
ASTM	D7793-17	Standard Specification for Insulated Vinyl Siding	9.27.12.1.(2)
ASTM	D8052/D8052M-17	Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies	A-5.4.1.2.(1)
ASTM	E90-09	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	5.8.1.2.(1) 5.8.1.4.(1) 9.11.1.2.(1)
ASTM	E96/E96M-16	Standard Test Methods for Water Vapor Transmission of Materials	5.5.1.2.(3) 9.13.2.2.(2) 9.25.4.2.(1) 9.25.4.2.(2) 9.25.5.1.(1) 9.30.1.2.(1)
ASTM	E283-04	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen	5.9.3.4.(2) A-5.9.3.4.(2)
ASTM	E330/E330M-14	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference	A-5.9.3.2.(1)
ASTM	E331-00	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference	5.9.3.5.(2) A-5.9.3.5.(2)
ASTM	E336-11	Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings	5.8.1.2.(2) 5.8.1.4.(7) 9.11.1.2.(2) A-9.11.
ASTM	E413-16	Classification for Rating Sound Insulation	A-1.4.1.2.(1)(4) 5.8.1.2.(1) 5.8.1.2.(2) 5.8.1.4.(7) 5.8.1.5.(3)

			9.11.1.2.(1) 9.11.1.2.(2)
ASTM	E492-09e1	Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	A-9.11.
ASTM	E547-00	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference	5.9.3.5.(2) A-5.9.3.5.(2)
ASTM	E597-95	Practice for Determining a Single Number Rating of Airborne Sound Insulation for Use in Multi-Unit Building Specifications	A-9.11.
ASTM	E736/E736M-17	Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members	Table 9.10.3.1.-B
ASTM	E779-10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	10.2.3.5.(1)
ASTM	E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors	A-5.4.1.2.(2) A-5.9.2.3.(1) A-5.9.3.4.(2)
ASTM	E1007-19	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures	A-9.11.
ASTM	E1105-15	Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference	A-5.9.2.3.(1) A-5.9.3.5.(2)
ASTM	E1186-17	Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems	A-5.4.1.2.(2)
ASTM	E1300-16	Standard Practice for Determining Load Resistance of Glass in Buildings	4.3.6.1.(1) 9.6.1.3.(1)
ASTM	E2190-19	Standard Specification for Insulating Glass Unit Performance and Evaluation	Table 5.9.1.1. 9.6.1.2.(1)

ASTM	E2307-15b	Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus	3.1.8.3.(4) A-3.1.8.3.(2) 9.10.9.2.(4)
ASTM	E2357-18	Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies	A-5.4.1.1.(3)
ASTM	E 2397/E 2397M19	Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems	5.6.1.2.(2) Table 5.9.1.1.
ASTM	E3158-18	Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building	10.2.2.21.(1) 10.2.3.5.(1)
ASTM	F476-14	Standard Test Methods for Security of Swinging Door Assemblies	9.7.5.2.(2) A-9.7.5.2.(2)
ASTM	F842-01 or 04	Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact	9.7.5.1.(3)
ASTM	F1667-18a	Standard Specification for Driven Fasteners: Nails, Spikes, and Staples	9.23.3.1.(1) 9.26.2.3.(1) 9.29.5.6.(1)
ASTM	F2090-17	Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms	A-9.8.8.1.(4)
ASTM	G115-10	Standard Guide for Measuring and Reporting Friction Coefficients	4.1.8.18.(18)
BC	2023	British Columbia Fire Code	1.1.1.1.(1)(4) A-1.1.1.2.(1)(4) 1.1.4.1.(1) 1.4.1.2.(1)(4) 2.1.1.2.(4)(4) A-2.2.1.1.(1)(4) A-3.2.1.1.(1)(4) 3.1.13.1.(1) 3.2.3.21.(1) 3.2.5.16.(1) 3.3.1.2.(1) 3.3.1.10.(1) 3.3.2.3.(1) 3.3.2.16.(1) 3.3.4.3.(4) 3.3.5.2.(1) 3.3.6.1.(1) 3.3.6.3.(1) 3.3.6.3.(2) 3.3.6.4.(1)

			3.3.6.4.(2) 3.3.6.6.(1) 3.7.3.1.(1) A-3.1.2.3.(1) A-3.2.4.6.(2) A-3.2.6. A-3.2.7.8.(3) A-3.3. A-3.3.1.7.(1) A-3.3.3.1.(1) A-3.3.6.1.(1) A-3.9.3.1.(1) 6.3.4.2.(3) 6.3.4.3.(1) 6.3.4.4.(1) 6.9.1.2.(1) 8.1.1.1.(3) 8.1.1.3.(1) 9.10.20.4.(1) 9.10.21.8.(1)
BC	2023	Book II (Plumbing Systems) of the British Columbia Building Code	1.1.2.1.(1)[4] 2.1.1.2.(4)[4] A-2.2.1.1.(1)[4] A-3.2.1.1.(1)[4] A-4.1.6.4.(3) 5.6.2.2.(2) 6.3.2.15.(8) 6.3.2.15.(10) 6.3.2.16.(6) 7.1.2.1.(1) 7.1.2.1.(2) 7.1.2.1.(3) 7.1.2.1.(4) 9.31.6.2.(1) Appendix C
BC	R.S.B.C. 1996 c.293	Mines Act	1.4.1.2.(1)[4]
BC	R.S.B.C. 2018 c.47	Professional Governance Act	1.4.1.2.(1)[4]
BC	S.B.C. 1998 c.43	Strata Property Act	A-9.37.1.1.
BC	S.B.C. 2003 c.39	Safety Standards Act	3.2.6.7.(2) 3.3.6.2.(4) 3.5.2.1.(1) 3.5.2.1.(2) 3.5.4.1.(2) 3.6.1.2.(1) 3.6.2.1.(6) 3.6.2.7.(1) 6.2.1.5.(1) 6.2.1.5.(2) 9.10.22.1.(1) 9.31.6.2.(2) 9.33.5.2.(1) 9.34.1.1.(1) A-3.5.2.1.(1)

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BC	S.B.C. 2015	Building Act	2.2.1.1.(1)(4)
BC	S.B.C. 2007 c.42	Climate Change Accountability Act	9.37.1.2.(2) 10.3.1.2.(1)
BNQ	BNQ 3624-115/2016	Polyethylene (PE) Pipe and Fittings for Soil and Foundation Drainage	Table 5.9.1.1. 9.14.3.1.(1)
CCBFC	NRCC 35951	Guidelines for Application of Part 3 of the National Building Code of Canada to Existing Buildings	A-1.1.1.1.(1)(4)
CCBFC	NRCC 38732	National Farm Building Code of Canada 1995	1.1.1.1.(3)(4) A-5.1.2.1.(1)
CCBFC	NRCC 40383	User's Guide – NBC 1995, Fire Protection, Occupant Safety and Accessibility (Part 3)	A-1.1.1.1.(1)(4)
CCBFC	NRCC 43963	User's Guide – NBC 1995, Application of Part 9 to Existing Buildings	A-1.1.1.1.(1)(4)
CCBFC	NRCC 56190	National Building Code of Canada 2015	A-4.1.8.4.(3) Appendix C
CCBFC	NRCC-CONST-56436E	National Plumbing Code of Canada 2020	7.1.2.1.(1)
CCBFC	NRCC-CONST-56438E	National Energy Code of Canada for Buildings 2020	A-3.2.1.1.(1)(4) A-5.4.1. A-2.2.8.1.(1)(5) 10.2.2.1.(1) 10.2.2.2.(2) 10.2.2.2.(3) 10.2.2.2.(4) Table 10.2.3.3.-A Table 10.2.3.3.-B 10.2.3.4.(1) 10.2.3.4.(4) A-10.2.2.2. A-10.2.3.3.(2) A-10.2.3.4.
CCBFC	NRCC-CONST-56529E	Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)	A-1.1.1.1.(1)(4) A-4.1.1.3.(1) A-4.1.1.3.(2) A-4.1.2.1. A-4.1.2.1.(1) A-Table 4.1.2.1. A-4.1.3. A-4.1.3.2.(2) A-4.1.3.2.(4) A-4.1.3.2.(5) A-4.1.3.3.(2)

			A-4.1.3.4.(1) A-Table 4.1.3.4. A-4.1.3.5.(1) A-4.1.3.5.(3) A-4.1.3.6.(1) A-4.1.3.6.(2) A-4.1.3.6.(3) A-4.1.3.6.(4) A-4.1.5.5. A-4.1.5.8. A-4.1.5.17. A-4.1.6.1.(1) A-4.1.6.2. A-4.1.6.3.(2) A-4.1.6.4.(1)
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			A-4.1.8.16.(7) A-4.1.8.16.(8)(a) A-4.1.8.16.(10) A-4.1.8.17.(1) A-4.1.8.18. A-4.1.8.18.(7)(e) A-4.1.8.18.(13) and 4.4.3.1.(1) A-4.1.8.18.(14) and (15) A-4.1.8.18.(16) A-4.1.8.19.(3)(a) A-4.1.8.19.(4) and 4.1.8.21.(5) A-4.1.8.21.(4)(a) A-4.2.4.1.(3) A-4.2.4.1.(5) A-4.2.5.1.(1) A-4.2.6.1.(1) A-4.2.7.2.(1) A-4.3.6.1.(1) A-4.4.2.1.(1) A-5.1.4.2. A-5.2.2.2.(4) Table C-3
CGSB	CAN/CGSB-1.501-M89	Method for Permeance of Coated Wallboard	5.5.1.2.(2) 9.25.4.2.(7)
CGSB	CAN/CGSB-7.2-94	Adjustable Steel Columns	9.17.3.4.(1) A-9.17.3.4.
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EGBC	Version 1.1	Professional Practice Guidelines – Retaining Wall Design	A-9.14.5.3.(2)
EPA	625/R-92/016 (1994)	Radon Prevention in the Design and Construction of Schools and Other Large Buildings	A-5.4.1.1. 6.2.1.1.(1)
FEMA	450-1-2003	NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures	A-4.1.8.18.(14) and (15)
FEMA	P-750-2009	NEHRP Recommended Seismic Provisions for New Buildings and Other Structures	A-4.1.8.18.(14) and (15)
FLL	2008	Guidelines for the Planning, Construction and Maintenance of Green Roofing	A-5.6.1.2.(2)
FM Approvals	2008	Approval Standard for Quick Response Storage Sprinklers for Fire Protection	A-3.2.5.12.(10)
FPI	Project 43-10C-024 (1988)	Deflection Serviceability Criteria for Residential Floors	A-9.23.4.2.(2)
HC	2004	Fungal Contamination in Public Buildings: Health Effects and Investigation Methods	A-5.5.1.1.
HC	2007	Radon: A Guide for Canadian Homeowners	A-5.4.1.1. A-6.2.1.1. A-9.13.4.3.
HC	2008	Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)	A-5.4.1.1. A-6.2.1.1.
HC	2008	Guide for Radon Measurements in Residential Dwellings (Homes)	A-9.13.4.3.
HC	H46-2/90-156E	Exposure Guidelines for Residential Indoor Air Quality	A-6.3.1.5. A-9.25.5.2.
HC	R.S.C. 1985, c. H-3	Hazardous Products Act	A-1.4.1.2.(1)(4) A-9.25.2.2.(2)
HC	WHMIS 1988	Workplace Hazardous Materials Information System (WHMIS)	A-1.4.1.2.(1)(4) A-3.3.1.2.(1)
HC	SOR/2015-17	Hazardous Products Regulations	1.4.1.2.(1)(4) A-3.3.1.2.(1)

HPVA	ANSI/HPVA HP-1-2009	American National Standard for Hardwood and Decorative Plywood	Table 5.9.1.1. 9.27.8.1.(1) 9.30.2.2.(1)
HRAI	2017 Edition	HRAI Digest	6.2.1.1.(1) 9.32.2.3.(4) 9.32.3.2.(1) 9.33.4.1.(1)
HVI	HVI Publication 915-2013	Loudness Testing and Rating Procedure	9.32.3.10.(2) Table 9.32.3.10.-B
HVI	HVI Publication 916-2013	Airflow Test Procedure	9.32.3.10.(1)
IEC	60268-16:2011	Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index	A-3.2.4.22.(1)(b)
ISO	3864-1:2011	Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings	3.4.5.1.(2) 9.9.11.3.(2)
ISO	7010:2011	Graphical symbols – Safety colours and safety signs – Registered safety signs	3.4.5.1.(2) A-3.4.5.1.(2)(c) 9.9.11.3.(2)
ISO	7240-19:2007	Fire detection and alarm systems – Part 19: Design, installation, commissioning and service of sound systems for emergency purposes	A-3.2.4.22.(1)(b)
ISO	7731:2003	Ergonomics – Danger signals for public and work areas – Auditory danger signals	A-3.2.4.22.(1)(b)
ISO	8201:1987	Acoustics – Audible emergency evacuation signal	3.2.4.18.(2) A-3.2.4.18.(2)
ISO	10848-1:2006	Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document	5.8.1.4.(2) 5.8.1.4.(3) 5.8.1.5.(2) 5.8.1.5.(3)
ISO	15712-1:2005	Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 1: Airborne sound insulation between rooms	5.8.1.4.(1) 5.8.1.4.(2) 5.8.1.4.(4) 5.8.1.4.(5) 5.8.1.4.(6) 5.8.1.5.(1) 5.8.1.5.(2) 5.8.1.5.(5) 5.8.1.5.(6)
NEMA	SB 50:2008	Emergency Communications Audio Intelligibility Applications Guide	A-3.2.4.22.(1)(b)

NFPA	2010 Edition	Fire Protection Guide to Hazardous Materials	A-6.9.1.2.(1)
NFPA	2008	Fire Protection Handbook, Twentieth Edition	A-3.2.2.2.(1) A-3.6.2.7.(5)
NFPA	13-2019[6]	Standard for the Installation of Sprinkler Systems	3.1.9.1.(4) 3.2.4.8.(2) 3.2.4.15.(1) 3.2.5.12.(1) 3.2.5.12.(9) 3.2.8.2.(5) 3.2.8.3.(2) 3.3.2.14.(3) A-3.1.11.5.(3) and (4) A-3.2.4.9.(3)(f) A-3.2.5.12.(1) A-3.2.5.12.(6) A-3.2.5.13.(1) A-3.2.8.2.(3) 9.10.9.9.(4)
NFPA	13D-2016	Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	3.2.4.1.(2) 3.2.5.12.(3) 3.2.7.9.(4) A-3.2.5.12.(2) A-3.2.5.12.(6) A-3.2.5.13.(1) 9.10.2.2.(2) 9.10.18.2.(3)
NFPA	13R-2019[7]	Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies	3.2.5.12.(2) A-3.2.5.12.(2) A-3.2.5.12.(6) A-3.2.5.13.(1)
NFPA	14-2013	Standard for the Installation of Standpipe and Hose Systems	3.2.5.9.(1) 3.2.5.10.(1)
NFPA	20-2016	Standard for the Installation of Stationary Pumps for Fire Protection	3.2.4.9.(4) 3.2.5.18.(1) A-3.2.4.9.(3)(f)
NFPA	30-2018	Flammable and Combustible Liquids Code	A-6.9.1.2.(1)
NFPA	30A-2018	Code for Motor Fuel Dispensing Facilities and Repair Garages	A-6.9.1.2.(1)
NFPA	32-2016	Standard for Drycleaning Facilities	A-6.9.1.2.(1)
NFPA	33-2018	Standard for Spray Application Using Flammable or Combustible Materials	A-6.9.1.2.(1)
NFPA	34-2018	Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids	A-6.9.1.2.(1)
NFPA	35-2016	Standard for Manufacture of Organic Coatings	A-6.9.1.2.(1)

NFPA	36-2017	Standard for Solvent Extraction Plants	A-6.9.1.2.(1)
NFPA	40-2019	Standard for the Storage and Handling of Cellulose Nitrate Film	A-6.9.1.2.(1)
NFPA	51-2018	Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes	A-6.9.1.2.(1)
NFPA	51A-2012	Standard for Acetylene Cylinder Charging Plants	A-6.9.1.2.(1)
NFPA	55-2020	Compressed Gases and Cryogenic Fluids Code	A-6.9.1.2.(1)
NFPA	61-2017	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities	A-6.9.1.2.(1)
NFPA	68-2013	Standard on Explosion Protection by Deflagration Venting	3.3.6.4.(2) A-3.6.2.7.(5) A-6.9.1.2.(1)
NFPA	69-2014	Standard on Explosion Prevention Systems	A-3.6.2.7.(5) A-6.9.1.2.(1)
NFPA	72-2019	National Fire Alarm and Signaling Code	A-3.2.4.22.(1)(b)
NFPA	80-2013	Standard for Fire Doors and Other Opening Protectives	3.1.8.5.(2) 3.1.8.12.(2) 3.1.8.16.(1) 3.1.9.1.(5) A-3.1.8.1.(2) A-3.2.8.2.(3) 9.10.9.9.(5) 9.10.13.1.(1)
NFPA	80A-2012	Recommended Practice for Protection of Buildings from Exterior Fire Exposures	A-3
NFPA	82-2014	Standard on Incinerators and Waste and Linen Handling Systems and Equipment	6.2.2.1.(1) 9.10.10.5.(2)
NFPA	85-2019	Boiler and Combustion Systems Hazards Code	A-6.9.1.2.(1)
NFPA	86-2019	Standard for Ovens and Furnaces	A-6.9.1.2.(1)
NFPA	88A-2019	Standard for Parking Structures	A-6.9.1.2.(1)
NFPA	91-2015	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids	6.3.4.3.(1) A-6.9.1.2.(1)
NFPA	96-2014	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations	3.2.4.8.(2) 3.6.3.5.(1) A-3.3.1.2.(2)

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NFPA	101-2018	Life Safety Code	3.3.2.1.(2) 3.3.2.1.(3) A-3.3.2.1.(2)
NFPA	105-2013	Standard for Smoke Door Assemblies and Other Opening Protectives	3.1.8.5.(3) 3.1.8.5.(7)
NFPA	204-2018	Standard for Smoke and Heat Venting	A-6.9.1.2.(1)
NFPA	211-2019	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	6.3.3.2.(2) 6.3.3.3.(1)
NFPA	303-2016	Fire Protection Standard for Marinas and Boatyards	A-6.9.1.2.(1)
NFPA	307-2016	Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves	A-6.9.1.2.(1)
NFPA	409-2016	Standard on Aircraft Hangars	A-6.9.1.2.(1)
NFPA	415-2016	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways	A-6.9.1.2.(1)
NFPA	484-2019	Standard for Combustible Metals	A-6.9.1.2.(1)
NFPA	654-2017	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	A-6.9.1.2.(1)
NFPA	655-2017	Standard for Prevention of Sulfur Fires and Explosions	A-6.9.1.2.(1)
NFPA	664-2017	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	A-6.9.1.2.(1)
NFPA	1142-2007	Standard on Water Supplies for Suburban and Rural Fire Fighting	A-3.2.5.7.(1)
NFPA	1710-2010	Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments	A-3.2.3.1.(8)
NLGA	2017	Standard Grading Rules for Canadian Lumber	9.3.2.1.(1) A-9.3.2.1.(1) Table A-9.3.2.1.(1)-A

			A-Table 9.3.2.1. A-9.3.2.8.(1) A-9.23.10.4.(1)
NLGA	SPS-1-2017	Fingerjoined Structural Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NLGA	SPS-3-2017	Fingerjoined “Vertical Stud Use Only” Lumber	Table 9.10.3.1.-A A-9.23.10.4.(1)
NRC	1988	Performance and acceptability of wood floors – Forintek studies	A-9.23.4.2.(2)
NRC	2005	A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs	A-5.2.2.2.(4)
NRC	2024	National Whole-Building Life Cycle Assessment Practitioner’s Guide	10.4.1.2.(1)
NRC	17808-2005	Performance Guidelines for Basement Envelope Systems and Materials: Final Research Report	A-9.25.5.1.
NRC	BPN 54-85	The difference between a vapour barrier and an air barrier	A-9.25.1.1.(2)
NRC	CBD 222	Airtight houses and carbon monoxide poisoning	A-9.33.1.1.(2)
NRC	CBD 230	Applying building codes to existing buildings	A-1.1.1.1.(1)(4)
NRC	CBD 231	Moisture problems in houses	A-9.25.3.1.(1)
NRC	CRBCPI-Y2-R19	Guideline on Design for Durability of Building Envelopes	A-5.1.4.2. A-5.4.1.1.(3)
NRC	NRCC 49677-2007	Best Practice Guide on Fire Stops and Fire Blocks and their Impact on Sound Transmission	A-9.11.
NRC	RR-331-2017	Guide to Calculating Airborne Sound Transmission in Buildings	A-5.8.1.4. A-5.8.1.4.(4)(b)
NRCA	3rd Edition, 2017	The NRCA Vegetative Roof Systems Manual	A-5.6.1.2.(2)
NRCan	R.S.C. 1985, c. E-17	Explosives Act	3.3.6.2.(3)
NYCDH	2008	Guidelines on Assessment and Remediation of Fungi in Indoor Environments	A-5.5.1.1.
OMMAH	2012	2012 Building Code Compendium, Volume 2, Supplementary Standard SB-7, Guards for Housing and Small Buildings	A-9.8.8.2.
RCABC	2023	Roofing Practices Manual	A-1.4.1.1.(1) A-5.6.1.2.(2) A-5.6.2.2.(5)

SMACNA	ANSI/SMACNA 006-2006	HVAC Duct Construction Standards – Metal and Flexible	9.33.6.5.(2)
SPRI	ANSI/SPRI RP-4 2022	Wind Design Standard for Ballasted Single-ply Roofing Systems	A-5.2.2.2.(4)
SPRI	ANSI/SPRI VF-1 2023	External Fire Design Standard for Vegetative Roofs	3.1.14.4.(1)
SPRI	ANSI/ SPRI VR-1-2018	Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs	5.6.1.2.(2) Table 5.9.1.1.
SPRI	ANSI/SPRI WD-1-2020	Wind Design Standard Practice for Roofing Assemblies	A-5.2.2.2.(4)
TC	SOR/96-433	Canadian Aviation Regulations – Part III	4.1.5.13.(1)
TC	SOR/2001-286	Transportation of Dangerous Goods Regulations (TDGR)	1.4.1.2.(1)(4) A-1.4.1.2.(1)(4) A-3.3.1.2.(1)
TIAC	2013	Mechanical Insulation Best Practices Guide	A-6.3.2.5.
TPIC	2019	Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses	9.23.14.11.(1)
TWC	1993	Details of Air Barrier Systems for Houses	Table A-9.25.5.1.(1)
UL	ANSI/CAN/UL/ULC 300-2019	Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment	6.9.1.3.(1)
UL	ANSI/UL 1784-2015	Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives	3.1.8.4.(4)
UL	ANSI/CAN/UL 2524 - 2019	Standard For Safety In-building 2-Way Emergency Radio Communication Enhancement Systems	3.2.5.20.(4) A-3.2.5.20.
UL	2034-2008	Standard for Single and Multiple Station Carbon Monoxide Alarms	6.9.3.1.(6) 9.32.4.2.(8)
ULC	CAN/ULC-S101-14	Standard Method of Fire Endurance Tests of Building Construction and Materials	3.1.5.7.(2) 3.1.5.14.(5) 3.1.5.14.(6) 3.1.5.15.(3) 3.1.5.15.(4) 3.1.7.1.(1) 3.1.11.7.(1) 3.2.3.8.(1) A-3.1.5.14.(5)(d) 9.10.16.3.(1) Table 9.10.3.1.-B

ULC	CAN/ULC-S102-10	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies	3.1.5.24.(1) 3.1.12.1.(1) Table 5.9.1.1. Table 9.23.17.2.-A 9.29.5.2.(1)
ULC	CAN/ULC-S102.2:2018	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies	3.1.12.1.(2) 3.1.13.4.(1) 9.27.12.1.(4) 9.27.13.1.(2)
ULC	CAN/ULC-S102.3:2018	Standard Method of Fire Test of Light Diffusers and Lenses	3.1.13.4.(1)
ULC	CAN/ULC-S102.4:2017	Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways	3.1.4.3.(2) 3.1.5.21.(2) 3.1.5.23.(2)
ULC	CAN/ULC-S104-15	Standard Method for Fire Tests of Door Assemblies	3.1.8.4.(1) 3.2.6.5.(3)
ULC	CAN/ULC-S105:2016	Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104	9.10.13.6.(1)
ULC	CAN/ULC-S106-15	Standard Method for Fire Tests of Window and Glass Block Assemblies	3.1.8.4.(1)
ULC	CAN/ULC-S107:2019	Standard Methods of Fire Tests of Roof Coverings	3.1.15.1.(1)
ULC	CAN/ULC-S109-14	Standard Method for Flame Tests of Flame-Resistant Fabrics and Films	3.1.16.1.(1) 3.1.18.5.(1) 3.6.5.2.(2) 3.6.5.3.(1) 9.33.6.3.(1)
ULC	CAN/ULC-S110-13	Standard Methods of Test for Air Ducts	3.6.5.1.(2) 3.6.5.1.(5) 9.33.6.2.(2) 9.33.6.2.(4)
ULC	CAN/ULC-S111-13	Standard Method of Fire Tests for Air Filter Units	6.3.2.13.(1) 9.33.6.14.(1)
ULC	CAN/ULC-S112-10	Standard Method of Fire Test of Fire Damper Assemblies	3.1.8.4.(1) A-3.2.6.6.(1)
ULC	CAN/ULC-S112.1-10	Standard for Leakage Rated Dampers for Use in Smoke Control Systems	3.1.8.4.(3) 6.3.2.7.(3)
ULC	CAN/ULC-S112.2-07	Standard Method of Fire Test of Ceiling Firestop Flap Assemblies	3.6.4.3.(2) 9.10.13.14.(1)
ULC	CAN/ULC-S113:2016	Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC-S104 for Twenty Minute Fire Rated Closure Assemblies	9.10.13.2.(1) A-9.10.9.3.(2) A-9.10.13.2.(1)

ULC	CAN/ULC-S114:2018	Standard Method of Test for Determination of Non-Combustibility in Building Materials	1.4.1.2.(1)(4)
ULC	CAN/ULC-S115-11	Standard Method of Fire Tests of Firestop Systems	3.1.5.19.(3) 3.1.8.3.(3) 3.1.9.1.(1) 3.1.9.1.(2) 3.1.9.1.(3) 3.1.9.1.(6) 3.1.9.1.(7) 3.1.9.3.(1) 3.1.9.3.(2) 3.1.9.3.(4) 3.1.9.4.(4) 3.1.9.4.(7) A-3.1.8.3.(2) A-3.1.11.7.(7) 9.10.9.2.(3) 9.10.9.6.(1) 9.10.9.6.(2) 9.10.9.8.(1) 9.10.9.8.(6)
ULC	CAN/ULC-S124-06	Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic	3.1.5.15.(2) A-3.1.5.14.(5)(d)
ULC	CAN/ULC-S126-14	Standard Method of Test for Fire Spread Under Roof-Deck Assemblies	3.1.14.1.(1) 3.1.14.2.(1)
ULC	CAN/ULC-S134-13	Standard Method of Fire Test of Exterior Wall Assemblies	3.1.5.5.(1) 9.10.14.5.(2) 9.10.15.5.(2) 9.10.15.5.(3)
ULC	ULC-S135-04	Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)	3.1.5.1.(2)
ULC	CAN/ULC-S138-06	Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration	3.1.5.7.(1) 3.1.5.7.(3)
ULC	CAN/ULC-S139:2017	Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables	3.2.6.5.(6) 3.2.7.10.(2) 3.2.7.10.(3)
ULC	CAN/ULC-S143-14	Standard Method of Fire Tests for Non-Metallic Electrical and Optical Fibre Cable Raceway Systems	3.1.5.23.(1)
ULC	CAN/ULC-S144-12	Standard Method of Fire Resistance Test – Grease Duct Assemblies	3.6.3.5.(2) A-3.6.3.5.

ULC	CAN/ULC-S146-19	Standard Method of Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements	3.1.6.5.(1)
ULC	ULC-S332-93	Standard for Burglary Resisting Glazing Material	A-9.7.5.2.(1)
ULC	ULC-S505-74	Standard for Fusible Links for Fire Protection Services	3.1.8.10.(2)
ULC	CAN/ULC-S524:2019	Standard for Installation of Fire Alarm Systems	3.1.8.11.(3) 3.1.8.14.(3) 3.2.4.5.(1) 3.2.4.19.(5) 3.2.4.20.(7) 3.2.4.20.(8) 3.2.4.20.(10) 3.2.4.20.(15) A-3.2.4.7.(4) A-3.2.4.18.(9) and (10) A-3.2.4.19.(1)(g) A-3.2.4.20.(10) 9.10.19.4.(3) 9.10.19.6.(2)
ULC	CAN/ULC-S526-2016	Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories	3.2.4.19.(5) 3.2.4.19.(6) A-3.2.4.19.(3)
ULC	CAN/ULC-S531:2019	Standard for Smoke Alarms	3.2.4.20.(2) 3.3.2.18.(4) 9.10.19.1.(1)
ULC	CAN/ULC-S537:2019	Standard for Verification of Fire Alarm Systems	3.2.4.5.(2)
ULC	CAN/ULC-S540-13	Standard for Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance	3.2.4.21.(1) 9.10.2.2.(3) 9.10.2.2.(4) 9.10.19.8.(1)
ULC	CAN/ULC-S553-14	Standard for the Installation of Smoke Alarms	3.2.4.20.(13) 9.10.19.3.(2)
ULC	CAN/ULC-S561-13	Standard for Installation and Services for Fire Signal Receiving Centres and Systems	3.2.4.7.(4) A-3.2.4.7.(4)
ULC	CAN/ULC-S572:2017	Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems	3.4.5.1.(3) 3.4.5.1.(4) A-3.4.5.1.(4) 9.9.11.3.(3) 9.9.11.3.(4)
ULC	CAN/ULC-S610:2018	Standard for Factory-Built Fireplace Systems	9.22.8.1.(1)
ULC	ULC-S628-93	Standard for Fireplace Inserts	9.22.10.1.(1)

ULC	CAN/ULC-S629:2016	Standard for 650°C Factory-Built Chimneys	9.33.10.2.(1)
ULC	CAN/ULC-S639-M87	Standard for Steel Liner Assemblies for Solid-Fuel Burning Masonry Fireplaces	9.22.2.3.(1)
ULC	CAN/ULC-S701.1:2017	Standard for Thermal Insulation, Polystyrene Boards	Table 5.9.1.1. Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S702.1-14	Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification	3.1.6.3.(4) Table 5.9.1.1. A-5.9.1.1.(1) 9.10.9.8.(3) 9.10.3.1.(3) Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S703-09	Standard for Cellulose Fibre Insulation (CFI) for Buildings	Table 5.9.1.1. 9.10.3.1.(3) 9.25.2.2.(1)
ULC	CAN/ULC-S704.1:2017	Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced	Table 5.9.1.1. Table 9.23.17.2.-A 9.25.2.2.(1)
ULC	CAN/ULC-S705.1-18	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification	Table 5.9.1.1. 9.25.2.2.(1)
ULC	CAN/ULC-S705.2-05	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application	Table 5.9.1.1. 9.25.2.5.(1)
ULC	CAN/ULC-S706.1:2016	Standard for Wood Fibre Insulating Boards for Buildings	Table 5.9.1.1. 9.23.16.7.(3) Table 9.23.17.2.-A 9.25.2.2.(1) 9.29.8.1.(1)
ULC	CAN/ULC-S710.1:2019	Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1.
ULC	CAN/ULC-S711.1:2019	Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification	Table 5.9.1.1.
ULC	CAN/ULC-S716.1-12	Standard for Exterior Insulation and Finish Systems (EIFS) - Materials and Systems	5.9.4.1.(1) A-5.9.4.1.(1) 9.27.14.1.(1) 9.27.14.2.(1) A-9.27.14.2.(2)(a)
ULC	CAN/ULC-S716.2-12	Standard for Exterior Insulation and Finish Systems (EIFS) - Installation of EIFS Components and Water Resistive Barrier	A-5.9.4.1.(1) 9.27.14.3.(1)

ULC	CAN/ULC-S716.3-12	Standard for Exterior Insulation and Finish System (EIFS) - Design Application	A-5.9.4.1.(1) 9.27.14.3.(1)
ULC	CAN/ULC-S717.1:2017	Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties	Table 5.9.1.1. 9.15.4.1.(1)
ULC	CAN/ULC-S741-08	Standard for Air Barrier Materials – Specification	5.4.1.2.(2)
ULC	CAN/ULC-S742-11	Standard for Air Barrier Assemblies – Specification	5.4.1.2.(1) 5.4.1.2.(2) A-5.4.1.1.(3) A-5.4.1.2.(1) A-5.4.1.2.(2) A-5.4.1.2.(4)
ULC	CAN/ULC-S1001-11	Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems	3.2.9.1.(1) A-3.2.9.1.(1) 9.10.1.2.(1)
ULC	ULC/ORD-C199P-02	Combustible Piping for Sprinkler Systems	3.2.5.13.(2) 3.2.5.13.(5)
ULC	ULC/ORD-C1254.6-95	Fire Testing of Restaurant Cooking Area Fire Extinguishing System Units	6.9.1.3.(1)
USACE	Version 3-2012	Air Leakage Test Protocol for Building Envelope	10.2.3.5.(1)
WCLIB	No. 17 (2004)	Grading Rules for West Coast Lumber	A-Table 9.3.2.1.
WWPA	2017	Western Lumber Grading Rules 2017	A-Table 9.3.2.1.

Notes to Table 1.3.1.2.:

(1) While every effort was made to ensure the accuracy of the information in this Table, the *City* is not responsible for the accuracy, timeliness or reliability of the content presented therein. For all purposes of interpreting and applying the referenced standards, By-law users should refer to the most recent official versions of the referenced editions.

(2) See Table D-1.1.2. of Appendix D for the list of standards referenced therein.

(3) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.

(4) By-law reference is in Division A.

(5) By-law reference is in Division C.

(6) Subsection 9.3.15, Sprinkler-Protected Glazing, does not apply in the context of Division B.

(7) Subsection 6.5.3, Sprinkler-Protected Glazing, does not apply in the context of Division B.

(8) The current version in effect.

(9) The version of the standard as originally adopted

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1.3.2. Organizations

1.3.2.1. Abbreviations of Proper Names

1) The abbreviations of proper names in this By-law shall have the meanings assigned to them in this Article.

AAMA Fenestration and Glazing Industry Alliance (formerly American Architectural Manufacturers Association) (www.fgiaonline.org)

ACGIH American Conference of Governmental Industrial Hygienists (www.acgih.org)

ACI American Concrete Institute (www.concrete.org)

AHRI Air-Conditioning, Heating and Refrigeration Institute (www.ahrinet.org)

AISI American Iron and Steel Institute (www.steel.org)

ANSI	American National Standards Institute (www.ansi.org)
APA	The Engineered Wood Association (www.apawood.org)
ASCE	American Society of Civil Engineers (www.asce.org)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers (www.ashrae.org)
ASME	American Society of Mechanical Engineers (www.asme.org)
ASTM	ASTM International (www.astm.org)
BNQ	Bureau de normalisation du Québec (www.bnq.qc.ca/en)
CAN	National Standard of Canada designation (www.scc.ca) (The number or name following the CAN designation represents the agency under whose auspices the standard is issued.)
CAN3	designates CSA
CCBFC	Canadian Commission on Building and Fire Codes (see NRC)
CCME	Canadian Council of Ministers of the Environment (www.ccme.ca)
CGSB	Canadian General Standards Board (www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html)
CHC	Canadian Hydronics Council (www.chchydro.com)
CISC	Canadian Institute of Steel Construction (www.cisc-icca.ca)
CMHC	Canada Mortgage and Housing Corporation (www.cmhc.ca)
CoV	City of Vancouver (www.vancouver.ca)
CRCA	Canadian Roofing Contractors' Association (www.roofingcanada.com)
CSA	CSA Group (www.csagroup.org)
CSSBI	Canadian Sheet Steel Building Institute (www.cssbi.ca)
CWC	Canadian Wood Council (www.cwc.ca)
DOE	U.S. Department of Energy (www.energy.gov)
EC	Environment and Climate Change Canada (www.ec.gc.ca)
ECC	EIFS Council of Canada (www.eifscouncil.org)
EGBC	Engineers & Geoscientists British Columbia (www.egbc.ca)
EPA	Environmental Protection Agency (U.S.) (www.epa.gov)
FEMA	Federal Emergency Management Agency (U.S.) (www.fema.gov)
FLL	German Landscape Research, Development and Construction Society (shop.fll.de/en)
FPI	FPInnovations – Wood Products (formerly FCC – Forintek Canada Corporation) (www.fpinnovations.ca)
GRHC	Green Roofs for Healthy Cities (www.greenroofs.org)
HC	Health Canada (www.hc-sc.gc.ca)
HPVA	Decorative Hardwoods Association (formerly Hardwood Plywood & Veneer Association) (www.decorativehardwoods.org)
HRAI	Heating, Refrigeration and Air Conditioning Institute of Canada (www.hrai.ca)
HVI	Home Ventilating Institute (www.hvi.org)
ICC	International Code Council (www.iccsafe.org)

IEC	International Electrotechnical Commission (www.iec.ch)
ISO	International Organization for Standardization (www.iso.org)
NBC	National Building Code of Canada 2020
NCMA	National Concrete Masonry Association (www.ncma.org)
NECB	National Energy Code of Canada for Buildings 2020
NEMA	National Electrical Manufacturers Association (www.nema.org)
NFC	National Fire Code of Canada 2020
NFPA	National Fire Protection Association (www.nfpa.org)
NFRC	National Fenestration Rating Council (www.nfrc.org)
NLGA	National Lumber Grades Authority (www.nlga.org)
NPC	National Plumbing Code of Canada 2020
NRC	National Research Council of Canada (nrc.canada.ca)
NRCA	National Roofing Contractors Association (www.nrca.net)
NRCan	Natural Resources Canada (www.nrcan.gc.ca)
NYCDH	New York City Department of Health and Mental Hygiene (www.nyc.gov/health)
OMMAH	Ontario Ministry of Municipal Affairs and Housing (www.mah.gov.on.ca)
RCABC	Roofing Contractors Association of British Columbia (www.rcabc.org)
SEI	Structural Engineering Institute (www.asce.org/structural-engineering/structural-engineering)
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association (www.smacna.org)
SPRI	Single Ply Roofing Industry (www.spri.org)
TC	Transport Canada (tc.canada.ca)
TECA	Thermal Environmental Comfort Association (www.teca.ca)
TIAC	Thermal Insulation Association of Canada (www.tiac.ca)
TPIC	Truss Plate Institute of Canada (www.tpic.ca)
TWC	Tarion Warranty Corporation (formerly Ontario New Home Warranty Program) (www.tarion.com)
UL	Underwriters' Laboratories Inc. (www.ul.com)
ULC	ULC Standards (canada.ul.com/ulcstandards)
USACE	United States Army Corps of Engineers (www.erdc.usace.army.mil/Locations/CERL)
WCLIB	Pacific Lumber Inspection Bureau (formerly West Coast Lumber Inspection Bureau) (www.plib.org)
WWPA	Western Wood Products Association (www.wwpa.org)

Notes to Part 1
General

A-1.1.2.1.(1) Objectives and Functional Statements Attributed to Acceptable Solutions. The objectives and functional statements attributed to each By-law provision are listed in a table following the provisions in each Part.

Many provisions in Division B serve as modifiers of or pointers to other provisions, or serve other clarification or explanatory purposes. In most cases, no objectives and functional statements have been attributed to such provisions, which therefore do not appear in the above-mentioned tables.

For provisions that serve as modifiers of or pointers to other referenced provisions and that do not have any objectives and functional statements attributed to them, the objectives and functional statements that should be used are those attributed to the provisions they reference.

A-1.1.3.1.(2) Climatic Values. Climatic values for municipalities not listed in Appendix C can be obtained at www.climate.weather.gc.ca or by e-mail from the Engineering Climate Services Unit of Environment and Climate Change Canada at scg-ecs@ec.gc.ca.

A-1.1.3.1.(3) Winter Design Temperatures. The 2.5% values referred to in Sentence 1.1.3.1.(3) are the least restrictive temperatures that can be used. A designer may choose to use the 1% values given in Appendix C, which are in excess of the By-law minimums but are considered acceptable.

A-1.1.3.1.(4) Seismic Values. Figure A-1.1.3.1.(4) illustrates how to determine the seismic hazard values to be used in the application of the Part 4 and Part 9 seismic provisions.

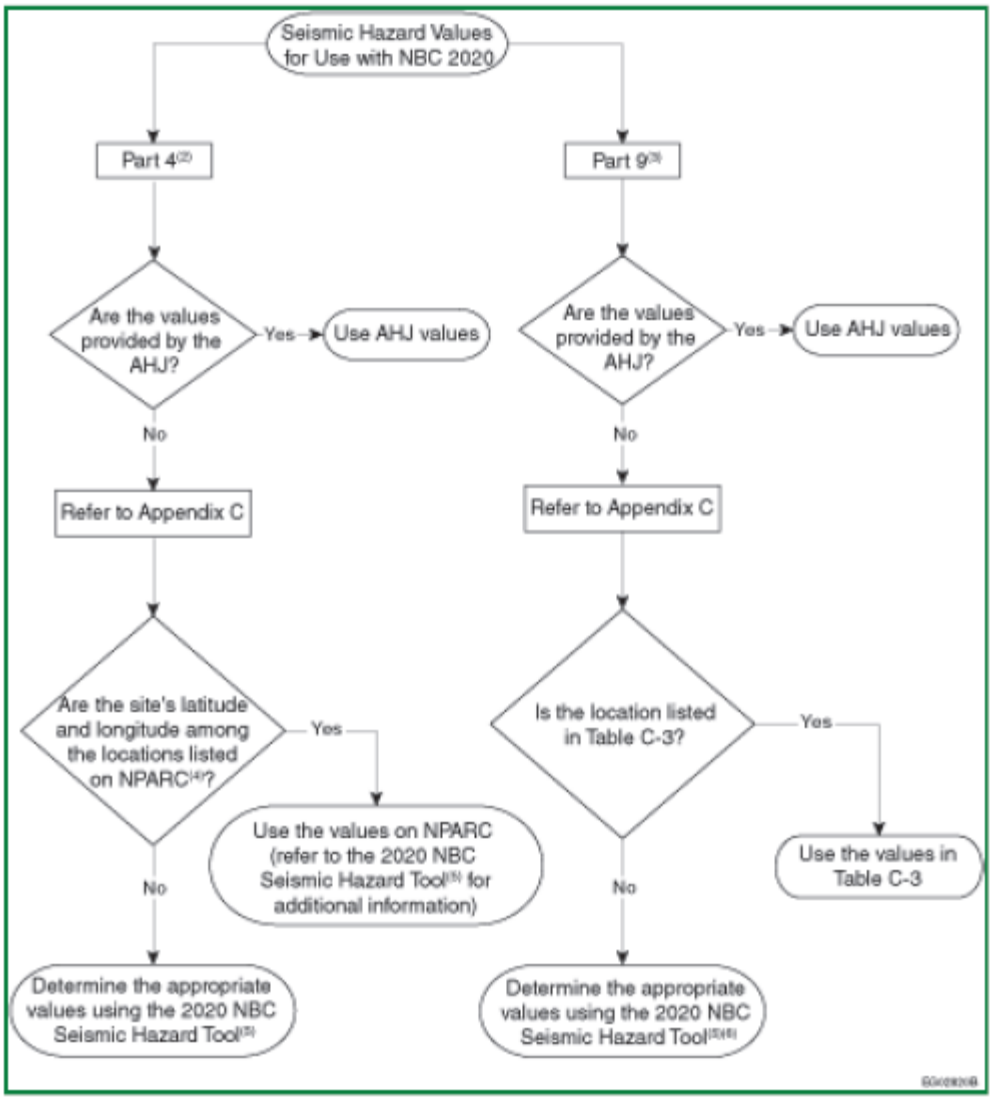

Figure A-1.1.3.1.(4)
Determining seismic hazard values for use in Part 4 and Part 9

Notes to Figure A-1.1.3.1.(4):
(1) The abbreviations used in the figure have the following meanings:
AHJ = authority having jurisdiction
NPARC = NRC Publications Archive
(2) See also the section entitled “Seismic Hazard for Part 4” in Appendix C.
(3) See also the section entitled “Seismic Hazard for Part 9” in Appendix C.
(4) The seismic hazard values available on NPARC at https://doi.org/10.4224/nqzr-dz38 were generated from the 2020 National Building Code of Canada Seismic Hazard Tool. This subset of values on NPARC is provided as a static, archival record for Code users.
(5) The 2020 National Building Code of Canada Seismic Hazard Tool is available at https://doi.org/10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b.
(6) Refer to the procedure set out in the section entitled “Seismic Hazard for Part 9” in Appendix C.

PART 2 – Reserved

Part 3
Fire Protection, Occupant Safety and Accessibility

(See Note A-3.)

Section 3.1. General

3.1.1. Scope and Definitions

3.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

3.1.1.2. Defined Words

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

3.1.1.3. Use of Term Storage Tank

1) For the purposes of this Part, the term “storage tank” shall mean a vessel for *flammable liquids* or *combustible liquids* having a capacity of more than 230 L and designed to be installed in a fixed location.

3.1.1.4. Fire Protection Information

1) Information to be submitted regarding major components of fire protection shall conform to the requirements of Subsection 2.2.3. of Division C.

3.1.2. Classification of Buildings or Parts of Buildings by Major Occupancy

(See Note A-3.1.2.)

3.1.2.1. Classification of Buildings

1) Except as permitted by Articles 3.1.2.3. to 3.1.2.5., and 3.1.2.7., every *building* or part thereof shall be classified according to its *major occupancy* as belonging to one of the Groups or Divisions described in Table 3.1.2.1. (See Note A-3.1.2.1.(1).)

2) A *building* intended for use by more than one *major occupancy* shall be classified according to all *major occupancies* for which it is used or intended to be used.

Table 3.1.2.1.
Major Occupancy Classification
Forming Part of Sentences 3.1.2.1.(1) and 3.1.2.2.(1)

Group	Division	Description of *Major Occupancies*
A	1	*Assembly occupancies* intended for the production and viewing of the performing arts
A	2	*Assembly occupancies* not elsewhere classified in Group A
A	3	*Assembly occupancies* of the arena type
A	4	*Assembly occupancies* in which occupants are gathered in the open air
B	1	*Detention occupancies*
B	2	*Treatment occupancies*

B	3	*Care occupancies*
C	—	*Residential occupancies*
D	—	*Business and personal services occupancies*
E	—	*Mercantile occupancies*
F	1	*High-hazard industrial occupancies*
F	2	*Medium-hazard industrial occupancies*
F	3	*Low-hazard industrial occupancies*

3.1.2.2. Occupancies of Same Classification

1) Any *building* is deemed to be occupied by a single *major occupancy*, notwithstanding its use for more than one *major occupancy*, provided that all *occupancies* are classified as belonging to the same Group classification or, where the Group is divided into Divisions, as belonging to the same Division classification described in Table 3.1.2.1.

3.1.2.3. Arena-Type Buildings

1) An arena-type *building* intended for occasional use for trade shows and similar exhibition purposes shall be classified as a Group A, Division 3 *occupancy*. (See Note A-3.1.2.3.(1).)

3.1.2.4. Police Stations

1) A police station with detention quarters is permitted to be classified as a Group B, Division 2 *major occupancy* provided the station is not more than 1 *storey* in *building height* and 600 m^2 in *building area*.

3.1.2.5. Convalescent, Children's Custodial, and Residential Care Homes

1) Convalescent homes and children's custodial homes are permitted to be classified as *residential occupancies* within the application of Part 3, provided that occupants are ambulatory and live as a single housekeeping unit in a *suite* with sleeping accommodation for not more than 10 persons.

2) A care facility accepted for residential use pursuant to provincial legislation, a *community care facility* or a *group residence*, is permitted to be classified as a *residential occupancy*, provided

a) occupants live as a single housekeeping unit in a *dwelling unit* with sleeping accommodation for not more than 10 persons,

b) *smoke alarms* are installed in conformance with Article 3.2.4.20.,

c) emergency lighting is provided in conformance with Subsection 3.2.7., and

d) the *building* is *sprinklered* throughout.

3.1.2.6. Storage of Combustible Fibres

1) *Buildings* or parts thereof used for the storage of baled *combustible fibres* shall be classified as *medium-hazard industrial occupancies*.

3.1.2.7. Group A, Division 2, Low Occupant Load

(See Note A-3.1.2.7.)

1) A *suite* of Group A, Division 2 *assembly occupancy*, except a child or infant daycare facility, is permitted to be classified as a Group D, *business and personal services occupancy* provided

a) the number of persons in the *suite* does not exceed 30, and

b) except as permitted by Sentence (2), the *suite* is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 1 hr.

2) The *fire separation* required by Sentence (1) need not have a *fire-resistance rating* where the *suite* is located in a *building* that is *sprinklered* throughout.

3) A permanent sign, with lettering not less than 50 mm high with a 12 mm stroke, indicating the lesser of the *occupant load* for the *suite* or 30 persons, shall be posted in a conspicuous location near the *suite's* principal entrance.

3.1.2.8. Daycare Facilities for Children

(See Note A-3.1.2.8.)

1) A daycare facility for children shall be classified as a Group A, Division 2 *assembly occupancy* or Group C *residential occupancy* as determined in accordance with Table 3.1.2.8., and provided with the fire and life safety provisions corresponding to that major occupancy, except as permitted by Sentence (2).

Table 3.1.2.8.
Fire Safety Requirements for Daycare Facilities for Children
Forming part of Sentence 3.1.2.8.

Age of *Children* (months)	Number of *Children*	*Major Occupancy* Permitted	*Sprinklers*	Fire Alarm	Smoke Detection[2] and CO Alarms	*Fire Separation* from Remainder of Building	Emergency Lighting
< 30	> 8	A2	*Building*	Required	Required	2 h	Required
	3–8	C	*Suite* Only	Required	Required	2 h	Required
		C[1]	*Suite* Only	Not Required	Required	No	Required
≥ 30	> 8	A2	*Building*	Required	Required	1 h	Required
	3– 8	C	*Suite* Only	Required	Required	1 h	Required
		C[1]	Not Required	Not Required	Required	No	Required

Notes to Table 3.1.2.8.:
[1] Applies to residential *buildings* with no more than 2 principal *dwelling units* or *row housing*
[2] Smoke detection shall include *smoke detectors* throughout normally occupied *floor areas* within the *suite* where the *building* is provided with a fire alarm system, and smoke alarms where required by Article 3.2.4.20.

2) The *fire-resistance rating* of a *fire separation* to separate the daycare facilities for children from the remainder of the *building* required by Table 3.1.2.8. need not exceed the *fire-resistance rating* of the floor assembly required by Subsection 3.2.2.

3.1.2.9. Retail Food Facility

1) A retail food facility is permitted to be classified as a Group E *major occupancy* provided it is designed to accommodate not more than 16 persons consuming food or drink.

3.1.3. Multiple Occupancy Requirements

3.1.3.1. Separation of Major Occupancies

1) Except as permitted by Sentences (2) and (3), *major occupancies* shall be separated from adjoining *major occupancies* by *fire separations* having *fire-resistance ratings* conforming to Table 3.1.3.1.

2) In a *building* not more than 3 *storeys* in *building height*, if not more than two *dwelling units* are contained together with a Group E *major occupancy*, the *fire-resistance rating* of the *fire separation* between the two *major occupancies* need not be more than 1 h.

3) In a *building* conforming to the requirements of Articles 3.2.8.2. to 3.2.8.8., the requirements of Sentence (1) for *fire separations* between *major occupancies* do not apply at the vertical plane around the perimeter of an opening through the horizontal *fire separation*.

Table 3.1.3.1.
Major Occupancy Fire Separations(1)
Forming Part of Sentence 3.1.3.1.(1)

Major Occupancy	Minimum *Fire-Resistance Rating* of *Fire Separation*, h												
	Adjoining *Major Occupancy*												
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	C(7)	D	E	F-1	F-2	F-3
A-1	—	1	1	1	2	2	2	1	1	2	(2)	2	1
A-2	1	—	1	1	2	2	2	1(3)	1(4)	2	(2)	2	1
A-3	1	1	—	1	2	2	2	1	1	2	(2)	2	1
A-4	1	1	1	—	2	2	2	1	1	2	(2)	2	1
B-1	2	2	2	2	—	2	2	2	2	2	(2)	2	2
B-2	2	2	2	2	2	—	1	2	2	2	(2)	2	2
B-3	2	2	2	2	2	1	—	1	2	2	(2)	2	2
C(7)	1	1(3)	1	1	2	2	1	—	1	2(5)	(2)	2(6)	1
D	1	1(4)	1	1	2	2	2	1	—	—	3	—	—
E	2	2	2	2	2	2	2	2(5)	—	—	3	—	—
F-1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	3	3	—	2	2
F-2	2	2	2	2	2	2	2	2(6)	—	—	2	—	—
F-3	1	1	1	1	2	2	2	1	—	—	2	—	—

Notes to Table 3.1.3.1.:
(1) Section 3.3. contains requirements for the separation of occupancies and tenancies that are in addition to the requirements for the separation of major occupancies.
(2) See Sentence 3.1.3.2.(1).
(3) Where the building or part thereof is constructed in accordance with 3.2.2.51., a fire separation with a 2 h fire-resistance rating is required between the Group C and Group A, Division 2 major occupancies.
(4) Where the building or part thereof is constructed in accordance with 3.2.2.60., a fire separation with a 2 h fire-resistance rating is required between the Group D and Group A, Division 2 major occupancies.
(5) See Sentence 3.1.3.1.(2).
(6) See Sentence 3.1.3.2.(2).
(7) See Article 3.2.1.7.

3.1.3.2. Prohibition of Occupancy Combinations

1) No *major occupancy* of Group F, Division 1 shall be contained within a *building* with any *occupancy* classified as Group A, B or C.

2) Except as permitted in Article 3.1.3.4. and 3.1.3.5., and Subsection 11.2.5., not more than one *suite* of *residential occupancy* shall be contained within a *building* classified as a Group F, Division 2 *major occupancy*. #14688

3.1.3.3. Artist Live/Work - Class A Artist Studio

1) A *building* containing *artist studio — class A* and residential quarters integrated with the studio for the use of artists occupying the studio may be designed as a Group C *major occupancy* provided

a) the *building* is *sprinklered* in conformance with NFPA 13, and

b) structural floor loads are based on a light *industrial occupancy*, with a minimum *live load* of 3.6 kPa and, where the *floor areas* are designated for residential use only, such as sleeping lofts, dinettes and bathrooms, with a minimum *live load* of 1.9 kPa.

3.1.3.4. Artist Live/Work - Class B Artist Studio

1) A *building* containing *artist studio — class B* and residential quarters integrated with the studio for the use of artists occupying the studio may be permitted provided

a) the *construction* requirements of Subsection 3.2.2. are based on the most restrictive requirements arising from the evaluation of the *building* as both a Group F Division 2 *occupancy* and a Group C *occupancy*,

b) the spatial separation requirements of the *building* are based on Table 3.2.3.1.E for a Group F, Division 2 occupancy,

c) the fire alarm is based on Group C *occupancy* requirements and where a fire alarm is required, *smoke detectors* are installed in corridors and stair shafts as required in Article 3.2.4.11.,

d) *smoke alarms* are provided in individual *suites* as required in Article 3.2.4.20.,

e) the *building* is *sprinklered* in conformance with NFPA 13 to a minimum Ordinary Hazard Group 1 classification,

f) standpipes are based on residential Group C *occupancy* requirements,

g) *accessible* design is based on Group C *occupancy* requirements, and

h) structural floor loads are based on a light *industrial occupancy*, with a minimum *live load* of 3.6 kPa and,

i) where *floor areas* are designated for residential use only, such as sleeping lofts, dinettes and bathrooms, with a minimum *live load* of 1.9 kPa.

2) Light and ventilation requirements can be borrowed from the working studio area.

3) Where a portion of the studio such as a dinette or sleeping loft is used solely as living space, *exit* travel distances from these spaces may be based on a Group C *residential occupancy*.

3.1.3.5. Industrial Flex Space

1) An *industrial flex space* use is permitted in a new *building* containing a Group C *major occupancy* provided

a) the total floor area of each *industrial flex space* unit or a single tenant *industrial flex space* is not more than 500 m^2,

b) the *industrial flex space* shall be located on the *first storey* and completely independent of the Group C portion of the *building*, including the *exit* system,

c) the ventilation systems for individual *industrial flex spaces* shall be completely separate and independent from each other and from the residential portion of the *building*,

d) a horizontal *fire separation* of concrete having a *fire-resistance rating* of no less than 2 hours shall be provided between the *industrial flex space* and the Group C *occupancy*,

e) vertical *fire separations* between *industrial flex space* units and any Group C portion of the *building* shall be of concrete or masonry *construction* having a *fire-resistance rating* of not less than 2 hours,

f) the Group C portion of the *building* shall be separated from the *industrial flex space* portion of the *building* by *construction* having a STC rating of not less than 55,

g) the penetrations between the horizontal *fire separation* in Clause (d) shall be FT rated,

h) the *industrial flex space* units shall be *sprinklered* in conformance with NFPA 13 to a minimum Ordinary Hazard Group 2 classification using only quick response heads and no reduction in design area,

i) the automatic *sprinkler system* noted in Clause (h) shall be a single system supplying the entire *building*, and shall be designed so that the *industrial flex spaces* as a whole and the Group C *occupancy* floors as a whole are supplied by separate water supply lines,

j) each individual *industrial flex space* unit shall have a minimum of two egress doors regardless of the unit size,

k) the principal egress door serving each *industrial flex space* unit shall *exit* directly to the street, and

l) except for the principal *exit* door in Clause (k), all other *exit* or egress doors shall lead to a *lane* or to an independent corridor leading to a public thoroughfare serving only the *industrial flex space* portion of the *building* and shall be separated from the remainder of the *building* by a concrete or masonry *fire separation* having a *fire-resistance rating* of not less than 2 hours.

2) An *industrial flex space* use is not permitted in an *existing building*.

3.1.4. Combustible Construction

3.1.4.1. Combustible Materials Permitted

1) A *building* permitted to be of *combustible construction* is permitted to be constructed of *combustible* materials, with or without *noncombustible* components. (See Note A-3.1.4.1.(1).)

2) The *flame-spread rating* on any exposed surface of foamed plastic insulation, and on any surface that would be exposed by cutting through the insulation in any direction, shall be not more than 500.

3.1.4.2. Protection of Foamed Plastics

(See Note A-3.1.4.2.)

1) Except as permitted in Sentence (2), foamed plastics that form part of a wall or ceiling assembly in *combustible construction* shall be protected from adjacent spaces in the *building*, other than adjacent concealed spaces within *attic or roof spaces*, crawl spaces, and wall and ceiling assemblies,

a) by one of the interior finishes described in Subsections 9.29.4. to 9.29.9.,

b) provided the *building* does not contain a Group A, Group B or Group C *major occupancy*, by sheet metal

i) mechanically fastened to the supporting assembly independent of the insulation,

ii) not less than 0.38 mm thick, and

iii) with a melting point not below 650°C, or

c) by any thermal barrier that meets the requirements of Sentence 3.1.5.15.(2) (see Note A-3.1.4.2.(1)(c)).

(See Note A-3.1.4.2.(1).)

2) A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastics is permitted in a *building* permitted to be of *combustible construction*, provided the panels

a) are protected on both sides by sheet metal not less than 0.38 mm thick having a melting point not less than 650°C,

b) do not contain an air space, and

c) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the space in which they are located or the space that they bound, as applicable.

(See Note A-3.1.4.2.(2) and 3.1.5.7.(3).)

3) The *flame-spread rating* of doors containing foamed plastics shall comply with Sentences 3.1.13.2.(1) to (3).

3.1.4.3. Wires and Cables

1) Except as required by Sentence (2) and Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are installed in a *building* permitted to be of *combustible construction* shall

a) not convey flame or continue to burn for more than 1 min when tested in conformance with the Vertical Flame Test (FT1 rating) in CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables," or

b) be located in

i) totally enclosed *noncombustible* raceways (see Note A-3.1.4.3.(1)(b)(i)),

ii) masonry walls,

iii) concrete slabs, or

iv) totally enclosed non-metallic raceways conforming to Clause 3.1.5.23.(1)(b).

(See Note A-3.1.4.3.(1).)

(See also Sentence 3.6.4.3.(1).)

2) Except as permitted in Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and are installed in a *plenum* in a *building* permitted to be of *combustible construction* shall exhibit the following characteristics when tested in conformance with CAN/ULC-S102.4, "Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways," (FT6 rating):

a) a horizontal flame distance of not more than 1.5 m,

b) an average optical smoke density of not more than 0.15, and

c) a peak optical smoke density of not more than 0.5.

3) Deleted.

4) Deleted.

3.1.4.4. Non-metallic Raceways

1) Totally enclosed non-metallic raceways used in a *plenum* in a *building* permitted to be of *combustible construction* shall meet the requirements of Clause 3.1.5.23.(1)(a).

3.1.4.5. Fire-Retardant-Treated Wood

1) If *fire-retardant-treated wood* is specified in this Part, the wood shall

a) be pressure impregnated with fire-retardant chemicals in conformance with CAN/CSA-O80 Series, "Wood preservation," and

b) have a *flame-spread rating* not more than 25.

3.1.4.6. Heavy Timber Construction Alternative

1) If *combustible construction* is permitted and is not required to have a *fire-resistance rating* more than 45 min, *heavy timber construction* is permitted to be used.

2) If *heavy timber construction* is permitted, it shall conform to Article 3.1.4.7.

3.1.4.7. Heavy Timber Construction

1) Wood elements in *heavy timber construction* shall be arranged in heavy solid masses and with essentially smooth flat surfaces to avoid thin sections and sharp projections.

2) Except as permitted by Sentences (3) to (6) and (12), the minimum dimensions of wood elements in *heavy timber construction* shall conform to Table 3.1.4.7.

Table 3.1.4.7.
Heavy Timber Dimensions
Forming Part of Sentence 3.1.4.7.(2)

Supported Assembly	Structural Element	Solid Sawn (width × depth), mm × mm	Glued-Laminated (width × depth), mm × mm	Round (diam), mm
Roofs only	Columns	140 × 191	130 × 190	180
	Arches supported on the tops of walls or abutments	89 × 140	80 × 152	—
	Beams, girders and trusses	89 × 140	80 × 152	—
	Arches supported at or near the floor line	140 × 140	130 × 152	—
Floors, floors plus roofs	Columns	191 × 191	175 × 190	200
	Beams, girders, trusses and arches	140 × 241 or 191 × 191	130 × 228 or 175 × 190	—

3) Where splice plates are used at splices of roof arches supported on the tops of walls or abutments, roof trusses, roof beams and roof girders in *heavy timber construction*, they shall be not less than 64 mm thick.

4) Floors in *heavy timber construction* shall be of glued-laminated or solid sawn plank not less than

a) 64 mm thick, splined or tongued and grooved, or

b) 38 mm wide and 89 mm deep set on edge and well spiked together.

5) Floors in *heavy timber construction* shall be laid

a) so that no continuous line of end joints will occur except at points of support, and covered with

i) tongued and grooved flooring not less than 19 mm thick laid crosswise or diagonally, or

ii) tongued and grooved phenolic-bonded plywood, strandboard or waferboard not less than 12.5 mm thick, and

b) not closer than 15 mm to the walls to provide for expansion, with the gap covered at the top or bottom.

6) Roofs in *heavy timber construction* shall be of tongued and grooved phenolic-bonded plywood, strandboard or waferboard not less than 28 mm thick, or glued-laminated or solid sawn plank that is

a) not less than 38 mm thick, splined or tongued and grooved, or

b) not less than 38 mm wide and 64 mm deep set on edge and laid so that no continuous line of end joints will occur except at the points of support.

7) Wood columns in *heavy timber construction* shall be continuous or superimposed throughout all *storeys*.

8) Superimposed wood columns in *heavy timber construction* shall be connected by

a) reinforced concrete or metal caps with brackets,

b) steel or iron caps with pintles and base plates, or

c) timber splice plates fastened to the columns by metal connectors housed within the contact faces.

9) Where beams and girders in *heavy timber construction* enter masonry, wall plates, boxes of the self-releasing type or hangers shall be used.

10) Wood girders and beams in *heavy timber construction* shall be closely fitted to columns, and adjoining ends shall be connected by ties or caps to transfer horizontal loads across the joints.

11) In *heavy timber construction*, intermediate wood beams used to support a floor shall be supported on top of the girders or on metal hangers into which the ends of the beams are closely fitted.

12) Roof arches supported on the top of walls or abutments, roof trusses, roof beams and roof girders in *heavy timber construction* are permitted to be not less than 64 mm wide provided

a) where two or more spaced members are used, the intervening spaces are

   i) blocked solidly throughout, or

   ii) tightly closed by a continuous wood cover plate not less than 38 mm thick secured to the underside of the members, or

b) the underneath of the roof deck or sheathing is *sprinklered*.

3.1.4.8. Exterior Cladding

1) Except as provided in Sentence (2), cladding on an exterior wall assembly of a *building* or part of a *building* conforming to Article 3.2.2.51. or 3.2.2.60. shall consist of

a) *noncombustible* cladding, or

b) except as provided in Sentence (4), a wall assembly that satisfies the criteria of Clause 3.1.5.5.(1)(b).

(See Note A-3.1.4.8.(1).) (See also Notes A-3.1.5.5.(1)(b)(i) and A-3.1.5.5.(1)(b)(ii).)

2) For *buildings* described in Sentence (1), *combustible* cladding representing up to 10% of the cladding on the face of an exterior wall facing a *street* or access route shall be permitted, provided all portions of the *combustible* cladding are located not more than 15 m from a *street* or access route conforming to Article 3.2.5.6., measured horizontally from the face of the *building*.

3) A wall assembly conforming to Clause (1)(b) that includes *combustible* cladding made of *fire-retardant-treated wood* shall be tested for fire exposure after the cladding has been subjected to the accelerated weathering test specified in ASTM D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

4) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Clause (1)(b).

5) Cladding described in this Article must also comply with the requirements of Article 3.2.3.7.

3.1.5. Noncombustible Construction

3.1.5.1. Noncombustible Materials

(See Note A-3.1.4.1.(1).)

1) Except as permitted by Sentences (2) to (4) and Articles 3.1.5.2. to 3.1.5.24., 3.1.13.4. and 3.2.2.16., a *building* or part of a *building* required to be of *noncombustible construction* shall be constructed with *noncombustible* materials. (See also Subsection 3.1.13. for the requirements regarding the *flame-spread rating* of interior finishes.)

2) Notwithstanding the definition of *noncombustible* materials stated in Article 1.4.1.2. of Division A, a material is permitted to be used in *noncombustible construction* provided that, when tested in accordance with ULC-S135, "Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)," at a heat flux of 50 kW/m^2,

a) its average total heat release is not more than 3 MJ/m^2,

b) its average total smoke extinction area is not more than 1.0 m^2, and

c) the test duration is extended beyond the time stipulated in the referenced standard until it is clear that there is no further release of heat or smoke.

3) If a material referred to in Sentence (2) consists of a number of discrete layers and testing reveals that the surface layer or layers protect the underlying layers such that complete combustion of the underlying layers

does not occur, the test shall be repeated by removing the outer layers sequentially until all layers have been exposed during testing, or until complete combustion has occurred.

4) The acceptance criteria for a material tested in accordance with Sentence (3) shall be based on the cumulative emissions from all layers, which must not exceed the criteria stated in Clauses (2)(a) and (b).

3.1.5.2. Minor Combustible Components

1) The following minor *combustible* components are permitted in a *building* required to be of *noncombustible construction*:

a) paint (see also Clause 3.1.13.1.(2)(b)),

b) self-adhesive tapes, mastics and caulking materials, including foamed plastic air sealants, applied to provide a seal between the major components of exterior wall construction, (see also Article 3.6.4.3. for limits on the use of *combustible* materials in *plenum* spaces),

c) *firestops* and *fire blocks* conforming to Sentence 3.1.9.1.(1) and Article 3.1.11.7.,

d) tubing for pneumatic controls provided it has an outside diameter of not more than 10 mm,

e) adhesives, *vapour barriers* and sheathing papers,

f) electrical outlet and junction boxes,

g) wood blocking intended for the attachment of window elements within exterior wall assemblies,

h) wood blocking within wall assemblies intended for the attachment of handrails, fixtures, and similar items mounted on the surface of the wall, and

i) similar minor components.

3.1.5.3. Combustible Roofing Materials

1) *Combustible* roof covering that has an A, B, or C classification determined in conformance with Subsection 3.1.15. is permitted on a *building* required to be of *noncombustible construction*.

2) *Combustible* roof sheathing and roof sheathing supports installed above a concrete deck are permitted on a *building* required to be of *noncombustible construction* provided

a) the concrete deck is not less than 50 mm thick,

b) the height of the roof space above the deck is not more than 1 m,

c) the roof space is divided into compartments by *fire blocks* in conformance with Article 3.1.11.5.,

d) openings through the concrete deck other than for *noncombustible* roof drains and plumbing piping are protected by masonry or concrete shafts

   i) constructed as *fire separations* having a *fire-resistance rating* not less than 1 h, and

   ii) extending from the concrete deck to not less than 150 mm above the adjacent roof sheathing,

e) the perimeter of the roof is protected by a *noncombustible* parapet extending from the concrete deck to not less than 150 mm above the adjacent sheathing, and

f) except as permitted by Clause (d), the roof space does not contain any *building* services.

3) *Combustible* cant strips, roof curbs, nailing strips and similar components used in the installation of roofing are permitted on a *building* required to be of *noncombustible construction*.

4) Wood nailer facings to parapets that are not more than 610 mm high are permitted on a *building* required to be of *noncombustible construction*, provided the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.5.4. Combustible Windows, Glazing and Skylights

1) *Combustible* skylight assemblies are permitted in a *building* required to be of *noncombustible construction* if the assemblies have a *flame-spread rating* not more than

a) 150 provided the assemblies

   i) have an individual area not more than 9 m^2,

   ii) have an aggregate horizontal projected area of the openings through the ceiling not more than 25% of the area of the ceiling of the room or space in which they are located, and

   iii) are spaced not less than 2.5 m from adjacent assemblies and from required *fire separations*, or

b) 75 provided the assemblies

   i) have an individual area not more than 27 m^2,

   ii) have an aggregate horizontal projected area of the openings through the ceiling not more than 33% of the area of the ceiling of the room or space in which they are located, and

   iii) are spaced not less than 1.2 m from adjacent assemblies and from required *fire separations*.

(See Note A-3.1.5.4.(1).)

2) *Combustible* vertical glazing installed no higher than the second *storey* is permitted in a *building* required to be of *noncombustible construction*.

3) Except as permitted by Sentence (4), the *combustible* vertical glazing permitted by Sentence (2) shall have a *flame-spread rating* not more than 75.

4) The *flame-spread rating* of *combustible* glazing is permitted to be not more than 150 if the aggregate area of glazing is not more than 25% of the wall area of the *storey* in which it is located, and

a) the glazing is installed in a *building* not more than 1 *storey* in *building height*,

b) the glazing in the *first storey* is separated from the glazing in the second *storey* in accordance with the requirements of Article 3.2.3.17. for opening protection, or

c) the *building* is *sprinklered* throughout.

5) *Combustible* window sashes and frames are permitted in a *building* required to be of *noncombustible construction*, provided they are vertically non-contiguous between *storeys*.

3.1.5.5. Combustible Cladding on Exterior Walls

1) Except as provided in Sentences (2) and (3), *combustible* cladding is permitted to be used on an exterior wall assembly in a *building* required to be of *noncombustible construction*, provided

a) the *building* is

   i) not more than 3 *storeys* in *building height*, or

   ii) *sprinklered* throughout, and

b) except as provided in Sentence (4), when tested in accordance with CAN/ULC-S134, "Standard Method of Fire Test of Exterior Wall Assemblies," the wall assembly satisfies the following criteria for testing and conditions of acceptance (see Note A-3.1.5.5.(1)(b)):

   i) flaming on or in the wall assembly does not spread more than 5 m above the opening (see Note A-3.1.5.5.(1)(b)(i)), and

   ii) the heat flux during the flame exposure on the wall assembly is not more than 35 kW/m^2 measured at 3.5 m above the opening (see Note A-3.1.5.5.(1)(b)(ii)).

2) Except as permitted by Articles 3.2.3.10. and 3.2.3.11., where the *limiting distance* in Tables 3.2.3.1.-B to 3.2.3.1.-E permits an area of *unprotected openings* of not more than 10% of the *exposing building face*, the construction requirements of Table 3.2.3.7. shall be met.

3) A wall assembly permitted by Sentence (1) that includes *combustible* cladding of *fire-retardant-treated wood* shall be tested for fire exposure after the cladding has been subjected to an accelerated weathering test as specified in ASTM D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

4) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Clause (1)(b).

3.1.5.6. Combustible Components in Exterior Walls

1) *Combustible* components, other than those permitted by Article 3.1.5.5. and Sentence 3.1.5.7.(2), are permitted to be used in an exterior wall assembly of a *building* required to be of *noncombustible construction*, provided

a) the *building* is

   i) not more than 3 *storeys* in *building height*, or

   ii) *sprinklered* throughout, and

b) the wall assembly

   i) except as provided in Sentence (2), satisfies the criteria of Clause 3.1.5.5.(1)(b), or

   ii) is protected by masonry or concrete cladding not less than 25 mm thick (see Note A-3.1.5.5.(1)(b)).

2) Exterior wall assemblies constructed in accordance with Section D-6 of Appendix D are deemed to comply with Subclause (1)(b)(i).

3.1.5.7. Factory-Assembled Panels

1) Except as provided in Sentence (2), factory-assembled wall and ceiling panels containing foamed plastic insulation with a *flame-spread rating* not more than 500 are permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building*

   i) is *sprinklered*,

   ii) is not more than 18 m high, measured from *grade* to the underside of the roof, and

   iii) does not contain a Group A, Group B, or Group C *major occupancy*, and

b) the panels

   i) do not contain an air space,

   ii) when tested in accordance with CAN/ULC-S138, "Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration," meet the criteria defined therein, and

   iii) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the room or space that they bound.

2) Factory-assembled exterior wall panels containing thermosetting foamed plastic insulation are permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building*

   i) is not more than 18 m high, measured from *grade* to the underside of the roof, and

   ii) does not contain a Group B or Group C *major occupancy*, and

b) the wall panels

   i) do not contain an air space,

ii) are protected on both sides by sheet steel not less than 0.38 mm thick,

iii) remain in place for not less than 10 min when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," where the exposed surface includes typical vertical and horizontal joints, and

iv) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the room or space that they bound.

3) A walk-in cooler or freezer consisting of factory-assembled wall, floor or ceiling panels containing foamed plastic insulation with a *flame-spread rating* not more than 500 is permitted to be used in a *building* required to be of *noncombustible construction*, provided

a) the *building* is *sprinklered*, and

b) the panels

i) are protected on both sides by sheet metal not less than 0.38 mm thick with a melting point not less than 650°C,

ii) do not contain an air space,

iii) when tested in accordance with CAN/ULC-S138, "Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration," meet the criteria defined therein, and

iv) when a sample panel with an assembled joint typical of field installation is subjected to the applicable test described in Subsection 3.1.12., have a *flame-spread rating* not more than that permitted for the space in which they are located or the space that they bound, as applicable.

(See Note A-3.1.4.2.(2) and 3.1.5.7.(3).)

3.1.5.8. Nailing Elements

1) Wood nailing elements attached directly to or set into a continuous *noncombustible* backing for the attachment of interior finishes are permitted in a *building* required to be of *noncombustible construction* provided the concealed space created by the wood elements is not more than 50 mm thick.

3.1.5.9. Combustible Millwork

1) *Combustible* millwork, including interior trim, doors and door frames, show windows together with their frames, aprons and backing, handrails, shelves, cabinets and counters, is permitted in a *building* required to be of *noncombustible construction*.

3.1.5.10. Combustible Flooring Elements

1) *Combustible stage* flooring supported on *noncombustible* structural members is permitted in a *building* required to be of *noncombustible construction*.

2) Wood members more than 50 mm but not more than 300 mm high applied directly to or set into a *noncombustible* floor slab are permitted for the construction of a raised platform in a *building* required to be of *noncombustible construction* provided the concealed spaces created are divided into compartments by *fire blocks* in conformance with Sentence 3.1.11.3.(2).

3) The floor system for the raised platform referred to in Sentence (2) is permitted to include a *combustible* subfloor and *combustible* finished flooring.

4) *Combustible* finished flooring is permitted in a *building* required to be of *noncombustible construction*.

3.1.5.11. Combustible Stairs in Dwelling Units

1) *Combustible* stairs are permitted in a *dwelling unit* in a *building* required to be of *noncombustible construction*.

3.1.5.12. Combustible Interior Finishes

1) Except as permitted in Sentences (2) and (3), *combustible* interior wall and ceiling finishes referred to in Clause 3.1.13.1.(2)(b) that are not more than 1 mm thick are permitted in a *building* required to be of *noncombustible construction*.

2) *Combustible* interior wall finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* required to be of *noncombustible construction*, provided they have a *flame-spread rating* not more than 150 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

3) Except as provided in Sentence (4), *combustible* interior ceiling finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* required to be of *noncombustible construction*, provided they have a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, except that not more than 10% of the ceiling area within each *fire compartment* is permitted to have a *flame-spread rating* not more than 150.

4) *Combustible* interior ceiling finishes made of *fire-retardant-treated wood* are permitted in a *building* required to be of *noncombustible construction*, provided they are not more than 25 mm thick or are exposed *fire-retardant-treated wood* battens.

3.1.5.13. Gypsum Board

1) Gypsum board with a tightly adhering paper covering not more than 1 mm thick is permitted in a *building* required to be of *noncombustible construction* provided the *flame-spread rating* on the surface is not more than 25.

3.1.5.14. Combustible Insulation

(See Notes A-3.1.4.2. and A-3.1.4.2.(1).)

1) Foamed plastic insulation shall conform to Article 3.1.5.15.

2) *Combustible* insulation with a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*.

3) *Combustible* insulation is permitted to be installed above roof decks, outside of *foundation* walls below ground level, and beneath concrete slabs-on-ground of *buildings* required to be of *noncombustible construction*.

4) Except as provided in Sentences (5) and (6), *combustible* insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry, or

d) concrete.

5) *Combustible* insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the exterior walls of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) gypsum board not less than 12.7 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry or concrete not less than 25 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," will not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 10 min (see Note A-3.1.5.14.(5)(d)) (see also Article 3.2.3.7.).

6) *Combustible* insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the interior walls, within ceilings and within roof assemblies of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) Type X gypsum board not less than 15.9 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled, conforming to

   i) ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,"

   ii) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,"

   iii) ASTM C1396/C1396M, "Standard Specification for Gypsum Board,"

   iv) ASTM C1658/C1658M, "Standard Specification for Glass Mat Gypsum Panels," or

   v) CAN/CSA A82.27-M, "Gypsum Board,"

b) non-*loadbearing* masonry or concrete not less than 50 mm thick,

c) *loadbearing* masonry or concrete not less than 75 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials,"

   i) does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and

   ii) remains in place for not less than 40 min.

3.1.5.15. Foamed Plastic Insulation

(See Notes A-3.1.4.2. and A-3.1.4.2.(1).)

1) Foamed plastic insulation is permitted to be installed above roof decks, outside of *foundation* walls below ground level, and beneath concrete slabs-on-ground of a *building* required to be of *noncombustible construction*.

2) Except as provided in Sentences (3), (4) and 3.1.5.7.(1), foamed plastic insulation with a *flame-spread rating* not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in a *building* required to be of *noncombustible construction*, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) not less than 12.7 mm thick gypsum board mechanically fastened to a supporting assembly independent of the insulation,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry,

d) concrete, or

e) any thermal barrier that meets the requirements of classification B when tested in conformance with CAN/ULC-S124, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic."

3) Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the exterior walls of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) gypsum board not less than 12.7 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled,

b) lath and plaster, mechanically fastened to a supporting assembly independent of the insulation,

c) masonry or concrete not less than 25 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 10 min (see Note A-3.1.5.14.(5)(d)) (see also Article 3.2.3.7.).

4) Foamed plastic insulation with a *flame-spread rating* more than 25 but not more than 500 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, is permitted in the interior walls, within ceilings and within roof assemblies of a *building* required to be of *noncombustible construction* that is not *sprinklered* and is more than 18 m high, measured from *grade* to the underside of the roof, provided the insulation is protected from adjacent space in the *building*, other than adjacent concealed spaces within wall assemblies, by a thermal barrier consisting of

a) Type X gypsum board not less than 15.9 mm thick, mechanically fastened to a supporting assembly independent of the insulation and with all joints either backed or taped and filled, conforming to

   i) ASTM C1177/C1177M, "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing,"

   ii) ASTM C1178/C1178M, "Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel,"

   iii) ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or

   iv) CAN/CSA A82.27-M, "Gypsum Board,"

b) non-*loadbearing* masonry or concrete not less than 50 mm thick,

c) *loadbearing* masonry or concrete not less than 75 mm thick, or

d) any thermal barrier that, when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials,"

   i) does not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and

   ii) remains in place for not less than 40 min.

3.1.5.16. Combustible Elements in Partitions

1) Except as permitted by Sentence (2), solid lumber *partitions* not less than 38 mm thick and wood framing in *partitions* located in a *fire compartment* not more than 600 m^2 in area are permitted to be used in a *building* required to be of *noncombustible construction* in a *floor area* that is not *sprinklered* throughout provided the *partitions*

a) are not required *fire separations*, and

b) are not located in a *care*, *treatment* or *detention occupancy*.

2) *Partitions* installed in a *building* of *noncombustible construction* are permitted to contain wood framing provided

a) the *building* is not more than 3 *storeys* in *building height*,

b) the *partitions* are not located in a *care*, *treatment* or *detention occupancy*, and

c) the *partitions* are not installed as enclosures for *exits* or *vertical service spaces*.

3) Solid lumber *partitions* not less than 38 mm thick and *partitions* that contain wood framing are permitted to be used in a *building* required to be of *noncombustible construction* provided

a) the *building* is *sprinklered* throughout, and

b) the *partitions* are not

i) located in a *care*, *treatment* or *detention occupancy*,

ii) installed as enclosures for *exits* or *vertical service spaces*, or

iii) used to satisfy the requirements of Clause 3.2.8.1.(1)(a).

3.1.5.17. Storage Lockers in Residential Buildings

1) Storage lockers in storage rooms are permitted to be constructed of wood in a *building* of *residential occupancy* required to be of *noncombustible construction*.

3.1.5.18. Combustible Ducts

1) Except as required by Sentence 3.6.4.3.(1), *combustible* ducts, including *plenums* and duct connectors, are permitted to be used in a *building* required to be of *noncombustible construction* provided these ducts and duct connectors are used only in horizontal runs.

2) *Combustible* duct linings, duct coverings, duct insulation, vibration isolation connectors, duct tape, pipe insulation and pipe coverings are permitted to be used in a *building* required to be of *noncombustible construction* provided they conform to the appropriate requirements of Subsection 3.6.5.

3) In a *building* required to be of *noncombustible construction*, *combustible* ducts need not comply with the requirements of Sentences 3.6.5.1.(1) and (2) provided the ducts are

a) part of a duct system conveying only ventilation air, and

b) contained entirely within a *dwelling unit*.

3.1.5.19. Combustible Piping Materials

1) Except as permitted by Clause 3.1.5.2.(1)(d) and Sentences (2) and (3), *combustible* piping and tubing and associated adhesives are permitted to be used in a *building* required to be of *noncombustible construction* provided that, except when concealed in a wall or concrete floor slab, they

a) have a *flame-spread rating* not more than 25, and

b) if used in a *building* described in Subsection 3.2.6., have a smoke developed classification not more than 50.

2) *Combustible* sprinkler piping is permitted to be used within a *sprinklered floor area* in a *building* required to be of *noncombustible construction*. (See also Article 3.2.5.13.)

3) Polypropylene pipes and fittings are permitted to be used for drain, waste and vent piping for the conveyance of highly corrosive materials and for piping used to distribute distilled or dialyzed water in laboratory and hospital facilities in a *building* required to be of *noncombustible construction*, provided

a) the *building* is *sprinklered* throughout,

b) the piping is not located in a vertical shaft, and

c) piping that penetrates a *fire separation* is sealed at the penetration by a *firestop* that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in

CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

3.1.5.20. Combustible Plumbing Fixtures

1) *Combustible* plumbing fixtures, including wall and ceiling enclosures that form part of the plumbing fixture, are permitted in a *building* required to be of *noncombustible construction* provided they are constructed of material having a *flame-spread rating* and smoke developed classification not more than that permitted for the wall surface of the room or space in which they are installed.

3.1.5.21. Wires and Cables

1) Except as required by Sentence (2) and Article 3.1.5.22., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes are permitted in a *building* required to be of *noncombustible construction*, provided

a) the wires and cables exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cable Trays (FT4 rating) in CSA C22.2 No. 0.3, “Test Methods for Electrical Wires and Cables,” except as otherwise required by Sentence 3.6.4.3.(1),

b) the wires and cables are located in

   i) totally enclosed *noncombustible* raceways (see Note A-3.1.4.3.(1)(b)(i)),

   ii) masonry walls,

   iii) concrete slabs,

   iv) a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or

   v) totally enclosed non-metallic raceways conforming to Clause 3.1.5.23.(1)(b), or

c) the wires and cables are communication cables used at the service entry to a *building* and are not more than 3 m long.

(See Note A-3.1.5.21.(1).)

2) Except as permitted in Article 3.6.4.3., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and are not located in totally enclosed *noncombustible* raceways are permitted to be installed in a *plenum* in a *building* required to be of *noncombustible construction*, provided the wires and cables exhibit a horizontal flame distance of not more than 1.5 m, an average optical smoke density of not more than 0.15, and a peak optical smoke density of not more than 0.5 when tested in conformance with CAN/ULC-S102.4, “Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways,” (FT6 rating).

3) **Deleted**.

4) **Deleted.**

3.1.5.22. Combustible Travelling Cables for Elevators

1) *Combustible* travelling cables are permitted on elevating devices in a *building* required to be of *noncombustible construction*.

3.1.5.23. Non-metallic Raceways

1) Except as required in Sentence (2), subject to the limits on the size of elements that penetrate *fire separations* when complying with Article 3.1.9.2., within a *fire compartment* of a *building* required to be of *noncombustible construction*, totally enclosed non-metallic raceways not more than 175 mm in outside diameter, or of an equivalent rectangular area, are permitted to be used to enclose optical fibre cables and electrical wires and cables, provided

a) where the wires and cables in the raceways meet or exceed the requirements of Clause 3.1.5.21.(1)(a), the non-metallic raceways meet the requirements for at least an FT4 rating in

i) CAN/CSA-C22.2 No. 262, “Optical Fiber Cable and Communication Cable Raceway Systems,” or

ii) CAN/ULC-S143, “Standard Method of Fire Tests for Non-Metallic Electrical and Optical Fibre Cable Raceway Systems,” and

b) where the wires and cables in the raceways do not meet or exceed the requirements of Clause 3.1.5.21.(1)(a), the non-metallic raceways exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test (FT4) – Conduit or Tubing on Cable Tray in Clause 6.16 of CSA C22.2 No. 211.0, “General Requirements and Methods of Testing for Nonmetallic Conduit.”

2) Totally enclosed non-metallic raceways used in a *plenum* in a *building* required to be of *noncombustible construction* shall exhibit a horizontal flame distance of not more than 1.5 m, an average optical smoke density of not more than 0.15, and a peak optical smoke density of not more than 0.5 when tested in conformance with CAN/ULC-S102.4, “Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cables and Non-Metallic Raceways,” (FT6 rating).

3.1.5.24. Decorative Wood Cladding

1) On *buildings* required to be of *noncombustible construction*, decorative wood cladding is permitted to be used on the exterior fascias and soffits of marquees or canopies on the *building* face of a *storey* having direct access to a *street* or access route, provided the wood cladding is *fire-retardant-treated wood* that has been conditioned in conformance with ASTM D2898, “Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing,” before being tested in accordance with CAN/ULC-S102, “Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.”

3.1.5.25. Di-electric Liquid Filled Equipment

1) Where *noncombustible* surfaces are required by the “Electrical Safety Regulations” or its referenced standards, to prevent the exposure of *combustible construction* from di-electric liquid filled equipment, exterior wall assemblies and roof surfaces within the stipulated area shall

a) have no opening, or part thereof, within 6 m that are in direct line of sight to the equipment unless the opening is provided with

i) a solid *noncombustible* barrier between the equipment and *unprotected opening*,

ii) wired glass or fire-resistant glazing in steel, metal clad, or fire-rated frames, or

iii) a fire-rated *closures* tested to CAN/ULC-S104,

b) where on or within a sphere 3 m of the equipment, and in the horizontal plane projected to the ground below, exterior walls and roofs shall be constructed with the following

i) *noncombustible* materials tested to CAN/ULC-S114,

ii) cladding consisting of concrete or masonry not less than 25 mm thick, sheet steel not less than 1.6 mm thick, or noncombustible materials tested to CAN/ULC-S101 “Fire Endurance Tests of Building Construction and Materials” and complying with the conditions of acceptance in Sentence 3.2.3.8.(2), or

iii) *noncombustible* roofing materials, and

c) except as otherwise required by Clause (b), where on or within 6 m of the equipment, and in the horizontal plane projected to the ground below, exterior walls and roofs shall be protected with

i) continuous *noncombustible* cladding, flashing or roofing materials meeting the acceptance criteria of CAN/ULC-S114

ii) Concrete roof tiles with no gaps wider than 3 mm,

iii) Concrete pavers with no concealed space over 25 mm,

iv) Class A roofing material tested in conformance CAN/ULC-S107,

v) Windows with *noncombustible* frames or frames complying with 3.1.5.4.(5), or

vi) minor *combustible* components as necessary for the attachment of the roofing and cladding to the *building* structure.

3.1.6. Encapsulated Mass Timber Construction

(See Note A-3.1.6.)

3.1.6.1. Scope

1) *Encapsulated mass timber construction* permitted in this Part shall conform to this Subsection.

3.1.6.2. Materials Permitted

1) Except as otherwise provided in this Part and Sentence 6.4.3.1.(1), materials used in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall conform to Subsection 3.1.5.

3.1.6.3. Structural Mass Timber Elements

(See Note A-3.1.6.3.)

1) Except as otherwise provided in this Subsection and Articles 3.2.2.16. and 3.2.3.19., a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to include structural mass timber elements, including beams, columns, arches, and wall, floor and roof assemblies, provided they comply with Sentences (2) and (3).

2) Structural mass timber elements referred to in Sentence (1) shall

a) except as provided in Sentence (4), be arranged in heavy solid masses containing no concealed spaces,

b) have essentially smooth flat surfaces with no thin sections or sharp projections, and

c) except as provided in Sentence 3.1.6.17.(1), conform to the minimum dimensions stated in Table 3.1.6.3.

3) Adhesives used in structural mass timber elements referred to in Sentence (1) that are constructed of cross-laminated timber shall conform to the elevated temperature performance requirements in ANSI/APA PRG 320, "Standard for Performance-Rated Cross-Laminated Timber."

4) Concealed spaces are permitted within structural mass timber elements referred to in Sentence (2) and need not conform to Sentence 3.1.6.4.(1), provided the concealed spaces are

a) *sprinklered* and divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.,

b) completely filled with rock or slag fibre insulation conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a density not less than 32 kg/m^3,

c) if horizontal, lined with not less than a single layer of 12.7 mm thick Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min, or

d) if vertical, lined with not less than a single layer of 12.7 mm thick Type X gypsum board or *noncombustible* material providing an *encapsulation rating* of not less than 25 min and vertically divided into compartments by *fire blocks* in conformance with Subsection 3.1.11.

Table 3.1.6.3.
Minimum Dimensions of Structural Mass Timber Elements in Encapsulated Mass Timber Construction
Forming Part of Sentences 3.1.6.3.(2), 3.1.6.8.(1) and 3.1.6.17.(1)

Structural Wood Elements	Minimum Thickness, mm	Minimum Width × Depth, mm × mm
Walls that are *fire separations* or exterior walls (1-sided fire exposure)	96	—

Walls that require a *fire-resistance rating*, but are not *fire separations* (2-sided fire exposure)	192	—
Floors(1) and roofs (1-sided fire exposure)	96	—
Beams, columns and arches (2- or 3-sided fire exposure)	—	192 × 192
Beams, columns and arches (4-sided fire exposure)	—	224 × 224

Notes to Table 3.1.6.3.:
(1) The minimum dimensions for floor assemblies are also applicable to mezzanines and exterior balconies.

3.1.6.4. Encapsulation of Mass Timber Elements

(See also Note A-3.1.6.3.)

1) Except as provided in Sentences (3) to (9), 3.1.6.3.(4), 3.1.6.16.(2) and 3.1.6.17.(2), and Articles 3.1.6.7. and 3.1.6.12., the exposed surfaces of structural mass timber elements conforming to Article 3.1.6.3. shall be protected from adjacent spaces in the *building*, including adjacent concealed spaces within wall, floor and roof assemblies, by a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* that

a) is not less than 50 minutes in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57., or

b) conforms to the minimum values stated in Table 3.2.2.93. for the applicable *major occupancy* and *building height*.

(See Note A-3.1.6.4.(1).)

2) Except as provided in Sentence 3.1.6.11.(1), the material or assembly of materials referred to in Sentence (1) shall consist of

a) gypsum board,

b) gypsum concrete,

c) *noncombustible* materials,

d) materials that conform to Sentences 3.1.5.1.(2) to (4), or

e) any combination of the materials listed in Clauses (a) to (d).

3) Except as provided in Sentence (5) and (7), the exposed surfaces of mass timber beams, columns and arches within a *suite* or *fire compartment* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating,* other than a residential suite, need not be protected in accordance with Sentence (1), provided

a) their aggregate exposed surface area does not exceed 35% of the total wall area of the perimeter of the *suite* or *fire compartment* in which they are located, and

b) the *flame-spread rating* on any exposed surface is not more than 150.

(See Note A-3.1.6.4.(3) to (8).)

4) Except as provided in Sentences (5) to (7), the exposed surfaces of mass timber walls within a *suite* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, other than a residential suite, need not be protected in accordance with Sentence (1), provided

a) each portion of an exposed surface of a mass timber wall faces

i) faces the same direction, or

ii) is separated from any other exposing mass timber wall by a horizontal distance of not less than 4.5 m , and

b) the *flame-spread rating* on any exposed surface is not more than 150.

(See Notes A-3.1.6.4.(4) and A-3.1.6.4.(3) to (8).)

5) Except as provided in Sentence (7), the aggregate exposed surface area of mass timber elements within a *suite* permitted in Sentences (3) and (4) shall not exceed 35% of the total wall area of the perimeter of the *suite*. (See Note A-3.1.6.4.(3) to (8).)

6) Except as provided in Sentence (7), the exposed surfaces of mass timber ceilings within a *suite* or *fire compartment*, other than an *exit, public corridor* or a residential *suite*, in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, need not be protected in accordance with Sentence (1), provided their aggregate surface area does not exceed

a) 10% of the total ceiling area of the *suite* or *fire compartment*, where the *flame-spread rating* on any exposed surface is not more than 150, or

b) 25% of the total ceiling area of the *suite* or *fire compartment*, where the *flame-spread rating* on any exposed surface of a mass timber wall or ceiling is not more than 75.

(See Note A-3.1.6.4.(3) to (8).)

7) The exposed surfaces of mass timber ceilings within a *suite* in a *building* or part of a *building* constructed in conformance with Article 3.2.2.48. or 3.2.2.57. or permitted by Article 3.2.2.93. to have a 50 min *encapsulation rating*, other than a residential *suite,* need not be protected in accordance with Sentence (1) or (6), provided

a) the aggregate surface area of any exposed mass timber beams, columns and arches does not exceed 20% of the total wall area of the perimeter of the *suite* in which they are located,

b) all surfaces of mass timber walls are

   i) protected in accordance with Sentence (1), or

   ii) mass timber walls that are not otherwise permitted to be exposed in accordance with Sentence (5) are protected by a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* of not less than 80 min, and

c) the *flame spread rating* on any exposed surface of a mass timber wall or ceiling is not more than 75. (See Note A-3.1.6.4.(3) to (8).)

8) Structural mass timber elements in a *building* or part of a *building* permitted by Article 3.2.2.93. to have a 0 min *encapsulation rating* need not be protected in accordance with Sentence (1), other than residential *suites*, provided

a) mass timber walls and ceilings within *vertical service spaces*, *public corridors*, and *exits* are protected on the interior side with a material or assembly of materials conforming to Sentence (2) that provides an *encapsulation rating* of not less than 25 min, and

b) concealed spaces are protected in conformance with Sentence 3.1.6.3.(4).

(See Note A-3.1.6.4.(3) to (8).)

9) In a *building* or part of a *building* required by Clause 3.1.6.4.(1)(b) to have a minimum *encapsulation rating* of 70 min, the upper surface of a mass timber floor or roof assembly is permitted to be encapsulated by a material or assembly of materials conforming to Sentence 3.1.6.4.(2) that provides an *encapsulation rating* of 50 min.

3.1.6.5. Determination of Encapsulation Ratings

1) Except as provided in Article 3.1.6.6., the rating of a material or assembly of materials that is required to have an *encapsulation rating* shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S146, "Standard Method of Test for the Evaluation of Encapsulation Materials and Assemblies of Materials for the Protection of Structural Timber Elements."

3.1.6.6. Encapsulation Materials

(See Note A-3.1.6.6.)

1) Gypsum-concrete topping and concrete not less than 38 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on the upper side of a mass timber floor or roof assembly.

2) One layer of Type X gypsum board conforming to ASTM C 1396/C 1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," not less than 12.7 mm thick, is deemed to have an *encapsulation rating* of 25 min when installed on a mass timber element in accordance with Sentence (6).

3) Two layers of Type X gypsum board conforming to ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 12.7 mm thick are deemed to have an *encapsulation rating* of 50 min when installed on a mass timber element in accordance with Sentence (6).

4) Two layers of Type X gypsum board conforming to ASTM C 1396/C 1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 15.9 mm thick, are deemed to have an *encapsulation rating* of 70 min when installed on a mass timber element in accordance with Sentence (6).

5) Three layers of Type X gypsum board conforming to ASTM C1396/C1396M, "Standard Specification for Gypsum Board," or CAN/CSA-A82.27-M, "Gypsum Board," each not less than 12.7 mm thick, are deemed to have an *encapsulation rating* of 80 min when installed on a mass timber element in accordance with Sentence (6).

6) The gypsum board described in Sentences (2) to (5) shall be

a) fastened with a minimum of two rows of screws in each layer

   i) directly to the mass timber element with screws of sufficient length to penetrate not less than 20 mm into the mass timber element that are spaced not more than 400 mm o.c. and 20 mm to 38 mm from the boards' edges, or

   ii) to wood furring or resilient metal or steel furring channels not more than 25 mm thick spaced not more than 400 mm o.c. on the mass timber element,

b) for multiple layer systems, installed with the joints in each layer staggered from those in the adjacent layer, and

c) installed in conformance with ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board," except that, for multiple layer systems, their joints need not be taped and finished.

(See Note A-3.1.6.6.(6).)

3.1.6.7. Combustible Roofing Materials

1) Wood roof sheathing and roof sheathing supports that do not conform to Articles 3.1.6.3. and 3.1.6.4. are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they are installed

a) above a concrete deck in accordance with Sentence 3.1.5.3.(2), or

b) above a deck of *encapsulated mass timber construction*, where

   i) said deck is permitted to be encapsulated between the roof sheathing supports by a material or assembly of materials conforming to Sentence 3.1.6.4.(2) that provides an *encapsulation rating* of not less than 50 min,

   ii) the height of the roof space is not more than 1 m,

   iii) the roof space is divided into compartments by *fire blocks* in conformance with Article 3.1.11.5.,

iv) openings through the deck other than for *noncombustible* roof drains and plumbing piping are protected by shafts constructed as *fire separations* having a *fire-resistance rating* not less than 1 h that extend from the deck to not less than 150 mm above the adjacent sheathing, and

v) except as permitted by Subclause (b)(iv), the roof space does not contain any *building* services.

2) *Combustible* cant strips, roof curbs, nailing strips and similar components used in the installation of roofing are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

3) Wood nailer facings to parapets that are not more than 610 mm high are permitted on a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the facings and any roof membranes covering the facings are protected by sheet metal.

3.1.6.8. Combustible Window Sashes and Frames

1) *Combustible* window sashes and frames are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided

a) each window in an exterior wall face is an individual unit separated from every other opening in the wall by *noncombustible* wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.6.3.,

b) windows in exterior walls in contiguous *storeys* are separated by not less than 1 m of *noncombustible* wall construction or mass timber wall construction conforming to the dimensions stated in Table 3.1.6.3., and

c) the aggregate area of openings in an exterior wall face of a *fire compartment* is not more than 40% of the area of the wall face.

3.1.6.9. Exterior Cladding

1) Except as provided in Sentences (2), (3), (4), (6) and (9), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be

a) *noncombustible*,

b) a material or combination of materials that satisfy the criteria of Sentence 3.1.5.1.(2),

c) except as provided in Sentence (7), a wall assembly that satisfies the criteria of Clause 3.1.5.5.(1)(b), or

d) a combination of the cladding described in Clauses (a) to (c). (See Note A-3.1.6.9.(1), (2), (4) and (6).)

2) Except as provided in Sentences (3), (4), (6) and (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* that is not more than 12 *storeys* in *building height* is permitted to consist of

a) *combustible* cladding that

i) is not contiguous over more than 4 *storeys*,

ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,

iii) is not more than 1.2 m in width,

iv) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction,

v) is separated from other portions of *combustible* cladding on adjacent *storeys* by a horizontal distance of not less than 2.4 m, and

vi) is separated from other portions of *combustible* cladding by a horizontal distance of not less than 1.2 m,

b) *combustible* cladding that

i) is not contiguous across adjacent *storeys*,

ii) represents not more than 10% of the cladding on each exterior wall of each *storey*,

iii) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, and

iv) is separated from other portions of *combustible* cladding on adjacent *storeys* by a horizontal distance of not less than 2.4 m,

c) *combustible* cladding representing up to 100% of the cladding on exterior walls of the first *storey*, provided all portions of the cladding can be directly accessed and are located not more than 15 m from a *street* or access route conforming to Article 3.2.5.6., measured horizontally from the face of the *building*,

or

d) a combination of *noncombustible* cladding and the cladding described in Clauses (a) to (c).

(See Note A-3.1.6.9.(1), (2), (4) and (6).)

3) The permitted area of *combustible* cladding in Clause (2)(a) or (b) shall not exceed 5% of the cladding on each exterior wall of each *storey* where the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the *building* exceeds 10 min in 10% or more of all fire department calls to the *building*. (See Note A-3.2.3.1.(8).)

4) Except as provided in Sentences (6) and (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* that is not more than 6 *storeys* in *building height* is permitted to consist of

a) *combustible* cladding that

i) represents not more than 10% of the cladding on each exterior wall of each *storey*, and

ii) has a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, or

b) a combination of the cladding described in Clause (a) and the cladding described in Sentence (1) and Clause (2)(c).

(See Note A-3.1.6.9.(1), (2), (4) and (6).)

5) Where *combustible* cladding conforming to Clause (2)(a), (b) or (4)(a) on an exterior wall of a *fire compartment* is exposed to *combustible* cladding conforming to Clause (2)(a), (b) or (4)(a) on an exterior wall of the same *fire compartment* or of another *fire compartment*, and the planes of the two walls are parallel or at an angle less than 135° measured from the exterior of the *building*, the different portions of *combustible* cladding shall

a) be separated by a horizontal distance of not less than 3 m, and

b) not be contiguous over more than 2 *storeys*.

6) Except as provided in Sentence (8), cladding on an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* and not more than 4 *storeys* in *building height* is permitted to consist of *combustible* material with a *flame-spread rating* not more than 75 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction. (See Note A-3.1.6.9.(1), (2), (4) and (6).)

7) An exterior wall assembly constructed in conformance with Section D-6 of Appendix D is deemed to satisfy the criteria of Clause (1)(c).

8) Except as provided in Article 3.2.3.10., where the *limiting distance* in Table 3.2.3.1.-D or 3.2.3.1.-E permits an area of *unprotected openings* of not more than 10% of the *exposing building face*, the construction requirements of Table 3.2.3.7. shall be met.

9) A wall assembly conforming to Clause (1)(c) that includes *combustible* cladding made of *fire-retardant-treated wood* shall be tested for fire exposure after the cladding has been subjected to the accelerated

weathering test specified in ASTM D2898, “Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.”

3.1.6.10. Combustible Components in Exterior Walls

1) Except as provided in Sentence (2), *combustible* components, other than those permitted by Article 3.1.6.9., are permitted to be used in an exterior wall assembly of a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the wall assembly meets the requirements of Clause 3.1.6.9.(2)(d).

2) An exterior wall assembly constructed in conformance with Section D-6 of Appendix D is deemed to satisfy the criteria of Sentence (1).

3) Non-*loadbearing* wood elements permitted in Article 3.1.5.6. need not conform to Article 3.1.6.3. in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

3.1.6.11. Nailing Elements

1) Wood nailing elements are permitted to be used for the attachment of a material or assembly of materials used to provide an *encapsulation rating* in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the concealed space created by the wood nailing elements is not more than 25 mm deep.

2) Except as permitted by Sentence 3.1.6.16.(2) and Article 3.1.6.6., wood nailing elements are permitted to be used for the attachment of interior finishes in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the concealed space created by the wood nailing elements is not more than 50 mm deep and

a) exposed surfaces in the concealed space have a *flame-spread rating* not more than 25, or

b) the concealed space is filled with *noncombustible* insulation.

3.1.6.12. Combustible Flooring Elements

1) Wood members that are more than 50 mm but not more than 300 mm high are permitted to be used for the construction of a raised platform in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, and they need not conform to Articles 3.1.6.3. and 3.1.6.4., provided

a) the concealed spaces created by the wood members are divided into compartments by *fire blocks* in conformance with Sentence 3.1.11.3.(4), and

b) the wood members are

   i) applied directly to or set into a *noncombustible* floor slab, or

   ii) applied directly to a mass timber floor assembly that conforms to the requirements of Article 3.1.6.3.

2) The upper surface of the mass timber floor assembly referred to in Subclause (1)(b)(ii) is permitted to be encapsulated only between the wood members by a material or assembly of materials conforming to Sentences 3.1.6.4.(1) and (2).

3) The floor system for the raised platform referred to in Sentence (1) is permitted to include a *combustible* subfloor and *combustible* finished flooring.

3.1.6.13. Combustible Stairs

1) Wood stairs and landings conforming to the requirements for floor assemblies in Article 3.1.6.3. and Sentences 3.1.6.4.(1) and (2) are permitted in an *exit* stairwell in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Wood stairs in a *suite* in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* need not conform to Articles 3.1.6.3. and 3.1.6.4.

3.1.6.14. Combustible Interior Finishes

1) Except as provided in Sentences (2) and (3), *combustible* interior wall and ceiling finishes referred to in Clause 3.1.13.1.(2)(b) that are not more than 1 mm thick are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Except as provided in Sentences 3.1.6.4.(3), (4), (7) and (8), *combustible* interior wall finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they have a *flame-spread rating* not more than 150 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

3) Except as provided in Sentences (4) and 3.1.6.4.(3), (6), (7) and (8), *combustible* interior ceiling finishes, other than foamed plastics, that are not more than 25 mm thick are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they have a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, except that not more than 10% of the ceiling area within each *fire compartment* is permitted to have a *flame-spread rating* not more than 150. (See Note A-3.1.11.3.(3).)

4) *Combustible* interior ceiling finishes made of *fire-retardant-treated wood* are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided they are not more than 25 mm thick or are exposed *fire-retardant-treated wood* battens.

3.1.6.15. Combustible Elements in Partitions

1) Solid lumber *partitions* not less than 38 mm thick and *partitions* containing wood framing that do not conform to Article 3.1.6.3. are permitted in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, provided the *partitions* are

a) protected on each face with not less than

   i) a single layer of 12.7 mm thick Type X gypsum board, with all joints either backed or taped and filled, conforming to ASTM C1396/C1396M, “Standard Specification for Gypsum Board,” or CAN/CSA A82.27-M, “Gypsum Board,”

   ii) a single layer of 19 mm thick *fire-retardant-treated wood*, on solid lumber *partitions*, or

   iii) a single layer of 19 mm thick *fire-retardant-treated wood*, on *partitions* containing wood framing, where the wood stud cavities are filled with *noncombustible* insulation, and

b) not installed as enclosures for *exits* or *vertical service spaces*.

3.1.6.16. Exposed Construction Materials and Components in Concealed Spaces

1) Except as provided in Sentence (2) and Article 3.1.11.7., and except as otherwise provided in this Subsection, only construction materials and components permitted in *noncombustible construction* shall be permitted to have exposed surfaces in concealed spaces within floor, roof, and wall assemblies in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*.

2) Exposed surfaces are permitted in a concealed space created by the attachment of a material or assembly of materials conforming to Sentence 3.1.6.4.(1), provided the concealed space is not more than 25 mm deep.

3.1.6.17. Penetration by Outlet Boxes

1) The minimum dimensions stated in Table 3.1.6.3. need not apply at cutouts in vertical or horizontal structural mass timber elements where outlet boxes are installed in accordance with Article 3.1.9.3. (See also Note A-3.1.9.2.(1).)

2) The exposed surfaces of the cutouts described in Sentence (1) need not be protected in accordance with Sentence 3.1.6.4.(1).

3) Outlet boxes on opposite sides of a structural mass timber element having a *fire-resistance rating* shall be separated by a distance of not less than 600 mm.

3.1.7. Fire-Resistance Ratings

3.1.7.1. Determination of Ratings

1) Except as permitted by Sentence (2) to (4), and Articles 3.1.7.2. and 3.6.3.5., the rating of a material, assembly of materials or a structural member that is required to have a *fire-resistance rating*, shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials."

2) A material, assembly of materials or a structural member is permitted to be assigned a *fire-resistance rating* on the basis of Appendix D.

3) A ceiling assembly is permitted to be assigned a *fire-resistance rating* on the basis of Assembly Number R1 in Table A-9.10.3.1.-B.

4) A ceiling membrane is permitted to be assigned a *fire-resistance rating* on the basis of Assembly Number M1 or M2 in Table A-9.10.3.1.-B.

3.1.7.2. Exception for Exterior Walls

1) The limit on the rise of temperature on the unexposed surface of an assembly as required by the tests referred to in Sentence 3.1.7.1.(1) shall not apply to an exterior wall that has a *limiting distance* of 1.2 m or more, provided correction is made for radiation from the unexposed surface in accordance with Sentence 3.2.3.1.(9).

3.1.7.3. Exposure Conditions for Rating

1) Floor, roof and ceiling assemblies shall be rated for exposure to fire on the underside.

2) *Firewalls* and interior vertical *fire separations* shall be rated for exposure to fire on each side.

3) Exterior walls shall be rated for exposure to fire from inside the *building*.

3.1.7.4. Minimum Fire-Resistance Rating

1) The use of materials or assemblies having a greater *fire-resistance rating* than required shall impose no obligation to exceed in whole or in part the minimum *fire-resistance ratings* required by this Part.

3.1.7.5. Rating of Supporting Construction

1) Except as permitted by Sentence (2) and by Articles 3.2.2.20. to 3.2.2.93. for mixed types of construction, all *loadbearing* walls, columns and arches in the *storey* immediately below a floor or roof assembly required to have a *fire-resistance rating* shall have a *fire-resistance rating* not less than that required for the supported floor or roof assembly.

2) *Loadbearing* walls, columns and arches supporting a *service room* or *service space* need not conform to Sentence (1).

3) Except as provided in Sentence (4) and except for *noncombustible* roof assemblies required by Clauses 3.2.2.51.(2)(c) and 3.2.2.60.(2)(c), if an assembly is required to be of *noncombustible construction* and have a *fire-resistance rating*, it shall be supported by *noncombustible construction*.

4) Except for portions of a *building* constructed in accordance with Article 3.2.2.7. that are required to be of *noncombustible construction*, assemblies of *noncombustible construction* in *buildings* or portions of *buildings* permitted to be of *encapsulated mass timber construction* are permitted to be supported by *encapsulated mass timber construction*.

3.1.8. Fire Separations and Closures

3.1.8.1. General Requirements

1) Any wall, *partition* or floor assembly required to be a *fire separation* shall

a) except as permitted by Sentence (2), be constructed as a continuous element in conformance with Article 3.1.8.3., and

b) as required in this Part, have a *fire-resistance rating* as specified (see Note A-3.1.8.1.(1)(b)) .

2) Openings in a *fire separation* shall be protected with *closures*, shafts or other means in conformance with Articles 3.1.8.4. to 3.1.8.19. and Subsections 3.1.9. and 3.2.8. (See Note A-3.1.8.1.(2).)

3.1.8.2. Combustible Construction Support

1) *Combustible construction* that abuts on or is supported by a *noncombustible fire separation* shall be constructed so that its collapse under fire conditions will not cause the collapse of the *fire separation*.

3.1.8.3. Continuity of Fire Separations

1) Except as permitted by Sentence 3.6.4.2.(2), a *horizontal service space* or other concealed space located above a required vertical *fire separation*, including the walls of a vertical shaft, shall be divided at the *fire separation* by an equivalent *fire separation* within the *service space*.

2) Except as provided in Sentence (5), the continuity of a *fire separation* having a *fire-resistance rating* that abuts another *fire separation*, a floor, a ceiling, or a roof shall be maintained by a *firestop* conforming to Sentence (3). (See Note A-3.1.8.3.(2).)

3) The *firestop* required in Sentence (2) shall have an FT rating not less than the *fire-resistance rating* of the abutting *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems."

4) Except as provided in Sentence (5), joints located in a horizontal plane between a floor and an exterior wall shall be sealed by a *firestop* that, when subjected to the fire test method in ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus," has an F rating not less than the *fire-resistance rating* of the horizontal *fire separation*.

5) Joints between ceilings and walls, between floors and walls, and between walls at corners need not comply with Sentences (2) and (4) where such joints consist of gypsum board that is attached to framing members and arranged so as to restrict the passage of flame and smoke through the joints. (See Note A-3.1.8.3.(5).)

3.1.8.4. Determination of Ratings and Classifications

1) Except as permitted by Sentences (2) and 3.1.8.16.(1), the *fire-protection rating* of a *closure* shall be determined in accordance with

a) CAN/ULC-S104, "Standard Method for Fire Tests of Door Assemblies,"

b) CAN/ULC-S106, "Standard Method for Fire Tests of Window and Glass Block Assemblies," or

c) CAN/ULC-S112, "Standard Method of Fire Test of Fire Damper Assemblies."

(See Articles 3.1.8.17. to 3.1.8.19. for additional requirements for *closures*.)

2) Except as permitted by Sentence 3.1.8.12.(1), the *fire-protection rating* of a *closure* shall conform to Table 3.1.8.4. for the required *fire-resistance rating* of the *fire separation*.

3) The leakage rate of smoke dampers and combination smoke/*fire dampers* shall

a) be determined in accordance with the applicable provisions in CAN/ULC-S112.1, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems," and

b) conform to Class I, II or III of that standard.

4) The leakage rate of a door assembly shall be determined in accordance with ANSI/UL 1784, "Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives."

Table 3.1.8.4.
Fire-Protection Rating of Closures
Forming Part of Sentence 3.1.8.4.(2)

Fire-Resistance Rating* of *Fire Separation	**Minimum *Fire-Protection Rating* of *Closure***
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h	1.5 h
3 h	2 h
4 h	3 h

3.1.8.5. Installation of Closures

1) Except where *fire dampers*, window assemblies and glass block are used as *closures*, *closures* of the same *fire-protection rating* installed on opposite sides of the same opening are deemed to have a *fire-protection rating* equal to the sum of the *fire-protection ratings* of the *closures*. (See Note A-3.1.8.1.(2).)

2) Except as otherwise specified in this Part, every door, *fire damper*, window assembly or glass block used as a *closure* in a required *fire separation* shall be installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives." (See Note A-3.1.8.1.(2).)

3) Except as otherwise specified in this Part, every smoke damper or combination smoke/*fire damper* used as a *closure* in a required *fire separation* shall be installed in conformance with NFPA 105, "Standard for Smoke Door Assemblies and Other Opening Protectives."

4) If a door is installed such that it could damage the integrity of a *fire separation* if its swing is unrestricted, door stops shall be installed to prevent the damage.

5) Protective guarding devices shall be

a) provided where necessary to prevent damage to the mechanical components of doors in *fire separations*, and

b) installed so as not to interfere with the proper operation of the doors.

6) A leakage-rated door assembly complying with Sentence 3.1.8.4.(4) shall be installed in

a) *fire separations* in protected *floor areas* referred to in Clause 11.3.8.1.(1)(b),

b) *fire separations* in *care* or *treatment occupancies* referred to in Sentence 3.3.3.5.(4),

c) except as provided in Sentence (8), *fire separations* of *public corridors* serving *dwelling units* in *storeys* that are not *sprinklered*, and

d) *firewalls* that are a *horizontal exit* referred to in Sentence 3.3.3.5.(3).

7) Leakage-rated door assemblies required by Sentence (6) shall be installed in accordance with NFPA 105, "Standard for Smoke Door Assemblies and Other Opening Protectives."

8) A leakage-rated door assembly need not be installed where a *dwelling unit* served by a *public corridor* has

a) a second and separate *means of egress*, or

b) an open-air balcony that is sized to accommodate the number of occupants for which the *dwelling unit* is intended.

9) A *closure* installed as part of a *vertical fire separation* within connecting *construction* described in Clause 1.3.3.4.(3)(b) of Division A, shall be protected by a dedicated water curtain that

a) consists of quick response sprinklers with a nominal k-factor of 5.6 of the upright or pendant type on each side,

b) is located such that

i) the water curtain sprinklers are between 150 mm and 300 mm horizontally from the interior face of the opening,

ii) the water curtain sprinklers are located and not more than 3.6 m vertically above the floor immediately below and within 300 mm of the ceiling per the manufacturers listing for the quick response sprinkler head and NFPA 13,

iii) if the opening is 1.8 m or less in width, have one sprinkler head installed at the center of the opening with no more than 0.9 m horizontally from the edge of the opening,

iv) if the opening is more than 1.8 m in width, have multiple sprinkler heads installed at 1.8 m on center with no more than 0.9 m horizontally from the edge of the opening, and

c) have sprinkler heads protected from spray and from cold solder effects from adjacent sprinklers (floor area or water curtain sprinkler heads) by means of baffles in accordance with NFPA 13, and be hydraulically designed to

i) discharge water at a minimum flow rate of 1.13 L/s (18 usgpm),

ii) sprinklers will be supplied on a separate zone, and

iii) be included in the most hydraulically demanding design area for the adjacent floor area sprinklers plus the inside and outside hose stream allowance per NFPA 13.

3.1.8.6. Maximum Openings

1) The size of an opening in an interior *fire separation* required to be protected with a *closure* shall be not more than 11 m^2, with no dimension more than 3.7 m, if a *fire compartment* on either side of the *fire separation* is not *sprinklered*.

2) The size of an opening in an interior *fire separation* required to be protected with a *closure* shall be not more than 22 m^2, with no dimension more than 6 m, provided the *fire compartments* on both sides of the *fire separation* are *sprinklered*.

3.1.8.7. Location of Fire Dampers and Smoke Dampers

1) Except as provided in Article 3.1.8.8., a *fire damper* having a *fire-protection rating* conforming to Sentence 3.1.8.4.(2) shall be installed in conformance with Article 3.1.8.10. in ducts or air-transfer openings that penetrate an assembly required to be a *fire separation*.

2) Except as provided in Article 3.1.8.9., a smoke damper or a combination smoke/*fire damper* shall be installed in conformance with Article 3.1.8.11. in ducts or air-transfer openings that penetrate an assembly required to be a *fire separation*, where the *fire separation*

a) separates a *public corridor*,

b) contains an egress door referred to in Sentence 3.4.2.4.(2),

c) serves an *assembly*, *care*, *treatment*, *detention* or *residential occupancy*, or

d) is installed to meet the requirements of Clause 11.3.8.1.(1)(b) or Sentence 3.3.3.5.(4).

3.1.8.8. Fire Dampers Waived

1) Except as provided in Sentence (2), the requirement for *fire dampers* stated in Sentence 3.1.8.7.(1) is permitted to be waived for

a) ducts that serve commercial cooking equipment (see also Article 6.3.1.6.),

b) continuous *noncombustible* ducts having a melting point above 760°C that penetrate a vertical *fire separation* required by Sentence 3.3.1.1.(1) between *suites* of *assembly*, *mercantile*, *low-hazard industrial*, *medium-hazard industrial* or *high-hazard industrial occupancy*,

c) ducts or air-transfer openings that penetrate a vertical *fire separation* not required to have a *fire-resistance rating*, or

d) *noncombustible* ducts or air-transfer openings that penetrate a horizontal *fire separation* not required to have a *fire-resistance rating*.

2) The requirement for *fire dampers* stated in Sentence 3.1.8.7.(1) is permitted to be waived for *noncombustible* branch ducts having a melting point above 760°C that penetrate a *fire separation*,

a) provided the ducts

i) have a cross-sectional area not more than 0.013 m^2 and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor, or

ii) extend not less than 500 mm inside *exhaust duct* risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or

b) where the *fire separation* separates a *vertical service space* from the remainder of the *building*, provided each individual duct exhausts directly to the outdoors at the top of the *vertical service space*.

3.1.8.9. Smoke Dampers Waived

1) Except as provided in Sentence (2), the requirement for smoke dampers or combination smoke/*fire dampers* stated in Sentence 3.1.8.7.(2) is permitted to be waived for ducts

a) that serve commercial cooking equipment (see also Article 6.3.1.6.),

b) in which all inlet and outlet openings serve not more than one *fire compartment*, or

c) that penetrate a vertical *fire separation* referred to in Clause 11.3.8.1.(1)(b) or in Sentence 3.3.3.5.(4), provided

i) the movement of air is continuous, and

ii) the configuration of the air-handling system prevents the recirculation of exhaust or return air under fire emergency conditions.

2) The requirement for smoke dampers or combination smoke/*fire dampers* stated in Sentence 3.1.8.7.(2) is permitted to be waived for *noncombustible* branch ducts having a melting point above 760°C that penetrate a *fire separation*,

a) provided the ducts

i) have a cross-sectional area not more than 0.013 m^2 and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor,

ii) extend not less than 500 mm inside *exhaust duct* risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or

iii) are required to function as part of a smoke control system, or

b) where the *fire separation* separates a *vertical service space* from the remainder of the *building*, provided each individual duct exhausts directly to the outdoors at the top of the *vertical service space*.

3.1.8.10. Installation of Fire Dampers

1) A *fire damper* shall be installed in the plane of the *fire separation* so as to stay in place should the duct become dislodged during a fire. (See Note A-3.1.8.10.(1).)

2) A *fire damper* shall be arranged so as to close automatically upon the operation of a fusible link conforming to ULC-S505, "Standard for Fusible Links for Fire Protection Services," or other heat-actuated or smoke-actuated device.

3) A heat-actuated device referred to in Sentence (2) shall

a) be located where it is readily affected by an abnormal rise in temperature in the duct, and

b) have a temperature rating approximately 30°C above the maximum temperature that would exist in the system, whether it is in operation or shut down.

4) A *fire damper* tested in the vertical or horizontal position shall be installed in the position in which it was tested.

5) A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper and the resetting of the release device. (See Note A-3.1.8.10.(5).)

3.1.8.11. Installation of Smoke Dampers

1) Where smoke dampers are used as a *closure* in an air-transfer opening, they shall be installed in the plane of the *fire separation*.

2) Where combination smoke/*fire dampers* are used as a *closure* in a duct, they shall be installed within 610 mm of the plane of the *fire separation*, provided there is no inlet or outlet opening between the *fire separation* and the damper.

3) Except as required by a smoke control system, smoke dampers and combination smoke/*fire dampers* shall be configured so as to close automatically upon a signal from an adjacent *smoke detector* located as described in CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," within 1.5 m horizontally of the duct or air-transfer opening in the *fire separation*

a) on both sides of the air-transfer opening, or

b) in the duct downstream of the smoke damper or combination smoke/*fire damper*.

4) Smoke dampers or combination smoke/*fire dampers* shall be installed in the vertical or horizontal position in which they were tested.

5) A tightly fitted access door shall be installed for each smoke damper and combination smoke/*fire damper* to provide access for their inspection and the resetting of the release device. (See Note A-3.1.8.10.(5).)

3.1.8.12. Twenty-Minute Closures

1) A door assembly having a *fire-protection rating* not less than 20 min is permitted to be used as a *closure* in

a) a *fire separation* not required to have a *fire-resistance rating* more than 1 h, located between

i) a *public corridor* and a *suite*,

ii) a corridor and adjacent sleeping rooms, or

iii) a corridor and adjacent classrooms, offices and libraries in Group A, Division 2 *major occupancies*, or

b) a *fire separation* not required to have a *fire-resistance rating* more than 45 min, located in a *building* not more than 3 *storeys* in *building height*.

2) The requirements for *noncombustible* sills and *combustible* floor coverings in NFPA 80, "Standard for Fire Doors and Other Opening Protectives," do not apply to a door described in Sentence (1).

3) A door described in Sentence (1) shall have clearances of not more than 6 mm at the bottom and not more than 3 mm at the sides and top.

3.1.8.13. Self-closing Devices

1) Except as permitted by Sentence (2), every door in a *fire separation*, other than doors to freight elevators and dumbwaiters, shall be equipped with a self-closing device designed to return the door to the closed position after each use.

2) A self-closing device need not be provided on a door that is located between

a) a classroom and a corridor providing *access to exit* from the classroom in a *building* that is not more than 3 *storeys* in *building height*,

b) a *public corridor* and an adjacent room of *business and personal services occupancy* in a *building* that is not more than 3 *storeys* in *building height* provided the door is not located in a dead-end portion of the corridor,

c) a patients' sleeping room and a corridor serving the patients' sleeping room, provided the room and corridor are within a *fire compartment* in a hospital or nursing home with *treatment* that complies with the requirements of Article 3.3.3.5., or

d) a patients' sleeping room and an adjacent room that serves the patients' sleeping room, provided these rooms are within a *fire compartment* in a hospital or nursing home with *treatment* that complies with the requirements of Article 3.3.3.5.

3.1.8.14. Hold-Open Devices

1) Except as provided in Sentences 3.1.8.10.(2) and 3.1.8.11.(3), a hold-open device is permitted to be used on a *closure* in a required *fire separation*, other than on an *exit* stair door in a *building* more than 3 *storeys* in *building height* and on a door for a vestibule required by Article 3.3.5.7., provided the device is designed to release the *closure* in conformance with this Article.

2) Except as provided in Sentences (5) and (6), where the *building* is provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release

a) in a single-stage system, upon any signal from the fire alarm system, and

b) in a 2-stage system,

i) upon any *alert signal* from the fire alarm system, or

ii) upon actuation of any adjacent *smoke detectors*.

3) Where the *building* is provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release upon a signal from a *smoke detector* connected to the fire alarm system and located as described in CAN/ULC-S524, “Standard for Installation of Fire Alarm Systems,” where the hold-open device is used on

a) an *exit* door,

b) a door opening into a *public corridor*,

c) an egress door referred to in Sentence 3.4.2.4.(2),

d) a *closure* serving an *assembly*, *care*, *treatment*, *detention*, or *residential occupancy*,

e) a door in a *fire separation* referred to in Clause 11.3.8.1.(1)(b) or Sentence 3.3.3.5.(4), or

f) a door required to function as part of a smoke control system.

4) Where the *building* is not provided with a fire alarm system, a hold-open device permitted by Sentence (1) shall release upon a signal from a *smoke alarm* located on each side of the *fire separation* at ceiling level within 1.5 m horizontally of the *closure* opening in the *fire separation*, where the hold-open device is used on *closures* described in Clauses (3)(a) to (e).

5) Where a hold-open device is used on *closures* other than those described in Sentences (3) and (4), it is permitted to be released upon actuation of a heat-actuated device.

6) A hold-open device used on a door located between a corridor used by the public and an adjacent sleeping room in a *treatment occupancy* need not release automatically as stated in Sentence (2).

3.1.8.15. Door Latches

1) Except as permitted by Article 3.3.3.5., a swing-type door in a *fire separation* shall be equipped with a positive latching mechanism designed to hold the door in the closed position after each use.

3.1.8.16. Fire Protective Glazing and Glass Block

1) Except as permitted by Articles 3.1.8.18. and 3.1.8.19. for the separation of *exits*, an opening in a *fire separation* having a *fire-resistance rating* not more than 1 h is permitted to be protected with fixed fire protective glazing, wired glass assemblies or glass blocks installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives." (See also Article 3.3.2.17.)

2) Wired glass assemblies permitted by Sentence (1) and described in Appendix D are permitted to be used as *closures* in vertical *fire separations* without being tested in accordance with Sentence 3.1.8.4.(1).

3) Glass blocks permitted by Sentence (1) shall be installed in accordance with Subsection 4.3.2. and reinforced with steel reinforcement in each horizontal joint.

4) Fire protective glazing permitted by Sentence (1), shall include glazing meeting a fire-protection rating when tested in accordance CAN/ULC-S104, and shall be installed in an appropriate fire-resistive frame.

3.1.8.17. Temperature Rise Limit for Doors

1) Except as permitted by Article 3.1.8.19., the maximum temperature rise on the opaque portion of the unexposed side of a door used as a *closure* in a *fire separation* in a location shown in Table 3.1.8.17. shall conform to the Table when tested in conformance with Sentence 3.1.8.4.(1).

Table 3.1.8.17.
Restrictions on Temperature Rise and Glazing for Closures
Forming Part of Articles 3.1.8.17. and 3.1.8.18.

Location	Minimum Required *Fire-Protection Rating* of Door	Maximum Temperature Rise on Opaque Portion of Unexposed Side of Door, °C	Maximum Aggregate Area of Wired Glass or Safety Glazing in a Door, m^2	Maximum Aggregate Area of Glass Block, Wired Glass or Safety Glazing Panels Not in a Door, m^2
Between a dead-end corridor and an adjacent *occupancy* where the corridor provides the only *access to exit* and is required to have a *fire-resistance rating*	Less than 45 min	No limit	No limit	No limit
	45 min	250 after 30 min	0.0645	0.0645
Between an *exit* enclosure and the adjacent *floor area* in a *building* not more than 3 *storeys* in *building height*	All ratings	No limit	0.8	0.8
Between an *exit* enclosure and the adjacent *floor area* (except as permitted above)	45 min	250 after 30 min	0.0645	0.0645
	1.5 h	250 after 1 h	0.0645	0.0645
	2 h	250 after 1 h	0.0645	0.0645
In a *firewall*	45 min	250 after 30 min	0.0645	0
	1.5 h	250 after 30 min	0.0645	0
	3 h	250 after 1 h	0	0

3.1.8.18. Area Limits for Wired Glass, Glass Block and Safety Glazing

1) Except as permitted by Article 3.1.8.19., the maximum aggregate area of wired glass or safety glazing in a door used in the locations shown in Table 3.1.8.17. shall conform to the Table. (See Note A-3.1.8.18.(1).)

2) Except as permitted by Article 3.1.8.19., the maximum aggregate area of glass block, wired glass or safety glazing panels not in a door used in the locations shown in Table 3.1.8.17. shall conform to the Table.

3.1.8.19. Temperature Rise and Area Limits Waived

1) The temperature rise limits and glass area limits required by Articles 3.1.8.17. and 3.1.8.18. are waived for a *closure* between an *exit* enclosure and an enclosed vestibule or corridor, provided

a) the vestibule or corridor is separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 45 min,

b) the *fire separation* required by Clause (a) contains no wired glass, glass block or safety glazing within 3 m of the *closure* into the *exit* enclosure, and

c) the vestibule or corridor contains no *occupancy*.

(See Note A-3.1.8.19.(1).)

3.1.9. Penetrations in Fire Separations and Fire-Rated Assemblies

(See Note A-3.1.9.)

3.1.9.1. Firestops

1) Except as provided in Sentences (2) to (7) and Article 3.1.9.3., penetrations of a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* shall be

a) sealed by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the required *fire-resistance rating* of the *fire separation*, or

b) cast in place, where the item penetrating the *fire separation* is steel, ferrous, copper, concrete or masonry (see Note A-3.1.9.1.(1)(b)).

(See also Article 3.1.9.4. for requirements regarding penetrations by *combustible* drain, waste and vent piping.)

2) Except as permitted in Sentence (6), penetrations of a *firewall* or a horizontal *fire separation* that is required to have a *fire-resistance rating* in conformance with Article 3.2.1.2. shall be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

3) Except as permitted in Sentences (6) and (7), penetrations of a *fire separation* in conformance with Sentence 3.6.4.2.(2) shall be sealed by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation* of the assembly.

4) Sprinklers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *firestop* requirements of Sentences (1) to (3), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems."

5) Unless specifically designed with a *firestop*, *fire dampers* are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *firestop* requirements of Sentences (1) to (3), provided the *fire damper* is installed in conformance with NFPA 80, "Standard for Fire Doors and Other Opening Protectives."

6) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentences (2) and (3) that are contained within the cavity of a wall above and below the horizontal *fire separation* are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test

method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” has an F rating not less than the *fire-resistance rating* for the *fire separation*.

7) Service equipment penetrations through a horizontal *fire separation* having a *fire-resistance rating* as described in Sentence (3) are permitted to be sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” has an F rating not less than the *fire-resistance rating* for the *fire separation*, provided the penetration

a) is contained within the concealed space of a floor or ceiling assembly having a *fire-resistance rating*,

b) is located above a ceiling membrane that is a horizontal *fire separation*, or

c) is contained within a *horizontal service space* conforming to Subsection 3.6.4. that is directly above or below the floor.

3.1.9.2. Service Equipment Penetrations

1) Ducts, electrical outlet boxes, pipes, totally enclosed raceways, optical fibre cables, electrical wires and cables, and other similar service equipment are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating*, provided they are protected at the penetration with a *firestop* conforming to Sentence 3.1.9.1.(1). (See Note A-3.1.9.2.(1).)

2) *Combustible* totally enclosed raceways that are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating*, provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.

3.1.9.3. Penetration by Outlet Boxes

(See Note A-3.1.9.3.) (See also Note A-3.1.9.2.(1).)

1) Except as provided in Sentence (3), outlet boxes are permitted to penetrate the membrane of an assembly required to have a *fire-resistance rating*, provided they are sealed at the penetration by a *firestop* that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems.”

2) *Combustible* outlet boxes are permitted to penetrate the membrane of an assembly required to have a *fire-resistance rating*, provided they are sealed at the penetration by a *firestop* that, when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems,” has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

3) Except as provided in Sentences 3.1.9.1.(2) and (3), *noncombustible* outlet boxes that penetrate a vertical *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* need not conform to Sentence (1), provided

a) they do not exceed

   i) 0.016 m^2 in area, and

   ii) an aggregate area of 0.065 m^2 in any 9.3 m^2 of surface area, and

b) the annular space between the membrane and the *noncombustible* electrical outlet boxes does not exceed 3 mm.

4) Outlet boxes on opposite sides of a vertical *fire separation* having a *fire-resistance rating* shall be separated by

a) a horizontal distance of not less than 600 mm,

b) a *fire block* conforming to Article 3.1.11.7., or

c) a *firestop* installed on each outlet box that has an FT rating not less than the *fire-resistance rating* of the *fire separation* when subjected to the fire test method in CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems.”

3.1.9.4. Combustible Piping Penetrations

1) *Combustible* sprinkler piping is permitted to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.

2) *Combustible* water distribution piping is permitted to penetrate a *fire separation* that is required to have a *fire-resistance rating*, provided the piping is protected at the penetration with a *firestop* in conformance with Clause (4)(a) or (b).

3) Except as permitted by Sentences (4), (5), (7) and (8), *combustible* piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates

a) a *fire separation* required to have a *fire-resistance rating*, or

b) a membrane that forms part of an assembly required to have a *fire-resistance rating*.

4) *Combustible* drain, waste and vent piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided

a) except as provided in Clause (b), the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems,"

b) in *buildings* more than 3 *storeys* in *building height*, the piping is sealed at the penetration by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

c) the piping is not located in a *vertical service space*.

5) *Combustible* drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a *vertical service space*.

6) *Combustible* piping for central vacuum systems is permitted to penetrate a *fire separation*, provided the installation conforms to the requirements that apply to *combustible* drain, waste and vent piping specified in Sentence (4).

7) Except as provided in Sentence (8), penetrations of a *fire separation* that incorporate transitions between *combustible* and *noncombustible* drain, waste and vent piping shall be sealed by a *firestop* that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side.

8) Transitions between vertical *noncombustible* drain, waste and vent piping and *combustible* branches for drain, waste and vent piping are permitted on either side of a *fire separation*, provided they are not located in a *vertical service space*. (See Note A-3.1.9.4.(8).)

3.1.9.5. Openings through a Membrane Ceiling

1) A membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of Appendix D is permitted to be penetrated by openings leading into ducts within the ceiling space, provided

a) the ducts are sheet steel, and

b) the number of openings and their protection conform to the requirements of Appendix D.

3.1.9.6. Plenums

1) A ceiling assembly used as a *plenum* shall conform to Article 3.6.4.3.

3.1.10. Firewalls

3.1.10.1. Prevention of Firewall Collapse

1) Except as permitted by Sentence (2), the connections and supports for structural framing members that are connected to or supported on a *firewall* and have a *fire-resistance rating* less than that required for the *firewall*, shall be designed so that the failure of the framing systems during a fire will not affect the integrity of the *firewall* during the fire.

2) Sentence (1) does not apply to a *firewall* consisting of two separate wall assemblies each tied to its respective *building* frame but not to each other, provided each wall assembly is

a) a *fire separation* having one half of the *fire-resistance rating* required for the *firewall* by Sentences 3.1.10.2.(1) and (2), and

b) designed so that the collapse of one wall assembly will not cause collapse of the other.

3) A *firewall* is permitted to be supported on the structural frame of a *building* of *noncombustible construction* provided the supporting frame has a *fire-resistance rating* not less than that required for the *firewall*.

4) Piping, ducts and totally enclosed *noncombustible* raceways shall be installed so that their collapse will not cause collapse of the *firewall*.

3.1.10.2. Rating of Firewalls

1) A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h, except that where the upper portion of a *firewall* separates *floor areas* containing other than Group E or Group F, Division 1 or 2 *major occupancies*, the *fire-resistance rating* of the upper portion of the *firewall* is permitted to be not less than 2 h.

2) A *firewall* that separates a *building* or *buildings* with *floor areas* containing *major occupancies* other than Group E or Group F, Division 1 or 2 shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h.

3) Except as permitted by Sentence (4), the required *fire-resistance rating* of a *firewall*, except for *closures*, shall be provided by masonry or concrete.

4) A *firewall* permitted to have a *fire-resistance rating* not more than 2 h need not be constructed of masonry or concrete, provided

a) the assembly providing the *fire-resistance rating* is protected against damage that would compromise the integrity of the assembly, and

b) the design conforms to Article 4.1.5.17.

(See Note A-3.1.10.2.(4).)

3.1.10.3. Continuity of Firewalls

1) A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated, except that a *firewall* located above a *basement storage garage* conforming to Article 3.2.1.2. is permitted to commence at the floor assembly immediately above the *storage garage*. (See also Sentence 3.1.10.1.(3).)

2) A *firewall* is permitted to terminate on the underside of a reinforced concrete roof slab, provided

a) the roof slab on both sides of the *firewall* has a *fire-resistance rating* not less than

i) 1 h if the *firewall* is required to have a *fire-resistance rating* not less than 2 h, or

ii) 2 h if the *firewall* is required to have a *fire-resistance rating* not less than 4 h, and

b) there are no concealed spaces within the roof slab in that portion immediately above the *firewall*.

3.1.10.4. Parapets

1) Except as permitted by Sentences (2) and 3.1.10.3.(2), a *firewall* shall extend above the roof surface to form a parapet not less than

a) 150 mm high for a *firewall* required to have a *fire-resistance rating* not less than 2 h, and

b) 900 mm high for a *firewall* required to have a *fire-resistance rating* not less than 4 h.

2) A *firewall* that separates 2 *buildings* with roofs at different elevations need not extend above the upper roof surface to form a parapet, provided the difference in elevation between the roofs is more than 3 m.

3.1.10.5. Maximum Openings

1) Openings in a *firewall* shall conform to the size limits described in Article 3.1.8.6.

2) The aggregate width of openings in a *firewall* within a *storey* shall be not more than 25% of the entire length of the *firewall*.

3.1.10.6. Exposure Protection for Adjacent Walls

1) The requirements of Article 3.2.3.14. shall apply to the external walls of 2 *buildings* that meet at a *firewall* at an angle less than 135°.

3.1.10.7. Combustible Projections

1) *Combustible* material shall not extend across the end of a *firewall* but is permitted to extend across a roof above a *firewall* that is terminated in conformance with Sentence 3.1.10.3.(2).

2) If *buildings* are separated by a *firewall*, *combustible* projections on the exterior of one *building*, including balconies, platforms, canopies, eave projections and stairs, that extend outward beyond the end of the *firewall*, shall not be permitted within 2.4 m of *combustible* projections and window or door openings of the adjacent *building*. (See also Article 3.2.3.6.)

3.1.11. Fire Blocks in Concealed Spaces

3.1.11.1. Separation of Concealed Spaces

1) Concealed spaces in interior wall, ceiling and crawl spaces shall be separated from concealed spaces in exterior walls and *attic or roof spaces* by *fire blocks* conforming to Article 3.1.11.7.

3.1.11.2. Fire Blocks in Wall Assemblies and Concealed Vertical Spaces

1) Except as permitted by Sentence (2), *fire blocks* conforming to Article 3.1.11.7. shall be provided to block off concealed spaces within a wall assembly and concealed vertical spaces forming part of a wood-framed building

a) at every floor level,

b) at every ceiling level where the ceiling forms part of an assembly required to have a *fire-resistance rating*, and

c) so that the maximum horizontal dimension is not more than 20 m and the maximum vertical dimension is not more than 3 m.

2) *Fire blocks* conforming to Sentence (1) are not required, provided

a) the wall space is filled with insulation,

b) the exposed construction materials and any insulation within the wall space are *noncombustible*,

c) the exposed materials within the space, including insulation but not including wiring, piping or similar services, have a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, and *fire blocks* are installed so that the vertical distance between them is not more than 10 m, or

d) the insulated wall assembly contains not more than one concealed air space, and the horizontal thickness of that air space is not more than 25 mm.

3.1.11.3. Fire Blocks between Nailing and Supporting Elements

1) In a *building* required to be of *noncombustible construction*, a concealed space in which there is an exposed ceiling finish with a *flame-spread rating* more than 25 shall be provided with *fire blocks* conforming to Article 3.1.11.7. between wood nailing elements so that the maximum area of the concealed space is not more than 2 m^2.

2) In a *building* required to be of *noncombustible construction*, *fire blocks* conforming to Article 3.1.11.7. shall be provided in the concealed spaces created by the wood members permitted by Sentence 3.1.5.10.(2) so that the maximum area of a concealed space is not more than 10 m^2.

3) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, a concealed space in which there is an exposed ceiling finish with a *flame-spread rating* more than 25 shall be provided with *fire blocks* conforming to Article 3.1.11.7. between wood nailing elements so that the maximum area of the concealed space is not more than 2 m^2. (See Note A-3.1.11.3.(3).)

4) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, *fire blocks* conforming to Article 3.1.11.7. shall be provided in the concealed spaces created by the wood members permitted by Sentence 3.1.6.12.(1) so that the maximum area of a concealed space is not more than 10 m^2.

3.1.11.4. Fire Blocks between Vertical and Horizontal Spaces

1) *Fire blocks* conforming to Article 3.1.11.7. shall be provided

a) at all interconnections between concealed vertical and horizontal spaces in interior coved ceilings, drop ceilings and soffits in which the exposed construction materials within the space have a *flame-spread rating* more than 25, and

b) at the end of each run and at each floor level in concealed spaces between stair stringers in which the exposed construction materials within the space have a *flame-spread rating* more than 25.

3.1.11.5. Fire Blocks in Horizontal Concealed Spaces

1) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and as required in Sentence (3), horizontal concealed spaces within a floor assembly or roof assembly of *combustible construction*, in which sprinklers are not installed, shall be separated by construction conforming to Article 3.1.11.7. into compartments

a) not more than 600 m^2 in area with no dimension more than 60 m if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and

b) not more than 300 m^2 in area with no dimension more than 20 m if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(1).)

2) A concealed space in an exterior cornice, a mansard-style roof, a balcony or a canopy in which exposed construction materials within the space have a *flame-spread rating* more than 25, shall be separated by construction conforming to Article 3.1.11.7.

a) at locations where the concealed space extends across the ends of required vertical *fire separations*, and

b) so that the maximum dimension in the concealed space is not more than 20 m.

3) Except as provided in Sentence (5), in *buildings* or parts thereof conforming to Article 3.2.2.51. or 3.2.2.60., horizontal concealed spaces within a floor assembly or roof assembly of *combustible construction* shall be separated by construction conforming to Article 3.1.11.7. into compartments that are

a) not more than 600 m^2 in area with no dimension more than 60 m, if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and

b) not more than 300 m² in area with no dimension more than 20 m, if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(3) and (4).)

4) Except for crawl spaces conforming to Sentence 3.1.11.6.(1) and except as provided in Sentence (5), in *buildings* or parts thereof conforming to Article 3.2.2.48., 3.2.2.57., or 3.2.2.93., horizontal concealed spaces within a floor assembly or roof assembly of *encapsulated mass timber construction* shall be separated by construction conforming to Article 3.1.11.7. into compartments that are

a) not more than 600 m² in area with no dimension more than 60 m, if the exposed construction materials within the space have a *flame-spread rating* not more than 25, and

b) not more than 300 m² in area with no dimension more than 20 m, if the exposed construction materials within the space have a *flame-spread rating* more than 25.

(See Note A-3.1.11.5.(3) and (4).)

5) *Fire blocks* conforming to Sentences (3) and (4) are not required where the horizontal concealed space within the floor or roof assembly is entirely filled with *noncombustible* insulation such that any air gap between the top of the insulation and the floor or roof deck does not exceed 50 mm.

3.1.11.6. Fire Blocks in Crawl Spaces

1) A crawl space that is not considered as a *basement* by Article 3.2.2.9. and in which sprinklers are not installed shall be separated by construction conforming to Article 3.1.11.7. into compartments not more than 600 m² in area with no dimension more than 30 m.

3.1.11.7. Fire Block Materials

1) Except as permitted by Sentences (2) to (5) and (8), *fire blocks* shall remain in place and prevent the passage of flames for not less than 15 min when subjected to the standard fire exposure in CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials."

2) Gypsum board not less than 12.7 mm thick and sheet steel not less than 0.38 mm thick need not be tested in conformance with Sentence (1), provided all joints have continuous support.

3) In a *building* required to be of *noncombustible construction*, wood nailing elements described in Article 3.1.5.8. need not be tested in conformance with Sentence (1).

4) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, wood nailing elements referred to in Article 3.1.6.11. need not be tested in conformance with Sentence (1).

5) In a *building* permitted to be of *combustible construction*, in a *combustible* roof system permitted by Sentences 3.1.5.3.(2) and 3.1.6.7.(1), and in a raised platform permitted by Sentences 3.1.5.10.(2) and 3.1.6.12.(1), *fire blocks* are permitted to be

a) solid lumber or a structural composite lumber product conforming to ASTM D5456, "Standard Specification for Evaluation of Structural Composite Lumber Products," not less than 38 mm thick,

b) phenolic bonded plywood, waferboard, or oriented strandboard not less than 12.5 mm thick with joints supported, or

c) two thicknesses of lumber or a structural composite lumber product conforming to ASTM D5456, "Standard Specification for Evaluation of Structural Composite Lumber Products," each not less than 19 mm thick with joints staggered, where the width or height of the concealed space requires more than one piece of lumber or structural composite lumber product not less than 38 mm thick to block off the space.

6) Openings through materials referred to in Sentences (1) to (5) shall be protected to maintain the integrity of the construction.

7) Where materials referred to in Sentences (1) to (5) are penetrated by construction elements or by service equipment, a *firestop* shall be used to seal the penetration. (See Note A-3.1.11.7.(7).)

8) In *buildings* permitted to be of *combustible construction*, semi-rigid fibre insulation board produced from glass, rock or slag is permitted to be used to block the vertical space in a double stud wall assembly formed at the intersection of the floor assembly and the walls, provided the width of the vertical space does not exceed 25 mm and the insulation board

a) has a density not less than 45 kg/m^3,

b) is securely fastened to one set of studs,

c) extends from below the bottom of the top plates in the lower *storey* to above the top of the bottom plate in the upper *storey*, and

d) completely fills the portion of the vertical space between the headers and between the wall plates.

(See Note A-3.1.11.7.(8).)

3.1.12. Flame-Spread Rating and Smoke Developed Classification

3.1.12.1. Determination of Ratings

1) Except as required by Sentence (2) and as permitted by Sentence (3), the *flame-spread rating* and smoke developed classification of a material, assembly, or structural member shall be determined on the basis of not less than three tests conducted in conformance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

2) The *flame-spread rating* and smoke developed classification of a material or assembly shall be determined on the basis of not less than three tests conducted in conformance with CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies," if the material or assembly

a) is designed for use in a relatively horizontal position with only its top surface exposed to air,

b) cannot be tested in conformance with Sentence (1) without the use of supporting material that is not representative of the intended installation, or

c) is thermoplastic.

3) A material, assembly, or structural member is permitted to be assigned a *flame-spread rating* and smoke developed classification on the basis of Appendix D.

3.1.13. Interior Finish

3.1.13.1. Interior Finishes, Furnishings and Decorative Materials

1) Except as otherwise provided by this Subsection, interior finishes, furnishings and decorative materials shall conform to Section 2.3. of Division B of the Fire By-law.

2) Interior finish material shall include any material that forms part of the interior surface of a floor, wall, *partition* or ceiling, including

a) interior cladding of plaster, wood or tile,

b) surfacing of fabric, paint, plastic, veneer or wallpaper,

c) doors, windows and trim,

d) lighting elements such as light diffusers and lenses forming part of the finished surface of the ceiling, and

e) carpet material that overlies a floor that is not intended as the finished floor.

3.1.13.2. Flame-Spread Rating

1) Except as otherwise required or permitted by this Subsection, the *flame-spread rating* of interior wall and ceiling finishes, including glazing and skylights, shall be not more than 150 and shall conform to Table 3.1.13.2.

Table 3.1.13.2.
Flame-Spread Ratings
Forming Part of Sentence forming 3.1.13.2.(1)

***Occupancy*, Location or Element**	**Maximum *Flame-Spread Rating* for Walls and Ceilings**	
	Sprinklered	**Not *Sprinklered***
Group A, Division 1 *occupancies*, including doors, skylights, glazing and light diffusers and lenses	150	75
Group B *occupancies*	150	75
Exits(1)	25	25
Lobbies described in Sentence 3.4.4.2.(2)	25	25
Covered vehicular passageways, except for roof assemblies of *heavy timber construction* in the passageways	25	25
Vertical service spaces	25	25

Notes to Table 3.1.13.2.:
(1) See Articles 3.1.13.8. and 3.1.13.10.

2) Except as permitted by Sentence (3), doors, other than those in Group A, Division 1 *occupancies*, need not conform to Sentence (1) provided they have a *flame-spread rating* not more than 200. (See Note A-3.1.13.2.(2).)

3) Doors within a *dwelling unit* need not conform to Sentences (1) and (2).

4) Up to 10% of the total wall area and 10% of the total ceiling area of a wall or ceiling finish that is required by Sentence (1) to have a *flame-spread rating* less than 150 is permitted to have a *flame-spread rating* not more than 150, except that up to 25% of the total wall area of lobbies described in Sentence 3.4.4.2.(2) is permitted to have a *flame-spread rating* not more than 150.

5) Except in the case of Group A, Division 1 *occupancies*, *combustible* doors, skylights, glazing and light diffusers and lenses shall not be considered in the calculation of wall and ceiling areas described in Sentence (4).

3.1.13.3. Bathrooms in Residential Suites

1) The *flame-spread rating* of interior wall and ceiling finishes for a bathroom within a *suite* of *residential occupancy* shall be not more than 200.

3.1.13.4. Light Diffusers and Lenses

1) The *flame-spread rating* of *combustible* light diffusers and lenses in all *occupancies* other than Group A, Division 1 is permitted to be more than the *flame-spread rating* limits required elsewhere in this Subsection, provided the light diffusers and lenses

a) have a *flame-spread rating* not more than 250 and a smoke developed classification not more than 600 when tested in conformance with CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies,"

b) fall to the bottom of the test apparatus before igniting when tested in conformance with CAN/ULC-S102.3, "Standard Method of Fire Test of Light Diffusers and Lenses,"

c) are not prevented from falling from the ceiling by construction located beneath the elements, and

d) are not used in a corridor that is required to be separated from the remainder of the *building* by a *fire separation* or in an *exit* shaft unless individual diffusers or lenses are not more than 1 m^2 in area and are not less than 1.2 m apart.

3.1.13.5. Skylights

1) Individual *combustible* skylights in a corridor that is required to be separated from the remainder of the *building* by a *fire separation* shall be not more than 1 m^2 in area and not less than 1.2 m apart.

3.1.13.6. Corridors

1) Except as permitted by Sentences (2) and (3), the *flame-spread rating* shall be not more than 75 for the interior wall finish of

a) a *public corridor*,

b) a corridor used by the public in an *assembly occupancy*, or

c) a corridor serving classrooms.

2) The *flame-spread rating* for corridors specified in Sentence (1) is permitted to be waived, provided the *flame-spread rating* is not more than

a) 25 on the upper half of the wall, and

b) 150 on the lower half of the wall.

3) Where the *floor area* is *sprinklered* throughout, the *flame-spread ratings* for corridors specified in Sentences (1) and (2) shall be not more than 150.

4) The *flame-spread ratings* specified in Sentences (1), (2) and (3) apply to *occupancies* in the corridor as well as to the corridor itself.

5) Except as provided in Sentence (6), the interior ceiling finish of corridors and *occupancies* referred to in Sentences (1) and (4) shall have a *flame-spread rating* not more than 25.

6) Where the *floor area* is *sprinklered* throughout, the *flame-spread rating* of the interior ceiling finish of corridors and *occupancies* referred to in Sentences (1) and (4) shall be not more than 150.

3.1.13.7. High Buildings

1) Except as permitted by Sentences (2) to (4), the interior wall, ceiling and floor finishes in a *building* regulated by the provisions of Subsection 3.2.6. shall conform to the *flame-spread rating* requirements in Articles 3.1.13.2. and 3.1.13.11. and to the *flame-spread rating* and smoke developed classification values in Table 3.1.13.7.

Table 3.1.13.7.
Flame-Spread Rating and Smoke Developed Classification in High Buildings
Forming Part of Sentence 3.1.13.7.(1)

Location or Element	Maximum *Flame-Spread Rating*			Maximum Smoke Developed Classification		
	Wall Surface	Ceiling Surface(1)	Floor Surface	Wall Surface	Ceiling Surface(1)	Floor Surface
Exit stairways, vestibules to *exit* stairs and lobbies described in Sentence 3.4.4.2.(2)	25	25	25	50	50	50
Corridors not within *suites*	(2)	(2)	300	100	50	500
Elevator cars	75	75	300	450	450	450
Elevator vestibules	25	25	300	100	100	300
Service spaces and *service rooms*	25	25	25	50	50	50
Other locations and elements	(2)	(2)	No Limit	300	50	No Limit

Notes to Table 3.1.13.7.:
(1) See Article 3.1.13.4. for lighting elements.
(2) Other requirements of this Part apply.

2) Except for a *building* of Group B *major occupancy* and elevator cars, the *flame-spread rating* and smoke developed classification of interior wall, floor and ceiling finishes need not conform to the values in Table 3.1.13.7., provided the *building* is *sprinklered*.

3) Trim and millwork in an *exit* stairway, a vestibule to an *exit* stairway, a lobby described in Sentence 3.4.4.2.(2), or a corridor not within a *suite* need not conform to the *flame-spread rating* and smoke developed classification requirements of Sentence (1) provided they have

a) a *flame-spread rating* not more than 150,

b) a smoke developed classification not more than 300, and

c) an aggregate area not more than 10% of the area of the wall or ceiling on which they occur.

4) A door serving an *exit* stairway, a vestibule to an *exit* stairway, a lobby described in Sentence 3.4.4.2.(2), or a corridor not within a *suite* need not conform to the *flame-spread rating* and smoke developed classification requirements of Sentence (1) provided

a) it has a *flame-spread rating* not more than 200,

b) it has a smoke developed classification not more than 300, and

c) the aggregate area of all doors is not more than 10% of the area of the wall in which they are located.

3.1.13.8. Noncombustible Construction

1) In a *building* required to be of *noncombustible construction*,

a) the *flame-spread ratings* required by Subsection 3.1.5. shall apply in addition to the requirements in this Subsection, and

b) the *flame-spread ratings* for *exits* in this Subsection shall also apply to any surface in the *exit* that would be exposed by cutting through the material in any direction, except that this requirement does not apply to doors, *heavy timber construction* in a *sprinklered building* and *fire-retardant-treated wood*.

3.1.13.9. Underground Walkways

1) Except for paint, the interior wall and ceiling finishes of an underground *walkway* shall be of *noncombustible* materials.

3.1.13.10. Exterior Exit Passageway

1) The wall and ceiling finishes of an exterior *exit* passageway that provides the only *means of egress* from the rooms or *suites* it serves, including the soffit beneath and the *guard* on the passageway, shall have a *flame-spread rating* not more than 25, except that a *flame-spread rating* not more than 150 is permitted for up to 10% of the total wall area and for up to 10% of the total ceiling area.

3.1.13.11. Elevator Cars

1) The wall and ceiling surfaces of elevator cars shall have a *flame-spread rating* not more than 75.

2) The wall, ceiling and floor surfaces of elevator cars shall have a smoke developed classification not more than 450.

3.1.13.12. Encapsulated Mass Timber Construction

1) In a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,

a) the *flame-spread ratings* required by Subsection 3.1.6. shall apply in addition to the requirements in this Subsection, and

b) the *flame-spread ratings* for *exits* required by this Subsection shall also apply to any surface in the *exit* that would be exposed by cutting through the material in any direction, except that this requirement does not apply to doors, structural mass timber elements conforming to Sentence 3.1.6.4.(3), *heavy timber construction*, and *fire-retardant-treated wood*.

3.1.14. Roof Assemblies

3.1.14.1. Fire-Retardant-Treated Wood Roof Systems

1) If a *fire-retardant-treated wood* roof system is used to comply with the requirements of Subsection 3.2.2., the roof deck assembly shall meet the conditions of acceptance of CAN/ULC-S126, "Standard Method of Test for Fire Spread Under Roof-Deck Assemblies."

2) Supports for the roof deck assembly referred to in Sentence (1) shall consist of

a) *fire-retardant-treated wood*,

b) *heavy timber construction*,

c) *noncombustible construction*, or

d) a combination thereof.

3.1.14.2. Metal Roof Deck Assemblies

1) Except as permitted by Sentence (2), a metal roof deck assembly shall meet the conditions of acceptance of CAN/ULC-S126, "Standard Method of Test for Fire Spread Under Roof-Deck Assemblies," if

a) it supports a *combustible* material above the deck that could propagate a fire beneath the roof deck assembly, and

b) the deck is used to comply with the requirements of Sentences 3.2.2.25.(2), 3.2.2.32.(2), 3.2.2.62.(2), 3.2.2.68.(2), 3.2.2.78.(2) and 3.2.2.85.(2) for *noncombustible construction*.

2) The requirements of Sentence (1) are waived provided

a) the *combustible* material above the roof deck is protected by not less than 12.7 mm thick gypsum board, mechanically fastened to a supporting assembly if located beneath the roof deck, or by a thermal barrier conforming to one of Clauses 3.1.5.15.(2)(c) to (e) that is located

i) on the underside of the *combustible* material, or

ii) beneath the roof deck,

b) the *building* is *sprinklered* throughout, or

c) the roof assembly has a *fire-resistance rating* not less than 45 min.

3.1.14.3. Overhead Skylight Glazing

1) All skylights shall be glazed with wired glass, laminated safety glass or *combustible* glazing, which is anchored to the skylight frame and to the *building* structure. (See Note A-3.1.14.3.)

3.1.14.4. Vegetated Roof Assemblies

1) A *vegetated roof assembly* is permitted in *combustible* and *noncombustible construction* if

a) the *vegetated roof assembly* is designed and constructed in conformance with ANSI/SPRI VF-1 "External Fire Design Standard for Vegetative Roofs",

b) the *vegetated roof assembly* conforms to the requirements in Part 5, and

c) except for *buildings* to which Part 9 applies as described in Sentence 1.3.3.3.(1) of Division A, the roof covering conforms with Subsection 3.1.15.

3.1.15. Roof Covering

(See Note A-1.4.1.1. of Division A concerning roof terminology)

3.1.15.1. Roof Covering Classification

1) A roof covering classification shall be determined in conformance with CAN/ULC-S107, "Standard Methods of Fire Tests of Roof Coverings."

3.1.15.2. Roof Coverings

1) Except as provided in Sentences (2) to (4), every roof covering shall have a Class A, B or C classification as determined in accordance with Article 3.1.15.1.

2) A roof covering is not required to have a Class A, B or C classification for

a) a tent,

b) an *air-supported structure*,

c) a *building* of Group A, Division 2 *occupancy* not more than 2 *storeys* in *building height* and not more than 1 000 m^2 in *building area* provided the roof covering is underlaid with *noncombustible* material, or

d) a steel *building* system referred to in Article 4.3.4.3., provided the roof covering consists of brick, masonry, concrete, metal sheets or metal shingles.

3) Except as provided in Sentence (5), roof coverings on *buildings* conforming to Article 3.2.2.51. or 3.2.2.60. shall have a Class A classification where the roof height is greater than 25 m measured from the floor of the *first storey* to the highest point of the roof.

4) Except as provided in Sentence (5), roof coverings in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction* shall have a Class A classification where the roof height is greater than 25 m measured from the floor of the *first storey* to the highest point of the roof.

5) Where *buildings* or parts thereof conforming to Article 3.2.2.48., 3.2.2.51., 3.2.2.57., 3.2.2.60., or 3.2.2.93., include non-contiguous roof assemblies at different elevations, the roof coverings referred to in Sentences (3) and (4) are permitted to be evaluated separately to determine the roof covering classification required.

3.1.16. Fabrics

3.1.16.1. Fabric Canopies and Marquees

1) Fabrics used as part of an awning, canopy or marquee that is located within or attached to a *building* of any type of construction shall conform to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films."

3.1.17. Occupant Load

3.1.17.1. Occupant Load Determination

1) The *occupant load* of a *floor area* or part of a *floor area* shall be based on

a) the number of seats in an *assembly occupancy* having fixed seats,

b) 2 persons per sleeping room in a *dwelling unit*, or

c) the number of persons for which the area is designed, but not less than that determined from Table 3.1.17.1. for *occupancies* other than those described in Clauses (a) and (b), unless it can be shown that the area will be occupied by fewer persons.

2) If a *floor area* or part thereof has been designed for an *occupant load* other than that determined from Table 3.1.17.1., a permanent sign indicating that *occupant load* shall be posted in a conspicuous location.

3) For the purposes of this Article, *mezzanines*, tiers and balconies shall be regarded as part of the *floor area*.

4) If a room or group of rooms is intended for different *occupancies* at different times, the value to be used from Table 3.1.17.1. shall be the value which gives the greatest number of persons for the *occupancies* concerned.

Table 3.1.17.1.
Occupant Load
Forming Part of Article 3.1.17.1.

Type of Use of *Floor Area* or Part Thereof	**Area per person, m^2**
Assembly uses space with fixed seats	(1)
space with non-fixed seats	0.75
stages for theatrical performances	0.75
space with non-fixed seats and tables	0.95
standing space	0.40
stadia and grandstands	0.60
bowling alleys, pool and billiard rooms	9.30
classrooms	1.85
school shops and vocational rooms	9.30
reading or writing rooms or lounges	1.85
dining, beverage and cafeteria space	1.20
laboratories in schools	4.60
Library stack areas (without reading areas)	9.3
Exercise rooms without equipment	1.40(4)
Exercise rooms with equipment	4.60(4)
Care, *treatment* or detention uses *suites*	(2)
care, *treatment* and sleeping room areas	10.00
detention quarters	11.60
Residential uses *dwelling units*	(2)
dormitories	4.60
Business and personal services uses personal services shops	4.60
offices	9.30
Mercantile uses *basements* and *first storeys*	3.70
second *storeys* having a principal entrance from a pedestrian thoroughfare or a parking area	3.70
other *storeys*	5.60
Industrial uses manufacturing or process rooms	4.60
storage garages	46.00

storage spaces (warehouse)	28.00
aircraft hangars	46.00
Other uses cleaning and repair goods	 4.60
kitchens	9.30
storage	46.00
public corridors intended for *occupancies* in addition to pedestrian travel	3.70(3)

Notes to Table 3.1.17.1.:
(1) See Clause 3.1.17.1.(1)(a).
(2) See Clause 3.1.17.1.(1)(b) (apply values for dwelling units to suites of care occupancy).
(3) See Note A-3.3.
(4) See Note A-3.1.17.1.

3.1.18. Tents and Air-Supported Structures

(See Note A-3.1.18.)

3.1.18.1. Means of Egress

1) Tents and *air-supported structures* shall conform to Sections 3.3. and 3.4.

3.1.18.2. Restrictions

1) An *air-supported structure* shall not be located above the *first storey* on any *building*.

2) An *air-supported structure* shall not be used for Groups B, C, or Group F, Division 1 *major occupancies* or for classrooms.

3) An *air-supported structure* shall be designed as open floor space without interior walls, *mezzanines*, intermediate floors or similar construction.

3.1.18.3. Clearance to Other Structures

1) Except as permitted by Sentences (2) to (4), every tent and *air-supported structure* shall conform to Subsection 3.2.3.

2) Tents and *air-supported structures*

a) shall not be erected closer than 3 m to other structures on the same property except as permitted by Sentences (3) and (4), and

b) shall be sufficiently distant from one another to provide an area to be used as a means of emergency egress.

3) Tents and *air-supported structures* not occupied by the public

a) need not be separated from one another, and

b) are permitted to be erected less than 3 m from other structures on the same property provided this spacing does not create a hazard to the public.

4) Tents not more than 120 m^2 in ground area, located on fair grounds or similar open spaces, need not be separated from one another provided this does not create a hazard to the public.

5) For the purposes of compliance with Sentence (1) to (3), Clusters of tents of up to 60 m^2 in aggregate floor area may be considered as a single tent for the purposes of establishing clearance to other structures.

3.1.18.4. Clearance to Flammable Material

1) The ground enclosed by a tent or *air-supported structure* and not less than 3 m of ground outside the structure shall be cleared of all flammable material or vegetation that will spread fire.

3.1.18.5. Flame Resistance

1) Every tent and *air-supported structure* and all tarpaulins and decorative materials used in connection with these structures shall conform to CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films."

3.1.18.6. Emergency Air Supply

1) An *air-supported structure* used as a place of assembly for more than 200 persons shall have either

a) an automatic emergency engine-generator set capable of powering one blower continuously for 4 h, or

b) a supplementary blower powered by an automatic internal combustion engine.

3.1.18.7. Electrical Systems

1) The electrical system and equipment in a tent or *air-supported structure*, including electrical fuses and switches, shall be inaccessible to the public.

2) Cables on the ground in areas used by the public in a tent or *air-supported structure* shall be placed in trenches or protected by covers to prevent damage from traffic.

Section 3.2. Building Fire Safety

3.2.1. General

3.2.1.1. Exceptions in Determining Building Height

1) A rooftop enclosure shall not be considered as a *storey* in calculating the *building height* if it is provided for

a) elevator machinery,

b) a *service room*,

c) a stairway used for no purpose other than for access or egress,

d) an elevator lobby used for no purpose other than for access or egress, or

e) a combination thereof.

2) Space under tiers of seats in a *building* of the arena type shall not be considered as adding to the *building height* provided the space is used only for dressing rooms, concession stands and similar purposes incidental to the *major occupancy* of the *building*.

3) Except as required by Sentence (5), the space above a *mezzanine* need not be considered as a *storey* in calculating the *building height*, provided

a) the aggregate area of *mezzanines* that are not superimposed does not exceed 40% of the open area of the room in which they are located (see Note A-3.2.1.1.(3)(a)), and

b) except as permitted in Sentences (7) and 3.3.2.13.(3), the space above the *mezzanine* is used as an open area without *partitions* or subdividing walls higher than 1 070 mm above the *mezzanine* floor.

4) Except as required by Sentence (5), the space above a *mezzanine* need not be considered as a *storey* in calculating the *building height*, provided

a) the aggregate area of *mezzanines* that are not superimposed and do not meet the conditions of Sentence (3) does not exceed 10% of the *floor area* in which they are located, and

b) the area of a *mezzanine* in a *suite* does not exceed 10% of the area of that *suite*.

5) Except as permitted by Sentence (6), each level of *mezzanine* that is partly or wholly superimposed above the first level of *mezzanine* shall be considered as a *storey* in calculating the *building height*.

6) Platforms intended solely for periodic inspection and elevated maintenance catwalks need not be considered as floor assemblies or *mezzanines* for the purpose of calculating *building height*, provided

a) they are not used for storage, and

b) they are constructed with *noncombustible* materials, unless the *building* is permitted to be of *combustible construction*.

7) The space above a *mezzanine* conforming to Sentence (3) is permitted to include an enclosed space whose area does not exceed 10% of the open area of the room in which the *mezzanine* is located provided the enclosed space does not obstruct visual communication between the open space above the *mezzanine* and the room in which it is located. (See Note A-3.2.1.1.(3)(a).)

8) A *service space* in which facilities are included to permit a person to enter and to undertake maintenance and other operations pertaining to *building* services from within the *service space* need not be considered a *storey* if it conforms to Articles 3.2.5.14. and 3.3.1.25., and Sentences 3.2.4.18.(11), 3.2.7.3.(2), 3.3.1.3.(7), 3.4.2.4.(3) and 3.4.4.4.(9). (See Note A-3.2.1.1.(8).)

3.2.1.2. Storage Garage Considered as a Separate Building

1) A *basement* used primarily as a *storage garage* is permitted to be considered as a separate *building* for the purposes of Subsection 3.2.2., Sentences 3.2.5.12.(2) and (3), and subsection 3.2.10., provided the floor and roof assemblies above the *basement* and the exterior walls of the *basement* above the adjoining ground level are constructed as *fire separations* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h and protected in conformance with Clause 3.1.10.2.(4)(a), except as permitted by Sentence (2). (See Notes A-3.1.10.2.(4) and A-3.2.5.12.(2).)

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2) The exterior wall of a *basement* that is required to be a *fire separation* with a *fire-resistance rating* in accordance with Sentence (1) is permitted to be penetrated by openings that are not protected by *closures* provided

a) the *storage garage* is *sprinklered* throughout,

b) every opening in the exterior wall is separated from *storeys* above the opening by a projection of the floor or roof assembly above the *basement*, extending not less than

   i) 1 m beyond the exterior face of the *storage garage* if the upper *storeys* are required to be of *noncombustible construction*, or

   ii) 2 m beyond the exterior face of the *storage garage* if the upper *storeys* are permitted to be of *combustible construction* or *encapsulated mass timber construction*, or

c) the exterior walls of any *storeys* located above the floor or roof assembly referred to in Sentence (1) are recessed behind the outer edge of the assembly by not less than

   i) 1 m if the upper *storeys* are required to be of *noncombustible construction*, or

   ii) 2 m if the upper *storeys* are permitted to be of *combustible construction* or *encapsulated mass timber construction*.

3) The floor or roof assembly projection referred to in Clause (2)(b) shall have a *fire-resistance rating* not less than 2 h and shall have no openings within the projection.

3.2.1.3. Roof Considered as a Wall

1) For the purposes of this Section any part of a roof that is pitched at an angle of 60° or more to the horizontal and is adjacent to a space intended for *occupancy* within a *building* shall be considered as part of an exterior wall of the *building*.

3.2.1.4. Floor Assembly over Basement

1) Except as permitted by Sentence 3.2.2.47.(3), 3.2.2.48.(3), 3.2.2.49.(3), 3.2.2.50.(3), 3.2.2.51.(3), 3.2.2.52.(3), 3.2.2.53.(3), 3.2.2.54.(3), 3.2.2.55.(3), or 3.2.2.93., a floor assembly immediately above a *basement* shall be constructed as a *fire separation* having a *fire-resistance rating* conforming to the requirements of Articles 3.2.2.20. to 3.2.2.93. for a floor assembly, but not less than 45 min.

2) All *loadbearing* walls, columns and arches supporting a floor assembly immediately above a *basement* shall have a *fire-resistance rating* not less than that required by Sentence (1) for the floor assembly.

3.2.1.5. Fire Containment in Basements

1) In a *building* in which an automatic *sprinkler system* is not required to be installed by Article 3.2.2.18., every *basement* shall

a) be *sprinklered* throughout, or

b) be subdivided into *fire compartments* not more than 600 m^2 in area by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly immediately above the *basement*.

2) **Deleted.**

3.2.1.6. Mezzanines

1) The floor assembly of a *mezzanine* that is required to be considered as a *storey* in calculating the *building height* shall be constructed in conformance with the *fire separation* requirements for floor assemblies stated in Articles 3.2.2.20. to 3.2.2.93.

3.2.1.7. Fire Containment in Combustible Buildings

1) All Group C *major occupancies* in a *building* of *combustible construction* greater than 2 *storeys* in *building height* shall be separated from all other *major occupancies* except as prohibited in Article 3.1.3.2. and except as permitted in Sentence (2) and (3), by a *fire separation* with at least a 2 h *fire-resistance rating* constructed of

a) concrete,

b) masonry, or

c) in a *sprinklered building, encapsulated mass timber construction* complying with Subsection 3.1.6.

2) The *fire-resistance rating* required in Sentence (1) is permitted to be 1.5 h for a *storage garage*.

3) *Encapsulated mass timber construction* floor assembly as required in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* determined by Sentences (1) or (2) for

a) the floor assembly above the storey, or

b) the floor assembly below the storey, if there is no floor assembly above.

4) Where a *building* of *combustible construction* greater than 2 *storeys* in *building height* contains an *occupancy* other than Group C or Group D on the second or third *storey* that is required to be constructed in accordance with Sentences 3.2.2.51.(5) or 3.2.2.60.(4), the *building* shall

a) be *sprinklered*, and

b) be divided into at least two horizontal *fire compartments* on each *storey* containing a *major occupancy* other than Group C or Group D where each *fire compartment* is

i) served by at least one *exit* stair, and

ii) constructed with *fire separations* with a *fire-resistance rating* not less than the floor assembly above.

(See Note A-3.2.1.7.(4))

3.2.2. Building Size and Construction Relative to Occupancy

3.2.2.1. Application

1) Except as permitted by Article 3.2.2.3., a *building* shall be constructed in conformance with this Subsection to prevent fire spread and collapse caused by the effects of fire. (See Subsection 3.1.3. for *fire separations* between *major occupancies*.)

3.2.2.2. Special and Unusual Structures

1) A structure that cannot be identified with the characteristics of a *building* in Articles 3.2.2.20. to 3.2.2.93. shall be protected against fire spread and collapse in conformance with good fire protection engineering practice. (See Note A-3.2.2.2.(1).) (See also Notes A-3 and A-3.2.5.12.(1).)

3.2.2.3. Exceptions to Structural Fire Protection

1) Fire protection is not required for

a) steel lintels above openings not more than 2 m wide in *loadbearing* walls and not more than 3 m wide in non-*loadbearing* walls,

b) steel lintels above openings more than 2 m wide in *loadbearing* walls and more than 3 m wide in non-*loadbearing* walls provided the lintels are supported at intervals of not more than 2 m by structural members with the required *fire-resistance rating*,

c) the bottom flanges of shelf angles and plates that are not a part of the structural frame,

d) steel members for framework around elevator hoistway doorways, steel for the support of elevator and dumbwaiter guides, counterweights and other similar equipment, that are entirely enclosed in a hoistway and are not a part of the structural frame of the *building*,

e) steel members of stairways and escalators that are not a part of the structural frame of a *building*,

f) steel members of porches, exterior balconies, exterior stairways, fire escapes, cornices, marquees and other similar appurtenances, provided they are outside an exterior wall of a *building*, and

g) *loadbearing* steel or concrete members wholly or partly outside a *building* face in a *building* not more than 4 *storeys* in *building height* and classified as Group A, B, C, D or F, Division 3 *major occupancy* provided the members are

   i) not less than 1 m away from any *unprotected opening* in an exterior wall, or

   ii) shielded from heat radiation in the event of a fire within the *building* by construction that will provide the same degree of protection that would be necessary if the member was located inside the *building*, with the protection extending on either side of the member a distance equal to the projection of the member from the face of the wall.

(See also Article 3.2.3.9.)

3.2.2.4. Buildings with Multiple Major Occupancies

1) The requirements restricting fire spread and collapse for a *building* of a single *major occupancy* classification are provided in this Subsection according to its *building height* and *building area*.

2) If a *building* contains more than one *major occupancy*, classified in more than one Group or Division, the requirements of this Subsection concerning *building* size and construction relative to *major occupancy* shall apply according to Articles 3.2.2.5. to 3.2.2.8.

3.2.2.5. Applicable Building Height and Area

1) In determining the fire safety requirements of a *building* in relation to each of the *major occupancies* contained therein, the *building height* and *building area* of the entire *building* shall be used.

3.2.2.6. Multiple Major Occupancies

1) Except as permitted by Articles 3.2.2.7. and 3.2.2.8., and Sentences 3.2.2.48.(4), 3.2.2.51.(5), 3.2.2.57.(3), 3.2.2.60.(4), and 3.2.2.93.(5) to (7), in a *building* containing more than one *major occupancy*, the requirements of this Subsection for the most restricted *major occupancy* contained shall apply to the whole *building*.

2) In a *building* or part of a *building* constructed in conformance with Article 3.2.2.48., 3.2.2.57., or 3.2.2.93. containing more than one *major occupancy*, the most restrictive encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for any *major occupancy* contained within a *storey* shall apply to the encapsulation required on the interior of a *public corridor* or *exit* within that *storey*.

3.2.2.7. Superimposed Major Occupancies

1) Except as provided in Article 3.2.2.8. and Sentences 3.2.2.18.(2), 3.2.2.48.(4), 3.2.2.51.(5), 3.2.2.57.(3), 3.2.2.60.(4), and 3.2.2.9.3.(5) to (7), in a *building* in which one *major occupancy* is located entirely above another *major occupancy*, the requirements in this Subsection for each portion of the *building* containing a *major occupancy* shall apply to that portion as if the entire *building* were of that *major occupancy*.

2) If one *major occupancy* is located above another *major occupancy*, the *fire-resistance rating* of the floor assembly between the *major occupancies* shall be determined on the basis of the requirements of this Subsection for the lower *major occupancy*. (See also Article 3.1.3.1.)

3) In a *building* or part of a *building* constructed in conformance with Article 3.2.2.48., 3.2.2.57., or 3.2.2.93., if one *major occupancy* is located above another *major occupancy,*

a) the most restrictive encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for any *major occupancy* contained within the *building* shall apply to the encapsulation required on the interior of *vertical service spaces* and *exit* stairs, and

b) the encapsulation requirements of Article 3.1.6.4. and Table 3.2.2.93. for a mass timber floor assembly between the *major occupancies* shall be determined on the basis of the requirements for

   i) the upper *major occupancy* for the encapsulation of the upper surface of the mass timber floor assembly, and

   ii) the lower *major occupancy* for the encapsulation of the underside of the mass timber floor assembly.

3.2.2.8. Exceptions for Major Occupancies

1) In a *building* in which the aggregate area of all *major occupancies* in a particular Group or Division is not more than 10% of the *floor area* of the *storey* in which they are located, these *major occupancies* need not be considered as *major occupancies* for the purposes of this Subsection, provided they are not classified as Group F, Division 1 or 2 *occupancies*.

3.2.2.9. Crawl Spaces

1) For the purposes of Articles 3.1.11.6., 3.2.1.4. and 3.2.1.5., a crawl space shall be considered as a *basement* if it is

a) more than 1.8 m high between the lowest part of the floor assembly and the ground or other surface below,

b) used for any *occupancy*,

c) used for the passage of *flue pipes*, or

d) used as a *plenum* in *combustible construction*.

2) A floor assembly immediately above a crawl space is not required to be constructed as a *fire separation* and is not required to have a *fire-resistance rating* provided the crawl space is not required to be considered as a *basement* by Sentence (1).

3.2.2.10. Streets

1) Every *building* shall face a *street* located in conformance with the requirements of Articles 3.2.5.4. and 3.2.5.5. for access routes.

2) For the purposes of Subsections 3.2.2. and 3.2.5. an access route conforming to Subsection 3.2.5. is permitted to be considered as a *street*.

3) **Reserved**.

4) A *building* is considered to face 2 *streets* provided not less than 50% of the *building* perimeter is located within 15 m of the *street* or *streets*.

5) A *building* is considered to face 3 *streets* provided not less than 75% of the *building* perimeter is located within 15 m of the *street* or *streets*.

6) Enclosed spaces, tunnels, bridges and similar structures, even though used for vehicular or pedestrian traffic, are not considered as *streets* for the purpose of this Part.

3.2.2.11. Exterior Balconies

1) Except as provided in Sentence (2), an exterior balcony shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93., as applicable to the *occupancy* classification of the *building*.

2) The floor assembly of an exterior balcony in a *building* or part of a *building* conforming to Article 3.2.2.48., 3.2.2.57., or 3.2.2.93. shall

a) be of *noncombustible construction*, or

b) be constructed in accordance with Article 3.1.6.3., but need not comply with Sentence 3.1.6.4.(1).

3.2.2.12. Exterior Passageways

1) An elevated exterior passageway used as part of a *means of egress* shall conform to the requirements of Articles 3.2.2.20. to 3.2.2.93. for *mezzanines*.

3.2.2.13. Occupancy on Roof

1) A portion of a roof that supports an *occupancy* shall be constructed in conformance with the *fire separation* requirements of Articles 3.2.2.20. to 3.2.2.93. for floor assemblies, and not the *fire-resistance rating* for roof assemblies.

3.2.2.14. Rooftop Enclosures

1) A rooftop enclosure for elevator machinery, an elevator lobby, or for a *service room* shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93.

2) A rooftop enclosure for elevator machinery or for a *service room*, not more than one *storey* high, is not required to have a *fire-resistance rating*.

3) A rooftop enclosure for a stairway shall be constructed in accordance with the type of construction required by Articles 3.2.2.20. to 3.2.2.93.

4) A rooftop enclosure for a stairway or an elevator lobby serving an *occupancy* on a roof that serves only one *dwelling unit* need not have a *fire-resistance rating* nor be constructed as a *fire separation*.

3.2.2.15. Storeys below Ground

1) If a *building* is erected entirely below the adjoining finished ground level and does not extend more than one *storey* below that ground level, the minimum precautions against fire spread and collapse shall be the same as are required for *basements* under a *building* of 1 *storey* in *building height* having the same *occupancy* and *building area*.

2) If any portion of a *building* is erected entirely below the adjoining finished ground level and extends more than one *storey* below that ground level, the following minimum precautions against fire spread and collapse shall be taken:

a) the *basements* shall be *sprinklered* throughout,

b) a floor assembly below the ground level shall be constructed as a *fire separation* with a *fire-resistance rating* not less than

i) 3 h if the *basements* are used as Group E or Group F, Division 1 or 2 *occupancies*, or

ii) 2 h if the *basements* are not used as Group E or Group F, Division 1 or 2 *occupancies*, and

c) all *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the construction that they support.

(See Note A-3.2.2.15.(2).)

3) **Deleted**.

3.2.2.16. Heavy Timber Roof Permitted

1) Unless otherwise permitted by Articles 3.2.2.20. to 3.2.2.93., a roof assembly in a *building* up to 2 *storeys* in *building height* is permitted to be of *heavy timber construction* regardless of *building area* or type of construction required, provided the *building* is *sprinklered* throughout.

2) If Sentence (1) permits a roof assembly to be of *heavy timber construction*, structural members in the *storey* immediately below the roof assembly are permitted to be of *heavy timber construction*.

3.2.2.17. Roof Assemblies and Mezzanines in Gymnasiums, Swimming Pools, Arenas and Rinks

1) The requirements for a roof assembly to have a *fire-resistance rating* stated in Articles 3.2.2.25., 3.2.2.30. and 3.2.2.32. are permitted to be waived for gymnasiums, swimming pools, arenas, and rinks, provided

a) the roof carries no loads other than normal roof loads, including permanent access walks, and ventilating, sound and lighting equipment, and

b) except as provided in Sentence (3), no part of the roof assembly is less than 6 m above the main floor or balcony.

(See Note A-3.2.2.17.(1).)

2) The requirements for a *mezzanine* to have a *fire-resistance rating* stated in Articles 3.2.2.25., 3.2.2.30. and 3.2.2.32. are permitted to be waived for gymnasiums, swimming pools, arenas, and rinks, provided

a) the *mezzanine* is not required to be considered as a *storey* as per Sentences 3.2.1.1.(3) to (5),

b) the *mezzanine* is used only for ventilating, sound and lighting equipment, and

c) except as provided in Sentence (3), no part of the *mezzanine* is less than 6 m above the main floor or balcony.

3) The restrictions concerning minimum distance stated in Clauses (1)(b) and (2)(c) shall not apply to

a) an inclined and stepped floor ascending from the main floor that is used for seating purposes only, or

b) a balcony used for seating purposes only.

3.2.2.18. Automatic Sprinkler System Required

1) Except as permitted by Sentence (2) and (3), an automatic *sprinkler system* conforming to the requirements of Articles 3.2.4.7., 3.2.4.8., 3.2.4.9. and 3.2.5.12. shall be installed throughout a *building* regulated by one or more of Articles 3.2.2.20., 3.2.2.21., 3.2.2.22., 3.2.2.23., 3.2.2.24., 3.2.2.26., 3.2.2.27., 3.2.2.29., 3.2.2.31., 3.2.2.33., 3.2.2.36., 3.2.2.37., 3.2.2.38., 3.2.2.39., 3.2.2.40., 3.2.2.41., 3.2.2.42., 3.2.2.43., 3.2.2.44., 3.2.2.45., 3.2.2.46., 3.2.2.47., 3.2.2.48., 3.2.2.49., 3.2.2.51., 3.2.2.52., 3.2.2.55., 3.2.2.56., 3.2.2.57.,

3.2.2.59., 3.2.2.60., 3.2.2.61., 3.2.2.63., 3.2.2.65., 3.2.2.66., 3.2.2.67., 3.2.2.69., 3.2.2.71., 3.2.2.72., 3.2.2.73., 3.2.2.74., 3.2.2.76., 3.2.2.77., 3.2.2.79., 3.2.2.81., 3.2.2.82., 3.2.2.84., 3.2.2.86., 3.2.2.88., 3.2.2.90., and 3.2.2.93.

2) If a *storey* in a *building* or a *floor area* is required to have an automatic *sprinkler system* installed throughout in accordance with one or more of Articles 3.2.2.20. to 3.2.2.93. or Section 3.3., the automatic *sprinkler system* shall also be installed throughout all lower *storeys* in the *building* notwithstanding permission in Articles 3.2.2.20. to 3.2.2.93. to construct one or more of those *storeys* without installing automatic sprinkler protection. (See Note A-3.2.2.18.(2).)

3) Except for *buildings* described in Sentence 1.3.3.6.(2) of Division A, all newly constructed *buildings* shall be provided with an automatic *sprinkler system* designed and installed in accordance with Article 3.2.5.12.

4) Where an *assembly occupancy* is located in a *basement*, the *basement* shall be *sprinklered* throughout.

3.2.2.19. Buildings Containing Impeded Egress Zones

1) A *building* containing an *impeded egress zone* and conforming to the appropriate requirements of Articles 3.2.2.20. to 3.2.2.93. is not required to conform to the requirements of Articles 3.2.2.36. and 3.2.2.37. for a Group B, Division 1 *major occupancy* provided

a) the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*,

c) it does not include

i) a *contained use area*,

ii) sleeping accommodation,

iii) a *high-hazard industrial occupancy*, or

iv) a *mercantile occupancy*,

d) the *building area* is not more than 6 400 m^2 if the *building* includes a *medium-hazard industrial occupancy*,

e) the *impeded egress zone* does not extend beyond the boundaries of the *fire compartment* in which it is located, and

f) the *occupant load* of the *impeded egress zone* is not more than 100.

3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.21. and 3.2.2.22., a *building* classified as Group A, Division 1 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.21. Group A, Division 1, One Storey, Limited Area, Sprinklered

1) A *building* classified as Group A, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*,

c) it has less than 40% of the area of the *building* as 2 *storeys* for the purpose of

i) development of productions, including preparation of scenery and costumes and rehearsal of performers,

ii) organization of performers, scenery and sound equipment,

iii) preparation by performers for a performance,

iv) managerial functions, or

v) toilets, rest rooms and similar public facilities,

d) it has no *occupancy* above or below the auditorium other than one which serves it or is dependent on it,

e) it is not more than 600 m^2 in *building area*, and

f) the *occupant load* is not more than 600.

2) The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations*

i) with a *fire-resistance rating* not less than 45 min, or

ii) of *heavy timber construction*, and

b) *loadbearing* walls, columns and arches shall

i) have a *fire-resistance rating* not less than that required for the supported assembly, or

ii) be of *heavy timber construction*.

3.2.2.22. Group A, Division 1, One Storey, Sprinklered

1) A *building* classified as Group A, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*,

c) no part of an auditorium floor is more than 5 m above or below *grade*,

d) no *occupancy* is above or below the auditorium other than one which serves it or is dependent on it, and

e) the *occupant load* of the auditorium floor is not more than 300.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly, or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

d) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.24. to 3.2.2.28. and 3.2.2.93. a *building* classified as Group A, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.24. Group A, Division 2, up to 6 Storeys, Any Area, Sprinklered

1) A *building* classified as Group A, Division 2, that is not limited by *building area*, is permitted to conform to Sentence (2), provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout, and

b) it is not more than 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.25. Group A, Division 2, up to 2 Storeys

1) A *building* classified as Group A, Division 2 is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.25.

Table 3.2.2.25.
Maximum Building Area, Group A, Division 2, up to 2 Storeys
Forming Part of Sentence 3.2.2.25.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 600	2 000	2 400
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) except as permitted by Article 3.2.2.17., *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) except as permitted by Article 3.2.2.17., roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 800 m^2 if facing one *street*,

ii) 1 000 m^2 if facing 2 *streets*, or

iii) 1 200 m^2 if facing 3 *streets*, and

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.26. Group A, Division 2, up to 2 Storeys, Increased Area, Sprinklered

1) A *building* classified as Group A, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 4 800 m^2 if 1 *storey* in *building height*, or

ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.27. Group A, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group A, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 2 400 m^2 if 1 *storey* in *building height* with no *basement*,

ii) 1 200 m^2 if 1 *storey* in *building height*, or

iii) 600 m^2 if 2 *storeys* in *building height*.

3.2.2.28. Group A, Division 2, One Storey

1) A *building* classified as Group A, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided

a) it is not more than 1 *storey* in *building height*, and

b) except as permitted by Sentence (2), it has a *building area* not more than

i) 400 m^2 if facing one *street*,

ii) 500 m² if facing 2 *streets*, or

iii) 600 m² if facing 3 *streets*.

2) In a *building* referred to in Sentence (1) without a *basement*, the *building area* limits of Sentence (1) are permitted to be doubled provided a *fire separation* with a *fire-resistance rating* not less than 1 h is used to separate the *building* into *fire compartments*, each one of which does not exceed the limits of Clause (1)(b).

3.2.2.29. Group A, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.30. to 3.2.2.34., a *building* classified as Group A, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.30. Group A, Division 3, up to 2 Storeys

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.30.

Table 3.2.2.30.
Maximum Building Area, Group A, Division 3, up to 2 Storeys
Forming Part of Sentence 3.2.2.30.(1)

No. of *Storeys*	**Maximum Area, m²**		
	Facing 1 *Street*	**Facing 2 *Streets***	**Facing 3 *Streets***
1	4 000	5 000	6 000
2	2 000	2 500	3 000

2) Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) except as permitted by Article 3.2.2.17., *mezzanines* shall have a *fire-resistance rating* not less than 1 h,

c) except as permitted by Article 3.2.2.17., roof assemblies shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *heavy timber construction*, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly, except that arches and structural members within the *storey* immediately below a roof assembly are permitted to be of *heavy timber construction*.

3) If intended for occasional use for trade shows and similar exhibition purposes, a *building* referred to in Sentence (1) that is more than 1 500 m² in *building area* shall be *sprinklered* throughout.

3.2.2.31. Group A, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 12 000 m^2 if 1 *storey* in *building height*, or

ii) 6 000 m^2 if 2 *storeys* in *building height*.

2) Except as permitted by Clause (c) and Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly, except that arches are permitted to be of *heavy timber construction*.

3.2.2.32. Group A, Division 3, One Storey, Increased Area

1) A *building* classified as Group A, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than

i) 2 400 m^2 if facing one *street*,

ii) 3 000 m^2 if facing 2 *streets*, or

iii) 3 600 m^2 if facing 3 *streets*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Article 3.2.2.17., *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

b) except as permitted by Article 3.2.2.17., roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 1 200 m^2 if facing one *street*,

ii) 1 500 m^2 if facing 2 *streets*, or

iii) 1 800 m^2 if facing 3 *streets*, and

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3) If intended for occasional use for trade shows and similar exhibition purposes, a *building* referred to in Sentence (1) that is more than 1 500 m^2 in *building area* shall be *sprinklered* throughout.

3.2.2.33. Group A, Division 3, One Storey, Sprinklered

1) A *building* classified as Group A, Division 3 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*, and

c) it has a *building area* not more than 7 200 m².

3.2.2.34. Group A, Division 3, One Storey

1) A *building* classified as Group A, Division 3 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than

i) 1 000 m² if facing one *street*,

ii) 1 250 m² if facing 2 *streets*, or

iii) 1 500 m² if facing 3 *streets*.

3.2.2.35. Group A, Division 4

1) Except as permitted by Sentences (2) and (3), a *building* classified as Group A, Division 4 shall be of *noncombustible construction*.

2) Roof assemblies and supporting arches and columns are permitted to be of *heavy timber construction*.

3) A *building* classified as Group A, Division 4 is permitted to be of *combustible construction* provided

a) the *occupant load* is less than 1 500, and

b) the *building* has a *limiting distance* not less than 6 m.

4) Sprinklers shall be installed in all spaces below tiers of seats in a *building* classified as Group A, Division 4 if those spaces are used for *occupancy*. (See Note A-3.2.2.35.(4).)

3.2.2.36. Group B, Division 1, Any Height, Any Area, Sprinklered

1) Except as permitted by Article 3.2.2.37., a *building* classified as Group B, Division 1 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.37. Group B, Division 1, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 12 000 m² if 2 *storeys* in *building height*, or

iii) not more than 8 000 m² if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.38. Group B, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.39. to 3.2.2.41., a *building* classified as Group B, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.39. Group B, Division 2, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 12 000 m^2 if 2 *storeys* in *building height*, or

iii) not more than 8 000 m^2 if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.40. Group B, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 2 400 m^2 if 1 *storey* in *building height*, or

ii) 1 600 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.41. Group B, Division 2, One Storey, Sprinklered

1) A *building* classified as Group B, Division 2 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*, and

c) it has a *building area* not more than 500 m^2.

3.2.2.42. Group B, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.43. to 3.2.2.46. and 3.2.2.93., a *building* classified as Group B, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.43. Group B, Division 3, up to 3 Storeys (Noncombustible), Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 12 000 m^2 if 2 *storeys* in *building height*, or

iii) not more than 8 000 m^2 if 3 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.44. Group B, Division 3, up to 3 Storeys, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 5 400 m² if 1 *storey* in *building height*,

ii) 2 700 m² if 2 *storeys* in *building height*, or

iii) 1 800 m² if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.45. Group B, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 2 400 m² if 1 *storey* in *building height*, or

ii) 1 600 m² if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.46. Group B, Division 3, One Storey, Sprinklered

1) A *building* classified as Group B, Division 3 is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*, and

c) it has a *building area* not more than 600 m².

3.2.2.47. Group C, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.48. to 3.2.2.55. and 3.2.2.93., a *building* classified as Group C shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.48. Group C, up to 12 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2), provided

a) it is *sprinklered* throughout,

b) it is not more than 12 *storeys* in *building height*,

c) it has a height not more than 50 m measured between the floor of the *first storey* and the uppermost floor level that does not serve a rooftop enclosure for elevator machinery, a stairway or a *service room* used only for service to the *building*, and

d) it has a *building area* not more than 6 000 m^2.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber construction* or *noncombustible construction*, used singly or in combination, and

a) except as provided in Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, that are entirely contained within these *dwelling units* shall have a *fire-resistance rating* not less than 1 h, but need not be constructed as *fire separations*.

4) Group A, Division 2 *major occupancies*, Group E *major occupancies* and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article, provided

a) the Group A, Division 2 *major occupancy* is located below the fourth *storey*,

b) the Group E *major occupancy* is located below the third *storey*, and

c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).) (See also Article 3.2.1.7)

3.2.2.49. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 2 *storeys* in *building height*,

ii) not more than 12 000 m^2 if 3 *storeys* in *building height*,

iii) not more than 9 000 m^2 if 4 *storeys* in *building height*,

iv) not more than 7 200 m^2 if 5 *storeys* in *building height*, or

v) not more than 6 000 m² if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.50. Group C, up to 3 Storeys, Noncombustible Construction

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.50.

Table 3.2.2.50.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.50.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	6 000	not limited	not limited
3	4 000	5 000	6 000

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

3.2.2.51. Group C, up to 6 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2), provided

a) it is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*,

c) it has a height not more than 18 m measured between the floor of the *first storey* and the uppermost floor level, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and

d) it has a *building area* not more than

i) 9 000 m² if 1 *storey* in *building height*,

ii) 4 500 m² if 2 *storeys* in *building height*,

iii) 3 000 m² if 3 *storeys* in *building height*,

iv) 2 250 m² if 4 *storeys* in *building height*,

v) 1 800 m² if 5 *storeys* in *building height*, or

vi) 1 500 m² if 6 *storeys* in *building height*.

2) *Buildings* referred to in Sentence (1) are permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and

a) except as provided in Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) roof assemblies shall have a *fire-resistance rating* not less than 1 h,

c) except as provided in Sentence (4), where the roof assembly has a height greater than 25 m measured from the floor of the *first storey* to the highest point of the roof assembly, the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5.,

d) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

e) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including those over *basements*, that are entirely contained within these *dwelling units* shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) Where *buildings* conforming to Sentence (2) include non-contiguous roof assemblies at different elevations, the roof assemblies are permitted to be evaluated separately to determine which ones are required to be constructed in accordance with Clause (2)(c).

5) Group A, Division 2 *major occupancies*, Group E *major occupancies*, and *storage garages* located in a *building* or part thereof within the scope of this Article are permitted to be constructed in accordance with this Article, provided

a) the Group A, Division 2 *major occupancy* and Group E *major occupancy* are located below the third *storey*, and

b) the *storage garage* is located below the fourth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.51.(5) and 3.2.2.60.(4).) (See also Article 3.2.1.7.)

3.2.2.52. Group C, up to 4 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 7 200 m² if 1 *storey* in *building height*,

ii) 3 600 m² if 2 *storeys* in *building height*,

iii) 2 400 m² if 3 *storeys* in *building height*, or

iv) 1 800 m² if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.53. Group C, up to 3 Storeys, Increased Area

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.53.

Table 3.2.2.53.
Maximum Building Area, Group C, up to 3 Storeys, Increased Area
Forming Part of Sentence 3.2.2.53.(1)

No. of *Storeys*	Maximum Area, m²		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	2 400	3 000	3 600
2	1 200	1 500	1 800
3	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns, and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.54. Group C, up to 3 Storeys

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.54.

Table 3.2.2.54.
Maximum Building Area, Group C, up to 3 Storeys
Forming Part of Sentence 3.2.2.54.(1)

No. of *Storeys*		Maximum Area, m^2		
		Facing 1 *Street*	**Facing 2 *Streets***	**Facing 3 *Streets***
1		1 800	2 250	2 700
2		900	1 125	1 350
3		600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 45 min but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.55. Group C, up to 3 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 5 400 m^2 if 1 *storey* in *building height*,

ii) 2 700 m^2 if 2 *storeys* in *building height*, or

iii) 1 800 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) except as permitted by Sentences (3) and (4), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 45 min but need not be constructed as *fire separations*.

4) In a *building* in which there is no *dwelling unit* above another *dwelling unit*, the *fire-resistance rating* for floor assemblies entirely within the *dwelling unit* is waived.

3.2.2.56. Group D, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.57. to 3.2.2.65. and 3.2.2.93., a *building* classified as Group D shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.57. Group D, up to 12 storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2), provided

a) it is *sprinklered* throughout,

b) it is not more than 12 *storeys* in *building height*,

c) it has a height not more than 50 m measured between the floor of the *first storey* and the uppermost floor level that does not serve a rooftop enclosure for elevator machinery, a stairway or a *service room* used only for service to the *building*, and

d) it has a *building area* not more than 7 200 m^2.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber construction* or *noncombustible construction*, used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Group A, Division 2 *major occupancies*, Group E *major occupancies*, Group F, Division 2 and 3 *major occupancies*, and *storage garages* located in a *building* or part of a *building* within the scope of this Article are permitted to be constructed in accordance with this Article, provided

a) the Group A, Division 2 *major occupancy* is located below the fourth *storey*,

b) the Group E *major occupancy* and Group F, Division 2 or 3 *major occupancy* are located below the third *storey*, and

c) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3). and 3.2.2.93.(5) to (7)) (See also Article 3.2.1.7)

3.2.2.58. Group D, up to 6 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) it is not more than 6 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.58.

Table 3.2.2.58.
Maximum Building Area, Group D, up to 6 Storeys
Forming Part of Sentence 3.2.2.58.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	7 200	not limited	not limited
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, except that in a *building* not more than 1 *storey* in *building height* this requirement is waived, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.59. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 2 *storeys* in *building height*,

ii) not more than 14 400 m^2 if 3 *storeys* in *building height*,

iii) not more than 10 800 m^2 if 4 *storeys* in *building height*,

iv) not more than 8 640 m^2 if 5 *storeys* in *building height*, or

v) not more than 7 200 m^2 if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.60. Group D, up to 6 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2), provided

a) it is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*,

c) it has a height not more than 18 m measured between the floor of the *first storey* and the uppermost floor level, excluding any floor level within a rooftop enclosure that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1), and

d) it has a *building area* not more than

i) 18 000 m^2 if 1 *storey* in *building height*,

ii) 9 000 m^2 if 2 *storeys* in *building height*,

iii) 6 000 m^2 if 3 *storeys* in *building height*,

iv) 4 500 m^2 if 4 *storeys* in *building height*,

v) 3 600 m^2 if 5 *storeys* in *building height*, or

vi) 3 000 m^2 if 6 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction*, used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) roof assemblies shall have a *fire-resistance rating* not less than 1 h,

c) except as provided in Sentence (3), where the roof assembly has a height greater than 25 m measured from the floor of the *first storey* to the highest point of the roof assembly, the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5.,

d) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

e) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Where *buildings* conforming to Sentence (2) include non-contiguous roof assemblies at different elevations, the roof assemblies are permitted to be evaluated separately to determine which ones are required to be constructed in accordance with Clause (2)(c).

4) Group A, Division 2 *major occupancies*, Group E *major occupancies*, Group F, Division 2 and 3 *major occupancies*, and *storage garages* located in a *building* or part thereof within the scope of this Article are permitted to be constructed in accordance with this Article, provided

a) the Group A, Division 2 *major occupancy*, Group E *major occupancy*, and Group F, Division 2 or 3 *major occupancy* are located below the third *storey*, and

b) the *storage garage* is located below the fourth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.51.(5) and 3.2.2.60.(4).)

3.2.2.61. Group D, up to 4 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than 3 600 m^2.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.62. Group D, up to 3 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.62.

Table 3.2.2.62.
Maximum Building Area, Group D, up to 3 Storeys
Forming Part of Sentence 3.2.2.62.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	4 800	6 000	7 200
2	2 400	3 000	3 600
3	1 600	2 000	2 400

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1. and the *building area* is not more than

i) 2 400 m^2 if facing one *street*,

ii) 3 000 m^2 if facing 2 *streets*, or

iii) 3 600 m^2 if facing 3 *streets*, and

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.63. Group D, up to 3 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 14 400 m^2 if 1 *storey* in *building height*,

ii) 7 200 m^2 if 2 *storeys* in *building height*, or

iii) 4 800 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.64. Group D, up to 2 Storeys

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.64.

Table 3.2.2.64.
Maximum Building Area, Group D, up to 2 Storeys
Forming Part of Sentence 3.2.2.64.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.65. Group D, up to 2 Storeys, Sprinklered

1) A *building* classified as Group D is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 3 000 m^2 if 1 *storey* in *building height*, or

ii) 2 400 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.66. Group E, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.67. to 3.2.2.71. and 3.2.2.93., a *building* classified as Group E shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.67. Group E, up to 4 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than 1 800 m^2.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.68 Group E, up to 3 Storeys

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.68.

Table 3.2.2.68.
Maximum Building Area, Group E, up to 3 Storeys
Forming Part of Sentence 3.2.2.68.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 500	1 500	1 500
2	1 200	1 500	1 500
3	800	1 000	1 500

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is of *noncombustible construction* or is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1.,

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

e) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.69. Group E, up to 3 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 7 200 m^2 if 1 *storey* in *building height*,

ii) 3 600 m^2 if 2 *storeys* in *building height*, or

iii) 2 400 m^2 if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

d) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.70. Group E, up to 2 Storeys

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.70.

Table 3.2.2.70.
Maximum Building Area, Group E, up to 2 Storeys
Forming Part of Sentence 3.2.2.70.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.71. Group E, up to 2 Storeys, Sprinklered

1) A *building* classified as Group E is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 3 000 m^2 if 1 *storey* in *building height*, or

ii) 1 800 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.72. Group F, Division 1, up to 4 Storeys, Sprinklered

1) Except as permitted by Articles 3.2.2.73. to 3.2.2.75., a *building* classified as Group F, Division 1 shall conform to Sentence (2) provided

a) it is not more than 4 *storeys* in *building height*, and

b) it has a *building area* not more than

i) 9 000 m^2 if 1 *storey* in *building height*,

ii) 4 500 m^2 if 2 *storeys* in *building height*,

iii) 3 000 m^2 if 3 *storeys* in *building height*, or

iv) 2 250 m^2 if 4 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.73. Group F, Division 1, up to 3 Storeys, Sprinklered

1) A *building* classified as Group F, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 3 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 3 600 m² if 1 *storey* in *building height*,

ii) 1 800 m² if 2 *storeys* in *building height*, or

iii) 1 200 m² if 3 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.74. Group F, Division 1, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 1 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 2 400 m² if 1 *storey* in *building height*, or

ii) 1 200 m² if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.75. Group F, Division 1, One Storey

1) A *building* classified as Group F, Division 1 is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than 800 m².

3.2.2.76. Group F, Division 2, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.77. to 3.2.2.81. and 3.2.2.93., a *building* classified as Group F, Division 2 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.77. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 18 000 m² if 1 *storey* in *building height*,

ii) 9 000 m² if 2 *storeys* in *building height*,

iii) 6 000 m² if 3 *storeys* in *building height*, or

iv) 4 500 m² if 4 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.78. Group F, Division 2, up to 3 Storeys

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) it is not more than 3 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.78.

Table 3.2.2.78.
Maximum Building Area, Group F, Division 2, up to 3 Storeys
Forming Part of Sentence 3.2.2.78.(1)

No. of *Storeys*	**Maximum Area, m²**		
	Facing 1 *Street*	**Facing 2 *Streets***	**Facing 3 *Streets***
1	1 500	1 500	1 500
2	1 500	1 500	1 500
3	1 070	1 340	1 500

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided that the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1.,

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

e) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.79. Group F, Division 2, up to 4 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 9 600 m^2 if 1 *storey* in *building height*,

ii) 4 800 m^2 if 2 *storeys* in *building height*,

iii) 3 200 m^2 if 3 *storeys* in *building height*, or

iv) 2 400 m^2 if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*, and

d) *loadbearing* walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3.2.2.80. Group F, Division 2, up to 2 Storeys

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.80.

Table 3.2.2.80.
Maximum Building Area, Group F, Division 2, up to 2 Storeys
Forming Part of Sentence 3.2.2.80.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	1 000	1 250	1 500
2	600	750	900

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.81. Group F, Division 2, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 2 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 4 500 m^2 if 1 *storey* in *building height*, or

ii) 1 800 m^2 if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.82. Group F, Division 3, Any Height, Any Area, Sprinklered

1) Except as permitted by Articles 3.2.2.83. to 3.2.2.93., a *building* classified as Group F, Division 3 shall conform to Sentence (2).

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* shall be *sprinklered* throughout,

b) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 h, except that floor assemblies are permitted to be *fire separations* with a *fire-resistance rating* not less than 1 h in a *storage garage* with all *storeys* constructed as *open-air storeys*,

c) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.83. Group F, Division 3, up to 6 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2), provided

a) it is not more than 6 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.83.

Table 3.2.2.83.
Maximum Building Area, Group F, Division 3, up to 6 Storeys
Forming Part of Sentence 3.2.2.83.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	not limited	not limited	not limited
2	7 200	9 000	10 800
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and

d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.84. Group F, Division 3, up to 6 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2), provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 6 *storeys* in *building height*, and

c) it has a *building area*

i) that is not limited if the *building* is not more than 1 *storey* in *building height*,

ii) not more than 21 600 m^2 if 2 *storeys* in *building height*,

iii) not more than 14 400 m^2 if 3 *storeys* in *building height*,

iv) not more than 10 800 m^2 if 4 *storeys* in *building height*,

v) not more than 8 640 m^2 if 5 *storeys* in *building height*, or

vi) not more than 7 200 m^2 if 6 *storeys* in *building height*.

2) Except as permitted by Article 3.2.2.16., the *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

a) floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3.2.2.85. Group F, Division 3, up to 4 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 4 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.85.

Table 3.2.2.85.
Maximum Building Area, Group F, Division 3, up to 4 Storeys
Forming Part of Sentence 3.2.2.85.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1	4 800	6 000	7 200
2	2 400	3 000	3 600
3	1 600	2 000	2 400
4	1 200	1 500	1 800

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a *fire-retardant-treated wood* roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 2 400 m^2 if facing one *street*,

ii) 3 000 m^2 if facing 2 *streets*, or

iii) 3 600 m^2 if facing 3 *streets*, and

d) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.86. Group F, Division 3, up to 4 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 4 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 14 400 m^2 if 1 *storey* in *building height*,

ii) 7 200 m^2 if 2 *storeys* in *building height*,

iii) 4 800 m^2 if 3 *storeys* in *building height*, or

iv) 3 600 m^2 if 4 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min,

b) *mezzanines* shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, and

c) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.87. Group F, Division 3, up to 2 Storeys

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) it is not more than 2 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 3.2.2.87.

Table 3.2.2.87.
Maximum Building Area, Group F, Division 3, up to 2 Storeys
Forming Part of Sentence 3.2.2.87.(1)

No. of *Storeys*	**Maximum Area, m²**		
	Facing 1 *Street*	**Facing 2 *Streets***	**Facing 3 *Streets***
1	1 600	2 000	2 400
2	800	1 000	1 200

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.88. Group F, Division 3, up to 2 Storeys, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 2 *storeys* in *building height*, and

c) it has a *building area* not more than

i) 7 200 m² if 1 *storey* in *building height*, or

ii) 2 400 m² if 2 *storeys* in *building height*.

2) The *building* referred to in Sentence (1) is permitted to be of *combustible construction* or *noncombustible construction* used singly or in combination, and

a) floor assemblies shall be *fire separations* and, if of *combustible construction*, shall have a *fire-resistance rating* not less than 45 min, and

b) *loadbearing* walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible construction*.

3.2.2.89. Group F, Division 3, One Storey

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided

a) it is not more than 1 *storey* in *building height*, and

b) it has a *building area* not more than

i) 5 600 m^2 if facing one *street*,

ii) 7 000 m^2 if facing 2 *streets*, or

iii) 8 400 m^2 if facing 3 *streets*.

3.2.2.90. Group F, Division 3, One Storey, Sprinklered

1) A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered* throughout,

b) it is not more than 1 *storey* in *building height*, and

c) it has a *building area* not more than 16 800 m^2.

3.2.2.91. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy

1) A *building* classified as Group F, Division 3 is permitted to conform to Sentence (2) provided it is

a) not more than 1 *storey* in *building height*,

b) used solely for low *fire load occupancies* such as

i) power generating plants, or

ii) plants for the manufacture or storage of *noncombustible* materials, and

c) not limited in *building area*.

2) The *building* referred to in Sentence (1) shall be of *noncombustible construction*.

3.2.2.92. Group F, Division 3, Storage Garages up to 22 m High

1) A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is

a) of *noncombustible construction*,

b) not more than 22 m high, measured between *grade* and the ceiling level of the top *storey*,

c) not more than 10 000 m^2 in *building area*, and

d) designed so that every portion of each *floor area* is within 60 m of an exterior wall opening.

3.2.2.93. Encapsulated Mass Timber Construction, Various Occupancies, Heights and Areas, Sprinklered

1) A *building* that is classified as Group A, Division 2, Group B, Division 3, Group C, Group D, Group E, or Group F, Division 2 or 3, is permitted to conform to Sentence (2) provided

a) except as permitted by Sentences 3.2.2.7.(1) and 3.2.2.18.(2), the *building* is *sprinklered*,

b) it has a *building height* not exceeding the number of *storeys* shown in Table 3.2.2.93. for the applicable *major occupancy* and minimum *encapsulation rating*,

c) it has a maximum height that conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy* and minimum *encapsulation rating* that is measured between the floor of the *first storey* and the uppermost floor level that does not serve a rooftop enclosure for elevator machinery, a stairway or a

service room used only for service to the *building*, Proposed Technical Code Content: Harmonized Variations for Mass Timber

d) it has a maximum *building area* that conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy*, and

e) except as provided in Sentences 3.1.6.3.(4) and 3.1.6.7.(1) and Article 3.1.6.4, the *encapsulation rating* conforms to the value shown in Table 3.2.2.93. for the applicable *major occupancy* and maximum *building height*.

(See Note A-3.2.2.93.(1) and Table 3.2.2.93. See also Articles 3.2.2.48 and 3.2.2

Table 3.2.2.93.
EMTC Requirements(1)
Forming part of Sentence 3.2.2.93.(1)

Occupancy	**Max. *Building Heights*, *Storeys***	**Max. Height, m**	**Max. *Building Area*, m2**	**Minimum *Encapsulation Rating*, min**
A-2	18	76	7200	70
	12	51		50
	6	26		0
B-3	10	42	8000	70
	6	26		50
	4	17		0
C	18	76	6000	70
	8	34		0
D	18	76	7200	70
	9	38		0
E	12	51	6000	70
	8	34		50
	6	26		0
F-2	10	42	4500	70
	7	30		50
	5	21		0
F-3	12	51	7200	70
	8	34		50
	5	21		0

Notes to Table 3.2.2.93.
(1) See Sentences (5) to (7) and Articles 3.2.2.4. to 3.2.2.8. for information pertaining to multiple *major occupancies*.

2) Except as provided in Article 3.2.2.16., the *building* referred to in Sentence (1) is permitted to be of *encapsulated mass timber construction* or *noncombustible construction*, used singly or in combination, and

a) except as provided in Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 2 hours,

b) *mezzanines* shall have a *fire-resistance rating* not less than 1 hour, and

c) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) In a *building* classified as a Group C *major occupancy* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, that are entirely contained within these *dwelling units* shall have a *fire-resistance rating* not less than 1 h, but need not be constructed as *fire separations*.

4) In *buildings* referred to in Sentence (1) where the roof assembly of an *exit* stairway or *vertical service space* used as an elevator hoistway has a height greater than 55 m measured from *grade* to the highest point of the roof assembly, the enclosure for the stairway or hoistway shall be of *encapsulated mass timber construction* or constructed of concrete.

5) Group E *major occupancies* and *storage garages* located in a *building* or part of a *building* classified as a Group A, Division 2, Group C, or Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group A, Division 2, Group C, or Group D *major occupancy* requirements contained in Table 3.2.2.93., provided

a) the Group E *major occupancy* is located below the third *storey*, and

b) the *storage garage* is located below the fifth *storey* (see also Article 4.4.2.1.).

(See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

6) Group A, Division 2 *major occupancies* located in a *building* or part of a *building* classified as a Group C or Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group C or Group D *major occupancy* requirements contained in Table 3.2.2.93., provided they are located below the fourth *storey*. (See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

7) Group F, Division 2 and 3 *major occupancies* located in a *building* or part of a *building* classified as a Group D *major occupancy* within the scope of this Article are permitted to be constructed in accordance with this Article and the corresponding Group D *major occupancy* requirements contained in Table 3.2.2.93., provided they are located below the third *storey*. (See Note A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7).)

3.2.3. Spatial Separation and Exposure Protection

(See Note A-3.2.3.)

3.2.3.1. Limiting Distance and Area of Unprotected Openings

1) Except as permitted by Articles 3.2.3.10. to 3.2.3.12., the area of *unprotected openings* in an *exposing building face* for the applicable *limiting distance* shall be not more than the value determined in accordance with

a) Table 3.2.3.1.-B or 3.2.3.1.-C for an *exposing building face* conforming to Article 3.2.3.2. of a *building* or *fire compartment* which is not *sprinklered*, or

b) Table 3.2.3.1.-D or 3.2.3.1.-E for an *exposing building face* conforming to Article 3.2.3.2. of a *sprinklered fire compartment* that is part of a *building* which is *sprinklered* in conformance with Section 3.2.

(See Note A-3.)

(See also Article 3.1.18.3.)

2) The area of the *unprotected openings* in an *exposing building face* shall be the aggregate area of *unprotected openings* expressed as a percentage of the area of the *exposing building face* in Table 3.2.3.1.-B, 3.2.3.1.-C, 3.2.3.1.-D or 3.2.3.1.-E. (See Sentence 3.2.3.2.(1).)

3) For the purpose of determining the type of construction and cladding and the *fire-resistance rating* of an exterior wall,

a) the *exposing building face* shall be taken as the projection of the exterior wall onto a vertical plane located so that no portion of the exterior wall of the *building* or of a *fire compartment*, if the *fire*

compartment complies with the requirements of Article 3.2.3.2., is between the vertical plane and the line to which the *limiting distance* is measured, and

b) the area of *unprotected openings* shall be determined from Table 3.2.3.1.-B, 3.2.3.1.-C, 3.2.3.1.-D or 3.2.3.1.-E.

4) For the purpose of determining the actual percentage of *unprotected openings* permitted in an exterior wall, the location of the *exposing building face* is permitted to be taken at a vertical plane located so that there are no *unprotected openings* between the vertical plane and the line to which the *limiting distance* is measured. (See Note A-3.2.3.1.(4).)

5) Except for *buildings* that are *sprinklered*, where the *limiting distance* is 2 m or less, individual *unprotected openings* in an *exposing building face* shall be no greater than

a) the area stated in Table 3.2.3.1.-A, or

b) where the *limiting distance* is equal to or greater than 1.2 m, the area calculated by

$$\text{Area} = 0.24(2 \times \text{LD} - 1.2)^2$$

where

Area = area of the *unprotected opening*, and

LD = *limiting distance*.

Table 3.2.3.1.-A
Maximum Concentrated Area of Unprotected Openings
Forming Part of Sentence 3.2.3.1.(5)

***Limiting Distance*, m**	**Maximum Area of Individual *Unprotected Openings*, m^2**
1.2	0.35
1.5	0.78
2.0	1.88

6) The spacing between individual *unprotected openings* described in Sentence (5) that serve a single room or space described in Sentence (7) shall not be less than

a) 2 m horizontally of another *unprotected opening* that is on the same *exposing building face* and serves the single room or space, or

b) 2 m vertically of another *unprotected opening* that serves the single room or space, or another room or space on the same *storey*.

7) For the purpose of Sentence (6), “single room or space” shall mean

a) two or more adjacent spaces having a full-height separating wall extending less than 1.5 m from the interior face of the exterior wall, or

b) two or more stacked spaces that are on the same *storey*.

8) A *limiting distance* equal to half the actual *limiting distance* shall be used as input to Tables 3.2.3.1.-B and 3.2.3.1.-C, where

a) the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the *building* exceeds 10 min in 10% or more of all fire department calls to the *building*, and

b) any *storey* in the *building* is not *sprinklered*.

(See Notes A-3.2.3.1.(8) and A-3.2.3.)

9) If the surface temperature on the unexposed surface of a wall assembly exceeds the temperature limit of a standard fire test as permitted by Article 3.1.7.2., an allowance shall be made for the radiation from the hot

unexposed wall surface by adding an equivalent area of *unprotected opening* to the area of actual openings as follows:

$$A_C = A + (A_F \times F_{EO})$$

where

A_C = corrected area of *unprotected openings* including actual and equivalent openings,

A = actual area of *unprotected openings*,

A_F = area of exterior surface of the *exposing building face*, exclusive of openings, on which the temperature limit of the standard test is exceeded, and

F_{EO} = an equivalent opening factor derived from the following expression:

$$F_{EO} = \frac{(T_u + 273)^4}{(T_e + 273)^4}$$

T_u = average temperature in degrees Celsius of the unexposed wall surface at the time the required *fire-resistance rating* is reached under test conditions,

T_e = 892°C for a *fire-resistance rating* not less than 45 min, 927°C for a *fire-resistance rating* not less than 1 h, and 1 010°C for a *fire-resistance rating* not less than 2 h.

10) Unless a *closure* used to protect an opening in an *exposing building face* has a protective performance equivalent to that required for the wall assembly in which it is located, an equivalent area of *unprotected opening*, determined in accordance with the procedures of Sentence (9) shall be added to the greater of

a) the actual area of *unprotected openings*, or

b) the corrected area of *unprotected openings*.

Table 3.2.3.1.-B
Unprotected Opening Limits for a Building or Fire Compartment that is not Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face		**Area of *Unprotected Opening* for Groups A, C, D, and F, Division 3 *Occupancies*, %**																										
Max. Area, m^2	**Ratio (L/H or H/L)(1)**	***Limiting Distance*, m**																										
		0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**16**	**18**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
10	Less than 3 : 1	0	8	10	18	29	46	91	100																		
	3 : 1 to 10 : 1	0	8	12	21	33	50	96	100																		
	over 10 : 1	0	11	18	32	48	68	100																			
15	Less than 3 : 1	0	7	9	14	22	33	63	100																		
	3 : 1 to 10 : 1	0	8	10	17	25	37	67	100																		
	over 10 : 1	0	10	15	26	39	53	87	100																		
20	Less than 3 : 1	0	7	9	12	18	26	49	81	100																	
	3 : 1 to 10 : 1	0	8	10	15	21	30	53	85	100																	
	over 10 : 1	0	9	14	23	33	45	72	100																		
25	Less than 3 : 1	0	7	8	11	16	23	41	66	98	100																
	3 : 1 to 10 : 1	0	8	9	13	19	26	45	70	100																	
	over 10 : 1	0	9	13	21	30	39	62	90	100																	
30	Less than 3 : 1	0	7	8	11	15	20	35	56	83	100																
	3 : 1 to 10 : 1	0	7	9	12	17	23	39	61	88	100																
	over 10 : 1	0	8	12	19	27	36	56	79	100																	
40	Less than 3 : 1	0	7	8	10	13	17	28	44	64	89	100															
	3 : 1 to 10 : 1	0	7	8	11	15	20	32	48	69	93	100															
	over 10 : 1	0	8	11	17	24	31	47	66	88	100																
50	Less than 3 : 1	0	7	8	9	12	15	24	37	53	72	96	100														
	3 : 1 to 10 : 1	0	7	8	10	14	18	28	41	57	77	100															
	over 10 : 1	0	8	10	15	21	28	41	57	76	97	100															
60	Less than 3 : 1	0	7	8	9	11	14	21	32	45	62	81	100														
	3 : 1 to 10 : 1	0	7	8	10	13	16	25	36	49	66	85	100														
	over 10 : 1	0	8	10	14	20	25	38	51	67	85	100															
	Less than 3 : 1	0	7	7	8	10	12	18	26	36	48	62	79	98	100												

80	3 : 1 to 10 : 1	0	7	8	9	11	14	21	29	40	52	67	84	100														
	over 10 : 1	0	8	9	13	17	22	32	44	56	70	86	100															
100	Less than 3 : 1	0	7	7	8	9	11	16	22	30	40	51	65	80	97	100												
	3 : 1 to 10 : 1	0	7	8	9	11	13	18	25	34	44	56	69	84	100													
	over 10 : 1	0	7	9	12	16	20	29	39	49	61	74	89	100														
150	Less than 3 : 1	0	7	7	8	9	10	13	17	22	29	37	46	56	67	79	93	100										
	3 : 1 to 10 : 1	0	7	7	8	10	11	15	20	26	33	41	50	60	71	84	97	100										
	over 10 : 1	0	7	8	11	13	17	24	31	39	48	57	68	79	91	100												
250	Less than 3 : 1	0	7	7	7	8	9	10	13	16	20	25	30	36	43	51	59	68	87	100								
	3 : 1 to 10 : 1	0	7	7	8	9	10	12	15	19	24	28	34	40	47	55	63	72	92	100								
	over 10 : 1	0	7	8	9	11	14	19	24	30	36	43	50	57	65	73	82	92	100									
350	Less than 3 : 1	0	7	7	7	8	8	9	11	14	16	20	24	28	33	38	44	50	64	81	99	100						
	3 : 1 to 10 : 1	0	7	7	8	8	9	11	13	16	19	23	27	32	37	42	48	55	69	85	100							
	over 10 : 1	0	7	8	9	10	12	16	21	25	30	36	41	47	53	59	66	73	88	100								
500	Less than 3 : 1	0	7	7	7	7	8	9	10	12	14	16	19	22	25	29	33	37	47	59	71	100						
	3 : 1 to 10 : 1	0	7	7	7	8	8	10	12	14	16	19	22	25	29	33	37	41	52	63	76	100						
	over 10 : 1	0	7	7	8	9	11	14	18	22	25	30	34	38	43	48	53	58	70	82	96	100						
1 000	Less than 3 : 1	0	7	7	7	7	7	8	9	9	10	12	13	14	16	18	20	22	27	33	39	58	82	100				
	3 : 1 to 10 : 1	0	7	7	7	7	8	9	10	11	12	14	15	17	19	21	23	26	31	37	43	63	86	100				
	over 10 : 1	0	7	7	8	8	9	11	13	16	19	21	24	27	30	33	36	39	46	53	60	82	100					
2 000	Less than 3 : 1	0	7	7	7	7	7	7	8	8	9	9	10	11	12	13	14	15	17	20	23	33	44	58	74	93	100	
	3 : 1 to 10 : 1	0	7	7	7	7	7	8	8	9	10	11	12	13	14	15	16	17	20	23	27	37	49	63	79	97	100	
	over 10 : 1	0	7	7	7	8	8	9	11	12	14	16	18	19	21	23	25	27	32	36	40	53	66	82	99	100		

Notes to Table 3.2.3.1.-B:

(1) Apply whichever ratio is greater.

L = Length of exposing building face

H = Height of exposing building face

Table 3.2.3.1.-C
Unprotected Opening Limits for a Building or Fire Compartment that is not Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face		**Area of *Unprotected Openings* for Groups E and F, Division 1 and 2 *Occupancies*, %**																														
Max. Area, m²	**Ratio (L/H or H/L)(1)**	***Limiting Distance*, m**																														
		0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**16**	**18**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
10	Less than 3 : 1	0	4	5	9	15	23	46	77	100																					
	3 : 1 to 10 : 1	0	4	6	10	17	25	48	79	100																					
	over 10 : 1	0	5	9	16	24	34	58	91	100																					
15	Less than 3 : 1	0	4	5	7	11	16	32	53	79	100																				
	3 : 1 to 10 : 1	0	4	5	8	13	18	34	55	82	100																				
	over 10 : 1	0	5	8	13	19	26	43	66	93	100																				
20	Less than 3 : 1	0	4	4	6	9	13	25	40	61	85	100																			
	3 : 1 to 10 : 1	0	4	5	7	11	15	27	43	63	87	100																			
	over 10 : 1	0	5	7	11	17	22	36	53	74	99	100																			
25	Less than 3 : 1	0	4	4	6	8	11	20	33	49	69	92	100																		
	3 : 1 to 10 : 1	0	4	5	7	9	13	22	35	51	71	94	100																		
	over 10 : 1	0	4	6	10	15	20	31	45	62	82	100																			
30	Less than 3 : 1	0	4	4	5	7	10	18	28	42	58	77	100																		
	3 : 1 to 10 : 1	0	4	4	6	9	12	20	30	44	60	80	100																		
	over 10 : 1	0	4	6	10	14	18	28	40	54	71	91	100																		
40	Less than 3 : 1	0	4	4	5	6	8	14	22	32	44	59	76	94	100																
	3 : 1 to 10 : 1	0	4	4	6	8	10	16	24	34	47	61	78	97	100																
	over 10 : 1	0	4	5	8	12	15	23	33	44	57	72	89	100																	
50	Less than 3 : 1	0	4	4	5	6	7	12	18	26	36	48	61	76	93	100															
	3 : 1 to 10 : 1	0	4	4	5	7	9	14	20	29	38	50	63	79	95	100															
	over 10 : 1	0	4	5	8	11	14	21	29	38	48	61	74	90	100																
60	Less than 3 : 1	0	4	4	4	5	7	11	16	23	31	40	52	64	78	94	100														
	3 : 1 to 10 : 1	0	4	4	5	6	8	12	18	25	33	43	54	66	81	96	100														
	over 10 : 1	0	4	5	7	10	13	19	26	34	43	53	64	77	92	100															
	Less than 3 : 1	0	4	4	4	5	6	9	13	18	24	31	40	49	60	71	84	98	100												

80	3 : 1 to 10 : 1	0	4	4	5	6	7	10	15	20	26	33	42	51	62	74	86	100																			
	over 10 : 1	0	4	5	6	9	11	16	22	28	35	43	52	62	73	85	98	100																			
100	Less than 3 : 1	0	4	4	4	5	5	8	11	15	20	26	32	40	48	58	68	79	100																		
	3 : 1 to 10 : 1	0	4	4	4	5	6	9	13	17	22	28	35	42	51	60	70	81	100																		
	over 10 : 1	0	4	4	6	8	10	14	19	25	31	37	44	52	61	71	81	92	100																		
150	Less than 3 : 1	0	4	4	4	4	5	6	8	11	14	18	23	28	33	40	46	54	70	89	100																
	3 : 1 to 10 : 1	0	4	4	4	5	6	8	10	13	16	20	25	30	36	42	49	56	73	92	100																
	over 10 : 1	0	4	4	5	7	8	12	16	20	24	29	34	39	46	52	59	67	84	100																	
250	Less than 3 : 1	0	4	4	4	4	4	5	7	8	10	12	15	18	22	25	29	34	44	55	68	100															
	3 : 1 to 10 : 1	0	4	4	4	4	5	6	8	10	12	14	17	20	24	27	32	36	46	57	70	100															
	over 10 : 1	0	4	4	5	6	7	9	12	15	18	21	25	28	32	37	41	46	56	68	81	100															
350	Less than 3 : 1	0	4	4	4	4	4	5	6	7	8	10	12	14	16	19	22	25	32	40	49	77	100														
	3 : 1 to 10 : 1	0	4	4	4	4	4	5	7	8	10	12	14	16	18	21	24	27	34	43	52	79	100														
	over 10 : 1	0	4	4	4	5	6	8	10	13	15	18	21	23	26	30	33	36	44	53	62	90	100														
500	Less than 3 : 1	0	4	4	4	4	4	4	5	6	7	8	9	11	13	14	16	19	24	29	36	55	78	100													
	3 : 1 to 10 : 1	0	4	4	4	4	4	5	6	7	8	9	11	13	14	16	18	21	26	31	38	57	80	100													
	over 10 : 1	0	4	4	4	5	5	7	9	11	13	15	17	19	21	24	26	29	35	41	48	68	92	100													
1 000	Less than 3 : 1	0	4	4	4	4	4	4	4	5	5	6	6	7	8	9	10	11	14	16	20	29	41	55	71	89	100										
	3 : 1 to 10 : 1	0	4	4	4	4	4	4	5	5	6	7	8	9	10	11	12	13	15	18	22	31	43	57	73	91	100										
	over 10 : 1	0	4	4	4	4	5	6	7	8	9	11	12	13	15	16	18	20	23	26	30	41	53	68	84	100											
2 000	Less than 3 : 1	0	4	4	4	4	4	4	4	4	4	5	5	5	6	6	7	7	9	10	12	16	22	29	37	46	56	68	80	94	100						
	3 : 1 to 10 : 1	0	4	4	4	4	4	4	4	5	5	5	6	6	7	7	8	9	10	12	13	18	24	31	39	49	59	70	83	96	100						
	over 10 : 1	0	4	4	4	4	4	5	5	6	7	8	9	10	11	12	13	14	16	18	20	26	33	41	50	59	70	81	94	100							

Notes to Table 3.2.3.1.-C:

(1) Apply whichever ratio is greater.

L = Length of exposing building face

H = Height of exposing building face

Table 3.2.3.1.-D
Unprotected Opening Limits for a Building or Fire Compartment that is Sprinklered Throughout
Forming Part of Sentence 3.1.6.9.(5) and Article 3.2.3.1.

Exposing Building Face	**Area of *Unprotected Opening* for Groups A, B, C, D and F, Division 3 *Occupancies*, %**											
Max. Area, m^2	***Limiting Distance*, m**											
	0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
10	0	16	24	42	66	100						
15	0	16	20	34	50	74	100					
20	0	16	20	30	42	60	100					
25	0	16	18	26	38	52	90	100				
30	0	14	18	24	34	46	78	100				
40	0	14	16	22	30	40	64	96	100			
50	0	14	16	20	28	36	56	82	100			
60	0	14	16	20	26	32	50	72	98	100		
80	0	14	16	18	22	28	42	58	80	100		
100	0	14	16	18	22	26	36	50	68	88	100	
150 or more	0	14	14	16	20	22	30	40	52	66	82	100

Table 3.2.3.1.-E
Unprotected Opening Limits for a Building or Fire Compartment that is Sprinklered Throughout
Forming Part of Sentence 3.1.6.9.(5) and Article 3.2.3.1.

Exposing Building Face	**Area of *Unprotected Opening* for Groups E and F, Division 1 and 2 *Occupancies*, %**																	
Max. Area, m^2	***Limiting Distance*, m**																	
	0	**1.2**	**1.5**	**2.0**	**2.5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
10	0	8	12	20	34	50	96	100										
15	0	8	10	16	26	36	68	100										
20	0	8	10	14	22	30	54	86	100									
25	0	8	10	14	18	26	44	70	100									
30	0	8	8	12	18	24	40	60	88	100								
40	0	8	8	12	16	20	32	48	68	94	100							
50	0	8	8	10	14	18	28	40	58	76	100							
60	0	8	8	10	12	16	24	36	50	66	86	100						
80	0	8	8	10	12	14	20	30	40	52	66	84	100					
100	0	8	8	8	10	12	18	26	34	44	56	70	84	100				
150	0	8	8	8	10	12	16	20	26	32	40	50	60	72	84	98	100	
200 or more	0	8	8	8	8	10	14	18	22	28	34	42	50	60	68	80	92	100

3.2.3.2. Area of Exposing Building Face

1) Except as permitted by Sentences (2) and (3), the area of an *exposing building face* shall be calculated as the total area of an exterior wall facing in one direction on any side of a *building* measured from the finished ground level to the uppermost ceiling.

2) If a *building* is divided by *fire separations* into *fire compartments*, the area of *exposing building face* is permitted to be calculated for each *fire compartment* provided the *fire separations* have a *fire-resistance rating* not less than 45 min.

3) In a *building* that is *sprinklered* throughout and contains an *interconnected floor space*, the area of the *exposing building face* for the *interconnected floor space* is permitted to be determined by considering each *storey* as a separate *fire compartment* notwithstanding openings through the floor assemblies.

3.2.3.3. Wall Enclosing Attic or Roof Space

1) An exterior wall enclosing an *attic or roof space* and located above an *exposing building face*, shall be constructed in conformance with the requirements for the *exposing building face*.

3.2.3.4. Party Wall

1) A *party wall* shall be constructed as a *firewall*. (See Note A-3.2.3.4.(1).)

3.2.3.5. Wall with Limiting Distance Less Than 1.2 m

1) Openings in a wall that has a *limiting distance* less than 1.2 m shall be protected by *closures* whose *fire-protection rating* is in conformance with the *fire-resistance rating* required for the wall.

2) Wired glass or glass block shall not be used for a *closure* referred to in Sentence (1).

3.2.3.6. Combustible Projections

1) Except for a *building* containing one or two *dwelling units* only, *combustible* projections on the exterior of a wall that could expose an adjacent *building* to fire spread and are more than 1 m above ground level, including balconies, platforms, canopies and stairs, shall not be permitted within

a) 1.2 m of a property line or the centre line of a *public way*, or

b) 2.4 m of a *combustible* projection on another *building* on the same property.

2) Except as provided in Sentence (4), where the *exposing building face* has a *limiting distance* of not more than 0.45 m, projecting roof soffits shall not be constructed above the *exposing building face*. (See Note A-3.2.3.6.(2).)

3) Except as provided in Sentence (4), where the *exposing building face* has a *limiting distance* of more than 0.45 m, the face of roof soffits shall not project to less than 0.45 m from the property line. (See Note A-3.2.3.6.(2).)

4) The face of a roof soffit is permitted to project to the property line, where it faces a *public way*. (See Note A-9.10.14.5.(11) and 9.10.15.5.(10).)

5) Where roof soffits project to less than 1.2 m from the centre line of a *public way*, or from an imaginary line between two *buildings* or *fire compartments* on the same property, they shall

a) have no openings, and

b) be protected by

i) not less than 0.38 mm thick sheet steel,

ii) unvented aluminum conforming to CAN/CGSB-93.2-M, “Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use,”

iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, “Gypsum Board Application,”

iv) not less than 11 mm thick plywood,

v) not less than 12.5 mm thick OSB or waferboard, or

vi) not less than 11 mm thick lumber.

6) For *buildings* of *combustible construction*, materials installed to provide the required protection of soffits may be covered with a *combustible* or *noncombustible* finish material.

3.2.3.7. Construction of Exposing Building Face

1) Except as provided in Sentences (3) and (4), and Articles 3.2.3.10. and 3.2.3.11., the *fire-resistance rating*, construction and cladding for *exposing building faces* of *buildings* or *fire compartments* of Group A, B, C, D or Group F, Division 3 *occupancy* classification shall comply with Table 3.2.3.7.

2) Except as provided in Sentences (3) and (4) and Article 3.2.3.10., the *fire-resistance rating*, construction and cladding for *exposing building faces* of *buildings* or *fire compartments* of Group E or Group F, Division 1 or 2 *occupancy* classification shall comply with Table 3.2.3.7.

Table 3.2.3.7.
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentences 3.1.6.9.(5) and 3.2.3.7.(1) to (4)

Occupancy* Classification of *Building* or *Fire Compartment	**Maximum Area of *Unprotected Openings* Permitted, % of *Exposing Building Face* Area**	**Minimum Required *Fire-Resistance Rating***	**Type of Construction Required**	**Type of Cladding Required**
	0 to 10	1 h	*Noncombustible*	*Noncombustible*

Group A, B, C, D, or Group F, Division 3	> 10 to 25	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 25 to 50	45 min	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 50 to < 100	45 min	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Combustible* or *Noncombustible*(1)(2)
Group E, or Group F, Division 1 or 2	0 to 10	2 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	2 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 25 to 50	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Noncombustible*
	> 50 to < 100	1 h	*Combustible*, *Encapsulated mass timber*, or *Noncombustible*	*Combustible* or *Noncombustible*(2)

Notes to Table 3.2.3.7.:

(1) The cladding on Group C buildings conforming to Article 3.2.2.51. and on Group D buildings conforming to Article 3.2.2.60. shall be noncombustible or consist of a wall that satisfies the requirements of Article 3.1.4.8.

(2) The cladding on *buildings* or parts thereof conforming to Articles 3.2.2.48., 3.2.2.57. or 3.2.2.93. shall conform to Article 3.1.6.9. or be noncombustible.

3) Except as provided in Articles 3.1.4.8. and 3.1.6.9., the requirement in Table 3.2.3.7. for *noncombustible* cladding for *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 10% of the *exposing building face* is permitted to be waived for exterior wall assemblies that comply with Article 3.1.5.5. or 3.1.5.6.

4) Except as provided in Articles 3.1.4.8. and 3.1.6.9., the requirement in Table 3.2.3.7. for *noncombustible* cladding for *buildings* or *fire compartments* where the maximum permitted area of *unprotected openings* is more than 25% but not more than 50% of the *exposing building face* is permitted to be waived where

a) the *limiting distance* is greater than 5 m,

b) the *building* or *fire compartment* and all *combustible* attic and roof spaces are *sprinklered* throughout,

c) the cladding

i) conforms to Subsections 9.27.6., 9.27.7., 9.27.8., 9.27.9. or 9.27.10.,

ii) is installed without furring members, or on furring not more than 25 mm thick, over gypsum sheathing at least 12.7 mm thick or over masonry, and

iii) after conditioning in conformance with ASTM D2898, “Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing,” has a *flame-spread rating* not greater than 25 on the exterior face when tested in accordance with Sentence 3.1.12.1.(1),

d) the cladding

i) conforms to Subsection 9.27.12.,

ii) is installed with or without furring members over gypsum sheathing at least 12.7 mm thick or over masonry,

iii) has a *flame-spread rating* not greater than 25 when tested in accordance with Sentence 3.1.12.1.(2), and

iv) does not exceed 2 mm in thickness, exclusive of fasteners, joints and local reinforcements (see Note A-3.2.3.7.(4)(d)(iv)), or

e) the exterior wall assembly complies with Article 3.1.5.5. or 3.1.5.6.

5) The construction requirements for the *exposing building face* stated in Sentences (1) and (2) shall be satisfied before increasing the *unprotected opening* area as permitted by Sentence 3.2.3.12.(1).

3.2.3.8. Protection of Exterior Building Face

1) Except as permitted by Sentence (3) and in addition to the requirements of Sentences 3.2.3.7.(1) and (2) and where the maximum permitted area of *unprotected openings* is greater than 10% of the *exposing building face*, foamed plastic insulation used in an exterior wall of a *building* more than 3 *storeys* in *building height* shall be protected on its exterior surface by

a) concrete or masonry not less than 25 mm thick, or

b) *noncombustible* material that complies with the criteria for testing and the conditions of acceptance stated in Sentence (2) when tested in conformance with CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials."

2) The criteria for testing and the conditions of acceptance for a wall assembly to satisfy the requirements of Clause (1)(b) are that

a) the fire exposed area of the wall assembly shall be not less than 9.3 m^2 and have no dimension less than 2.75 m,

b) the exposed surface shall include typical vertical and horizontal joints,

c) the test shall be continued for not less than 15 min and the standard time/temperature curve of the referenced standard shall be followed,

d) the *noncombustible* protective material must remain in place and no through openings should develop that are visible when viewed normal to the face of the material, and

e) the *noncombustible* protective material should not disintegrate in a manner that would permit fire to propagate along the surface of the test assembly.

3) The requirements of Sentence (1) are waived for wall assemblies that comply with the requirements of Article 3.1.5.5. (See Note A-3.1.4.1.(1).)

3.2.3.9. Protection of Structural Members

1) Structural members, including beams, columns and arches, that are placed wholly or partly outside the exterior face of a *building* and are less than 3 m from the property line or the centre line of a public thoroughfare shall be protected from exterior fire exposure by fire protection having a *fire-resistance rating* not less than that required for their protection from interior fire exposure, as stated in Articles 3.2.2.20. to 3.2.2.93., but not less than 1 h.

2) Structural members of *heavy timber construction*, including beams, columns and arches, that are placed wholly or partly outside the exterior face of a *building* and are 3 m or more from the property line or the centre line of a public thoroughfare need not be covered with *noncombustible* cladding.

3.2.3.10. Unlimited Unprotected Openings

1) An *exposing building face* in a *storage garage* with all *storeys* constructed as *open-air storeys* is permitted to have unlimited *unprotected openings* provided it has a *limiting distance* not less than 3 m.

2) The *exposing building face* of a *storey* that faces a *street* and is at the same level as the *street* is permitted to have unlimited *unprotected openings* if the *limiting distance* is not less than 9 m.

3.2.3.11. Low Fire Load, One Storey Building

1) An *exposing building face* of a *building* of *low-hazard industrial occupancy* conforming to Article 3.2.2.91. is permitted to be of *noncombustible construction* without a *fire-resistance rating* provided

a) it is not a *loadbearing* wall, and

b) the *limiting distance* is not less than 3 m.

3.2.3.12. Area Increase for Unprotected Openings

1) Except as required by Sentence 3.2.3.7.(5), the maximum area of *unprotected openings* in any *exposing building face* of a *building* that is not *sprinklered* is permitted to be doubled if the openings are glazed with

a) glass block conforming to the requirements of Article 3.1.8.16., or

b) wired glass assemblies conforming to Article D-2.3.15. of Appendix D.

3.2.3.13. Protection of Exit Facilities

1) Except as required by Sentence (3) and as permitted by Sentence 3.4.4.3.(1), if the plane of an exterior wall of an *exit* enclosure forms an angle less than 135° with the plane of an exterior wall of the *building* it serves, and an opening in the exterior wall of the *exit* enclosure could be exposed to fire from an opening in the exterior wall of the *building*, the opening in either the exterior wall of the *exit* or the exterior wall of the *building* shall be protected in conformance with the requirements of Sentence (4) where the opening in the exterior wall of the *building* is within 3 m horizontally and

a) less than 10 m below an opening in the exterior wall of the *exit*, or

b) less than 2 m above an opening in the exterior wall of the *exit*.

(See Note A-3.2.3.14.(1).)

2) If an unenclosed exterior *exit* stair, *ramp*, or confined path of travel, could be exposed to fire from an opening in the exterior wall of the *building* it serves, the opening in the exterior wall of the *building* shall be protected in conformance with the requirements of Sentence (4) where the opening in the exterior wall of the *building* is within 3 m horizontally and

a) less than 10 m below the *exit* stair or *ramp*, or confined path of travel, or

b) less than 5 m above the *exit* stair or *ramp*, or confined path of travel.

3) Except as permitted by Sentence 3.4.4.3.(1), if an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an opening in another *fire compartment* and the exterior walls of these *fire compartments* intersect at an exterior angle of less than 135°, the opening shall be protected in conformance with the requirements of Sentence (4).

4) The opening protection referred to in Sentences (1) to (3) shall consist of

a) glass block conforming to the requirements of Article 3.1.8.16.,

b) a wired glass assembly conforming to Article D-2.3.15. of Appendix D,

c) a *closure* conforming to the requirements of Subsection 3.1.8. and Articles 3.2.3.1. and 3.2.3.14., or

d) a dedicated sprinkler water curtain in accordance with Sentence (5).

5) An opening provided with a dedicated sprinkler water curtain for opening protection as permitted in Clause (4)(d) shall

a) be provided with tempered or laminated safety glass glazed openings where windows are provided,

b) be provided with quick response sprinklers with a nominal k-factor of 5.6 of the upright or pendant type,

c) be located such that

i) the water curtain sprinklers are between 150 mm and 300 mm horizontally from the interior face of the opening,

ii) the water curtain is located and not more than 3.6 m vertically above the floor immediately below and within 300 mm of a smooth horizontal ceiling per the manufacturers listing for the quick response sprinkler head and NFPA 13,

iii) if the opening is 1.8 m or less in width, the water curtain shall have one sprinkler head installed at the center of the opening with no more than 0.9 m horizontally from the edge of the opening, and

iv) if the opening is more than 1.8 m in width, have multiple sprinkler heads installed at 1.8 m on center with no more than 0.9 m horizontally from the edge of the opening, and

d) have sprinkler heads protected from spray and from cold solder effects from adjacent sprinklers (floor area or water curtain sprinkler heads) by means of baffles in accordance with NFPA 13, and be hydraulically designed to

i) discharge water at a minimum flow rate of 1.13 L/s (18 usgpm),

ii) sprinklers will be supplied off the floor area *sprinkler system*, and

iii) be included in the most hydraulically demanding design area for the adjacent floor area sprinklers plus the inside and outside hose stream allowance per NFPA 13.

3.2.3.14. Wall Exposed to Another Wall

1) Except as required by Sentences (3) and 3.2.3.13.(1) or as permitted by Sentence 3.2.3.19.(5), if an *unprotected opening* in an exterior wall of a *fire compartment* is exposed to an *unprotected opening* in the exterior wall of another *fire compartment*, and the planes of the 2 walls are parallel or at an angle less than 135°, measured from the exterior of the *building*, the *unprotected openings* in the 2 *fire compartments* shall be separated by a distance not less than D_o where

$$D_o = 2D - \left(\frac{\theta}{90} \times D\right)$$

but in no case less than 1 m, and

D = the greater required *limiting distance* for the *exposing building faces* of the 2 *fire compartments*, and

θ = the angle made by the intersecting planes of the *exposing building faces* of the 2 *fire compartments* (in the case where the exterior walls are parallel and face each other, θ = 0°).

(See Note A-3.2.3.14.(1).)

2) The exterior wall of each *fire compartment* referred to in Sentence (1) within the distance, D_o, shall have a *fire-resistance rating* not less than that required for the interior vertical *fire separation* between the *fire compartment* and the remainder of the *building*.

3) Sentence (1) does not apply to *unprotected openings* of *fire compartments* within a *building* that is *sprinklered* throughout, but shall apply to

a) *unprotected openings* of *fire compartments* on opposite sides of a *firewall*, and

b) exposure from *unprotected openings* of a *fire compartment* that is not protected by an automatic *sprinkler system*.

3.2.3.15. Wall Exposed to Adjoining Roof

1) Except as permitted by Sentence 3.2.3.19.(5), if a wall in a *building* is exposed to a fire hazard from an adjoining roof of a separate *fire compartment* that is not *sprinklered* in the same *building*, and the exposed wall contains windows within 3 *storeys* vertically and 5 m horizontally of the roof, the roof shall contain no skylights within 5 m of the exposed wall.

3.2.3.16. Protection of Soffits

1) Except as permitted by Sentences (3) and (4), where there is a common *attic or roof space* above more than 2 *suites* of *residential occupancy* or above more than 2 patients' sleeping rooms, and the common *attic or roof space* projects beyond the exterior wall of the *building*, the soffit, and any opening in the soffit or other surface of the projection located within 2 500 mm of a window or door opening, shall be protected by

a) *noncombustible* material

i) not less than 0.38 mm thick, and

ii) having a melting point not below 650°C,

b) plywood not less than 11 mm thick,

c) strandboard or waferboard not less than 12.5 mm thick, or

d) lumber not less than 11 mm thick.

2) The soffit protection required by Sentence (1) shall extend the full width of the opening and to not less than 1 200 mm on either side of it, and shall apply to all openings through the soffit within this limit.

3) If an eave overhang is completely separated from the remainder of the *attic or roof space* by the use of *fire blocks*, the requirements of Sentence (1) do not apply.

4) The protection required by Sentence (1) for projections is permitted to be omitted if

a) the *fire compartments* behind the window and door openings are *sprinklered* in accordance with Article 3.2.5.12., and

b) all rooms, including closets and bathrooms, having openings in the wall beneath the soffit are *sprinklered*, notwithstanding exceptions permitted in the standards referenced in Article 3.2.5.12. for the installation of automatic *sprinkler systems*.

3.2.3.17. Canopy Protection for Vertically Separated Openings

1) Except as permitted by Sentences (2) and (3), if a *storey* classified as a Group E or Group F, Division 1 or 2 *major occupancy* is required to be separated from the *storey* above by a *fire separation*,

a) every opening in the exterior wall of the lower *storey* that is located vertically below an opening in the *storey* above shall be separated from the *storey* above by a canopy projecting not less than 1 m from the face of the *building* at the intervening floor level, and

b) the canopy required by Clause (a) shall have a *fire-resistance rating* not less than that required for the floor assembly but need not be more than 1 h, except as required elsewhere in this Subsection.

2) Except as permitted by Sentence (3), the canopy required by Sentence (1) is permitted to be omitted if the exterior wall of the upper *storey* is recessed not less than 1 m behind the exterior wall containing the opening in the lower *storey*.

3) The requirements of Sentences (1) and (2) are permitted to be waived if the *building* is *sprinklered* throughout.

3.2.3.18. Covered Vehicular Passageway

1) A covered vehicular passageway designed as a receiving or shipping area shall be separated from every *building* or part of a *building* adjoining it by a *fire separation* having a *fire-resistance rating* not less than 1.5 h.

2) A covered vehicular passageway constructed below *grade* shall be of *noncombustible construction*.

3.2.3.19. Walkway between Buildings

1) Except as required by Sentence 3.2.3.20.(2), if *buildings* are connected by a *walkway*, each *building* shall be separated from the *walkway* by a *fire separation* with a *fire-resistance rating* not less than 45 min.

2) Except as permitted by Sentence (4), a *walkway* connected to a *building* required to be of *noncombustible construction* shall also be of *noncombustible construction*.

3) Except as provided in Sentence (4), a *walkway* connected to a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* shall be of *noncombustible construction* or *encapsulated mass timber construction*.

4) A *walkway* connected to a *building* required to be of *noncombustible construction* or to a *building* or part of a *building* permitted to be of *encapsulated mass timber construction* is permitted to be of *heavy timber construction*, provided

a) not less than 50% of the area of any enclosing perimeter walls is open to the outdoors, and

b) the *walkway* is at ground level.

5) A *walkway* of *noncombustible construction* used only as a pedestrian thoroughfare need not conform to the requirements of Articles 3.2.3.14. and 3.2.3.15.

6) A *walkway* between *buildings* shall be not more than 9 m wide.

3.2.3.20. Underground Walkway

1) An underground *walkway* shall not be designed or used for any purpose other than pedestrian travel unless

a) the purpose is acceptable to the *authority having jurisdiction*, and

b) sprinklers are installed in any space in the *walkway* containing an *occupancy*.

2) *Buildings* connected by an underground *walkway* shall be separated from the *walkway* by a *fire separation* with a *fire-resistance rating* not less than 1 h.

3) An underground *walkway* shall be of *noncombustible construction* suitable for an underground location.

4) In an underground *walkway*

a) smoke barrier doors shall be installed at intervals of not more than 100 m, or

b) the travel distance from the door of an adjacent room or space to the nearest *exit* shall be not more than one and a half times the least allowable travel distance to an *exit* for any of the adjacent *occupancies* as permitted by Sentence 3.4.2.5.(1).

5) An underground *walkway* between *buildings* shall be not more than 9 m wide.

3.2.3.21. Storage and Process Equipment Located Outdoors

1) Location of outdoor storage and outdoor process equipment in relation to *buildings* shall conform to Parts 3 and 4 of Division B of the Fire By-law.

3.2.3.22. Installation of Service Lines Under Buildings

1) When a *building* is erected over existing buried flammable gas mains, such service lines shall be encased in gas-tight conduits in conformance with CAN/CSA-Z662, “Oil and gas pipeline systems.”

3.2.4. Fire Alarm and Detection Systems

(See Note A-3.2.4.)

3.2.4.1. Determination of Requirement for a Fire Alarm System

1) Except as permitted in Sentences (2) and (3), a fire alarm system shall be installed in *buildings* in which an automatic *sprinkler system* is required by this Part.

2) *Buildings* in which a *sprinkler system* is installed in accordance with NFPA 13D, “Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” need not comply with Sentence (1).

3) *Buildings* that contain fewer than 9 sprinklers conforming to Sentence 3.2.5.12.(4) need not comply with Sentence (1).

4) Except as permitted by Sentences (5), (6) and 3.2.4.2.(4), a fire alarm system shall be installed in a *building* that is not *sprinklered* throughout and that contains

a) a *contained use area*,

b) an *impeded egress zone*,

c) more than 3 *storeys*, including the *storeys* below the *first storey*,

d) a total *occupant load* more than 300, other than in open air seating areas,

e) an *occupant load* more than 150 above or below the *first storey*, other than in open air seating areas,

f) a school, college, or child care facility, including a daycare facility for children, with an *occupant load* more than 40,

g) a licensed beverage establishment or a licensed restaurant, with an *occupant load* more than 150,

h) a *low-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,

i) a *medium-hazard industrial occupancy* with an *occupant load* more than 75 above or below the *first storey*,

j) a *residential occupancy* with sleeping accommodation for more than 10 persons,

k) a *high-hazard industrial occupancy* with an *occupant load* more than 25, or

l) an *occupant load* more than 300 below an open air seating area.

5) A fire alarm system is not required in a *residential occupancy* that is not *sprinklered*, where

a) not more than 4 *suites* share a common *means of egress*, or

b) each *suite* has direct access to an exterior *exit* facility leading to ground level.

6) A fire alarm system is not required in a *storage garage* conforming to Article 3.2.2.92. that is contained in a *building* that is not *sprinklered* provided there are no other *occupancies* in the *building*.

7) A fire alarm system shall be installed in *buildings* designed and constructed in accordance with Subsection 3.2.10. (See Note A-3.2.10.2.(1) and (2).)

3.2.4.2. Continuity of Fire Alarm System

1) Except as permitted by Sentence (6), if there are openings through a *firewall*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways, the requirements in this Subsection shall apply to the *floor areas* on both sides of the *firewall* as if they were in the same *building*.

2) Except as permitted by Sentence (4), if a *building* contains more than one *major occupancy* and a fire alarm system is required, a single system shall serve all *occupancies*.

3) Except as permitted by Sentence (4), if a fire alarm system is required in any portion of a *building*, it shall be installed throughout the *building*.

4) Except as required by Sentence (5), the requirements in this Subsection are permitted to be applied to each portion of a *building* not more than 3 *storeys* in *building height*, in which a vertical *fire separation* having a *fire-resistance rating* not less than 1 h separates the portion from the remainder of the *building* as if it were a separate *building*, provided there are no openings through the *fire separation*, other than those for piping, tubing, wiring and totally enclosed *noncombustible* raceways.

5) The permission in Sentence (4) to consider separated portions of a *building* as separate *buildings* does not apply to *service rooms* and storage rooms.

6) *Buildings* interconnected by *walkways* permitted in Articles 3.2.3.19. and 3.2.3.20. or by vestibules provided in conformance with Article 3.2.6.3. shall be treated as separate *buildings* for the purpose of fire alarm installation required by this Subsection.

3.2.4.3. Types of Fire Alarm Systems

1) A fire alarm system shall be

a) a single-stage system in a Group F, Division 1 *occupancy*,

b) except as permitted in Clause (c), a 2-stage system in a Group B *occupancy*,

c) a single- or 2-stage system in a Group B, Division 3 *occupancy* where the *building* is 3 *storeys* or less in *building height*, and

d) a single- or 2-stage system in all other cases.

3.2.4.4. Description of Fire Alarm Systems

1) A single stage fire alarm system shall, upon the operation of any manual station, waterflow detecting device, or *fire detector*, cause an *alarm signal* to sound on all audible signal devices in the system. (See Note A-3.2.4.4.(1).)

2) A 2-stage fire alarm system shall

a) cause an *alert signal* to sound upon the operation of any manual station, waterflow detecting device, or *fire detector*,

b) automatically cause an *alarm signal* to sound if the *alert signal* is not acknowledged within 5 min of its initiation, and

c) have manual stations, each of which is equipped so that the use of a key or other similar device causes an *alarm signal* to sound that continues to sound upon removal of the key or similar device from the manual station (see Note A-3.2.4.4.(2)(c)).

(See Note A-3.2.4.4.(2).)

3) A 2-stage fire alarm system is permitted to be zone coded so that, upon the operation of any manual station, waterflow detecting device, or *fire detector*,

a) a coded *alert signal* is sounded indicating the zone of alarm initiation,

b) the coded *alert signal* is repeated in its entirety not less than 4 times, and

c) a continuous *alert signal* is sounded upon completion of the coded signals referred to in Clause (b) and Sentence (4).

4) If a second manual station, waterflow detecting device, or *fire detector* is operated in a fire alarm system with zone coding as permitted by Sentence (3), in a zone other than that for which the first *alert signal* was sounded, the coded *alert signal* for the first zone shall be completed before the coded *alert signal* for the second zone is repeated not less than 4 times.

3.2.4.5. Installation and Verification of Fire Alarm Systems

1) Fire alarm systems, including the voice communication capability where provided, shall be installed in conformance with CAN/ULC-S524, “Standard for Installation of Fire Alarm Systems.”

2) Fire alarm systems shall be verified in conformance with CAN/ULC-S537, “Standard for Verification of Fire Alarm Systems,” to ensure they are operating satisfactorily.

3.2.4.6. Silencing of Alarm Signals

1) A fire alarm system shall be designed so that when an *alarm signal* is actuated, it cannot be silenced automatically before a period of time has elapsed that is not less than

a) 5 min for a *building* not required to be equipped with an annunciator, and

b) 20 min for any other *building*.

2) Except as permitted by Sentence 3.2.4.18.(8) and Sentences 3.2.4.22.(2) and (3), a fire alarm system shall not incorporate manual silencing switches other than those installed inside the fire alarm control unit. (See Note A-3.2.4.6.(2).)

3) A manual silencing switch, accessible only to authorized personnel, shall be installed inside of the annunciator described in Sentence 3.2.4.8.(1). (See Note A-3.2.4.6.(3).)

3.2.4.7. Signals to Fire Department

1) A single stage fire alarm system installed in a *building* of *assembly occupancy* that has an *occupant load* more than 300 shall be designed to notify the fire department, in conformance with Sentence (4), that an *alarm signal* has been initiated.

2) A fire alarm system that includes waterflow-indicating devices shall be designed to notify the fire department in conformance with Sentence (4) when an alarm is initiated.

3) A 2-stage fire alarm system shall be designed to notify the fire department, in conformance with Sentence (4), that an *alert signal* has been initiated.

4) Notification of the fire department, as required by Sentences (1) to (3), shall be provided in conformance with CAN/ULC-S561, "Standard for Installation and Services for Fire Signal Receiving Centres and Systems." (See Note A-3.2.4.7.(4).)

5) Where a single stage fire alarm system is installed in a *building* that is not *sprinklered* throughout and Sentence (1) does not apply, a legible notice that is not easily removed shall be affixed to the wall near each manual station stating

a) that the fire department is to be notified in the event of a fire emergency, and

b) the emergency telephone number for the municipality or for the fire department (see Note A-3.2.4.7.(5)(b)).

6) Helicopter landing areas on roofs shall be provided with telephone extensions or means to notify the fire department.

3.2.4.8. Annunciator and Zone Indication

1) Except as permitted by Sentences (3) to (5), an annunciator shall be installed in close proximity to a *building* entrance that faces a *street* or an access route for fire department vehicles that complies with Sentence 3.2.5.5.(1).

2) Except as permitted by Sentence (6), (8), (9) and (10), the annunciator required by Sentence (1) shall have separate zone indication of the actuation of the alarm initiating devices, *smoke detectors, heat detectors,* manual stations and waterflow detecting devices, in each

a) *floor area* so that the area of coverage for each zone in a *building* that is not *sprinklered* is not more than 2 000 m^2,

b) *floor area* so that the area of coverage for each zone is neither

i) more than one *storey*, nor

ii) more than the system area limits specified in NFPA 13, "Standard for the Installation of Sprinkler Systems,"

c) shaft required to be equipped with *smoke detectors*,

d) air-handling system required to be equipped with *smoke detectors*,

e) fire extinguishing system required by NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations,"

f) *contained use area*,

g) *impeded egress zone*,

h) *fire compartment* required by Sentence 3.3.3.5.(2), and

i) *floor area* required to be equipped with *smoke detector* or *detectors* as required by Clause 3.2.4.11.(1)(h) to

i) initiate an *alert signal* in a 2 stage system or an *alarm signal* in a single stage system, and

ii) indicate the actuation of each device separately on the fire alarm system annunciator.

(See Note A-3.2.4.8.(2).)

3) An annunciator need not be provided for a fire alarm system if not more than one zone indicator is required by Sentence (2).

4) If an annunciator is not installed as part of a fire alarm system in conformance with Sentence (1), a visible and audible trouble signal device shall be provided inside the main entrance of the *building*.

5) The requirements of Sentence (1) are waived in a *building*

a) in which an automatic *sprinkler system* is not installed,

b) that has an aggregate area for all *storeys* of not more than 2 000 m^2, and

c) that is not more than 3 *storeys* in *building height*.

6) The area limits of Clause (2)(a) are waived for an interior undivided open space used as an arena, a rink, or a swimming pool provided that other spaces in the *building* that are separated from the open space are individually zoned in accordance with the requirements of Sentence (2).

7) A fire alarm control unit installed in close proximity to a *building* entrance that faces a *street* or an access route for fire department vehicles that complies with Sentence 3.2.5.5.(1) is deemed to satisfy the requirement for an annunciator, provided all indicators required for an annunciator or trouble signal device are included on the control unit.

8) If a fire alarm system is required in a *building* of *residential occupancy* containing *row housing* or in residential blocks where the egress of the *dwelling units* conforms to Sentence 3.3.4.4.(3) or Clause 9.9.9.1.(1)(b) and the *building* is no more than 4 *storeys* above the adjacent ground or *storage garage*, the *building* shall be provided with

a) a single electrically supervised fire alarm system for the entire *building*,

b) at least one sprinkler zone for each block of *row housing* or each residential block,

c) a *sprinkler system* which is monitored by the fire alarm system and an off-site monitoring service, and

d) a strobe light located outside the principal entrance of each *dwelling unit* and connected to an internal *smoke alarm* within the *dwelling unit.*

9) In a multi-level residential *suite*, where a single egress door is provided and the egress door opens directly into a *public corridor* or an exterior *exit* passageway or onto a *street*, a separate zone for sprinkler water flow detecting devices on each *storey* is not required provided

a) the actuation of a sprinkler waterflow detecting device in the *suite* shall be zoned at the *public corridor* or exterior *exit* passageway floor level, and

b) a strobe light is installed and maintained outside the *suite* entrance of the *dwelling unit*, and connected to an internal *smoke alarm* within the *dwelling unit*.

10) A separate zone for waterflow detecting devices is not required for a shaft described in Clause 3.2.4.8.(2)(c).

11) The annunciator required by Sentence (1) shall have indicator lamps for the separate zone indications required by Sentence (2). (See Note A-3.2.4.8.(11).)

3.2.4.9. Electrical Supervision

1) Electrical supervision shall be provided for a fire alarm system.

2) If a fire alarm system in a *building* is required to have an annunciator by Sentence 3.2.4.8.(1), except for hose valves, all valves controlling water supplies in a standpipe system shall be equipped with an electrically supervised switch for transmitting a trouble signal to the annunciator in the event of movement of the valve handle.

3) An automatic *sprinkler system* shall be electrically supervised to indicate a supervisory signal on the *building* fire alarm system annunciator for each of the following:

a) movement of a valve handle that controls the supply of water to sprinklers,

b) loss of excess water pressure required to prevent false alarms in a wet pipe system,

c) loss of air pressure in a dry pipe system,

d) loss of air pressure in a pressure tank,

e) a significant change in water level in any water storage container used for firefighting purposes,

f) loss of power to any automatically starting fire pump (see Note A-3.2.4.9.(3)(f)), and

g) a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for firefighting purposes.

4) A fire pump shall be electrically supervised as stipulated in NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection."

5) Heat-tracing cables installed on standpipe risers and sprinkler lines shall be electrically supervised by the fire alarm system for loss of power.

6) Indication of a supervisory signal in accordance with Sentences (3) and (5) shall be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4).

7) Except as permitted by Sentence (8), a radio antenna system shall perform a self-test at least twice daily and shall be electrically supervised to indicate a trouble signal on the *building* fire alarm system annunciator for:

a) loss of power to any head-end equipment, and

b) fundamental failure of a self-test.

8) Electrical supervision of a radio antenna system in a *building* in which a fire alarm system is not installed shall be provided by an *acceptable* method.

9) A trouble signal indicating the nature of the trouble in accordance with Sentence (3) and (7) shall be transmitted to a Fire Signal Receiving Centre conforming to CAN/ULC-S561, "Installation and Services for Fire Signal Receiving Centres and Systems" as provided for in Sentence 3.2.4.7.(4).

3.2.4.10. Fire Detectors

1) *Fire detectors* required by this By-law shall be connected to the fire alarm system.

2) Except as permitted by Sentence (3), if a fire alarm system is required in a *building* that is not *sprinklered*, *fire detectors* shall be installed in the following spaces:

a) storage rooms not within *dwelling units*,

b) *service rooms* not within *dwelling units*,

c) janitors' rooms,

d) rooms in which hazardous substances are to be used or stored (see Note A-3.3.1.2.(1)),

e) elevator hoistways and dumbwaiter shafts, and

f) laundry rooms in *buildings* of *residential occupancy*, but not those within *dwelling units*.

3) *Fire detectors* required by Sentence (2) need not be provided within *floor areas* that are *sprinklered*.

4) *Fire detectors* required by Sentence (2) shall be installed in elevator hoistways and dumbwaiter shafts where a *sprinkler system* is not installed within the hoistway or shaft.

3.2.4.11. Smoke Detectors

1) If a fire alarm system is installed, *smoke detectors* shall be installed in

a) except as permitted in Sentence (2), each sleeping room and each corridor serving as part of a *means of egress* from sleeping rooms in portions of a *building* classified as a Group B *major occupancy*,

b) each room in a *contained use area* and corridors serving those rooms,

c) each corridor in portions of a *building* classified as a Group A, Division 1 *major occupancy*,

d) each *public corridor* in portions of a *building* classified as a Group C *major occupancy*,

e) each *exit* stair shaft other than those serving only a Group A, Division 4 *major occupancy* or an open *storage garage*,

f) the vicinity of draft stops required by Article 3.2.8.6.,

g) elevator machine rooms, and

h) each *floor area* in front of the elevator or elevators.

(See Note A-3.2.4.11.(1).)

2) *Smoke detectors* need not be installed in sleeping rooms and in corridors serving the sleeping rooms within a *suite* of *care occupancy* where *smoke alarms* are installed in accordance with Article 3.2.4.20.

3) *Smoke detectors* required in the sleeping rooms of a *care*, *treatment* or *detention occupancy* shall, upon actuation, provide an audible and visible signal to staff serving those rooms so that the room or location containing the actuated *smoke detector* can be easily identified. (See Note A-3.2.4.11.(3).)

4) *Smoke detectors* required in Clause (1)(g) shall, upon actuation, recall the elevators served by the elevator machine room in which the *smoke detector* is installed.

5) Except as permitted in Sentences (6) and (7), *smoke detectors* installed in *buildings* required to be equipped with a fire alarm system shall be located near the entrance to *walkways* described in Articles 3.2.3.19. and 3.2.3.20. or vestibules provided in conformance with Article 3.2.6.3.

6) *Smoke detectors* installed at the entrance to the *walkways* in conformance with Article 3.1.8.14. shall be deemed to meet the requirements of Sentence (5).

7) *Smoke detectors* required by Sentence (5) may be replaced with *fire detectors* in Group F *occupancies* where the *smoke detectors* may be subjected to false alarms due to the activities within the *building*.

3.2.4.12. Prevention of Smoke Circulation

1) If a fire alarm system is installed, an air-handling system shall be designed to prevent the circulation of smoke upon a signal from a duct-type *smoke detector* if the air-handling system

a) serves more than one *storey*,

b) serves more than one *suite* in a *storey*, or

c) serves more than one *fire compartment* required by Sentence 3.3.3.5.(2).

3.2.4.13. Vacuum Cleaning System Shutdown

1) A central vacuum cleaning system in a *building* equipped with a fire alarm system shall be designed to shut down upon actuation of the fire alarm system.

3.2.4.14. Deleted.

3.2.4.15. System Monitoring

1) An automatic *sprinkler system* shall be equipped with waterflow detecting devices and, if an annunciator is required by Article 3.2.4.8., shall be installed so that each device serves

a) not more than one *storey*, and

b) except as required by Sentence 3.2.4.8.(2), an area on each *storey* that is not more than the system area limits as specified in NFPA 13, "Standard for the Installation of Sprinkler Systems."

2) Waterflow-detecting devices required by Sentence (1) shall be connected to the fire alarm system so that, upon its actuation, an *alert signal* or an *alarm signal* is initiated.

3) The actuation of each waterflow detecting device required by Sentence (1) shall be indicated separately on the fire alarm system annunciator.

3.2.4.16. Manual Stations

1) Except as permitted by Sentences (2) and (3), where a fire alarm system is installed, a manual station shall be installed in every *floor area* near

a) every principal entrance to the *building*, and

b) every required *exit, and*

c) every other egress facility that has been designed and identified as an *exit* and has all the features of a required *exit*.

(See Note A-3.2.4.16.(1).)

2) In a *building* that is *sprinklered* throughout, a manual station is not required at an exterior egress doorway from a *suite* that does not lead to an interior shared *means of egress* in a hotel or motel not more than 3 *storeys* in *building height*, provided each *suite* is served by an exterior *exit* facility leading directly to ground level.

3) In a *building* that is *sprinklered* throughout, a manual station is not required at an exterior egress doorway from a *dwelling unit* that does not lead to an interior shared *means of egress* in a *building* not more than 3 *storeys* in *building height* containing only *dwelling units*, provided each *dwelling unit* is served by an exterior *exit* facility leading directly to ground level.

4) In a *building* referred to in Sentence (2) or (3), manual stations shall be installed near doorways leading from shared interior corridors to the exterior.

5) Where a fire alarm system is installed, a manually operated fire alarm station shall be installed on the roof at each *exit* from a helicopter landing area.

3.2.4.17. Alert and Alarm Signals

1) In a 2-stage fire alarm system described in Sentence 3.2.4.4.(2), the same audible signal devices are permitted to be used to sound the *alert signals* and the *alarm signals*.

2) If audible signal devices with voice reproduction capabilities are intended for paging and similar voice message use, other than during a fire emergency, they shall be installed so that *alert signals* and *alarm signals* take priority over all other signals.

3) Audible signal devices forming part of a fire alarm or voice communication system shall not be used for playing music or background noise.

3.2.4.18. Audibility of Alarm Systems

(See Note A-3.2.4.18.)

1) Audible signal devices forming part of a fire alarm system shall be installed in a *building* so that

a) *alarm signals* are clearly audible throughout the *floor area* and throughout any *occupancy* on a roof, and

b) *alert signals* are clearly audible in continuously staffed locations, and where there are no continuously staffed locations, throughout the *floor area* and throughout any *occupancy* on a roof.

(See Note A-3.2.4.18.(1).)

2) The sound pattern of an *alarm signal* shall conform to the temporal pattern defined in Clause 4.2 of ISO 8201, "Acoustics – Audible emergency evacuation signal." (See Note A-3.2.4.18.(2).)

3) The sound patterns of *alert signals* shall be significantly different from the temporal patterns of *alarm signals*. (See Note A-3.2.4.18.(3).)

4) The fire *alarm signal* sound pressure level shall be not more than 110 dBA in any normally occupied area. (See Note A-3.2.4.18.(4).)

5) The sound pressure level in a sleeping room from a fire alarm audible signal device shall be not less than 75 dBA in a *building* of *residential* or *care occupancy* when any intervening doors between the device and the sleeping room are closed. (See Note A-3.2.4.18.(5).)

6) Audible signal devices in sleeping rooms in a *building* of *residential* or *care occupancy* shall emit a low frequency signal. (See Note A-3.2.4.18.(6).)

7) Except as required by Sentence (5), the sound pressure level from a fire alarm system's audible signal device within a *floor area* shall be not less than 10 dBA above the ambient noise level and not less than 65 dBA when any intervening doors between the device and the rest of the *floor area* are closed.

8) Except as permitted by Sentence (12), audible signal devices located within a *dwelling unit* shall include a means for them to be manually silenced for a period of not more than 10 min, after which time the devices shall restore themselves to normal operation. (See Note A-3.2.4.18.(8).)

9) Audible signal devices within a *dwelling unit* or a *suite* of *residential* or *care occupancy* shall be connected to the fire alarm system

a) in a manner such that a single open circuit at one device will not impair the operation of other audible signal devices on that same circuit that serve the other *dwelling units* or *suites* of *residential* or *care occupancy*, or

b) on separate signal circuits that are not connected to the devices in any other *dwelling unit*, *public corridor* or *suite* of *residential* or *care occupancy*.

(See Note A-3.2.4.18.(9).)

10) In a *building* or part thereof classified as a *residential* or *care occupancy*,

a) separate circuits shall be provided for audible signal devices on each *floor area*, and

b) audible signal devices within *dwelling units* or *suites* of *residential* or *care occupancy* shall be wired on separate signal circuits from those not within *dwelling units* or *suites* of *residential* or *care occupancy*.

(See Note A-3.2.4.18.(9) and (10).)

11) Audible signal devices shall be installed in a *service space* referred to in Sentence 3.2.1.1.(8) and shall be connected to the fire alarm system.

12) Audible signal devices within *dwelling units* that are wired on separate signal circuits in accordance with Clause (10)(b) need not include a means for manual signal silencing as required by Sentence (8), provided the fire alarm system includes a provision for an automatic signal silence within *dwelling units*, where

a) the automatic signal silence cannot occur within the first 60 s of operation or within the zone of initiation,

b) a subsequent alarm elsewhere in the *building* will reactuate the silenced audible signal devices within *dwelling units*,

c) after a period of not more than 10 min, the silenced audible signal devices will be restored to continuous audible signal if the alarm is not acknowledged, and

d) the voice communication systems referred to in Articles 3.2.4.22. and 3.2.4.23. have a provision to override the automatic signal silence to allow the transmission of voice messages through silenced audible signal device circuits that serve the *dwelling units*.

(See Note A-3.2.4.18.(8).)

13) If a 2-stage fire alarm system has been installed with an automatic signal silence as described in Sentence (12), the system shall be designed so that any silenced audible signal devices serving *dwelling units* are reactuated whenever an *alarm signal* is required to be transmitted as part of the second stage. (See Note A-3.2.4.18.(8).)

14) An audible signal device forming part of a fire alarm system provided so as to sound alarm signals that are clearly audible throughout any *occupancy* on a roof or balcony, shall be located

a) in the vicinity of an exterior door providing access to a private residential roof deck or balcony with a depth greater than 3m, or

b) on exterior public roofs or balconies.

(See Note A-3.2.4.18.(14).)

3.2.4.19. Visible Signals

1) Where a fire alarm system is installed, visible signal devices shall be provided in addition to *alarm signal* devices

a) in *buildings* or portions thereof intended for use primarily by persons who are deaf or hard of hearing,

b) in *assembly occupancies* in which music and other sounds associated with performances could exceed 100 dBA,

c) in any *floor area* in which the ambient noise level is more than 87 dBA,

d) in any *floor area* in which the occupants

i) use ear protection devices,

ii) are located in an audiometric booth, or

iii) are located in sound-insulating enclosures,

e) in *public corridors* serving a Group B, C, D or E *major occupancy*,

f) in corridors used by the public serving a Group A *major occupancy*,

g) in not less than 10% of the *suites* of *residential occupancy* in a hotel or motel (see Note A-3.2.4.19.(1)(g)), and

h) in washrooms, except those located within

i) *suites* of *residential occupancy*,

ii) *suites* of *care occupancy*, or

iii) patients' sleeping rooms.

2) Visible signal devices are permitted to be installed in lieu of audible signal devices in the compartments referred to in Article 3.3.3.6.

3) Visible signal devices required by Sentence (1) shall be installed so that the signal from at least one device is visible throughout the *floor area* or portion thereof in which they are installed. (See Note A-3.2.4.19.(3).)

4) Visible signal devices shall be installed in the rooms and spaces required by Article 3.2.4.20. and Section 3.8. and shall

a) conform to Sentence (5) where a fire alarm system is provided,

b) conform to Sentence (6) where a fire alarm system is not provided,

c) have a luminous intensity of not less than

i) 75 candela, if the strobe light is located in a sleeping room or bed space, and

ii) 15 candela, if the strobe light is not located in a sleeping room or bed space,

d) produce between 1 and 3 flashes per second, with the flashes synchronized when more than one strobe light is visible from a single location, and

e) be installed in each

i) sleeping room or bed space,

ii) room closed off from the living area by a door, including bathrooms, and

iii) living area and any hallway serving the living area.

5) The visible signal devices required by Sentence (4) shall

a) consist of strobe lights conforming to CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories," that are designed to operate as part of the fire alarm system, and

b) be located in conformance with the installation requirements for visible signal devices in CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."

6) Where a fire alarm system is not provided, the visible signal devices required by Sentence (4) shall

a) consist of strobe lights conforming to CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories,"

b) be connected to, and activated by,

i) the *smoke alarms* required by Article 3.2.4.20. and 9.10.19.1., or

ii) the *smoke detectors* permitted by Articles 3.2.4.20., 3.2.4.21. or 9.10.19.8., and

c) be located not less than 2 100 mm above the floor on a wall or ceiling in a location that will maximize effectiveness.

7) Each *adaptable dwelling unit* shall be provided with special outlet boxes and cover plates that

a) are designed, located and wired specifically to allow strobe lights to operate in conformance with

i) Sentence (5) where a fire alarm system is provided, or

ii) Sentence (6) where a fire alarm system is not provided,

b) are permanently identified as "FIRE – Strobe Light Connection Only,"

c) are installed in the locations described in Clause (4)(e), and

d) for the purposes of providing power to the strobe lights that may be connected to the outlet boxes, are assumed that the total special outlets for at least 20 percent of the *adaptable dwelling units* in the *building* are in use.

3.2.4.20. Smoke Alarms

1) Except as provided in Article 3.2.4.21., *smoke alarms* shall be installed in accordance with this Article.

2) Except as required by Sentence (5) and permitted by Sentence (10), *smoke alarms* conforming to CAN/ULC-S531, "Standard for Smoke Alarms," shall be installed in each *dwelling unit* and, except for *care*, *treatment* or *detention occupancies* required to have a fire alarm system, in each sleeping room not within a *dwelling unit* or *suite* of *care occupancy*.

3) At least one *smoke alarm* shall be installed on each *storey* of a *dwelling unit* or *suite* of *care occupancy*.

4) On any *storey* of a *dwelling unit* containing sleeping rooms, a *smoke alarm* shall be installed

a) in each sleeping room, and

b) in a location between the sleeping rooms and the remainder of the *storey*, and if the sleeping rooms are served by a hallway, the *smoke alarm* shall be located in the hallway.

5) Where a *care occupancy* has individual *suites* for residents, a *smoke alarm* shall be installed

a) in each sleeping room, and

b) in a location between the sleeping rooms and the remainder of the *suite*, and if the sleeping rooms are served by a corridor within the *suite*, the *smoke alarm* shall be located in the corridor.

6) A *smoke alarm* shall be installed on or near the ceiling.

7) In hotels and motels with a fire alarm system, *smoke alarms* installed in rooms required to have a visible signal device connected to the fire alarm system as specified in Clause 3.2.4.19.(1)(g) shall have a visible signal component installed in accordance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."

8) In hotels and motels without a fire alarm system, *smoke alarms* installed in sleeping rooms of not less than 10% of the *suites* of *residential occupancy* shall have a visible signal component installed in accordance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems." (See also Note A-3.2.4.19.(1)(g).)

9) Except as permitted in Sentence (10), *smoke alarms* referred in Sentence (2) shall

a) be installed with permanent connections to an electrical circuit (see Note A-3.2.4.20.(9)(a)),

b) have no disconnect switch between the overcurrent device and the *smoke alarm*, and

c) except for the visible signal component required in Sentences (7) and (8), in case the regular power supply to the *smoke alarm* is interrupted, be provided with a battery as an alternative power source that can continue to provide power to the *smoke alarm* for a period of no less than 7 days in the normal condition, followed by 4 minutes of alarm.

10) *Suites* of *residential occupancy* are permitted to be equipped with *smoke detectors* in lieu of *smoke alarms*, provided the *smoke detectors*

a) are capable of independently sounding audible signals with a sound pressure level between 75 dBA and 110 dBA within the individual *suites* (see also Note A-3.2.4.18.(4)),

b) except as permitted in Sentence (11), are installed in conformance with CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," and

c) form part of the fire alarm system.

(See Note A-3.2.4.20.(10).)

11) *Smoke detectors* permitted to be installed in lieu of *smoke alarms* as stated in Sentence (10) are permitted to sound localized alarms within individual *suites*, and need not sound an alarm throughout the rest of the *building*.

12) If more than one *smoke alarm* is required in a *dwelling unit*, the *smoke alarms* shall be interconnected so that the actuation of one *smoke alarm* will cause all *smoke alarms* within the *dwelling unit* to sound.

13) A *smoke alarm* required by Sentence (2) shall be installed in conformance with CAN/ULC-S553, "Standard for the Installation of Smoke Alarms."

14) Except as permitted in Sentence (15), a manually operated silencing device shall be incorporated within the circuitry of a *smoke alarm* installed in a *dwelling unit* so that it will silence the signal emitted by the *smoke alarm* for a period of not more than 10 min, after which the *smoke alarm* will reset and again sound the alarm if the level of smoke in the vicinity is sufficient to reactuate the *smoke alarm*.

15) *Suites* of *residential occupancy* equipped with *smoke detectors* installed to CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," as part of the fire alarm system in lieu of *smoke alarms* as permitted by

Sentence (10), need not incorporate the manually operated device required in Sentence (14). (See Note A-3.2.4.20.(10).)

16) The sound patterns of *smoke alarms* shall

a) meet the temporal patterns of *alarm signals* (see Note A-3.2.4.18.(2)), or

b) be a combination temporal pattern and voice relay.

17) Sleeping rooms and bed spaces provided in *care occupancies* in a *building* that is not equipped with a 2-stage fire alarm system shall be equipped with visible signal devices conforming to this Article. (See also Clause 3.2.4.3.(1)(c).)

3.2.4.21. Residential Fire Warning Systems

1) Except where a fire alarm system is installed or required in a *building*, *smoke detectors* forming part of a residential fire warning system installed in conformance with CAN/ULC-S540, "Standard for Residential Fire and Life Safety Warning Systems: Installation, Inspection, Testing and Maintenance," are permitted to be installed in lieu of all *smoke alarms* required by Article 3.2.4.20., provided the system

a) is capable of sounding audible signals in accordance with Articles 9.10.19.2. and 9.10.19.5.,

b) is powered in accordance with Article 9.10.19.4., and

c) is provided with a silencing device in accordance with Article 9.10.19.6.

3.2.4.22. Voice Communication Systems for High Buildings

(See also Article 3.2.5.20)

1) A voice communication system required by Subsection 3.2.6. shall

a) consist of a two-way means of communication with the central alarm and control facility and to the mechanical control centre from each *floor area*, and

b) be capable of broadcasting prerecorded, synthesized, or live messages from the central alarm and control facility that are audible and intelligible in all parts of the *building*, except that this requirement does not apply to elevator cars (see Note A-3.2.4.22.(1)(b)).

2) The voice communication system referred to in Sentence (1) shall include a means to silence the *alarm signal* in a single stage fire alarm system while voice instructions are being transmitted, but only after the *alarm signal* has initially sounded for not less than 30 s.

3) The voice communication system referred to in Sentence (1) shall include a means to silence the *alert signal* and the *alarm signal* in a 2-stage fire alarm system while voice instructions are being transmitted, but only after the *alert signal* has initially sounded for not less than

a) 10 s in hospitals that have supervisory personnel on duty for twenty-four hours each day, or

b) 30 s for all other *occupancies*.

4) The voice communication system referred to in Clause (1)(b) shall be designed so that the *alarm signal* in a 2-stage fire alarm system can be selectively transmitted to any zone or zones while maintaining an *alert signal* or selectively transmitting voice instructions to any other zone or zones in the *building*.

5) Except where a radio antenna system conforming to Sentence 3.2.5.20.(1) is installed, the 2-way communication system referred to in Clause (1)(a) shall be installed so that emergency telephones are located in each *floor area* near *exit* stair shafts.

6) Visible signal devices required by Sentence 3.2.4.19.(1), Article 3.2.4.20. and Section 3.8. shall continue to emit a visible signal while voice instructions are being transmitted.

7) Where the facility is not equipped with staff trained to provide instructions over the loudspeakers, a pre-recorded message shall be provided.

3.2.4.23. One-Way Voice Communication Systems

1) Except for Group B, Division 1 and Group F, Division 1 *major occupancies*, where a fire alarm system is required under Subsection 3.2.4., a one-way voice communication system shall be installed in *buildings* where a 2-stage fire alarm system is installed and whose *occupant load* exceeds 1 000.

2) The one-way voice communication system required by Sentence (1) shall consist of loudspeakers that are

a) operated from the central alarm and control facility or, in the absence of such a facility, from a designated area, and

b) except in elevator cars, designed and located so that transmitted messages are audible and intelligible in all parts of the *building*.

(See Note A-3.2.4.22.(1)(b).)

3) Where the facility is not equipped with staff trained to provide instructions over the loudspeakers, a pre-recorded message shall be provided.

4) The one-way voice communication system required by Sentence (1) shall meet the silencing and transmission requirements of Sentences 3.2.4.22.(2) to (4) and (6).

3.2.5. Provisions for Firefighting

(See Note A-3.)

3.2.5.1. Access to Above-Grade Storeys

1) Except for *storeys* below the *first storey*, direct access for firefighting shall be provided from the outdoors to every *storey* that is not *sprinklered* throughout and whose floor level is less than 25 m above *grade*, by at least one unobstructed window or access panel for each 15 m of wall in each wall required to face a *street* by Subsection 3.2.2.

2) An opening for access required by Sentence (1) shall

a) have a sill no higher than 900 mm above the inside floor, and

b) be not less than 1 100 mm high by not less than

i) 550 mm wide for a *building* not designed for the storage or use of *dangerous goods*, or

ii) 750 mm wide for a *building* designed for the storage or use of *dangerous goods*.

3) Access panels above the *first storey* shall be readily openable from both inside and outside, or the opening shall be glazed with plain glass.

4) Where locking devices to prevent access to *floor areas* are installed on *exit* doors

a) a master key shall be provided in an *acceptable* location accessible to firefighters, or

b) the *exit* doors shall be provided with a wired glass panel measuring no less than 0.0645 m^2 in area and located not more than 300 mm from the door opening hardware.

3.2.5.2. Access to Basements

1) Direct access from at least one *street* shall be provided from the outdoors in a *building* that is not *sprinklered* to each *basement* having a horizontal dimension more than 25 m.

2) The access required by Sentence (1) is permitted to be provided by

a) doors, windows or other means that provide an opening not less than 1 100 mm high and 550 mm wide, with a sill no higher than 900 mm above the inside floor, or

b) an interior stairway immediately accessible from the outdoors.

3.2.5.3. Roof Access

1) Except as permitted by Sentence (2), on a *building* more than 3 *storeys* in *building height* where the slope of the roof is less than 1 in 4, all main roof areas shall be provided with direct access from the *floor areas* immediately below, either by

a) a stairway, or

b) a hatch not less than 550 mm by 900 mm with a fixed ladder.

2) A building of residential occupancy not more than 4 storeys in building height need not be provided with direct access from the floor areas immediately below, provided

a) there is no common patio, balcony, or deck area, and

b) dwelling units are provided with direct stair access from floor areas immediately below.

3.2.5.4. Access Routes

1) Every *building* shall be provided with access routes for fire department vehicles

a) to the *building* face having a principal entrance, and

b) to each *building* face having access openings for firefighting as required by Articles 3.2.5.1. and 3.2.5.2.

(See Note A-3.2.5.4.(1).)

3.2.5.5. Location of Access Routes and Paths of Travel

1) Except as provided by Sentences (2) and (3), access routes required by Article 3.2.5.4. shall be located so that

a) the principal entrance is no less than 3 m and no more than 15 m from the closest portion of the access route, measured horizontally along the path of travel from the access route to the principal entrance (see Note A-3.2.5.5.(2)(a).), and

b) every access opening required by Articles 3.2.5.1. and 3.2.5.2. are located not less than 3 m and not more than 15 m from the closest portion of the access route required for fire department use, measured horizontally from the face of the *building*. (See Note A-3.2.5.5.(1).)

2) Paths of travel for firefighters shall not be more than 45 m to the principal *suite* entry for

a) a *building* or portion of a *building*, of *residential occupancy* containing *dwelling units* with *means of egress* provided directly to the exterior at adjacent ground level, or

b) non-residential portions of a *building*, which are cut off from and have no internal access to the remainder of the *building*. (See Note A-3.2.5.5.(3)(b).)

3) The path of travel for firefighters to the main entry of a *dwelling unit* permitted by Clause (2)(a) may be increased to

a) 65 m where

i) *dwelling units* are separated from adjacent *floor areas* by a *fire separation* with at least 1 h *fire-resistance rating*,

ii) the *building sprinkler system* is hydraulically designed to flow all sprinklers within a compartment as required by the relevant sprinkler design standard plus 2 additional sprinklers in that compartment or adjacent connected compartment,

iii) each bathroom, clothes closet, linen closet, and pantry must have sprinkler coverage, notwithstanding the exemptions set out in the applicable sprinkler design standard,

iv) a strobe light is installed outside the principal entrance of the *dwelling unit*, and is connected to an internal *smoke alarm* within the *dwelling unit*,

v) *sprinkler systems* are monitored by a fire alarm system or residential fire warning system and by an off-site monitoring service,

vi) lighting and emergency lighting is provided along the path of travel for firefighters with a minimum illumination level of 1 lx, and average illumination of not less than 10 lx, and

vii) the *building* is provided with a fire alarm system and passive graphic with annunciator, or

b) 90 m where

i) the requirements of Subclauses (a)(i) to (a)(vii) are met,

ii) no principal *dwelling unit* or its *ancillary residential unit* is located above another *dwelling unit*,

iii) a 64 mm diameter fire department hose connection is located adjacent to the path of travel for firefighters located not more than 45 m measured from the hose connection to the principal entrance of each of the *dwelling units*, and

iv) the location of the fire department hose connections required by Subclause (b)(iii) are indicated on the fire alarm system passive graphic.

4) The access route from the hydrant location to the *building* location or the principal entrance of the *building* as described in Sentences (5) and (6), shall be no more than 90 m. (See Note A-3.2.5.5.(4).)

5) Where the access route runs continuously across the face of a *building*, the length of the access route shall be measured by measuring the shortest distance between a line drawn perpendicular to the access route and through the hydrant and a line drawn perpendicular to the access route and through the principal entrance of the *building*. (See Note A-3.2.5.5.(5).)

6) Where the access route terminates before the principal entrance of a *building*, the length of the access route shall be measured by measuring from a line drawn perpendicular to the access route and through the hydrant straight along the access route to its terminus and thereafter along the actual path of travel to the principal entrance. (See Note A-3.2.5.5.(6).)

3.2.5.6. Access Route Design and Paths of Travel

1) A portion of a roadway or yard provided as a required access route for fire department use shall

a) have a clear width not less than 6 m, unless it can be shown that lesser widths are satisfactory,

b) have a centre-line radius not less than 12 m,

c) have an overhead clearance not less than 5 m,

d) have a change of gradient not more than 1 in 12.5 over a minimum distance of 15 m,

e) be designed to support the expected loads imposed by firefighting equipment and be surfaced with concrete, asphalt or other material designed to permit accessibility under all climatic conditions,

f) have turnaround facilities for any dead-end portion of the access route more than 90 m long, and

g) be connected with a public thoroughfare.

(See Note A-3.2.5.6.(1).)

2) For *buildings* conforming to Article 3.2.2.51. or 3.2.2.60., no portion of the access route described in Sentence 3.2.2.10.(3) shall be more than 20 m below the uppermost floor level.

3) The unobstructed path of travel for firefighters from the curb to the main entrance or *suite* entrance door as required in Sentences 3.2.5.5.(1) to (3) and every access opening as required in Articles 3.2.5.1. and 3.2.5.2. shall be

a) no less than

i) 1.2 m in width, or

ii) 900 mm in width where serving not more than one *dwelling unit* or *ancillary residential unit*, and

b) surfaced with concrete, asphalt or similar material.

(See Note A-3.2.5.6.(3).)

3.2.5.7. Water Supply

1) Every *building* shall be provided with an adequate water supply for firefighting. (See Note A-3.2.5.7.(1).)

2) Except for *buildings* constructed of encapsulated mass timber construction in conformance with Article 3.2.2.48., 3.22.57. or 3.2.2.93., and except for *buildings* designed and constructed in accordance with Subsection 3.2.10., *buildings* that are *sprinklered* throughout with a *sprinkler* system conforming to Article 3.2.5.12. or have a standpipe system conforming to Article 3.2.5.8. to 3.2.5.10. are deemed to comply with Sentence (1).

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3.2.5.8. Standpipe Systems

1) Except as permitted by Sentence (2), a standpipe system shall be installed in a *building* that is

a) more than 3 *storeys* in *building height*,

b) more than 14 m high measured between *grade* and the ceiling of the top *storey*, or

c) not more than 14 m high measured between *grade* and the ceiling of the top *storey* but has a *building area* exceeding the area shown in Table 3.2.5.8. for the applicable *building height* unless the *building* is *sprinklered* throughout.

2) A standpipe system need not be installed in a *storage garage* conforming to Article 3.2.2.92., provided the *building* is not more than 15 m high.

Table 3.2.5.8.
Building Limits without Standpipe Systems
Forming Part of Sentence 3.2.5.8.(1)

***Occupancy* Classification**	***Building Area*, m²**		
	1 *storey*	**2 *storeys***	**3 *storeys***
Group A	2 500	2 000	1 500
Group C	2 000	1 500	1 000
Group D	4 000	3 000	2 000
Group F, Division 2	1 500	1 500	1 000
Group F, Division 3	3 000	2 000	1 000

3.2.5.9. Standpipe System Design

1) Except as provided in Sentences (2) to (5), Articles 3.2.5.10. and 3.2.5.11., and Sentence 3.2.4.9.(2), the design, construction, installation and testing of a standpipe system shall conform to NFPA 14, "Standard for the Installation of Standpipe and Hose Systems."

2) A dry standpipe that is not connected to a water supply shall not be considered as fulfilling the requirements of this Article.

3) If more than one standpipe is provided, the total water supply need not be more than 30 L/s.

4) The residual water pressure at the design flow rate at the topmost hose connection of a standpipe system that is required to be installed in a *building* is permitted to be less than 690 kPa provided

a) the *building* is *sprinklered* throughout,

b) the water supply at the base of the sprinkler riser is capable of meeting, without a fire pump, the design flow rate and pressure demand of the *sprinkler system*, including the inside and outside hose allowance, and

c) fire protection equipment is available to deliver, by means of the fire department connection, the full demand flow rate at a residual water pressure of 690 kPa at the topmost hose connection of the standpipe system (see Note A-3.2.5.9.(4)(c)).

5) A fire department connection shall be provided for every standpipe system.

6) If a standpipe system is required by Sentence 3.2.5.8.(1) and an *exit* stair shaft is not provided in the *building*, a standpipe system may be omitted if

a) a 64 mm diameter fire department hose connection is located adjacent to the path of travel for firefighters and is connected to a fire department connection in conformance with 3.2.5.15., and

b) the hose connection shall be available to reach all portions of the area with 30 m of hose plus 9 m of hose stream distance.

7) A standpipe system may be omitted from *dwelling units* where

a) the *building* is of *residential occupancy* throughout,

b) the path of travel may not exceed 15 m from the principal entrance of *suite* to the fire department access route,

c) egress from each *suite* complies with Sentence 3.3.4.4.(3), and

d) the travel distance from any point on the *floor area* to the primary entrance of each *suite* does not exceed 30 m.

3.2.5.10. Hose Connections

1) Hose connections shall be located in *exits*, in accordance with NFPA 14, "Standard for the Installation of Standpipe and Hose Systems."

2) Hose connections are not required within a *floor area*.

3) Hose connections shall be provided with sufficient clearance to permit the use of a standard fire department hose key.

4) Except as permitted by Sentence (5), 64 mm diam hose connections shall be installed in a standpipe system.

5) Hose connections for 64 mm diam hose are not required in a *building* that is not more than 25 m high, measured between *grade* and the ceiling level of the top *storey* and in which an automatic *sprinkler system* is not installed.

3.2.5.11. Hose Stations

1) Hose stations for 38 mm diam hose shall be installed for a standpipe system in a *building* that is not *sprinklered* throughout.

2) Hose stations for a 38 mm diam hose shall be installed for a standpipe system within every *floor area* that is not *sprinklered* throughout. (See Note A-3.2.5.11.(2).)

3) Hose stations shall be located in the *floor area* within 5 m of *exits* and at other locations to provide coverage of the entire *floor area*.

4) A hose station located on one side of a *horizontal exit* shall be considered to serve only the *floor area* on that side of the *horizontal exit*.

5) A hose cabinet shall be located so that its door, when fully opened, will not obstruct the required width of a *means of egress*.

6) Where a *building* or part thereof is used as a *distillery* and the *building* is *sprinklered* in conformance with Article 3.2.5.12., small hose (38 mm) stations are permitted to be supplied from interior sprinkler piping.

7) Where a hose station is provided in grain handling and storage facilities in which *combustible dusts* are produced in quantities or concentrations that create an explosion or fire hazard, fog and fine spray nozzles shall

be used instead of nozzles that discharge a solid stream of water to prevent *combustible dusts* from being raised into suspension.

3.2.5.12. Automatic Sprinkler Systems

1) Except as permitted by Sentences (2) to (4) and (9), an automatic *sprinkler system* shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems." (See Note A-3.2.5.12.(1).)

2) Instead of the requirements of Sentence (1), NFPA 13R, "Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies," is permitted to be used for the design, construction and installation of an automatic *sprinkler system* installed

a) in a *building* of Group C *major occupancy* containing no other *major occupancies* that

   i) is not more than 4 *storeys* in *building height* and conforms to Article 3.2.2.47., 3.2.2.49., 3.2.2.51., 3.2.2.52. or 3.2.2.55., or

   ii) is not more than 3 *storeys* in *building height* and conforms to Article 9.10.1.3., or

b) in a *building* of *care occupancy* with not more than 10 occupants that is not more than 3 *storeys* in *building height* and conforms to one of Articles 3.2.2.42. to 3.2.2.46.

(See Note A-3.2.5.12.(2).)

3) Instead of the requirements of Sentence (1), NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," is permitted to be used for the design, construction and installation of an automatic *sprinkler system* installed

a) in a *building* of *residential occupancy* throughout that contains not more than two principal *dwelling units*, where

   i) each principal *dwelling unit* has its own sprinkler water supply, and

   ii) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes." (See Note 3.2.5.12.(3)(a)(ii).)

b) in a *building* of *care occupancy*, provided

   i) it contains not more than two *suites* of *care occupancy*,

   ii) it has not more than five residents throughout, and

   iii) a 30-minute water supply demand can be met, and

c) in a *building* of *residential occupancy* throughout that contains more than two principal *dwelling units*, provided

   i) no principal *dwelling unit* or its *ancillary residential unit* is located above another principal *dwelling unit* or its *ancillary residential unit*,

   ii) all principal *dwelling units* are separated by a vertical *fire separation* having a *fire-resistance rating* of not less than 1 h that provides continuous protection from the top of the footing to the underside of the roof deck, with any space between the top of the wall and the roof deck tightly filled with mineral wool or *noncombustible* material,

   iii) each principal *dwelling unit* has its own sprinkler water supply provided in accordance with NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,"

   iv) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," and

v) where the *sprinkler system* is taken into consideration for the reduction of *limiting distance*, all rooms, including closets, bathrooms and attached garages, that adjoin an *exposing building face* are *sprinklered*, notwithstanding any exemption stated in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.", and

d) a detached *ancillary building* subordinate to a principal detached house or duplex on the same parcel of land, where the associated *building* is also *sprinklered* to NFPA 13D in accordance with this Sentence, where

i) each bathroom, clothes closet, linen closet, and pantry must have sprinkler coverage, notwithstanding the exemptions set out in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," and

ii) a passive purge *sprinkler system* design is used as described in NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes." (see Note 3.2.5.12.(3)(a)(ii))

(See Note A-3.2.5.12.(2) also see 3.2.5.5. and 9.10.20.3.)

4) If a *building* contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the *building* provided the required flow for the sprinklers can be met by the domestic system.

5) If a water supply serves both an automatic *sprinkler system* and a system serving other equipment, control valves shall be provided so that either system can be shut off independently.

6) Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic *sprinkler systems*, sprinklers shall not be omitted in any room or closet in the *storey* immediately below a roof assembly. (See Note A-3.2.5.12.(6).)

7) Notwithstanding the requirements of the standards referenced in Sentences (1) and (2) regarding the installation of automatic *sprinkler systems*, in *buildings* conforming to Article 3.2.2.48., 3.2.2.51., 3.2.2.57., 3.2.2.60., or 3.2.2.93., sprinklers shall be provided under exterior projections used to support balconies or decks exceed 610 mm in depth measured perpendicular to the exterior wall. (See Note A-3.2.5.12.(7).)

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8) Sprinklers in elevator machine rooms shall have a temperature rating not less than that required for an intermediate temperature classification and shall be protected against physical damage. (See Note A-3.2.5.12.(8).)

9) Except as provided in Subsection 3.2.8., closely spaced sprinklers and associated draft stops need not be installed around floor openings in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems."

10) Fast response sprinklers shall be installed in *residential occupancies*, *care occupancies*, *treatment occupancies* and *detention occupancies*. (See Note A-3.2.5.12.(10).)

11) Except as permitted by Sentence (12), all unenclosed balconies, exterior decks, porches and patios of *buildings sprinklered* to NFPA 13R or NFPA 13, shall be provided with sprinklers if

a) the framing or cladding is of *combustible construction*,

b) the depth of balcony, deck, porch, or patio is more than 1200 mm, and

c) the balcony, roof overhang or structure above is more than 300 mm overlapping the balcony, deck or patio below and is located less than 3 m above the finished floor of the balcony, deck or patio below.

12) Automatic sprinkler protection for an unenclosed exterior balcony of a residential *building* may be omitted if

a) the *building* is of *noncombustible construction*, and

b) the exterior wall assembly adjoining the balcony and the exterior ceiling assembly covering the balcony are constructed with *noncombustible* materials or assemblies satisfying the criteria of Clause 3.1.5.5.(1)(b).

13) Notwithstanding the requirements of the standards referenced by Sentence (3) regarding the installation of automatic *sprinkler systems*, sprinklers shall be provided in any *storage garage* or carport attached to a *building* of *residential occupancy* where a *fire separation* is not provided between the *storage garage* or carport and adjacent *floor areas*.

14) Where NFPA 13R, "*Installation of Sprinkler Systems in Low-Rise Residential Occupancies*," is used for the design, construction and installation of an automatic *sprinkler system* installed in a residential *building* containing not more than four *dwelling units* and accessory uses, water service pipe, as defined in the Building By-law Book II (Plumbing Systems) is permitted to be designed and constructed per requirements in NFPA 13D.

15) Where a single detached or duplex building within the scope of Division A, Article 1.3.3.3. is permitted to be design to NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," a fire department connection is not required despite the requirements of the referenced standard.

3.2.5.13. Combustible Sprinkler Piping

1) *Combustible* sprinkler piping shall be used only for *sprinkler systems* in *residential occupancies* and other light-hazard *occupancies*. (See Note A-3.2.5.13.(1).)

2) *Combustible* sprinkler piping shall meet the requirements of ULC/ORD-C199P, "Combustible Piping for Sprinkler Systems."

3) Except as permitted by Sentence (5), *combustible* sprinkler piping shall be separated from the area served by the *sprinkler system*, and from any other *fire compartment*, by ceilings, walls, or soffits consisting of, as a minimum,

a) lath and plaster,

b) gypsum board not less than 9.5 mm thick,

c) plywood not less than 13 mm thick, or

d) a suspended membrane ceiling with

i) steel suspension grids, and

ii) lay-in panels or tiles having a mass not less than 1.7 kg/m^2.

4) Except as permitted by Sentence (5), *combustible* sprinkler piping may be located above a ceiling provided that the distance between the edge of any ceiling opening that is not protected in conformance with Sentence (3) and the nearest sprinkler is not more than 300 mm.

5) Where *combustible* sprinkler piping has been tested in conformance with ULC/ORD-C199P, "Combustible Piping for Sprinkler Systems," and has been shown to meet the requirements therein without additional protection, conformance to Sentences (3) and (4) is not required.

3.2.5.14. Sprinklered Service Space

1) An automatic *sprinkler system* shall be installed in a *service space* referred to in Sentence 3.2.1.1.(8) if flooring for access within the *service space* is other than catwalks.

2) The *sprinkler system* required by Sentence (1) shall be equipped with waterflow detecting devices, with each device serving not more than one *storey*.

3) The waterflow detecting devices required by Sentence (2) shall be connected to the fire alarm system, to

a) initiate an *alert signal* in a 2-stage system or an *alarm signal* in a single stage system, and

b) indicate separately on the fire alarm system annunciator the actuation of each device.

3.2.5.15. Fire Department Connections

(Also See Note A-3.2.5.5.)

1) The fire department connection for a standpipe system shall be located horizontally within 5 m of the principal entrance of a *building*, have unobstructed access for a distance of not less than 1 m and be visible from the *street*.

2) The fire department connection for an automatic *sprinkler system* shall be located horizontally within 5 m of the principal entrance of a *building*, have unobstructed access for a distance of not less than 1 m and be visible from the *street*.

3.2.5.16. Portable Fire Extinguishers

1) Portable extinguishers shall be provided and installed in accordance with the Fire By-law.

2) In a Group B, Division 1 *major occupancy*, portable fire extinguishers are permitted to be located in secure areas, or in lockable cabinets provided

a) identical keys for all cabinets are located at all supervisory or security stations, or

b) electrical remote release devices are provided and are connected to an emergency power supply.

3.2.5.17. Protection from Freezing

1) Equipment forming part of a fire protection system shall be protected from freezing if

a) it could be adversely affected by freezing temperatures, and

b) it is located in an unheated area.

3.2.5.18. Fire Pumps

1) If a fire pump is installed, it shall be installed in accordance with the requirements of NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection." (See Note A-3.2.5.18.(1).)

3.2.5.19. Location of Building Safety Facilities for Firefighters

1) Fire fighting installations and *building* safety facilities including central control facility, firefighters' elevator and stairwells equipped with standpipes shall be centrally located in close proximity to the firefighters' entrance.

3.2.5.20. Radio Antenna Systems

(See Note A-3.2.5.20.).

1) Except as permitted by Sentence (2), an *acceptable* radio antenna system shall be installed in every *building* that

a) is more than 6 *storeys* in *building height*,

b) contains more than 1 *storey* in the *basement*, or

c) contains more than 1200 m² of *floor area* in the *basement*.

2) A radio antenna system shall not be required for

a) government *buildings* requiring security against transfer of signals inside and outside of *buildings*,

b) where, in the opinion of the *Chief Building Official*, in consultation with the Fire Chief, radio signals compromise the intended use of the *building*, and

c) *buildings* of *residential occupancy* only with no more than two principal *dwelling units*.

3) A radio antenna system shall provide not less than 98% coverage at in each of the following critical locations in the *building*

a) e*xit* stair shafts,

b) e*xit* corridors,

c) *public corridors,*

d) corridors used by the public,

e) corridors serving classrooms or patients' sleeping rooms,

f) within 5 m of the fire alarm control unit,

g) within 5 m of the central alarm and control facility,

h) within 5 m of the fire alarm annunciator,

i) fire pump room,

j) emergency generator room,

k) electrical service and transformer room,

l) elevator machine room,

m) elevator lobbies,

n) elevator hoistways,

o) corridors in the *basement* and not within a *suite*, and

p) s*torage garages* and associated vehicle ramps.

4) A radio antenna system shall comply with ANSI/CAN/UL 2524 "Standard For Safety In-building 2-Way Emergency Radio Communication Enhancement Systems."

3.2.6. Additional Requirements for High Buildings

(See Note A-3.2.6.)

3.2.6.1. Application

1) Except as provided in Sentence (2) and (3), this Subsection applies to a *building*

a) more than 18 m high, measured between *grade* and the floor level of the top *storey*, or

b) containing a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or 3 *occupancy*.

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2) Deleted

3) A *building* or that portion of a *building* separated in accordance with Division A, Article 1.3.3.4., need not comply with the requirements of this Subsection, provided

a) the *building* or that portion of a *building* does not exceed 6 *storeys* in *building height*,

b) the *building* or that portion of a *building* does not contain a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or Group B, Division 3 *major occupancy*,

c) the principal entrance for firefighters is located on the *storey* which requires vertical travel to the topmost floor level to be not more than 18 m,

d) except where vestibules designed to limit movement of smoke from a fire in a *floor area* below the lowest exit *storey* into upper *storeys* are provided, stairs and elevators shall not directly connect more than 6 consecutive *storeys* (See Note A-3.2.6.2.(4).),

e) *exit* stair enclosures are constructed as *fire separations* with a *fire-resistance rating* of not less than a 2 h, and

f) the *building* sprinklers are designed in accordance with NFPA 13 "Installation of Sprinkler Systems", except that the design area of the *floor areas* above the *basement* shall be twice the design area otherwise permitted by NFPA 13 "Installation of Sprinkler Systems" after all reductions in design area have been applied.

(See Note A-3.2.6.1.(2).)

3.2.6.2. Limits to Smoke Movement

1) A *building* to which this Subsection applies shall be designed in accordance with Sentences (2) to (6) and Article 3.2.6.3. to limit the danger to occupants and firefighters from exposure to smoke in a *building* fire.

2) A *building* referred to in Sentence (1) shall be designed so that, during a period of 2 h after the start of a fire, each *exit* stair serving *storeys* below the lowest *exit level* will not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis determined in accordance with Subsection 1.1.3. (See Note A-3.2.6.2.(2).)

3) Each stairway that serves *storeys* above the lowest *exit level* shall have a vent to the outdoors, at or near the bottom of the stair shaft, that

a) has an openable area of 0.05 m^2 for every door between the stair shaft and a *floor area*, but not less than 1.8 m^2,

b) opens directly to the outdoors or into a vestibule that has a similar opening to the outdoors, and

c) has a door or *closure* that

i) is openable manually, and

ii) can remain in the open position during a fire emergency.

(See Note A-3.2.6.2.(3).)

4) Measures shall be taken to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys*. (See Note A-3.2.6.2.(4).)

5) Except for exhaust fans in kitchens, washrooms and bathrooms in *dwelling units*, and except for fans used for smoke venting as required by Article 3.2.6.6., air moving fans in a system that serves more than 2 *storeys* shall be designed and installed so that in the event of a fire these fans can be stopped by means of a manually operated switch at the central alarm and control facility.

6) Except as provided in Article 3.2.4.12. or where there is a conflict with other smoke control measures in the *building*, air-handling systems used to provide make-up air to *public corridors* serving *suites* in a Group C *major occupancy* shall not shut down automatically upon activation of the fire alarm so as to maintain corridor pressurization.

3.2.6.3. Connected Buildings

1) If a *building* described in Article 3.2.6.1. is connected to any other *building*, measures shall be taken to limit movement of contaminated air from one *building* into another during a fire. (See Note A-3.2.6.3.(1).)

3.2.6.4. Emergency Operation of Elevators

1) Automatic and manual emergency recall shall be provided for all elevators serving *storeys* above the *first storey*.

2) Key-operated switches for emergency recall required by Sentence (1) shall be provided in a conspicuous location at

a) each elevator lobby on the recall level, and

b) the central alarm and control facility required by Article 3.2.6.7.

3) In-car emergency service switches shall be provided in all elevator cars.

4) Keys to operate the switches required by Sentences (2) and (3) shall be

a) provided in a suitably identified box conspicuously located on the outside of an elevator hoistway near the central alarm and control facility required by Article 3.2.6.7., and

b) kept at the central alarm and control facility.

5) The automatic emergency recall provided in accordance with Sentence (1) shall be activated by smoke detectors installed in a) each floor area in front of the elevator(s), b) the elevator hoistway c) the elevator machine room, or d) any room containing elevator control equipment.

6) Where smoke detectors as provided in accordance with Sentence (5), are activated on the recall level, the automatic emergency recall signal shall automatically direct the elevator to an alternate floor level.

7) Smoke detectors provided in accordance with Sentence (5) shall be designed as part of the building fire alarm system.

8) Smoke detectors installed in an elevator lobby to comply with Clause 3.2.6.4.(5)(a) shall be located such that the detector is not more than its rated detection distance from the elevator doors that it serves.

3.2.6.5. Elevator for Use by Firefighters

1) At least one elevator shall be provided for use by firefighters in conformance with Sentences (2) to (6).

2) The elevator referred to in Sentence (1) shall have a useable platform area not less than 2.2 m^2 and shall be capable of carrying a load of 900 kg to the top floor that it serves from a landing on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. within 1 min.

3) Each elevator for use by firefighters shall

a) be provided with a *closure* at each shaft opening so that the interlock mechanism remains mechanically engaged and electrical continuity is maintained in the interlock circuits and associated wiring for a period of not less than 1 h when the assembly is subjected to the standard fire exposure described in CAN/ULC-S104, "Standard Method for Fire Tests of Door Assemblies,"

b) be protected with a vestibule containing no *occupancy* and separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 45 min, or

c) be protected with a corridor containing no *occupancy* and separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

4) Except as permitted by Sentence (5), an elevator referred to in Sentence (1) shall be capable of providing transportation from the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. to every floor that is above *grade* in the *building* and that is normally served by the elevator system.

5) If it is necessary to change elevators to reach any floor referred to in Sentence (4), the system shall be designed so that not more than one change of elevator is required when travelling to any floor in the *building* from the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5.

6) **Deleted**.

3.2.6.6. Venting to Aid Firefighting

1) Means of venting each *floor area* to the outdoors shall be provided by windows, wall panels, smoke shafts, or the *building* exhaust system. (See Note A-3.2.6.6.(1).)

2) Fixed glass windows shall not be used for the venting required by Sentence (1) if the breaking of the windows could endanger pedestrians below.

3) Openable windows used for the venting required by Sentence (1) shall be permanently marked so that they are easily identifiable.

4) Elevator hoistways shall not be designed for the venting required by Sentence (1).

3.2.6.7. Central Alarm and Control Facility

1) A central alarm and control facility shall be provided on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. in a location that

a) is readily accessible to firefighters entering the *building*, and

b) takes into account the effect of background noise likely to occur under fire emergency conditions, so that the facility can properly perform its required function under these conditions.

(See Note A-3.2.6.7.(1).)

2) The central alarm and control facility required by Sentence (1) shall include

a) means to control the voice communication system required by Article 3.2.6.8., so that messages can be sent to

i) all loudspeakers simultaneously,

ii) individual *floor areas*, and

iii) *exit* stairwells,

b) means to indicate audibly and visually *alert signals* and *alarm signals* and a switch to

i) silence the audible portion of these signals, and

ii) indicate visually that the audible portion has been silenced,

c) means to indicate visually that elevators are on emergency recall,

d) an annunciator conforming to Article 3.2.4.8.,

e) means to transmit *alert signals* and *alarm signals* to the fire department in conformance with Article 3.2.4.7.,

f) means to release hold-open devices on doors to vestibules,

g) means to manually actuate *alarm signals* in the *building* selectively to any zone or zones,

h) means to silence the *alarm signals* referred to in Clause (g) in conformance with Sentences 3.2.4.22.(2) and 3.2.4.22.(3),

i) means, as appropriate to the measure for fire safety provided in the *building*, to

i) actuate auxiliary equipment identified in Articles 3.2.6.2., 3.2.6.3. and 3.2.6.6., or

ii) communicate with a continually staffed auxiliary equipment control centre,

j) means to communicate with telephones in elevator cars, separate from connections to firefighters' telephones, if elevator cars are required by the Safety Standards Act and pursuant regulations to be equipped with a telephone,

k) means to indicate visually, individual *sprinkler system* waterflow signals,

l) means to indicate audibly and visually, sprinkler and standpipe system supervisory signals and trouble signals,

m) a switch to silence the audible portion of a supervisory signal or a trouble signal, and

n) visual indication that the audible portion of a supervisory signal or a trouble signal has been silenced.

(See Note A-3.2.6.7.(2).)

3.2.6.8. Voice Communication System

1) A voice communication system conforming to Article 3.2.4.22. shall be provided in all buildings conforming to 3.2.6.1.(1).

3.2.6.9. Testing

1) The systems for control of smoke movement and mechanical venting required by Articles 3.2.6.2. and 3.2.6.6. shall be tested to ensure satisfactory operation. (See Note A-3.2.6.9.(1).)

3.2.7. Lighting and Emergency Power Systems

3.2.7.1. Minimum Lighting Requirements

1) An *accessible* path of travel required by Section 3.8., an *exit*, a *public corridor*, or a corridor providing *access to exit* for the public or serving patients' sleeping rooms or classrooms shall be equipped to provide illumination to an average level not less than 50 lx at floor or tread level and at angles and intersections at changes of level where there are stairs or *ramps*.

2) The minimum level of the illumination required by Sentence (1) shall be 10 lx.

3) Rooms and spaces used by the public shall be equipped to provide illumination as described in Sentences (4) to (7) and Article 9.34.2.7.

4) The minimum level of illumination over the entire length of escalators and moving walks shall be not less than 100 lx at the level of the treads and walking surfaces.

5) Except as provided in Sentence (6) and except for light switches and internally illuminated controls, the minimum level of illumination at controls required by Article 3.8.2.6. shall be not less than 100 lx.

6) Where visual information is provided at controls referred to in Sentence (5), the minimum level of illumination at the controls shall be not less than 200 lx, except where the visual information is internally illuminated.

7) Except for internally illuminated signs, the minimum level of illumination at signs displaying visual information required by Clauses 3.4.6.10.(5)(b) and 3.4.6.16.(5)(g), Subclause 3.4.6.16.(5)(l)(ii), Clause 3.4.6.16.(6)(d), Sentence 3.4.6.18.(3), Clause 3.4.6.18.(4)(a) and Articles 3.4.6.19. and 3.8.2.10. shall be not less than 200 lx.

8) Lighting outlets in a *building* of *residential occupancy* shall be provided in conformance with Subsection 9.34.2.

3.2.7.2. Recessed Lighting Fixtures

1) A recessed lighting fixture shall not be located in an insulated ceiling unless the fixture is designed for this type of installation.

3.2.7.3. Emergency Lighting

1) Emergency lighting shall be provided to an average level of illumination not less than 10 lx at floor or tread level in

a) *exits*,

b) principal routes providing *access to exit* in open *floor areas* and in *service rooms*,

c) corridors used by the public,

d) corridors serving sleeping rooms in a *treatment occupancy*,

e) corridors serving sleeping rooms in a *care occupancy*, except corridors serving sleeping rooms within individual *suites* of *care occupancy*,

f) corridors serving classrooms,

g) underground *walkways*,

h) *public corridors*,

i) *floor areas* or parts thereof where the public may congregate

   i) in Group A, Division 1 *occupancies*, or

   ii) in Group A, Division 2 and 3 *occupancies* having an *occupant load* of 60 or more,

j) *floor areas* or parts thereof where persons are cared for that are within daycare facilities, including daycare facilities for children,

k) food preparation areas in commercial kitchens,

l) public washrooms,

m) locations where doors are equipped with an electromagnetic lock as described in Clauses 3.4.6.16.(5)(k) and (6)(g), and

n) universal washrooms, universal shower rooms and accessible change spaces required by Article 3.8.2.8.

2) Emergency lighting to provide an average level of illumination of not less than 10 lx at floor or catwalk level shall be included in a *service space* referred to in Sentence 3.2.1.1.(8).

3) The minimum value of the illumination required by Sentences (1) and (2) shall be not less than 1 lx.

4) In addition to the requirements of Sentences (1) to (3), the installation of battery-operated emergency lighting in buildings or part thereof where *treatment* is provided shall conform to the appropriate requirements of CSA Z32, "Electrical safety and essential electrical systems in health care facilities."

3.2.7.4. Emergency Power for Lighting

1) An emergency power supply shall be

a) provided to maintain the emergency lighting required by this Subsection from a power source such as batteries or generators that will continue to supply power in the event that the regular power supply to the *building* is interrupted, and

b) so designed and installed that upon failure of the regular power it will assume the electrical load automatically for a period of

i) 2 h for a *building* within the scope of Subsection 3.2.6.,

ii) 1 h for a *building* of Group B *major occupancy* classification that is not within the scope of Subsection 3.2.6.,

iii) 1 h for a *building* constructed in accordance with Article 3.2.2.51. or 3.2.2.60., and

iv) 30 min for a *building* of any other *occupancy*.

(See Note A-3.2.7.4.(1).)

2) If self-contained emergency lighting units are used, they shall conform to CSA C22.2 No. 141, "Emergency lighting equipment."

3.2.7.5. Emergency Power Supply Installation

1) Except as required by Articles 3.2.7.6. and 3.2.7.7., an emergency electrical power supply system shall be installed in conformance with CSA C282, "Emergency electrical power supply for buildings." (See Sentence 3.2.7.8.(1) for emergency electrical power supply for voice communication systems.)

3.2.7.6. Emergency Power for Treatment Occupancies

1) Except as required by Article 3.2.7.7., an emergency electrical power supply system for emergency equipment required by this Part for *treatment occupancies* shall be installed in conformance with CSA Z32, "Electrical safety and essential electrical systems in health care facilities." (See Note A-3.2.7.6.(1).)

3.2.7.7. Fuel Supply Shut-off Valves

1) If a liquid or gas fuel-fired engine or turbine for an emergency electric power supply is dependent on a fuel supply from outside the *building*, the fuel supply shall be provided with a suitably-identified separate shut-off valve outside the *building*.

3.2.7.8. Emergency Power for Fire Alarm Systems

1) Fire alarm systems, including those incorporating a voice communication system, shall be provided with an emergency power supply conforming to Sentences (2) to (4).

2) The emergency power supply required by Sentence (1) shall be supplied from

a) a generator,

b) batteries, or

c) a combination thereof.

3) The emergency power supply required by Sentence (1) shall be capable of providing

a) supervisory power for not less than 24 h, and

b) immediately following that period, emergency power under full load for not less than

i) 2 h for a *building* within the scope of Subsection 3.2.6.,

ii) 1 h for a *building* classified as a Group B *major occupancy* that is not within the scope of Subsection 3.2.6.,

iii) 1 h for a *building* constructed in accordance with Article 3.2.2.51. or 3.2.2.60.,

iv) 5 min for a *building* not required to be equipped with an annunciator, and

v) 30 min for any other *building*.

(See Note A-3.2.7.8.(3).)

4) The emergency power supply required by Sentence (1) shall be designed so that, in the event of a failure of the normal power source, there is an immediate automatic transfer to emergency power with no loss of information.

3.2.7.9. Emergency Power for Building Services

1) An emergency power supply capable of operating under a full load for not less than 2 h shall be provided by an emergency generator for

a) every elevator serving *storeys* above the *first storey* in a *building* that is more than 36 m high measured between *grade* and the floor level of the top *storey*, other than in a *building* complying with Sentence 3.2.6.1.(2), and every elevator for firefighters in conformance with Sentence (2),

b) except as provided in Sentence (4), equipment that supplies water for fire suppression as required by Articles 3.2.5.7. and 3.2.5.8. and Sentences 3.2.5.12.(1) and (2) and 3.2.5.18.(1), if the supply depends solely on electrical power supplied to the *building*,

c) fans and other electrical equipment that are installed to maintain the air quality specified in Articles 3.2.6.2. and 3.3.3.6.,

d) fans required for venting by Article 3.2.6.6., and

e) fans required by Clause 3.2.8.4.(1)(c) and Article 3.2.8.7. in *buildings* within the scope of Subsection 3.2.6.

(See Note A-3.2.7.9.(1).)

2) Except as permitted by Sentence (3), the emergency power supply for elevators required by Clause (1)(a) shall be capable of operating all elevators for firefighters plus one additional elevator simultaneously.

3) Sentence (2) does not apply if the time to recall all elevators under emergency power supply is not more than 5 min, each from its most remote *storey* to

a) the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5., or

b) to a transfer lobby.

4) The emergency power supply required by Clause (1)(b) for the equipment that supplies water for fire suppression need not be provided for *sprinkler systems* conforming to NFPA 13D, “Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.”

3.2.7.10. Protection of Electrical Conductors

1) The protection of electrical and emergency conductors referred to in Clauses (a) to (c) shall be protected against exposure to fire, for a period of no less than 1 h, from the source of the emergency power supply to the branch circuits serving equipment, for:

a) electrical conductors located within *buildings* identified in Article 3.2.6.1. serving

i) fire alarms,

ii) emergency lighting, or

iii) emergency equipment within the scope of Articles 3.2.6.2. to 3.2.6.8.,

b) emergency conductors serving fire pumps, and

c) electrical conductors serving mechanical systems serving

i) areas of refuge identified in Clause 3.3.3.6.(1)(b),

ii) *contained use areas* identified in Clauses 3.3.3.7.(4)(a) and (b), or

iii) intended for fire and life safety purposes.

(See Note A-3.2.7.10.(1).).

2) Except as otherwise required by Sentence (3) and permitted by this Article, electrical conductors that are used in conjunction with systems identified in Sentence (1) shall

a) conform to CAN/ULC-S139, "Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables," including the hose stream application, to provide a circuit integrity rating of not less than 1 h (see Note A-3.2.7.10.(2)(a) and (3)(a)) (see also Clause 3.2.6.5.(6)(b)), or

b) be located in a *service space* that is separated from the remainder of the *building* by a *fire separation* that has a *fire-resistance rating* not less than 1 h.

3) Electrical conductors identified in Clause (1)(c) shall

a) conform to CAN/ULC-S139, "Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables," including the hose stream application, to provide a circuit integrity rating of not less than 2 h (see Note A-3.2.7.10.(2)(a) and (3)(a)), or

b) be located in a *service space* that is separated from the remainder of the *building* by a *fire separation* that has a *fire-resistance rating* not less than 2 h.

4) The *service spaces* referred to in Clauses (2)(b) and (3)(b) shall not contain any *combustible* materials other than the conductors being protected.

5) Except as stated in Sentences (7) and (9), the electrical conductors referred to in Sentence (1) are those that extend from the source of emergency power to

a) the equipment served, or

b) the distribution equipment supplying power to the equipment served, if both are in the same room (see Note A-3.2.7.10.(5)(b)).

6) If a fire alarm transponder or annunciator in one *fire compartment* is connected to a central processing unit or another transponder or annunciator located in a different *fire compartment*, the electrical conductors connecting them shall be protected in accordance with Sentence (2).

7) Fire alarm system branch circuits within a *storey* that connect transponders and individual devices need not conform to Sentence (2). (See Note A-3.2.7.10.(7).)

8) Except as permitted in Sentence (9), if a distribution panel supplies power to emergency lighting, the power supply conductors leading up to the distribution panel shall be protected in accordance with Sentence (2).

9) Conductors leading from a distribution panel referred to in Sentence (8) to emergency lighting units in the same *storey* need not conform to Sentence (2).

1**0)** Distribution panels serving emergency lighting units located on other *storeys* shall be installed in a *service room* separated from the *floor area* by a *fire separation* having a *fire-resistance rating* of at least 1 h.

11) Conductors leading from a distribution panel to emergency lighting units located on other *storeys* shall be protected in accordance with Sentence (2) between the distribution panel and the *floor area* where the emergency lighting units are located.

3.2.8. Mezzanines and Openings through Floor Assemblies

3.2.8.1. Application

1) Except as permitted by Article 3.2.8.2. and Sentence 3.3.4.2.(3), the portions of a *floor area* or a *mezzanine* that do not terminate at an exterior wall, a *firewall* or a vertical shaft shall

a) terminate at a vertical *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly and extending from the floor assembly to the underside of the floor or roof assembly above, or

b) be protected in conformance with the requirements of Articles 3.2.8.3. to 3.2.8.8.

2) The penetration of a floor assembly by an *exit* or a *vertical service space* shall conform to the requirements of Sections 3.4., 3.5. and 3.6.

3) A *floor area* containing sleeping rooms in a *building* of Group B, Division 2 *major occupancy* shall not be constructed as part of an *interconnected floor space*.

3.2.8.2. Exceptions to Special Protection

1) A *mezzanine* need not terminate at a vertical *fire separation* nor be protected in conformance with the requirements of Articles 3.2.8.3. to 3.2.8.8. provided the *mezzanine*

a) serves a Group A, Division 1 *major occupancy*,

b) serves a Group A, Division 3 *major occupancy* in a *building* not more than 2 *storeys* in *building* height, or

c) serves a Group A, C, D, E or F *major occupancy* and

i) is 500 m^2 or less in area, and

ii) conforms to Sentence 3.2.1.1.(3) or (4).

2) Except for floors referred to in Sentence 3.1.10.3.(1) and Article 3.2.1.2., openings through a horizontal *fire separation* for vehicular ramps in a *storage garage* are not required to be protected with *closures* and need not conform to this Subsection.

3) If a *closure* in an opening in a *fire separation* would disrupt the nature of a manufacturing process, such as a continuous flow of material from *storey* to *storey*, the *closure* for the opening is permitted to be omitted provided precautions are taken to offset the resulting hazard. (See Note A-3.2.8.2.(3).)

4) An *interconnected floor space* in a Group B, Division 1 *occupancy* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.8. provided the *interconnected floor space* does not interconnect more than 2 adjacent *storeys*.

5) Except as permitted by Sentence (6), openings for escalators and inclined moving walks need not conform to the requirements in Articles 3.2.8.3. to 3.2.8.8. provided

a) the opening for each escalator or walk does not exceed 10 m^2,

b) the *building* is *sprinklered* throughout,

c) closely spaced sprinklers and associated draft stops are installed around the openings in conformance with NFPA 13, “Standard for the Installation of Sprinkler Systems,” and

d) the *interconnected floor space* contains only Group A, Division 1, 2 or 3, Group D or Group E *major occupancies* (see Note A-3.2.8.2.(6)(c)).

6) An *interconnected floor space* need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.8., provided

a) it consists of the *first storey* and the *storey* next above or below it, but not both,

b) it is *sprinklered* throughout or, where the *building area* is not more than one half of the area permitted by Subsection 3.2.2., the openings through the floor are used only for stairways, escalators or moving walks (see Note A-3.2.8.2.(6)(b)), and

c) it contains only Group A, Division 1, 2 or 3, Group D, Group E, or Group F, Division 2 or 3 *major occupancies* (see Note A-3.2.8.2.(6)(c)).

3.2.8.3. Sprinklers

1) A *building* containing an *interconnected floor space* shall be *sprinklered* throughout.

2) Except for large floor openings as defined in NFPA 13, "Standard for the Installation of Sprinkler Systems," closely spaced sprinklers and associated draft stops shall be installed around floor openings in conformance with NFPA 13.

3.2.8.4. Vestibules

1) An *exit* opening into an *interconnected floor space* shall be protected at each opening into the *interconnected floor space* by a vestibule

a) with doorways that are not less than 1.8 m apart,

b) that is separated from the remainder of the *floor area* by a *fire separation* that is not required to have a *fire-resistance rating* (see Note A-3.1.8.1.(1)(b)), and

c) that is designed to limit the passage of smoke so that the *exit* stair shaft does not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis determined in accordance with Subsection 1.1.3. (see Note A-3.2.8.4.(1)(c)).

2) An *exit* opening into an *interconnected floor space* shall conform to Sentence 3.4.3.2.(6).

3) If an elevator hoistway opens into an *interconnected floor space* and into *storeys* above the *interconnected floor space*, either the elevator doors opening into the *interconnected floor space* or the elevator doors opening into the *storeys* above the *interconnected floor space* shall be protected by vestibules conforming to Sentence (1).

3.2.8.5. Protected Floor Space

1) A *protected floor space* used to satisfy the requirements of Clause 3.4.3.2.(6)(b) shall

a) be separated from the *interconnected floor space* by a *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly of the *storey* in which it is located,

b) have all openings in the vertical *fire separation* between a *protected floor space* and the adjacent *interconnected floor space* protected by vestibules conforming to Sentence 3.2.8.4.(1), and

c) be designed so that it is not necessary to enter the *interconnected floor space* to reach an *exit*.

3.2.8.6. Draft Stops

1) A draft stop shall be provided at each floor level within an *interconnected floor space*, immediately adjacent to and surrounding the opening, and shall be not less than 500 mm deep measured from ceiling level down to the underside of the draft stop.

3.2.8.7. Mechanical Exhaust System

1) A mechanical exhaust system shall be provided to remove air from an *interconnected floor space* at a rate of 4 air changes per hour. (See Note A-3.2.8.7.(1).)

2) The mechanical exhaust system required by Sentence (1) shall be actuated by a switch located on the *storey* containing the entrance for firefighter access referred to in Articles 3.2.5.4. and 3.2.5.5. near the annunciator for the fire alarm system.

3.2.8.8. Combustible Content Limits

1) An *interconnected floor space* shall be designed so that the *combustible* contents, excluding interior finishes, in those parts of a *floor area* in which the ceiling is more than 8 m above the floor, are limited to not more than 16 g of *combustible* material for each cubic metre of volume of the *interconnected floor space*.

3.2.9. Integrated Fire Protection and Life Safety Systems

3.2.9.1. Testing

1) Where fire protection and life safety systems and systems with fire protection and life safety functions are integrated with each other, they shall be tested as a whole in accordance with CAN/ULC-S1001, "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems," to verify that they have been properly integrated. (See Note A-3.2.9.1.(1).)

3.2.10. Requirements for Residential buildings with a Single Exterior Exit Stairs

(See Note A-3.2.10.) (See also Note A-3.)

3.2.10.1. Application

1) Except as provided in Sentences (2) to (4), this Subsection applies to *buildings* of only *residential occupancy* that

a) are not more than six *storeys* in *building height*,

b) have a height not more than 18 m measured between the floor of the *first storey* and the uppermost floor level, excluding any floor level within a rooftop *enclosure* that is not considered as a *storey* in calculating *building height* in accordance with Sentence 3.2.1.1.(1),

c) contain not more than

i) six *dwelling units* on each floor from the *first storey* to the third *storey*, and

ii) four *dwelling units* on each floor above the third *storey*,

d) does not exceed an *occupant load* of 24 persons per floor, and

e) have a *travel distance* from

i) any part of the *floor area* to an *exit* not more than 25 m, and

ii) each *dwelling unit* to an *exit* of not more than 6 m.

2) This Subsection does not apply to *floor areas* permitted by Article 3.4.2.1. to be served by one *exit*.

3) This Subsection does not apply to detached houses, semi-detached houses, houses with an *ancillary residential unit*, duplexes, triplexes, townhouses or *row housing*.

4) Residential *buildings* with a single *exit* are not permitted for

a) hotels, motels, dormitories or lodging houses,

b) residential clubs, colleges or schools,

c) monasteries,

d) seniors' residences, or

e) care facilities accepted for residential use pursuant to provincial legislation.

5) This Subsection, in accordance with the application of this Article and in conformance with the provisions of this Subsection and all other applicable provisions of this By-law, may be used as an alternate to the requirements for a second exit in Subsection 3.4.2.

3.2.10.2. Building Construction

1) Notwithstanding the permissions in Sentences 3.2.5.12.(2) to (4), a *building* to which this Subsection applies shall be *sprinklered* throughout with an automatic *sprinkler system* designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems." (See Note A-3.2.10.2.(1) and (2).) (See Sentence 3.2.4.1.(7).)

2) Notwithstanding the permission in Sentence 3.2.5.12.(12), all balconies and decks shall be *sprinklered* in accordance with Sentence (1). (See Note A- 3.2.10.2.(1) and (2).)

3) The *exit* facility shall

a) be comprised of an exterior *exit* passageway that

i) is constructed of *noncombustible construction*, *encapsulated mass timber construction*, or *heavy timber construction*,

ii) is separated from the adjacent *floor area* by a *fire separation* having a *fire-resistance rating* not less than that required by the floor assembly, but not less than 45 minutes,

iii) has not less than 50% of the exterior side open to the outdoors, and

iv) leads to an exterior *exit* stairway constructed of *non-combustible construction*, *encapsulated mass timber construction*, or *heavy timber construction*,

b) be designed to minimize the impact of inclement weather on the exterior *exit* passageway, and on the treads and landings of the exterior *exit* stair,

c) discharge directly to the exterior of the *building* without passing through a lobby,

d) be designed to limit the probability of storage or the accumulation of material, and

e) have signs posted in conspicuous locations near each landing to indicate that storage is not permitted.

(See Note A-3.2.10.1.(3).)

4) The discharge from the *exit* stair described in Clause (3)(c) shall be located not less than 3 m and not more than 15 m from the closest portion of the access route required for fire department use, measured horizontally from the face of the *building*. (See Note A3.2.10.2.(4).)

5) Glazed openings in the *fire separation* referred to in Subclause (3)(a)(ii) are permitted to be protected by sprinklers used for *floor area* coverage provided the sprinklers are located not more than 300 mm horizontally from the openings.

6) A door assembly having a *fire-protection rating* not less than 20 minutes is permitted to be used in the *fire-separation* referred to in Subclause (3)(a)(ii).

3.2.10.3. Deleted.

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3.2.10.4. Deleted.

Section 3.3. Safety within Floor Areas

(See Note A-3.3.)

3.3.1. All Floor Areas

3.3.1.1. Separation of Suites

1) Except as permitted by Sentences (2) and (3), a *suite* shall be separated from adjoining *suites* by a *fire separation* having a *fire-resistance rating* not less than 1 h. (See also Subsection 3.3.3. for *care*, *treatment* or *detention occupancies*, Article 3.3.4.2. for *residential occupancies*, and Article 3.1.8.7. for *fire dampers*.)

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) *Occupancies* that are served by *public corridors* conforming to Clause 3.3.1.4.(4)(b) in a *building* that is *sprinklered* throughout, are not required to be separated from one another by *fire separations* provided the *occupancies* are

a) *suites* of *business and personal services occupancy*,

b) fast food vending operations that do not provide seating for customers,

c) *suites* of *mercantile occupancy*, or

d) any combination of these occupancies.

4) No *fire separation* is required between *suites* of *business and personal services occupancy*.

5) Except as permitted by Sentence (6), each *suite* other than a residential *suite*, located at ground level and having direct access to the street shall be separated from horizontally and vertically adjoining *suites* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

6) The *fire separation* required by Sentence (5) need not be provided to a *storage garage* (See Article 3.3.5.6.).

3.3.1.2. Hazardous Substances, Equipment and Processes

1) Except as provided in Subsections 3.3.5. and 3.3.6., the storage, handling and use of hazardous substances shall be in conformance with

a) the Fire By-law, and

b) provincial regulations or other regulatory enactments.

(See Note A-3.3.1.2.(1).)

2) Systems for the ventilation of cooking equipment that is not within a *dwelling unit* and is used in processes producing grease-laden vapours shall be designed and installed in conformance with Articles 3.6.3.5., 6.3.1.6. and 6.9.1.3. (See Note A-3.3.1.2.(2).)

3) A fuel-fired *appliance* shall not be installed in a corridor serving as an *access to exit*.

3.3.1.3. Means of Egress

(See Note A-3.3.1.3.)

1) *Access to exit* within *floor areas* shall conform to Subsections 3.3.2. to 3.3.5., in addition to the requirements of this Subsection.

2) If a podium, terrace, platform or contained open space is provided, egress requirements shall conform to the appropriate requirements of Sentence 3.3.1.5.(1) for rooms and *suites*.

3) *Means of egress* shall be provided from every podium, terrace, platform or contained open space used or intended for *occupancy*, to *exits* in conformance with the requirements of Section 3.4.

4) *Means of egress* from an *occupancy* on a roof serving only a single *dwelling unit* shall be provided in conformance with Article 3.3.4.4.

5) Except as permitted by Sentence (4) and except as required by Sentence (6), a *means of egress* at the roof level, designed in conformance with the requirements for *exits* in Section 3.4., shall be provided from an *occupancy* on a roof.

6) At least two separate *means of egress* at the roof level, designed in conformance with the requirements for *exits* in Section 3.4., shall be provided from a roof used or intended for an *occupant load* more than 60.

7) For the purposes of Sentences (5) and (6), the occupied area of the *occupancy* on a roof shall be used in place of *floor area*.

8) A rooftop enclosure that does not serve as part of a *means of egress* for an *occupancy* on a roof in accordance with Sentence (5) or (6) shall be provided with an *access to exit* that leads to an *exit*

a) at the roof level, or

b) on the *storey* immediately below the roof.

9) A rooftop enclosure which is more than 200 m^2 in area shall be provided with at least 2 *means of egress*.

10) Two points of egress shall be provided for a *service space* referred to in Sentence 3.2.1.1.(8) if

a) the area is more than 200 m^2, or

b) the travel distance measured from any point in the *service space* to a point of egress is more than 25 m.

11) Except as permitted by Sentences 3.3.4.4.(5) and (6), each *suite* in a *floor area* that contains more than one *suite* shall have

a) an exterior *exit* doorway, or

b) a doorway

i) into a *public corridor*, or

ii) to an exterior passageway.

12) Except for *buildings* designed and constructed in accordance with Subsection 3.2.10., and except as permitted by this Section and by Sentence 3.4.2.1.(2), at the point where a doorway referred to in Sentence (11) opens onto a *public corridor* or exterior passageway, it shall be possible to go in opposite directions to each of 2 separate *exits*.

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3.3.1.4. Public Corridor Separations

1) Except as otherwise required by this Part or as permitted by Sentence (4), a *public corridor* shall be separated from the remainder of the *storey* by a *fire separation*.

2) Except as permitted by Sentence (3) and Clauses (4)(a) and (b), the *fire separation* between a *public corridor* and the remainder of the *storey* shall have a *fire-resistance rating* not less than 45 min.

3) If a *storey* is *sprinklered* throughout, no *fire-resistance rating* is required for a *fire separation* between a *public corridor* and the remainder of the *storey*, provided the corridor does not serve a *care*, *treatment* or *detention occupancy* or a *residential occupancy*. (See Note A-3.1.8.1.(1)(b).)

4) No *fire separation* is required in a *sprinklered floor area* between a *public corridor* and

a) except as required by Sentences 3.3.3.5.(8) and 3.3.4.2.(1), and notwithstanding Sentence 3.4.2.4.(2), the remainder of a *storey*, provided the travel distance from any part of the *floor area* to an *exit* is not more than 45 m,

b) a room or a *suite*, provided the *public corridor* complies with Sentence 3.3.1.9.(4) and Clause 3.4.2.5.(1)(d), or

c) a space containing plumbing fixtures required by Subsection 3.7.2., provided the space and the *public corridor* are separated from the remainder of the *storey* by a *fire separation* having a *fire-resistance rating* not less than that required between the *public corridor* and the remainder of the *storey*.

3.3.1.5. Egress Doorways

1) Except for *dwelling units*, a minimum of 2 egress doorways located so that one doorway could provide egress from the room or *suite* as required by Article 3.3.1.3. if the other doorway becomes inaccessible to the occupants due to a fire which originates in the room or *suite*, shall be provided for every room and every *suite*

a) that is used for a *high-hazard industrial occupancy* and whose area is more than 15 m^2,

b) intended for an *occupant load* more than 60,

c) in a *floor area* that is not *sprinklered* throughout, and

i) the area of a room or *suite* is more than the value in Table 3.3.1.5.-A, or

ii) the travel distance within the room or *suite* to the nearest egress doorway is more than the value in Table 3.3.1.5.-A, or

d) in a *floor area* that is *sprinklered* throughout and does not contain a *high-hazard industrial occupancy* and

i) the travel distance to an egress doorway is more than 25 m, or

ii) the area of the room or *suite* is more than the value in Table 3.3.1.5.-B.

2) Where 2 egress doorways are required by Sentence (1), they shall be placed at a distance from one another equal to or greater than one third of the maximum overall diagonal dimension of the area to be served, measured as the shortest distance that smoke would have to travel between the nearest required egress doors.

Table 3.3.1.5.-A
Egress in Floor Area not Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy* of Room or *Suite	**Maximum Area of Room or *Suite*, m^2**	**Maximum Distance to Egress Doorway, m**
Group A	150	15
Group C	100(1)	15(1)
Group D	200	25
Group E	150	15
Group F, Division 2	150	10
Group F, Division 3	200	15

Notes to Table 3.3.1.5.-A:
(1) See Article 3.3.4.4. for dwelling units.

Table 3.3.1.5.-B
Egress in Floor Area Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy* of Room or *Suite	**Maximum Area of Room or *Suite*, m^2**
Group A	200
Group B, Division 1	100
Group B, Division 2	
sleeping rooms	100
other than sleeping rooms	200
Group B, Division 3 sleeping rooms not in *suites*	100

individual *suites*	150
other than sleeping rooms	200
Group C	150(1)
Group D	300
Group E	200
Group F, Division 2	200
Group F, Division 3	300

Notes to Table 3.3.1.5.-B:
(1) See Article 3.3.4.4. for dwelling units.

3.3.1.6. Travel Distance

1) If more than one egress doorway is required from a room or *suite* referred to in Article 3.3.1.5., the travel distance within the room or *suite* to the nearest egress doorway shall not exceed the maximum travel distances specified in Clauses 3.4.2.5.(1)(a), (b), (c) and (f) for *exits*.

3.3.1.7. Deleted

(see Article 11.3.8.1.)

3.3.1.8. Headroom and Protruding Objects

1) Except within the *floor area* of a *storage garage*, the minimum headroom clearance in every *access to exit* shall conform to the requirements of Article 3.4.3.4. for *exits*. (See also Sentence 3.3.5.4.(5).)

2) Except as permitted by Sentence (3) and except for paths of travel in *service rooms* and *dwelling units*, protruding *building* elements located within 1 980 mm of the floor shall not project more than 100 mm horizontally into paths of travel in a manner that would create a hazard. (See Note A-3.3.1.8.(2) and (3).)

3) The horizontal projection of a protruding *building* element referred to in Sentence (2) is permitted to be more than 100 mm, provided the clearance between the protruding element and the floor is less than 680 mm. (See Note A-3.3.1.8.(2) and (3).)

3.3.1.9. Corridors

1) The minimum width of a *public corridor* shall be 1 100 mm.

2) Except as required by Sentence 3.3.3.3.(3), the minimum unobstructed width of a corridor used by the public or a corridor serving classrooms or patients' sleeping rooms shall be 1 100 mm.

3) If a corridor contains an *occupancy*, the *occupancy* shall not reduce the unobstructed width of the corridor to less than its required width.

4) If a *public corridor* conforming to Clause 3.4.2.5.(1)(d) contains an *occupancy*,

a) the *occupancy* shall be located so that for pedestrian travel there is an unobstructed width not less than 3 m at all times adjacent and parallel to all rooms and *suites* that front onto the *public corridor*, and

b) the combined area of all *occupancies* in the *public corridor* shall be not more than 15% of the area of the *public corridor*.

5) Except for a dead-end corridor that is entirely within a *suite* or as permitted by Sentences 3.3.3.3.(1) and 3.3.4.4.(6), a dead-end corridor is permitted provided it is not more than 6 m long.

3.3.1.10. Aisles

1) Except as otherwise stated in this Section, aisles shall be provided in conformance with the Fire By-law.

3.3.1.11. Door Swing

1) Except as permitted by Sentence (5) and Article 3.3.1.12., a door that opens into a corridor or other facility providing *access to exit* from a *suite* or room not located within a *suite* shall swing on a vertical axis.

2) Except as permitted by Article 3.3.1.12., a door that opens into a corridor or other facility providing *access to exit* from a room or *suite* that is used or intended for an *occupant load* more than 60 or for a *high-hazard industrial occupancy* shall swing in the direction of travel to the *exit*.

3) Every door that divides a corridor that is not wholly contained within a *suite* shall swing on a vertical axis in the direction of travel to the *exit*.

4) If a pair of doors is installed in a corridor that provides *access to exit* in both directions, the doors shall swing in opposite directions, with the door on the right hand side swinging in the direction of travel to the *exit*.

5) Doors that serve storage *suites* not more than 28 m^2 in area in warehousing *buildings* need not conform to Sentence (1).

3.3.1.12. Sliding Doors

1) Except as permitted by Sentences (2) and 3.3.1.11.(5), a sliding door provided in the locations described in Article 3.3.1.11. shall

a) be designed and installed to swing on the vertical axis in the direction of travel to the *exit* when pressure is applied, and

b) be identified as a swinging door by means of a label or decal affixed to it.

2) In a Group B, Division 1 *occupancy*, or in an *impeded egress zone* in other *occupancies*, sliding doors used in an *access to exit* need not conform to Sentence (1) and Article 3.3.1.11.

3) Movable *partitions* used to separate a *public corridor* from an adjacent *business and personal services occupancy* or a *mercantile occupancy* need not conform to Sentence (1) and Sentences 3.3.1.11.(1) and (2), provided the *partitions* are not located in the only *means of egress*. (See Note A-3.3.1.12.(3).)

3.3.1.13. Doors and Door Hardware

(See also Sentence 3.8.3.6.(17).)

1) Except as required by Article 3.3.3.4., a door that opens into or is located within a *public corridor* or other facility that provides *access to exit* from a *suite* shall

a) provide a clear opening of not less than 850 mm if there is only one door leaf,

b) in a doorway with multiple leaves, have the active leaf providing a clear opening of not less than 850 mm,

c) not open onto a step, and

d) have a threshold not more than 13 mm higher than the surrounding finished floor surface, and where it is higher than 6 mm, shall be beveled to a slope not steeper than 1 in 2, except where it

   i) is used to confine the spillage of *flammable liquids* within a *service room* or within a room in an *industrial occupancy*, or

   ii) provides access to an exterior balcony, unless the balcony is required by Clause 11.3.8.1.(1)(c).

2) Except as provided in Sentences (6) and (7), a door in an *access to exit* shall be readily openable in travelling to an *exit* without requiring keys, special devices or specialized knowledge of the door-opening mechanism.

3) Except as permitted by Sentence (4), door release hardware shall comply with Clause 3.8.3.8.(1)(b) and the door shall be openable with not more than one releasing operation. (See also Sentence 3.8.3.6.(4).)

4) An egress door from an individual *dwelling unit* or from a *suite* of *residential occupancy* is permitted to be provided with additional devices that require a releasing operation additional to the main door release

hardware, provided the devices are readily operable from the inside without the use of keys, special devices or specialized knowledge. (See Note A-3.3.1.13.(4).)

5) Except as provided in Sentence 3.4.6.17.(9), door release hardware shall be installed between 900 mm and 1 100 mm above the finished floor.

6) An egress door in an *access to exit* serving a *contained use area* or an *impeded egress zone* is permitted to be equipped with locking devices, provided they can be released either locally or remotely in conformance with Sentence (8) or (9). (See Note A-3.3.1.13.(6).)

7) Except as permitted by Sentence (11), a door in an *access to exit* is permitted to be equipped with an electromagnetic lock conforming with Sentences 3.4.6.16.(5) or (6). (See Note A-3.3.1.13.(7).)

8) Local locking devices permitted by Sentence (6) shall be operable by a key from both sides of the door.

9) Controls for the remote release of door locking devices permitted by Sentence (6) shall be located in an area readily available to security personnel.

10) Locking devices permitted by Sentence (6) that are electrically operated shall be

a) designed to operate on emergency power, and

b) capable of manual release by security personnel.

11) An egress door from a *public corridor* or lobby that provides a *means of egress* through a *suite* of Group D *occupancy* to an *exit* may, where *acceptable* to the *Chief Building Official*, be provided with an electromagnetic locking device where

a) the egress door is designed to prevent locking during normal working hours and is provided with signage stating "*This door shall not be locked during the normal hours of business operation.*",

b) the *public corridor* or lobby, does not contain an *occupancy* and serves only *suites* of Group D *occupancy*,

c) the *public corridor* or lobby is provided with direct access to at least one *exit*,

d) the *building* is *sprinklered* and provided with a *fire alarm system*, and

e) all electromagnetic locking devices along the path to the exit are designed to

i) release immediately on an *alarm signal* or from a *smoke detector* in the *public corridor* or lobby, or upon loss of power controlling the electromagnetic locking mechanism and its associated auxillary control,

ii) release immediately upon actuation of a manually operated switch accessible only to authorized personnel, and

iii) be reset manually by actuation of the switch referred to in Subclause (ii) upon its release.

(See Note A-3.3.1.13.(11).)

3.3.1.14. Ramps and Stairways

1) Except as permitted by Sentence (2), Article 3.3.4.7. and Subsection 3.3.2., *ramps* and stairways that do not serve as *exits* shall conform to the requirements for *exit ramps* and stairways stated in Sentence 3.4.3.2.(8) and Articles 3.4.3.4., and 3.4.6.1. to 3.4.6.9.

2) *Ramps* and stairways that serve *service rooms*, *service spaces* or *industrial occupancies* need not comply with Sentence (1), provided

a) they are intended only for occasional use for servicing equipment and machinery, and

b) they do not serve as *exits*.

3.3.1.15. Exterior Passageways

1) An exterior passageway leading to a required *exit* shall conform to the requirements of Section 3.4. for exterior *exit* passageways.

3.3.1.16. Tapered Treads in a Curved Flight

1) *Flights* of stairs shall consist solely of

a) straight *flights*, or

b) curved *flights* complying with Sentence (2).

2) *Tapered treads* in a curved *flight* that is not required as an *exit* shall have

a) a minimum *run* of 150 mm,

b) a *run* not less than 280 mm when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread, and

c) a riser conforming to Sentence 3.4.6.8.(2).

3) *Tapered treads* shall have a consistent angle and uniform *run* and rise dimensions in accordance with the construction tolerances stipulated in Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread.

4) All *tapered treads* within a *flight* shall turn in the same direction.

3.3.1.17. Capacity of Access to Exits

(See Article 3.3.1.9. for minimum widths of corridors.)

1) The capacity of an *access to exit* shall be based on the *occupant load* of the portion of the *floor area* served.

2) In an *access to exit* the required width of *ramps* with a slope not more than 1 in 8, doorways, and corridors shall be based on not less than 6.1 mm per person.

3) In an *access to exit* the required width of a *ramp* with a slope more than 1 in 8 shall be based on not less than 9.2 mm per person.

4) In an *access to exit* from a *floor area* used or intended to be used for patients in a Group B, Division 2 *occupancy* or residents in a Group B, Division 3 *occupancy*, the required width of corridors, doorways, and *ramps* shall be based on not less than 18.4 mm per person.

5) The capacity of stairs in an *access to exit* shall conform to the requirements for stairs in Sentences 3.4.3.2.(1) to (3).

6) In a *building* that is not *sprinklered* throughout in accordance with Sentence 3.2.5.12.(1), an *access to exit* that is part of the principal entrance serving a dance hall or a licensed beverage establishment with an *occupant load* more than 250 shall provide at least one half of the required *exit* width.

3.3.1.18. Guards

1) Except as provided in Sentence (5) and Article 3.3.2.9., a *guard* not less than 1 070 mm high shall be provided

a) around any roof to which access is provided for purposes other than maintenance,

b) at openings into smoke shafts referred to in Subsection 3.2.6. that are less than 1 070 mm above the floor, and

c) at each raised floor, *mezzanine*, balcony, gallery, interior or exterior vehicular ramp, and at other locations where (see Note A-9.8.8.1.)

i) the difference in elevation is more than 600 mm between the walking surface and the adjacent surface, or

ii) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2.

2) Except as provided in Sentences (3) and 3.3.2.9.(4) and Articles 3.3.4.7. and 3.3.5.10., openings through *guards* shall be of a size that prevents the passage of a spherical object whose diameter is more than 100 mm.

3) Openings through *guards* other than those required by Sentence (1) that serve *occupancies* other than *industrial occupancies* shall be of a size that

a) prevents the passage of a spherical object whose diameter is 100 mm, or

b) permits the passage of a spherical object whose diameter is 200 mm.

(See Note A-9.8.8.5.(4).)

4) Except for *guards* conforming to Article 3.3.5.10., *guards* that protect a level located more than one *storey* or 4.2 m above the adjacent level shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level protected by the *guard* facilitates climbing. (See Note A-9.8.8.6.(1).)

5) Sentence (1) does not apply

a) to the front edges of *stages*,

b) to floor pits in *repair garages*,

c) to loading docks, or

d) where access is provided for maintenance purposes only.

6) Swimming pools greater than 450 mm deep shall be protected in conformance with Article 9.8.8.1.

3.3.1.19. Tactile Walking Surface Indicators

1) Except as provided in Sentence (2), tactile attention indicators complying with Clauses 4.3.5.3.1, 4.3.5.3.3 and 4.3.5.3.4 of CSA B651, "Accessible design for the built environment," shall be installed

a) at the top of *flights* of stairs that are unenclosed, and

b) at drop-off edges with a change in elevation greater than 300 mm that are unprotected by a *guard*.

(See Note A-3.3.1.19.(1).)

2) Sentence (1) does not apply to *service spaces*, bleachers addressed in Subsection 3.3.2., *stages*, loading docks, *industrial occupancies*, within *dwelling units*, and to stairs and drop-off edges serving not more than two *dwelling units*.

3.3.1.20. Transparent Doors and Panels

1) Except as permitted by Sentence (5), a glass or transparent door shall be designed and constructed so that the existence and position of the door is readily apparent, by attaching visually contrasting hardware, bars or other permanent fixtures to it.

2) The visibility of fully glazed transparent doors, sidelights and panels shall be enhanced through the inclusion of mullions, markings or other elements that

a) are visually contrasting,

b) are at least 50 mm high,

c) extend the full width of the door, sidelight or panel, and

d) are located between 1 350 mm and 1 500 mm above the floor.

3) A glass door shall be constructed of

a) laminated or tempered safety glazing conforming to CAN/CGSB-12.1, "Safety Glazing," or

b) wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass."

4) Except as permitted by Sentence (5), transparent panels used in an *access to exit* that, because of their physical configuration or design, could be mistaken as a *means of egress* shall be made inaccessible by barriers or railings.

5) Sliding glass *partitions* that separate a *public corridor* from an adjacent *occupancy* and that are open during normal working hours need not conform to Sentences (1) and (4), provided the *partitions* are suitably marked in conformance with Sentence (2) to indicate their existence and position.

6) Where vision glass is provided in doors or transparent sidelights, the lowest edge of the glass shall be no higher than 900 mm above floor level.

7) Glass in doors and in sidelights that could be mistaken for doors, within or at the entrances to *dwelling units* and in public areas, shall conform to the requirements of Article 9.6.1.4.

8) A window in a public area that extends to less than 1 000 mm above the floor and is located above the second *storey* in a *building* of *residential occupancy*, shall be protected by a barrier or railing to not less than 1 070 mm above the floor, or the window shall be non-openable and designed to withstand the lateral design loads for balcony *guards* required by Article 4.1.5.14.

9) An openable window which is located less than 1 070 mm above interior floor level, and which opens to a space more than 600 mm below the level of the interior floor, shall be protected by

a) an opening mechanism that limits the unobstructed opening to no more than 100 mm measured either vertically or horizontally, provided the opening is at least 100 mm above the floor, or

b) a *guard* in conformance with Article 3.3.1.18.

3.3.1.21. Exhaust Ventilation and Explosion Venting

1) Except as provided in Sentence (2), an exhaust ventilation system designed in conformance with the appropriate requirements of Part 6 shall be provided in a *building* or part of a *building* in which dust, fumes, gases, vapour or other impurities or contaminants have the potential to create a fire or explosion hazard. (See also Article 4.2.4.13.)

2) Where a *fire separation* required to have a *fire-resistance rating* is penetrated by a ventilation system required by Sentence (1) for power-ventilated enclosures in laboratories, the ducts shall be

a) continuously enclosed from the first penetrated *fire separation* to any subsequent *fire separations* or concealed spaces and all the way through to the outdoors so that the highest *fire-resistance rating* of all the penetrated *fire separations* is maintained, and

b) exempted from the requirement to be equipped with a *fire damper*, smoke damper and combination smoke/*fire damper* as stated in Article 3.1.8.7.

3) Explosion relief devices, vents or other protective measures conforming to Subsection 6.3.1. and Article 6.9.1.2. shall be provided for a space in which substances or conditions that have the potential to create an explosion hazard are present as a result of the principal use of a *building*.

3.3.1.22. Janitors' Rooms

1) Except as permitted by Sentences (2) and (3), a room or space within a *floor area* for the storage of janitorial supplies shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the room or space is located is *sprinklered* throughout.

3.3.1.23. Common Laundry Rooms

1) Except as permitted by Sentences (2) and (3), in a *building* of *residential occupancy*, a laundry room in a *floor area* that is not within a *dwelling unit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire separation* required by Sentence (1) is not required to have a *fire-resistance rating* if the *floor area* in which the laundry room is located is *sprinklered* throughout.

3.3.1.24. Obstructions

1) No obstruction shall be permitted in any *occupancy* that would restrict the width of a normal *means of egress* from any part of a *floor area* to less than 750 mm unless an alternative *means of egress* is provided adjacent to, accessible from, and plainly visible from the obstructed *means of egress*. (See Note A-3.3.1.24.(1).)

3.3.1.25. Signs in Service Spaces

1) Illuminated signs conforming to Sentences 3.4.5.1.(2) and (6) shall be provided to indicate the direction to egress points in a *service space* referred to in Sentence 3.2.1.1.(8).

3.3.1.26. Welding and Cutting

1) Except as provided in Sentence (2), welding and cutting operations shall be carried out in a room

a) separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or

b) protected by an automatic fire extinguishing system.

2) Sentence (1) shall not apply to *industrial occupancies* where the welding and cutting operations do not present a fire or explosion hazard to adjacent areas.

3.3.2. Assembly Occupancy

3.3.2.1. Scope

1) This Subsection applies to *assembly occupancies* and to outdoor places of assembly.

2) Except as required in Sentence (3), provisions 12.2.3.2, 12.2.3.3, 12.2.5.4, 12.2.5.5, 12.2.5.6, 12.2.11.1, 12.4.1 and 12.4.2 of Chapter 12 of NFPA 101, “Life Safety Code,” are permitted to be used in lieu of Articles 3.3.2.4., 3.3.2.5., 3.3.2.9., 3.3.2.11. and 3.3.2.12. (See Note A-3.3.2.1.(2).)

3) The minimum clear width of aisle accessways between rows of seats shall be calculated according to provisions 12.2.5.5.2, 12.2.5.5.4.1 and 12.2.5.5.5.1 of Chapter 12 of NFPA 101, “Life Safety Code,” except that in no case shall the width be less than 400 mm.

3.3.2.2. Fire Separations

1) Except as permitted by Sentence (2), the seating area of a Group A, Division 1 *occupancy* shall be separated from adjacent *occupancies* in the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 1 h if the *occupant load* in the seating area exceeds 200.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) If usable space exists under tiers of seats in arena-type *buildings*, a *fire separation* with a *fire-resistance rating* not less than 45 min shall be provided between the space and the seats or the space shall be *sprinklered*.

3.3.2.3. Non-fixed Seating

1) Non-fixed seating shall conform to the Fire By-law.

3.3.2.4. Fixed Seats

1) Except for the requirements of Article 3.3.2.8. for bench-type seats and except as required or permitted by Sentence (2) and Articles 3.3.2.11. and 3.3.2.12., fixed seats in places of assembly shall be

a) attached or secured to the floor, platform or platform riser,

b) provided with arms and back, and

c) arranged in rows having an unobstructed passage not less than 400 mm wide measured horizontally between plumb lines from the backs of the seats in one row and the edges of the furthest forward projection of the seats in the next row in the unoccupied position.

2) For fixed seats with backs and with folding tablet arms, the value of 400 mm required by Clause (1)(c) shall be measured when the tablet arms are in the use position, but is permitted to be measured in the stored position provided

a) there are not more than 7 seats between any seat and the nearest aisle,

b) the seats are located in a lecture hall or an auditorium used for instructional purposes, and

c) the tablet arm, when raised manually to a vertical position, falls by the force of gravity to the stored position.

(See Note A-3.3.2.4.(2).)

3) Except as permitted by Sentence (4), aisles shall be located so that there are not more than 7 seats with backs or 20 seats without backs between any seat and the nearest aisle.

4) The requirements of Sentence (3) do not apply if

a) egress doorways are provided to serve both ends of rows of seats,

b) each doorway referred to in Clause (a) serves not more than 3 rows of seats, and

c) each row contains not more than 100 seats.

3.3.2.5. Aisles

1) Except as required by Articles 3.3.2.11. and 3.3.2.12., aisles leading to *exits* shall be provided in conformance with Sentences (2) to (17) in places of assembly which contain fixed seats.

2) The minimum clear width of aisles shall be not less than 1 100 mm, except that the width is permitted to be reduced to not less than

a) 750 mm if serving not more than 60 seats, and

b) 900 mm if serving seats on one side only.

3) Except in the case of bleacher seats, the minimum clear width of aisles referred to in Sentence (2) shall be measured at the point farthest from an *exit*, cross aisle or foyer and shall be increased by 25 mm for each metre of distance toward the *exit*, cross aisle or foyer.

4) Aisles shall terminate in a cross aisle, foyer or *exit*, and the width of the cross aisle, foyer or *exit* shall be not less than the required width of the widest aisle plus 50% of the total required width of the remaining aisles that it serves.

5) Dead-end aisles shall be not more than 6 m long.

6) The length of travel to an *exit* door by any aisle shall be not more than 45 m.

7) Side aisles shall be not less than 1 100 mm wide if seating is provided in conformance with Sentence 3.3.2.4.(4).

8) An aisle that has a slope not more than 1 in 8 shall not be stepped.

9) An aisle that slopes more than 1 in 8 shall be stepped.

10) The passageway between rows of seats served by a stepped aisle shall be level at right angles to the line of travel.

11) The riser of a step in an aisle shall be

a) not less than 110 mm high, and

b) not more than 200 mm high.

12) Variations are permitted in riser height provided

a) the height of adjacent risers does not vary by more than 6 mm, and

b) the width of a tread or a platform in the direction of travel is not less than 430 mm.

13) Steps in an aisle shall

a) have a *run* not less than 230 mm exclusive of nosings,

b) have a tread width not less than 250 mm,

c) extend to the adjacent rows of seats in a manner that will not create a hazard from tripping, and

d) have a finish on the treads conforming to Sentence 3.4.6.1.(1).

14) The location of every riser in an aisle shall be made apparent from both directions of travel by strategically placed lighting or contrasting marking stripes.

15) A platform in an aisle shall be level, except that a slope not more than 1 in 50 is permitted for a platform that is not less than 430 mm wide in the direction of *exit* travel.

16) If a step is used at the entry to a row of seats from a stepped aisle, an unobstructed platform not less than 800 mm square shall be provided adjacent to the aisle.

17) The finish of the surface of a platform in or adjacent to a stepped aisle shall conform to Sentence 3.4.6.1.(1).

3.3.2.6. Corridors

1) Except as permitted by Sentences (2) to (4), a corridor used by the public in an *assembly occupancy* as an *access to exit* shall be separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) The *fire-resistance rating* required by Sentence (1) is permitted to be waived if the *floor area* in which the corridor is located is *sprinklered* throughout.

4) The requirement for a *fire separation* stated in Sentence (1) is permitted to be waived if the distance from any point in the *floor area* to an *exit* measured along the path of travel to the *exit* does not exceed the travel distance permitted by Article 3.4.2.5.

3.3.2.7. Doors

1) A door equipped with a latching mechanism in an *access to exit* from a room or *suite* of *assembly occupancy* containing an *occupant load* more than 100 shall be equipped with a device that complies with Sentence 3.4.6.16.(3).

3.3.2.8. Fixed Bench-Type Seats without Arms

1) If fixed bench-type seats without arms are provided, the seat width per person shall be assumed to be 450 mm.

2) The centre-to-centre spacing between rows of bench-type seats shall be not less than 760 mm if back rests are provided, and not less than 550 mm if back rests are not provided.

3) A clear space of not less than 300 mm shall be provided between the back of each seat and the front of the seat immediately behind it.

3.3.2.9. Guards

1) Except as required by Sentences (2) to (4) for bleacher seats, *guards* shall be installed in outdoor and indoor places of assembly with fixed seats so that

a) at the fascia of every box, balcony or gallery where the seats extend to the edge, the height of *guards* is not less than

   i) 760 mm in front of the seats, and

   ii) 920 mm if located at the end of aisles or at the foot of steps,

b) the height of *guards* along every cross aisle other than those adjacent to the fascia of every box, balcony or gallery is not less than 660 mm, except that *guards* need not be provided if the backs of the seats along the front side of the aisle are not less than 600 mm above the floor of the aisle, and

c) where the seating is arranged in successive tiers and the height of rise between platforms is more than 450 mm, the height of *guards* is not less than 660 mm along the entire row of seats at the edge of the platform.

2) The backs and ends of bleacher seats more than 1 200 mm above the ground or floor that are not adjacent to a wall shall be protected with a *guard*

a) not less than 1 070 mm high above an adjacent aisle surface or foot rest, and

b) not less than 920 mm high above the centre of an adjacent seat board.

3) If the front of a bleacher is more than 600 mm above the ground or floor, it shall be protected with a *guard* not less than 840 mm high above the front foot rest.

4) The size of any opening in a *guard* required by Sentences (2) and (3) shall not allow the passage of a sphere whose diameter is more than 300 mm.

3.3.2.10. Handrails in Aisles with Steps

(See Note A-3.3.2.10.)

1) Handrails shall be provided in aisles with steps in conformance with Table 3.3.2.10.

Table 3.3.2.10.
Types and Location of Handrails in Aisles with Steps
Forming Part of Sentence 3.3.2.10.(1)

Aisle Width	Aisle Serving Seating on One Side	Aisle Serving Seating on Both Sides
	Handrail Requirements	
Less than 1 100 mm	a continuous handrail located on the side of the aisle opposite the seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)	a handrail located on one side at the end of each row of seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)
1 100 mm or more	a centre-line handrail that conforms to Sentence (2) or a continuous handrail located on the side of the aisle opposite the seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14), plus a handrail located at the end of each row of seats that conforms to Sentences 3.4.6.5.(5) to (8), (11), (13) and (14)	a centre line handrail that conforms to Sentence (2)

2) Handrails installed along aisle centre lines as required by Table 3.3.2.10. shall

a) comply with Sentences 3.4.6.5.(5) to (7) and (14),

b) have gaps not less than 560 mm and not more than 915 mm wide, measured horizontally, at intervals not exceeding five rows,

c) comply with Sentence 3.4.6.5.(11) at terminations and required gaps, and

d) have an intermediate rail located 305 mm below the principal handrail.

3.3.2.11. Outdoor Places of Assembly

1) A Group A, Division 4 *occupancy* and each tier or balcony that has a capacity of more than

a) 1 000 persons shall have not less than 3 separate *exits*, or

b) 4 000 persons shall have not less than 4 separate *exits*.

2) In a Group A, Division 4 *occupancy*, every seat shall be located so that the travel distance is not more than 45 m measured along the path of travel from the seat to

a) the ground,

b) an *exit*,

c) an opening to a passageway leading from the seating area, or

d) a portal, a vomitory or any other opening through the seating deck structure.

3) *Exits* from outdoor stadia or grandstands shall be located not more than 25 m apart.

4) The capacity of a *means of egress* for a Group A, Division 4 *occupancy* shall conform to the requirements of Sentence 3.4.3.2.(3).

5) Aisles in a Group A, Division 4 *occupancy* shall

a) be located so that there are not more than 20 seats between any seat and the nearest aisle, and

b) be not less than 1 200 mm wide, except that an aisle serving less than 60 persons is permitted to be 750 mm wide.

3.3.2.12. Bleachers

1) Steps provided in aisles of bleachers of the telescopic type shall

a) have risers not more than 250 mm high, and

b) have treads with a *run* not less than 280 mm.

2) If the vertical distance between seating platforms in bleachers is more than 280 mm, an intermediate step shall be provided the full width of the aisle and proportioned to provide 2 equal risers between platforms.

3) If the vertical distance between seating platforms in bleachers is more than 450 mm, 2 intermediate steps shall be provided the full width of the aisle so that there are 3 equal risers between platforms.

4) If the passageway between rows of seats is not a closed deck, footboards shall be provided so that

a) the total width of the footboards shall be not less than three quarters of the centre-to-centre spacing between rows of seats, and

b) the spacing between footboard members shall be not more than 25 mm.

5) Openings above footboards and below the seats in rows of bleacher seats shall be provided with intermediate construction so that there is no opening that would permit the passage of a sphere of more than 100 mm in diameter.

3.3.2.13. Libraries

1) Except as permitted by Sentence (2), a library book storage room that is not normally accessible to the public shall be separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 2 h if it

a) is more than 250 m^2 in area, or

b) contains book stacks that

i) are more than 10 m high, or

ii) penetrate more than one floor assembly.

2) The *fire separation* required by Sentence (1) is not required if the book storage room is *sprinklered*.

3) Open book shelves are permitted above and below a *mezzanine* floor in a library *building* provided the height of the shelves is not more than 2.1 m but not more than 75% of the floor-to-ceiling height of the space above or below the *mezzanine* floor assembly.

3.3.2.14. Stages for Theatrical Performances

1) A *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas, shall be *sprinklered*.

2) A *fire separation* with a *fire-resistance rating* not less than 1 h shall be provided between a *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas.

3) Except as permitted by Sentence (6), a *stage* for theatrical performances and ancillary spaces, including workshops, dressing rooms and storage areas, shall be separated from the seating area by a *fire separation* having a *fire-resistance rating* not less than 1 h, except for a proscenium opening protected with

a) a sprinkler deluge system conforming to the requirements of NFPA 13, “Standard for the Installation of Sprinkler Systems,”

b) an unframed fire curtain if the opening is not more than 20 m wide, or

c) a semi-rigid fire curtain if the opening is more than 20 m wide.

4) A fire curtain required by Sentence (3) shall be of a type *acceptable* to the *Chief Building Official* and designed to close

a) automatically upon the actuation of the *sprinkler system*,

b) automatically upon actuation of the fire alarm system, and

c) manually by remote control devices located at the curtain control panel and at each side of the *stage*.

5) At least 2 vents for the purpose of venting fire and smoke to the outside of a *building* shall be provided above a *stage* designed for theatrical performances and shall

a) have an aggregate area not less than one eighth of the area of the *stage* behind the proscenium opening, and

b) be arranged to open automatically upon actuation of the *sprinkler system*.

6) The *fire separation* referred to in Sentence (3) is not required between a *stage* and a seating area in a *building* that is *sprinklered* throughout, provided a sprinkler deluge system is installed at the boundary between the *stage* and the seating area.

3.3.2.15. Risers for Stairs

1) In a Group A, Division 2 *occupancy* used for the serving of food and beverages, an interior *flight* of stairs with fewer than 3 risers is permitted provided it

a) is not less than 900 mm wide,

b) is illuminated at all times that occupants are on the premises, and

c) has a handrail on each side.

3.3.2.16. Storage Rooms

1) Where storage rooms are required by Part 4 of Division B of the Fire By-law for the storage of *flammable liquids* or *combustible liquids* in *assembly occupancies*, such rooms shall not be located above or below the *first storey*.

3.3.2.17. Safety Glazing

1) Except as permitted in Sentence (3), glazing in all fixed and operable panels of doors shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

2) Except as permitted in Sentence (4), glazing in all fixed and operable panels of windows shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

3) Glazing in individual fixed or operable panels of a door need not comply with Sentence (1), where

a) the bottom exposed edge of the glazing is located more than 1 525 mm above the walking surface on each side of the door, or

b) the glazed opening in the door does not permit the passage of a sphere whose diameter is more than 75 mm.

4) Glazing in individual fixed or operable panels of a window need not comply with Sentence (2), where

a) the bottom exposed edge of the glazing is located more than 1 525 mm above the walking surface on each side of the window, or

b) the glazing is located more than 915 mm away from the walking surface on each side of the window measured perpendicular to the plane of the glazing.

3.3.2.18. Deleted

(See Article 3.1.2.8.)

3.3.3. Care, Treatment or Detention Occupancies

3.3.3.1. Application

1) This Subsection applies to *care*, *treatment* and *detention occupancies*. (See Note A-3.3.3.1.(1).)

3.3.3.2. Separations between Care, Treatment or Detention Occupancies and Repair Garages

1) The *fire separation* required by Sentence 3.3.5.5.(1) between a *care*, *treatment* or *detention occupancy* and a *repair garage* shall have no openings.

3.3.3.3. Corridors

1) Except as provided in Sentence (2), a corridor used by the public or serving patients' or residents' sleeping rooms shall have no dead-end portion.

2) Corridors are permitted to have dead-portions, where

a) the area served by the dead-end portion has a second and separate *means of egress*, or

b) the corridor serves a *suite* of *care occupancy* and the dead-end portion does not exceed 6 m.

3) Corridors shall be not less than

a) 2 400 mm wide in *buildings* of *treatment occupancy* where the corridors may be used to move patients or residents in beds,

b) 1 650 mm wide

i) in *buildings* of *care* or *treatment occupancy* where the corridors will not be used to move patients or residents in beds, and

ii) in *buildings* of *care occupancy* with more than 10 residents and where the corridors serve the residents, or

c) 1 100 mm wide in *buildings* of *care occupancy* with not more than 10 residents.

4) Paired doors in a corridor referred to in Clause (3)(a) shall

a) swing in opposite directions, the right-hand door swinging in the direction of travel, and

b) be not less than 1 100 mm wide.

3.3.3.4. Doorway Width

1) Except as provided in Sentence (2) and within individual *suites* of *care occupancy*, the minimum clear width of a doorway shall be 850 mm where it opens into or is located within a *public corridor* or other facility that provides *access to exit* for patients or residents in *floor areas* containing *care* or *treatment occupancies*.

2) The minimum clear width of doorways through which it is necessary to move patients in bed shall be 1 050 mm. (See Note A-3.3.3.4.(2).)

3.3.3.5. Compartments and Fire Separations

1) *Floor areas* containing patients' or residents' sleeping rooms in a *care* or *treatment occupancy* where overnight sleeping accommodation is provided for more than a total of 10 patients or residents shall conform to Sentences (2) to (13).

2) Except as permitted by Sentence (3), a *floor area* described in Sentence (1) shall be divided into not less than 2 *fire compartments*, each not more than 1 000 m^2 in area.

3) The *floor area* on either side of a *horizontal exit* conforming to Article 3.4.6.10. is permitted to be considered as a *fire compartment* in applying the requirements of this Article.

4) Except as permitted by Sentence (5), *fire separations* separating *fire compartments* required by Sentence (2) shall have a *fire-resistance rating* not less than 1 h.

5) The *fire-resistance rating* of a *fire separation* referred to in Sentence (4) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

6) The travel distance from any point within each *fire compartment* referred to in Sentence (2) to a door to an adjoining *fire compartment* shall be not more than 45 m.

7) Each *fire compartment* referred to in Sentence (2) shall be capable of accommodating, in addition to its own occupants, the occupants of the largest adjacent *fire compartment* based on a clear floor space of 2.5 m^2 per patient in the adjacent *fire compartment*.

8) Except as provided in Sentences (9) to (13), walls between patients' or residents' sleeping rooms and the remainder of the *floor area* shall be constructed as *fire separations* but are not required to have a *fire-resistance rating* unless one is required by other provisions in this Part. (See Note A-3.1.8.1.(1)(b).)

9) The *fire separation* requirements of Sentence (8) do not apply to walls within a group of intercommunicating patients' or residents' sleeping rooms, provided the group of rooms does not

a) contain more than 5 patients or residents, or

b) include storage, bathing or toilet facilities serving persons not occupying the group of rooms.

(See Note A-3.3.3.5.(9).)

10) The *fire separation* requirements of Sentence (8) do not apply to walls within individual *suites* of *care occupancy*.

11) A door in a *fire separation* required by Sentence (8) is permitted to be equipped with a roller latch.

12) Except as permitted by Sentence (13), a *fire separation* required by Sentence (8) shall not have any grilles, louvres or other openings.

13) A door or wall separating a patient's or resident's sleeping room from an ensuite toilet room, shower room or similar ancillary space is permitted to incorporate grilles and louvres, provided

a) the adjacent rooms are not used to store flammable or *combustible* materials, and

b) the openings are located so that smoke cannot pass through these rooms to other parts of the *building*.

(See Note A-3.3.3.5.(13).)

14) Walls between individual *suites* of *care occupancy* and the remainder of the *floor area* in *buildings* of *care occupancy* shall be constructed as *fire separations* with a *fire-resistance rating* not less than that specified for *residential occupancies* in Sentences 3.3.4.2.(1) and (2).

15) Floor assemblies within individual *suites* of *care occupancy* need not be constructed as *fire separations*, provided the *suites* meet the conditions described in Clauses 3.3.4.2.(3)(a) and (b).

16) The *fire-resistance rating* of the *fire separation* required by Sentence 3.3.5.6.(1) is permitted to be waived if the *fire separation* is located between individual *suites* of *care occupancy* and an attached *storage garage* containing not more than 5 vehicles, provided the conditions described in Sentence 3.3.4.2.(4) are met.

17) *Fire dampers* in *fire separations* between *fire compartments* described in Sentence (2) shall be designed to close upon a signal from a *smoke detector* in either *fire compartment*. (See Note A-3.3.3.5.(17).)

3.3.3.6. Areas of Refuge

1) Compartments containing rooms such as operating rooms, recovery rooms, delivery rooms and intensive care units, from which it is impracticable to move patients in an emergency, shall be

a) separated from adjacent spaces by *fire separations* having a *fire-resistance rating* not less than 1 h, and

b) provided with a mechanical air supply so that during a period of 2 h after the start of a fire in another space, the compartments will not contain more than 1% by volume of contaminated air from the fire area.

3.3.3.7. Contained Use Areas

1) A *contained use area* shall conform to Sentences (2) to (5).

2) A *contained use area* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

3) Except as permitted by Sentence (4), a *building* that includes a *contained use area* shall be *sprinklered* throughout.

4) A *contained use area*, in a *building* for which Articles 3.2.2.20. to 3.2.2.93. do not require the installation of an automatic *sprinkler system*, is not required to be *sprinklered* as required by Sentence (3) provided

a) the *building* is designed so that during a period of 2 h after the start of a fire in the *contained use area* other *fire compartments* will not contain more than 1% by volume of contaminated air from the *contained use area*,

b) the *building* is designed so that during a period of 2 h after the start of a fire in another part of the *building* the *contained use area* will not contain more than 1% by volume of contaminated air from the other part of the *building*,

c) all doors are designed to be remotely released in conformance with Sentence 3.3.1.13.(6), and

d) the *contained use area* does not contain any rooms lined with *combustible* padding.

5) A corridor serving a *contained use area* shall have no dead-end portion unless the area served by the dead-end portion has a second and separate *means of egress*.

3.3.4. Residential Occupancy

3.3.4.1. Scope

1) This Subsection applies to *residential occupancies*.

3.3.4.2. Fire Separations

1) Except as permitted by Sentences (2), 3.2.2.9.(2), *suites* of *residential occupancy* shall be separated from each other and the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

2) The *fire-resistance rating* of the *fire separation* required by Sentence (1) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

3) Floor assemblies within a *dwelling unit* need not be constructed as *fire separations* provided the dwelling unit complies with Sentence (6) or

a) the distance between the lowest floor level and the uppermost floor level within the *dwelling unit* is not more than 6 m, and

b) the *dwelling unit* is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than

i) 1 h if the *building* is not *sprinklered* throughout,

ii) 45 min if the *building* is *sprinklered* throughout and it is not more than 3 *storeys* in *building height*, or

iii) 1 h if the *building* is *sprinklered* throughout and it is more than 3 *storeys* in *building height*.

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4) The *fire-resistance rating* of the *fire separation* required by Sentence 3.3.5.6.(1) is permitted to be waived if the *fire separation* is located between a *dwelling unit* and an attached *storage garage* containing not more than 5 vehicles, provided

a) the *dwelling unit* and the attached *storage garage* are *sprinklered*,

b) the *dwelling unit* and the attached *storage garage* are separated from the remainder of the *building* in conformance with Sentences (1) to (3),

c) there are no air duct systems connecting the *storage garage* and the *dwelling unit*,

d) the construction between the *storage garage* and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and

e) every door between the *storage garage* and the *dwelling unit* is

i) tight fitting and weather-stripped to provide an effective barrier against the passage of gas and exhaust fumes,

ii) fitted with a self-closing device, and

iii) not located in a room intended for sleeping.

5) The *fire separation* required by Sentence 3.3.5.6.(1) is not required between a *dwelling unit* and an attached *storage garage*, serving that *dwelling unit* only, provided

a) the *dwelling unit* and its attached *storage garage* are separated from the remainder of the *building* in conformance with Sentences (1) to (3),

b) there are no air duct systems connecting the *storage garage* and the *dwelling unit*,

c) the construction between the *storage garage* and the *dwelling unit* provides an effective barrier to gas and exhaust fumes, and

d) every door between the *storage garage* and the *dwelling unit* is

i) tight fitting and weather-stripped to provide an effective barrier against the passage of gas and exhaust fumes,

ii) fitted with a self-closing device, and

iii) not located in a room intended for sleeping.

6) Floor assemblies within a *dwelling unit* need not be constructed as *fire separations* provided

a) the *dwelling unit* does not

i) exceed 4 *storeys* in height, or

ii) include more than 1 *storey of basement,*

b) the *building* is *sprinklered*,

c) *means of egress* is provided directly to the exterior in accordance with Article 3.3.4.4.,

d) an unenclosed balcony or deck is provided directly accessed from the uppermost floor level, that

i) is not more than 10 m above adjacent ground,

ii) is not less than 1500 mm deep from the outside face of the exterior wall to the inside edge of the balcony with a clear width of not less than 1700 mm, and

iii) provides not less than 2 m^2 of balcony space for each bedroom, and

e) the balcony or deck required by Clause (d), shall be separated from the remainder of the *building* by a *fire separation* with not less than a 1 h *fire-resistance rating*, except

i) the *fire-resistance rating* may be not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for the floor assembly below the *floor area*, and

ii) openings in the *fire separation* may be protected by a water curtain designed in conformance with Sentence 3.2.3.13.(5).

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(see Note A-3.3.4.2.(6))

3.3.4.3. Storage Rooms

1) Sprinklers shall be installed in a storage room provided for the use of tenants in a *residential occupancy* within a *floor area* but not contained within a *suite*.

2) Except as permitted by Sentence (3), a storage room referred to in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

3) The *fire-resistance rating* of the *fire separation* required by Sentence (2) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

4) Except for the storage of *flammable liquids* and *combustible liquids* inside a *building* containing not more than one principal *dwelling unit* and garages or sheds attached to these *dwelling units*, where storage rooms are required by Part 4 of Division B of the Fire By-law for the storage of *flammable liquids* or *combustible liquids* in *residential occupancies*, such rooms shall not be located above or below the *first storey*.

3.3.4.4. Egress from Dwelling Units

1) Single *storey dwelling units* in an apartment *building* need not lead to a *public corridor* or exterior passageway on the same *storey* provided the *dwelling units* are served by private stairways leading directly to a public *access to exit* on the *storey*

a) immediately above, and

b) immediately below.

(See Note A-3.3.4.4.(1).)

2) Except as permitted by Sentences (3), (4), and (7), a *dwelling unit* containing more than one *storey* shall have an *exit* door or an egress door opening directly into a public *access to exit* from the uppermost *storey* and from the lowest *storey* of the *dwelling unit* so that each of these *storeys* is served by an *exit* or egress door located not more than 2.0 m above or below its floor level.

3) A single *exit* is permitted from a *dwelling unit* provided the *exit* is an exterior doorway not more than 2.0 m above adjacent ground level and

a) it is not necessary to travel up or down more than one *storey* to reach the *exit* door,

b) in a *sprinklered building*, it is not necessary to travel up or down more than two *storeys* to reach the *exit* door, provided the travel distance to a single *exit* door does not exceed 25 m, or

c) the uppermost floor level opens to a balcony not more than 6 m above adjacent ground level.

4) An egress door from either the uppermost *storey* or the lowest *storey* of a *dwelling unit*, as required by Sentence (2), need not be provided if that *storey* is served by a stairway that

a) leads to a public *access to exit*,

b) has no direct access to any other *storey* in the *dwelling unit*, and

c) is separated from the other *storeys* in the *dwelling unit* by a *fire separation* having a *fire-resistance rating* not less than 45 min.

5) In a *building* of *residential occupancy* not more than 3 *storeys* in *building height*, a doorway from a *dwelling unit* is permitted to open directly into an *exit* stairway provided the *dwelling unit* has a second and separate *means of egress*.

6) If a *dwelling unit* has a second and separate *means of egress*, one *means of egress* from a *dwelling unit* is permitted to pass through

a) an interior corridor served by a single *exit*,

b) an exterior balcony served by a single *exit* stairway, or

c) an exterior passageway served by a single *exit* stairway.

7) A single *means of egress* is permitted from a *dwelling unit* in a *sprinklered building* if it is not necessary to travel more than 18 m from the most remote point within the *dwelling unit*, and (See Note A-3.3.4.4.(7).)

a) one *storey* up or down, or

b) two *storeys* above the *first storey* of the *building*.

3.3.4.5. Automatic Locking Prohibition

1) Except for hotels and motels, a door opening onto a *public corridor* which provides *access to exit* from a *suite* shall be designed not to lock automatically. (See Note A-3.3.4.5.(1).)

3.3.4.6. Sound Transmission

1) Occupants of *dwelling units* shall be protected from airborne noise in conformance with Section 5.8.

3.3.4.7. Stairs, Ramps, Landings, Handrails and Guards for Dwelling Units

1) Except as required in Article 3.3.4.8., stairs, *ramps*, landings, handrails and *guards* within a *dwelling unit* shall conform to the appropriate requirements in Section 9.8.

2) Exterior stairs, *ramps*, landings, handrails and *guards* serving a single *dwelling unit*, and loads on *guards* serving not more than two *dwelling units*, shall conform to the appropriate requirements in Section 9.8.

3.3.4.8. Protection of Openable Windows

1) Except as provided in Sentence (2), openable windows in *suites* of *residential occupancy* shall be protected by

a) a *guard* with a minimum height of 1 070 mm constructed in accordance with Article 3.3.1.18., or

b) a mechanism that can only be released with the use of tools or special knowledge to control the free swinging or sliding operation of the openable part of the window so as to limit any clear unobstructed opening to not more than 100 mm measured either vertically or horizontally.

2) Windows need not be protected in accordance with Sentence (1) where

a) the only opening having greater dimensions than those allowed by Clause (1)(b) is located higher than 1 070 mm above the finished floor, or

b) the bottom edge of the openable portion of the window is located less than 1 800 mm above the floor or ground on the other side of the window.

3.3.4.9. Resistance to Forced Entry

1) *Dwelling units* shall conform to Article 9.7.2.1. and Subsection 9.7.5.

3.3.5. Industrial Occupancy

3.3.5.1. Scope

1) This Subsection applies to *industrial occupancies*.

3.3.5.2. Fire Extinguishing Systems

1) In addition to other requirements in this By-law for the installation of automatic fire extinguishing systems, an appropriate fire extinguishing system shall be installed in every *industrial occupancy floor area* to provide protection if required by

a) provincial or territorial regulations or other regulatory enactments, or

b) the Fire By-law, in the absence of the regulations or bylaws referred to in Clause (a).

3.3.5.3. Basements

1) A *basement* shall not be used for the storage, manufacture or handling of volatile solids, liquids or gases that generate explosive air-vapour mixtures or for processes that involve explosive dusts.

2) Entrances and *exits* to a *basement* and to rooms containing *building* services shall be separate from the remainder of the *building* in a *building* in which

a) the storage, manufacture or handling of volatile materials can generate explosive air-vapour mixtures, or

b) processes occur that produce explosive dusts.

3) *Basements* and rooms referred to in Sentence (2) shall be separated from the remainder of the *building* with a vapour-tight separation.

3.3.5.4. Repair and Storage Garages

1) If access is provided from a *storage garage* to a stair tower or elevator serving *occupancies* above the level of the *storage garage*, the access shall be through a vestibule conforming to Sentence 3.3.5.7.(4).

2) Treads and landings in interior stairs that extend to the roof of a *storage garage* shall be designed to be free of accumulations of ice and snow.

3) A mechanical *storage garage* not more than 4 *storeys* in *building height*, in which no persons other than parking attendants are permitted above the *street* floor level, need not have a *fire separation* between the *exits* and the remainder of the *building*.

4) A garage shall be provided with natural or mechanical ventilation in conformance with the requirements of Subsection 6.3.1. and Article 6.9.1.2. to prevent excessive accumulation of carbon monoxide, exhaust fumes or flammable and toxic vapours.

5) The clear height in a *storage garage* shall be not less than 2 m.

6) Where garage floors or ramps are 600 mm or more above the adjacent ground or floor level, every opening through such floors and the perimeter of floors and ramps shall be provided with

a) a continuous curb not less than 140 mm high, a *guard* not less than 1 070 mm high, and a vehicle guardrail not less than 500 mm high conforming to Sentence (7), or

b) a full-height wall conforming to Sentence (7).

7) Vehicle guardrails and full-height walls required in Sentence (6) shall be designed and constructed to withstand the loading values stipulated in Sentence 4.1.5.15.(1).

8) **Deleted**.

3.3.5.5. Repair Garage Separation

1) A *repair garage* and any ancillary spaces serving it, including waiting rooms, reception rooms, tool and parts storage areas and supervisory office space, shall be separated from other *occupancies* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

3.3.5.6. Storage Garage Separation

1) Except as permitted by Sentences 3.3.4.2.(4) and (5), a *storage garage* shall be separated from other *occupancies* by a *fire separation* with a *fire-resistance rating* not less than 1.5 h.

3.3.5.7. Vestibules

1) Except as provided in Sentence (2), if access is provided through a *fire separation* between a *storage garage* and a Group A, Division 1 or Group B *occupancy*, the access shall be through a vestibule conforming to Sentence (4).

2) If access is provided through a *fire separation* between a *storage garage* and a Group B, Division 3 *occupancy* with not more than 10 occupants, access need not be through a vestibule, provided the *fire separation* complies with Clauses 3.3.4.2.(5)(b) to (d).

3) In a *building* more than 3 *storeys* in *building height*, access through a *fire separation* between a *storage garage* and a Group A, Division 2, 3 or 4, or a Group C *occupancy*, shall be through a vestibule conforming to Sentence (4).

4) If access is provided through a vestibule, as required by Sentences (1), (3) and 3.3.5.4.(1), the vestibule shall

a) be not less than 1.8 m long,

b) be ventilated

i) naturally to outside air by a vent that has an unobstructed area of not less than 0.1 m^2 for each door that opens into the vestibule but not less than 0.4 m^2, or

ii) mechanically at a rate of 14 m^3/h for each square metre of vestibule floor surface area, and

c) have openings between the vestibule and an adjoining *occupancy* provided with self-closing doors with no hold-open devices.

3.3.5.8. Dispensing of Fuel

1) Facilities for the dispensing of fuel having a *flash point* below 37.8°C shall not be installed above any space intended for *occupancy*.

2) Facilities for the dispensing of fuel having a *flash point* below 37.8°C shall not be installed in any *building*, except that this requirement does not apply to a canopy which is open on not less than 75% of its perimeter.

3.3.5.9. Multiple-Tenant Self-Storage Warehouses

1) Except as provided in Sentence 3.9.3.1.(5) or unless the *building* is *sprinklered* throughout, each individual tenancy in a multiple tenant self storage warehouse classified as an *industrial occupancy* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 45 min.

3.3.5.10. Guards

1) Except where they serve *storage garages*, *guards* in *industrial occupancies* are permitted to consist of

a) a top railing, and

b) one or more intermediate rails spaced such that openings through the *guard* are of a size that prevents the passage of a spherical object whose diameter is 535 mm.

3.3.6. Design of Hazardous Areas

3.3.6.1. Application

1) This Subsection applies to design and fire protection requirements for *buildings* or parts thereof used for the storage, handling, use and processing of *dangerous goods*, including *flammable liquids* and *combustible liquids*, in quantities in excess of those identified in Table 3.2.7.1. of Division B of the Fire By-law. (See Note A-3.3.6.1.(1).)

3.3.6.2. Storage of Dangerous Goods

1) Solid and liquid *dangerous goods* classified as oxidizers or organic peroxides shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

2) Reactive materials shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h. (See Note A-3.3.6.2.(2).)

3) The design of *buildings* or parts thereof used for the storage of *dangerous goods* classified as explosives shall conform to the “Explosives Act” and its Regulations, published by Natural Resources Canada.

4) Where wiring or electrical equipment is located in areas in which flammable gases or vapours, *combustible dusts* or *combustible fibres* are present in quantities sufficient to create a hazard, such wiring and

electrical equipment shall conform to the requirements for hazardous locations as required by the Safety Standards Act and pursuant regulations. (See Note A-3.3.6.2.(4).)

3.3.6.3. Indoor Storage of Anhydrous Ammonia and Flammable, Toxic and Oxidizing Gases

1) Where required by the Fire By-law, cylinders of *dangerous goods* classified as flammable gases stored indoors shall be located in a room

a) that is separated from the remainder of the *building* by a gas-tight *fire separation* having a *fire-resistance rating* of at least 2 h,

b) that is located on an exterior wall of the *building*,

c) that can be entered from the exterior, and

d) whose *closures* leading to the interior of the *building* are

i) equipped with self-closing devices that keep the *closures* closed when not in use, and

ii) constructed so as to prevent the migration of gases from the room into other parts of the *building*.

2) Where required by the Fire By-law, cylinders of anhydrous ammonia or *dangerous goods* classified as toxic or oxidizing gases stored indoors shall be located in a room

a) that is separated from the remainder of the *building* by a gas-tight *fire separation* having a *fire-resistance rating* of at least 1 h,

b) that is located on an exterior wall of the *building*,

c) that can be entered from the exterior, and

d) whose *closures* leading to the interior of the *building* are

i) equipped with self-closing devices that keep the *closures* closed when not in use, and

ii) constructed so as to prevent the migration of gases from the room into other parts of the *building*.

3.3.6.4. Storage and Dispensing Rooms for Flammable Liquids and Combustible Liquids

1) *Fire separations* for rooms where *flammable liquids* and *combustible liquids* are stored are required to be constructed with a *fire-resistance rating* in conformance with Subsection 4.2.9. of Division B of the Fire By-law.

2) Where Class IA or IB liquids specified in Subsection 4.1.2. of Division B of the Fire By-law are dispensed within a storage room, the room shall be designed to prevent critical structural and mechanical damage from an internal explosion in conformance with good engineering practice such as that described in NFPA 68, “Standard on Explosion Protection by Deflagration Venting.” (See Note A-3.3.6.4.(2).)

3.3.6.5. Tire Storage

1) A tire storage area designed to contain more than 375 m^3 of rubber tires shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h. (See Note A-3.3.6.5.(1).)

3.3.6.6. Ammonium Nitrate Storage

1) Where Article 3.2.9.1. of Division B of the Fire By-law applies due to the quantity and nature of the stored product, and as stipulated in Sentences (2) to (6), *buildings* used for the storage of ammonium nitrate shall be classified as *medium-hazard industrial occupancies* (Group F, Division 2).

2) *Buildings* intended for the storage of ammonium nitrate shall be not more than one *storey* in *building* height.

3) *Buildings* intended for the storage of ammonium nitrate shall not

a) have *basements* or crawl spaces, or

b) contain open floor drains, tunnels, elevator pits or other pockets that might trap molten ammonium nitrate.

4) *Buildings* intended for the storage of ammonium nitrate shall have not less than 0.007 m^2 of vent area for each square metre of storage area, unless mechanical ventilation is provided.

5) All flooring in storage areas described in Sentence (1) shall be constructed of *noncombustible* materials.

6) *Buildings* intended for the storage of ammonium nitrate shall be designed to prevent the ammonium nitrate from coming into contact with *building* materials that

a) will cause the ammonium nitrate to become unstable,

b) may corrode or deteriorate by reason of contact with the ammonium nitrate, or

c) will become impregnated with the ammonium nitrate.

(See Note A-3.3.6.6.(6).)

3.3.6.7. Flooring Materials

1) Floors in areas where *dangerous goods* are stored shall be constructed of impermeable materials to prevent the absorption of chemicals.

3.3.6.8. Fire Separations in Process Plants

1) In *process plants*, areas where unstable liquids are handled or where small-scale unit chemical processes occur shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* of not less than 2 h.

3.3.6.9. Basements and Pits

1) *Process plants* where Class I and II *flammable liquids* and *combustible liquids* are handled shall not be constructed with *basements* or covered pits.

3.3.7. Building Security

3.3.7.1. Scope

1) This Subsection is intended to address issues of life safety through the security of buildings.

3.3.7.2. Skylights

1) All openable skylights shall be designed to prevent opening from the outside when in the closed and locked position.

2) All exterior skylight fasteners shall be tamperproof.

3.3.7.3. Doors

1) All entrance and exterior doors to dwelling units, doors between dwelling units and attached garages, and doors which provide direct or indirect access from storage garages to dwelling units shall conform to Subsections 9.6.1. and 9.7.3.

3.3.7.4. Sidelights to Doors

1) All sidelights to doors and all windows adjacent to doors located within 915 mm of the door locks shall conform to Sentence 9.6.1.4.(1).

3.3.7.5. Exterior Sliding Windows

1) In buildings of residential occupancy, all exterior windows with a sliding sash located within 5 m of finished grade, shall be provided with a positive, automatically locking mechanism and installed so that the sliding sash cannot be removed from its frame when in the locked position.

3.3.7.6. Security Gates for Storage Garage

1) Security gates installed at vehicle entrances or at secured areas in storage garages shall comply with the follow provisions.

a) Except as required in Clause (1)(b), a security gate shall be designed and installed with clearance between the moving parts and adjacent surfaces which is sufficient to prevent injury or entrapment and is no grater than 100 mm.

b) If a horizontally sliding security gate opens by sliding into a pocket guard enclosure constructed against a wall,

i) the clearance between the pocket guard enclosure and the wall surface shall be no greater than 25 mm; and

ii) the clearance between and pocket guard enclosure and the gate frame shall be no greater than 25 mm on each side of the gate frame.

c) A security gate shall be designed and installed with

i) a load sensitive device designed to reverse the gate on contact with an obstruction,

ii) a five second audible or visual warning device indicating the opening or closing of the gate, and

iii) a maximum clearance between the gate frame and wall surface of no more than 25 mm.

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3.3.7.7. Security for Storage Garage

1) The provisions of Sentences (2) to (7) shall apply to a *storage garage* with more than 19 parking spaces.

2) If access is provided from a *storage garage* to a stair tower or to an elevator through a vestibule or other intervening room or space, the stair tower, vestibules, and intervening room or space shall

a) be provided with glazing arranged to providing the greatest unobstructed view from the *storage garage* into the stair tower or to the elevator,

b) if required by Subsection 3.2.6. or 3.4.1. to be constructed as a *fire separation* with a *fire-resistance rating*, a vertical *fire separation* containing glazing may be constructed

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i) as a *fire separation* with a *fire-resistance rating* of not less than 1 hr,

ii) with full or half glazed *closures* with a *fire-protection rating* of not less than 45 min between the vestibule or other inventing room or space leading to the stair tower or elevator, and

iii) with a row of sprinkler heads running the full width of the glazing, installed on the garage side of the vestibule at a spacing of 1800 mm on centre parallel to the glass, located between 150 mm to 300 mm perpendicular to the glazing and vertically installed on the garage ceiling in conformance with NFPA requirements.

c) *closures* permitted by Clause (2)(b)(ii) may be glazed with clear wired glass in steel frames or fire protective glazing in fire-resistive frames complying with 3.1.8.16.,

(See Note A-3.3.7.7.(2).)

3) A stair shaft serving a *storage garage* or portion of a *storage garage* with public access and which is connected to a *storey* containing an *occupancy* other than a *storage garage*, shall terminate at that *storey*. (See Note A-3.3.7.7.(3))

4) Except for open-air *storage garages* and *buildings* of *residential occupancy*, a *storage garage* shall be provided with *exits*

a) which only serve the *storage garage,* do not provide a common path of travel for other *floor areas,* and exit directly outside the *building*, or

b) serve the *storage garage* and *floor areas* at or above the *exit* level where

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i) the *exit* from the stair extends to the exterior door without adjoining dead-ends corridors,

ii) interior and exterior doors in the *exit* from the *storage garage* to the exterior are designed to maximize visibility of the egress route, adjoining spaces within the *exit* enclosure, and spaces provided with door opening into the *exit* enclosure,

iii) doors providing access into the *exit* from *floor areas* other than the *storage garage* are provided with hardware to prevent vandalism and unauthorized access to the *building floor area*, and

iv) the *exit* corridor has an average illumination level of at least 220 lx is maintained.

(see Note A-3.3.7.7.(3) and (4))

5) Except as provided in Sentence 3.3.7.7.(6), an exterior stair shaft or elevator vestibule which serves as access to a *storage garage* shall be unenclosed.

6) An enclosed exterior stair shaft or elevator vestibule which serves as access to a *storage garage* shall conform to Clauses (2)(a) and (c) but need not conform to the *fire separation* and *fire-resistance rating* requirements.

7) Where the stair shaft or vestibule in Sentence (5) or (6) is required to have a *fire-resistance rating*, due to spatial separation requirements, the provisions of Clauses (2)(a), (b) and (c) shall apply.

8) Despite the provisions of Sentence 3.2.7.1.(2) and Table 9.34.2.7., *storage garages* shall meet the following average lighting levels measured at floor level

a) 550 lx in the first 15 m of entrance roadway,

b) 110 lx in traffic aisles, and

c) 220 lx in pedestrian access vestibules, stairwells and elevator lobbies.

3.3.7.8. Washrooms in Public Buildings

1) Public access to washrooms in a public *building* shall be located in areas which are open to the public and shall not be located in enclosed stairwells.

3.3.7.9. Mailbox Construction in Multi-Family Buildings

(See Note A-3.3.7.9.)

1) In a *multi-family building* or parts thereof, commonly accessible mailbox assembly serving at least 20 *dwelling unit*s shall

a) be constructed of heavy gauge metal,

b) designed to resist prying and tampering,

c) be well secured to framing members, blocking, or other solid construction,

d) have individual storage compartment access doors made of 16 gauge steel or 4.76 mm thick aluminum,

e) be hinged so that the hinge or hinge pin cannot be removed from the outside when the doors are closed, and

f) be provided with a 5 pin cylinder cam lock that when locked, the bolt will engage with the frame for each storage compartment.

3.3.8. Public Storage Facilities

3.3.8.1. Egress From Storage Lockers

1) Despite the provisions of this By-law, an egress door from a storage locker in a public storage facility is not required to swing on a vertical axis if

a) the *building* is

i) fully *sprinklered*, and

ii) equipped with a fire alarm system in conformance with Subsection 3.2.4.,

b) each storage area is provided with

i) individual storage lockers separated from the remainder of the *floor area* by a solid wall assembly without openings, and

ii) provided with a continuous steel mesh ceiling installed across the entire storage area, #14688

c) the storage locker

i) does not exceed 50 m^2 in *floor area*,

ii) travel distance to the egress door does not exceed 10 m, and

iii) is equipped with a steel mesh ceiling not less than 460 mm below the sprinkler head, and #14688

d) the storage locker door is

i) an overhead door serves a single storage locker, and

ii) equipped with a failsafe locking mechanism.

Section 3.4. Exits

3.4.1. General

3.4.1.1. Scope

1) *Exit* facilities complying with this Section shall be provided from every *floor area* that is intended for *occupancy*.(See Note A-3.4.1.1.(1).)

3.4.1.2. Separation of Exits

1) Except as permitted by Sentence (2), if more than one *exit* is required from a *floor area*, each *exit* shall be separate from every other *exit* leading from that *floor area*.

2) If more than 2 *exits* are provided from a *floor area*, *exits* are permitted to converge in conformance with Sentence 3.4.3.1.(2), provided the cumulative capacity of the converging *exits* does not contribute more than 50% of the total required *exit* width for the *floor area*. #14576

3.4.1.3. Access to Exits

1) *Access to exits* shall conform to Section 3.3.

3.4.1.4. Types of Exit

1) Subject to the requirements of this Section, an *exit* from any *floor area* shall be one of the following, used singly or in combination:

a) an exterior doorway,

b) an exterior passageway,

c) an exterior *ramp*,

d) an exterior stairway,

e) a fire escape (conforming to Subsection 3.4.7.),

f) a *horizontal exit*,

g) an interior passageway,

h) an interior *ramp*, or

i) an interior stairway.

3.4.1.5. Exterior Exit Passageways

1) Access to an exterior *exit* passageway from a *floor area* shall be through *exit* doors at the floor level.

3.4.1.6. Restricted Use of Horizontal Exits

1) Except as permitted by Sentence (2), *horizontal exits* shall not comprise more than one half of the required number of *exits* from any *floor area*.

2) In a hospital or nursing home with *treatment*, *horizontal exits* serving patients' sleeping rooms shall comprise not more than two thirds of the required number of *exits* from any *floor area*. (See Note A-3.4.1.6.(2).)

3.4.1.7. Slide Escapes

1) A slide escape shall not be erected on any *building* as a required *exit*, but is permitted to be provided as an additional egress facility if unusual hazards are foreseen.

3.4.1.8. Transparent Doors and Panels

1) Glass and transparent panels in an *exit* shall conform to the appropriate requirements of Article 3.3.1.20. for glass and transparent panels in an *access to exit*.

3.4.1.9. Mirrors near Exits

1) No mirror shall be placed in or adjacent to any *exit* in a manner that would confuse the direction of *exit*.

3.4.1.10. Combustible Glazing in Exits

1) *Combustible* glazing is not permitted in wall or ceiling assemblies or in *closures* used to construct an *exit* enclosure.

3.4.2. Number and Location of Exits from Floor Areas

3.4.2.1. Minimum Number of Exits

1) Except for *buildings* designed and constructed in accordance with Subsection 3.2.10., and except as permitted by Sentences (2) to (4), every *floor area* intended for *occupancy* shall be served by at least 2 *exits*.

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2) A *floor area* in a *building* not more than 2 *storeys* in *building height*, is permitted to be served by one *exit* provided the total *occupant load* served by the *exit* is not more than 60, and

a) in a *floor area* that is not *sprinklered* throughout, the *floor area* and the travel distance are not more than the values in Table 3.4.2.1.-A, or

b) in a *floor area* that is *sprinklered* throughout

   i) the travel distance is not more than 25 m, and

   ii) the *floor area* is not more than the value in Table 3.4.2.1.-B.

Table 3.4.2.1.-A
Criteria for One Exit (Floor Area Not Sprinklered Throughout)
Forming Part of Sentence 3.4.2.1.(2)

Occupancy* of *Floor Area	**Maximum *Floor Area*, m^2**	**Maximum Travel Distance, m**
Group A	150	15
Group B	75	10
Group C	100	15
Group D	200	25
Group E	150	15
Group F, Division 2	150	10

Group F, Division 3	200	15

Table 3.4.2.1.-B
Criteria for One Exit (Floor Area Sprinklered Throughout)
Forming Part of Sentence 3.4.2.1.(2)

Occupancy* of *Floor Area	**Maximum *Floor Area*, m²**
Group A	200
Group B	100
Group C	150
Group D	300
Group E	200
Group F, Division 2	200
Group F, Division 3	300

3) Except as permitted by Sentence (4), if Sentence (2) permits a single *exit* from a *floor area* classified as Group B or Group C *occupancy*, the *exit* shall be an exterior doorway not more than 1.5 m above adjacent ground level.

4) The requirements of Sentences (1) and (2) are permitted to be waived for *dwelling units* that have an *access to exit* conforming to Sentences 3.3.4.4.(1) to (4) and 3.3.4.4.(7).

5) *Exits* are not required directly from rooftop enclosures that comply with Sentences 3.3.1.3.(8) and (9) or where they are served by *means of egress* in conformance with Sentences 3.3.1.3.(4) to (5).

3.4.2.2. Means of Egress from Mezzanines

1) Except as permitted by Sentences (2) and (3), the space above a *mezzanine* shall be served by *means of egress* leading to *exits* accessible at the *mezzanine* level on the same basis as *floor areas*.

2) The *means of egress* from a *mezzanine* need not conform to Sentence (1), provided

a) the *mezzanine* is not required to terminate at a vertical *fire separation*, as permitted in Sentence 3.2.8.2.(1),

b) the *occupant load* of the *mezzanine* is not more than 60,

c) the area of the *mezzanine* does not exceed the area limits stated in Table 3.4.2.2., and

d) the distance limits stated in Table 3.4.2.2. measured along the path of travel are not exceeded from any point on the *mezzanine* to

   i) an egress door serving the space that the *mezzanine* overlooks, if the space is served by a single egress door, or

   ii) the egress stairway leading to an *access to exit* in the space below if that space is required to be served by 2 or more egress doorways in conformance with Sentence 3.3.1.5.(1).

3) At least half of the required *means of egress* from a *mezzanine* shall comply with Sentence (1) if the *mezzanine* is not required to terminate at a *fire separation* as permitted by Sentence 3.2.8.2.(1).

Table 3.4.2.2.
Criteria for Egress from Mezzanine Space
Forming Part of Sentence 3.4.2.2.(2)

***Occupancy* of Space**	**Maximum Area, m^2**	**Distance Limits, m**
Assembly occupancy	150	15
Residential occupancy	100	15
Business and personal services occupancy	200	25
Mercantile occupancy	150	15
Medium-hazard industrial occupancy	150	10
Low-hazard industrial occupancy	200	15

3.4.2.3. Distance between Exits

1) Except as provided in Sentence (2) and (5), the least distance between 2 *exits* from a *floor area* shall be #14576

a) one half the maximum diagonal dimension of the *floor area*, but need not be more than 9 m for a *floor area* having a *public corridor*, or

b) one half the maximum diagonal dimension of the *floor area*, but not less than 9 m for all other *floor areas*.

(See Note A-3.4.2.3.(1).)

2) *Exits* need not comply with Sentence (1) where

a) the *floor area* is divided so that not less than one third of the *floor area* is on each side of a *fire separation*, and

b) it is necessary to pass through the *fire separation* to travel from one *exit* to another *exit*.

3) The minimum distance between *exits* referred to in Sentence (1) shall be the shortest distance that smoke would have to travel between the *exits*, assuming that the smoke will not penetrate an intervening *fire separation*.

4) Except as provided in Sentence (5), the distance between 2 exterior discharges of *exit* stairs serving the same *floor area* shall be

a) not less than 9 m, or

b) not less than 6 m, where

i) the *building* is *sprinklered* throughout, and

ii) the 2 exterior discharges are located within 15 m of a *street*.

5) The minimum distance between *exits* from a *floor area* and exterior discharges from *exit* stairs serving the same floor area referred to in Sentences (1) and (4) need not exceed 4.5 m where the *building*

a) is of *residential occupancy* throughout,

b) is not more than six storeys in *building height*, and

c) has a *building area* not exceeding 600 m² (see Note 3.4.2.3.(5)).

6) *Exits* within scissor stairs referred to in Sentence (5) shall be constructed with a barrier to continuous air leakage between the stairways which extends from the lowest stair landings to the top of the stairs. #14576

3.4.2.4. Travel Distance

1) Except as permitted by Sentence (2), for the purposes of this Subsection, travel distance means the distance from any point in the *floor area* to an *exit* measured along the path of travel to the *exit*.

2) The travel distance from a *suite* or a room not within a *suite* is permitted to be measured from an egress door of the *suite* or room to the nearest *exit*, provided

a) the *suite* or room is separated from the remainder of the *floor area* by a *fire separation*

   i) having a *fire-resistance rating* not less than 45 min in a *floor area* that is not *sprinklered* throughout, or

   ii) which is not required to have a *fire-resistance rating*, in a *floor area* that is *sprinklered* throughout, and

b) the egress door opens onto

   i) an exterior passageway,

   ii) a corridor used by the public that is separated from the remainder of the *floor area* in conformance with the requirements in Article 3.3.1.4. for the separation of *public corridors*, or

   iii) a *public corridor* that is separated from the remainder of the *floor area* in conformance with Article 3.3.1.4. (see Note A-3.1.8.1.(1)(b)).

3) Travel distance to an *exit* shall be not more than 50 m from any point in a *service space* referred to in Sentence 3.2.1.1.(8).

3.4.2.5. Location of Exits

1) Except as permitted by Sentences (2) and 3.3.2.5.(6), if more than one *exit* is required from a *floor area*, the *exits* shall be located so that the travel distance to at least one *exit* shall be not more than

a) 25 m in a *high-hazard industrial occupancy*,

b) 40 m in a *business and personal services occupancy*,

c) 45 m in a *floor area* that contains an *occupancy* other than a *high-hazard industrial occupancy*, provided it is *sprinklered* throughout,

d) 105 m in any *floor area*, served by a *public corridor*, in which rooms and *suites* are not separated from the remainder of the *floor area* by a *fire separation*, provided

   i) the *public corridor* is not less than 9 m wide,

   ii) the ceiling height in the *public corridor* is not less than 4 m above all floor surfaces,

   iii) the *building* is *sprinklered* throughout, and

   iv) not more than one half of the required egress doorways from a room or *suite* open into the *public corridor* if the room or *suite* is required to have more than one egress doorway,

e) 60 m in any *storage garage* that conforms to the requirements of Article 3.2.2.92., and

f) 30 m in any *floor area* other than those referred to in Clauses (a) to (e).

2) Except for a *high-hazard industrial occupancy*, Sentence (1) need not apply if *exits* are placed along the perimeter of the *floor area* and are not more than 60 m apart, measured along the perimeter, provided each main aisle in the *floor area* leads directly to an *exit*.

3) *Exits* shall be located and arranged so that they are clearly visible or their locations are clearly indicated and they are accessible at all times.

3.4.2.6. Principal Entrances

1) For the purposes of this Section, at least one door at every principal entrance to a *building* providing access from the exterior at ground level shall be designed in accordance with the requirements for *exits*.

2) In a *building* that is not *sprinklered* throughout in accordance with Sentence 3.2.5.12.(1), the principal entrance serving a dance hall or a licensed beverage establishment with an *occupant load* more than 250 shall provide at least one half of the required *exit* width.

3.4.3. Width and Height of Exits

3.4.3.1. Exit Width Based on Occupant Load

1) For the purpose of determining the aggregate width of *exits*, the *occupant load* of every room or *floor area* shall be determined in conformance with Subsection 3.1.17.

2) Except as permitted by Sentence 3.4.3.2.(4), the required *exit* width shall be cumulative if 2 or more *exits* converge.

3.4.3.2. Exit Width

1) Except as permitted by Sentence (3), the minimum aggregate required width of *exits* serving *floor areas* intended for *assembly occupancies*, *residential occupancies*, *business and personal services occupancies*, *mercantile occupancies*, and *industrial occupancies* shall be determined by multiplying the *occupant load* of the area served by

a) 6.1 mm per person for *ramps* with a slope of not more than 1 in 8, doorways, corridors and passageways,

b) 8 mm per person for a stair consisting of steps whose rise is not more than 180 mm and whose *run* is not less than 280 mm, or

c) 9.2 mm per person for

   i) *ramps* with a slope of more than 1 in 8, or

   ii) stairs, other than stairs conforming to Clause (b).

2) The minimum aggregate width of *exits* serving *floor areas* intended for a *care*, *treatment* or *detention occupancy* shall be determined by multiplying the *occupant load* of the area served by 18.4 mm per person.

3) The minimum aggregate width of *means of egress* serving a Group A, Division 4 *occupancy* shall be determined by multiplying the *occupant load* of the area served by

a) 1.8 mm per person for

   i) aisles,

   ii) stairs other than *exit* stairs, and

   iii) *ramps* and passageways in vomitories and *exits*, and

b) 2.4 mm per person for *exit* stairs.

4) Except as required by Sentences 3.4.3.2.(5) and (6), the required *exit* width need not be cumulative in an *exit* serving 2 or more *floor areas* located one above the other.

5) The required *exit* width for an *exit* stair in an assembly hall or *theatre* serving more than one balcony level shall conform to Sentence (6).

6) The required *exit* width for *exit* stairs that serve *interconnected floor space* designed in accordance with Articles 3.2.8.3. to 3.2.8.8. shall be cumulative, unless

a) the stairs provide not less than 0.3 m^2 of area of treads and landings for each occupant of the *interconnected floor space* (see Note A-3.4.3.2.(6)(a)), or

b) *protected floor space*s conforming to Article 3.2.8.5. are provided at each floor level and the *protected floor space* on a floor level has not less than 0.5 m^2 of space for each occupant of that floor level of the *interconnected floor space*.

(See Note A-3.4.3.2.(6).)

7) If more than one *exit* is required, every *exit* shall be considered as contributing not more than one half of the required *exit* width.

8) The minimum widths of *exits* shall conform to Tables 3.4.3.2.-A and 3.4.3.2.-B.

Table 3.4.3.2.-A
Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group A, Group B, Division 1, and Groups C, D, E and F Occupancies
Forming Part of Sentence 3.4.3.2.(8)

***Occupancy* Classification**	***Exit* Corridors and Passageways, mm**	***Ramps*, mm**	**Stairs, mm**	**Doorways, mm**
Group A, Group B, Division 1, Group C, Group D, Group E, Group F	1 100	1 100	900(1) 1 100(2)	850

Notes to Table 3.4.3.2.-A:
(1) Serving not more than 2 storeys above the lowest exit level or not more than 1 storey below the lowest exit level.
(2) Serving more than 2 storeys above the lowest exit level or more than 1 storey below the lowest exit level.

Table 3.4.3.2.-B
Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group B, Division 2 and Division 3 Occupancies
Forming Part of Sentence 3.4.3.2.(8)

***Occupancy* Classification**	***Exit* Corridors and Passage-ways, mm**	***Ramps*, mm**		**Stairs, mm**		**Doorways, mm**	
		Not serving patients' or residents' sleeping rooms(1)	**Serving patients' or residents' sleeping rooms(1)**	**Not serving patients' or residents' sleeping rooms(1)**	**Serving patients' or residents' sleeping rooms(1)**	**Not serving patients' or residents' sleeping rooms(1)**	**Serving patients' or residents' sleeping rooms(1)**
Group B, Division 2	1 100	1 100	1 650	900(2) 1 100(3)	1 650	850	1 050
Group B, Division 3							
with more than 10 residents	1 100	1 100	1 100	900(2) 1 100(3)	1 100(2) 1 650(3)	850	850
with not more than 10 residents	1 100	1 100	1 100	900(2) 1 100(3)	900(2) 1 100(3)	850	850

Notes to Table 3.4.3.2.-B:
(1) Minimum widths of ramps, stairs and doorways do not apply within individual suites of care occupancy.
(2) Serving not more than 2 storeys above the lowest exit level or not more than 1 storey below the lowest exit level.
(3) Serving more than 2 storeys above the lowest exit level or more than 1 storey below the lowest exit level.

3.4.3.3. Exit Width Reduction

1) Except as permitted by Sentences (2) and (4), no fixture, turnstile or construction shall project into or be fixed within the required width of an *exit*.

2) Swinging doors in their swing shall not reduce the required width of *exit* stairs or landings to less than 750 mm or reduce the width of an *exit* passageway to less than the minimum required width.

3) Doors shall be installed so that, when open, they do not diminish nor obstruct the required width of the *exit*.

4) Handrails and construction below handrails, including handrail supports and stair stringers, shall not project more than 100 mm into the required width of a *means of egress*.

3.4.3.4. Headroom Clearance

(See Note A-3.4.3.4.)

1) Except as permitted by Sentences (4) and (5), every *exit* shall have a clear height over the clear width of the *exit* of not less than 2 050 mm.

2) The clear height of stairways shall be measured vertically over the clear width of the stairway, from the straight line tangent to the tread and landing nosings to the lowest element above. (See Note A-9.8.7.4.)

3) The clear height of landings shall be measured within the clear width of the landing vertically to the lowest element above.

4) Except as permitted by Sentence (5), the headroom clearance for doorways shall be not less than 2 030 mm.

5) No door closer or other device shall be installed so as to reduce the headroom clearance of a doorway to less than 1 980 mm.

3.4.4. Fire Separation of Exits

3.4.4.1. Fire-Resistance Rating of Exit Separations

1) Except as permitted by Sentences (2), 3.3.5.4.(3), 3.4.4.2.(2) and 3.4.4.3.(1), every *exit* shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required by Subsection 3.2.2., but not less than 45 min, for

a) the floor assembly above the *storey*, or

b) the floor assembly below the *storey*, if there is no floor assembly above.

2) The *fire-resistance rating* of the *fire separation* referred to in Sentence (1) need not be more than 2 h.

3) If an *exit* stair in an assembly hall or *theatre* serves more than one balcony level, the *exit* stair shall be separated from the remainder of the *building* in conformance with Sentence (1).

3.4.4.2. Exits through Lobbies

1) Except as permitted by Sentence (2), no *exit* from a *floor area* above or below the *first storey* shall lead through a lobby.

2) Not more than one *exit* from a *floor area* is permitted to lead through a lobby, provided

a) the lobby floor is not more than 4.5 m above *grade*,

b) the path of travel through the lobby to the outdoors is not more than 15 m,

c) the adjacent rooms or premises having direct access to the lobby do not contain a *care*, *residential* or *industrial occupancy*,

d) the lobby is not located within an *interconnected floor space* other than as described in Sentence 3.2.8.2.(6),

e) the lobby conforms to the requirements for *exits*, except that

   i) rooms other than *service rooms* and storage rooms are permitted to open onto the lobby,

   ii) the *fire separation* between the lobby and a room used for the sole purpose of control and supervision of the *building* need not have a *fire-resistance rating*,

   iii) the *fire separation* between the lobby and adjacent *occupancies* that are permitted to open onto the lobby need not have a *fire-resistance rating* provided the lobby and adjacent *occupancies* are *sprinklered*, and

iv) passenger elevators are permitted to open onto the lobby, provided the elevator doors are designed to remain closed except while loading and unloading passengers, and

(see Note A-3.4.4.2.(2)(e))

f) a *fire separation*, constructed in accordance with Sentence 3.4.4.1.(1), is maintained between the lobby and any *exit* permitted by this Sentence to lead through the lobby.

3.4.4.3. Exterior Passageway Exceptions

1) The requirements of Sentences 3.4.4.1.(1) and 3.2.3.13.(1) and (3) do not apply to an exterior *exit* passageway provided

a) not less than 50% of the exterior side is open to the outdoors, and

b) an *exit* stair is provided at each end of the passageway.

3.4.4.4. Integrity of Exits

1) A *fire separation* that separates an *exit* from the remainder of the *building* shall have no openings except for

a) standpipe and sprinkler piping,

b) electrical wires and cables, totally enclosed *noncombustible* raceways and *noncombustible* piping that serve only the *exit*,

c) openings required by the provisions of Subsection 3.2.6.,

d) *exit* doorways, and

e) wired glass and glass block permitted by Article 3.1.8.16., and

f) wires, cables, totally enclosed *noncombustible* raceways, and distributed antenna for a radio antenna system conforming to Sentence 3.2.5.20.(1).

2) *Exits* within scissors stairs and other contiguous *exit* stairways shall be separated from each other by a smoke-tight *fire separation* having a *fire-resistance rating* not less than that required for the floor assembly through which they pass.

3) *Fire separations* separating contiguous stairs described in Sentence (2) shall not be pierced by doorways, ductwork, piping or any other openings that affect the continuity of the separation.

4) A fuel-fired *appliance* shall not be installed in an *exit*.

5) An *exit* shall not be used as a *plenum* for a heating, ventilating or air-conditioning system.

6) An *exit* shall be designed for no purpose other than for exiting, except that an *exit* is permitted also to be designed to serve as an access to a *floor area*.

7) A *service room* shall not open directly into an *exit*.

8) Storage rooms, washrooms, toilet rooms, laundry rooms and similar ancillary rooms shall not open directly into an *exit*.

9) *Service spaces* referred to in Sentence 3.2.1.1.(8) shall not open directly into an *exit*.

3.4.5. Exit Signs

3.4.5.1. Exit Signs

1) Every *exit* door shall have an *exit* sign providing visual information placed over or adjacent to it if the *exit* serves

a) a *building* more than 2 *storeys* in *building height*,

b) a *building* having an *occupant load* of more than 150, or

c) a room or *floor area* that has a fire escape as part of a required *means of egress*.

2) Every *exit* sign providing visual information shall

a) be visible on approach to the *exit*,

b) consist of a green and white or lightly tinted graphical symbol meeting the colour specifications referred to in ISO 3864-1, "Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings," and

c) conform to ISO 7010, "Graphical symbols – Safety colours and safety signs – Registered safety signs," for the following symbols (see Note A-3.4.5.1.(2)(c)):

i) E001 emergency exit (left hand),

ii) E002 emergency exit (right hand),

iii) E005 Direction, arrow (90° increments), safe condition, and

iv) E006 Direction, 45° arrow (90° increments), safe condition.

3) Internally illuminated *exit* signs shall be continuously illuminated and

a) where illumination of the sign is powered by an electrical circuit, be constructed in conformance with CSA C22.2 No. 141, "Emergency lighting equipment," or

b) where illumination of the sign is not powered by an electrical circuit, be constructed in conformance with CAN/ULC-S572, "Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

(See Note A-3.4.5.1.(3).)

4) Externally illuminated *exit* signs shall be continuously illuminated and be constructed in conformance with CAN/ULC-S572, "Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems." (See Note A-3.4.5.1.(4).)

5) The circuitry serving lighting for externally and internally illuminated *exit* signs shall

a) serve no equipment other than emergency equipment, and

b) be connected to an emergency power supply as described in Article 3.2.7.4.

6) Where no *exit* is visible from a *public corridor*, from a corridor used by the public in a Group A or B *major occupancy*, or from principal routes serving an open *floor area* having an *occupant load* of more than 150, an *exit* sign conforming to Clauses (2)(b) and (c) with an arrow or pointer indicating the direction of egress shall be provided.

7) Except for egress doorways described in Sentence 3.3.2.4.(4), an *exit* sign conforming to Sentences (2) to (5) shall be placed over or adjacent to every egress doorway from rooms with an *occupant load* of more than 60 in Group A, Division 1 *occupancies*, dance halls, licensed beverage establishments, and other similar *occupancies* that, when occupied, have lighting levels below that which would provide easy identification of the egress doorway.

3.4.5.2. Exit Signs with Tactile Information

1) An *exit* sign displaying the word "EXIT" in tactile form that complies with Subsection 3.8.3. shall be mounted on the approach side of *exit* doors described in Sentence 3.4.5.1.(1), in the direction of travel to the *exit*.

3.4.5.3. Signs for Stairs and Ramps at Exit Level

1) In a *building* more than 2 *storeys* in *building height*, any part of an *exit ramp* or stairway that continues up or down past the lowest *exit level* shall have a posted sign clearly indicating that it does not lead to an *exit*.

3.4.6. Types of Exit Facilities

(See Note A-3.4.6.)

3.4.6.1. Slip Resistance of Ramps and Stairs

1) The surfaces of *ramps*, and landings and treads

a) shall have a finish that is slip resistant, and

b) if accessible to the public, shall have either a colour contrast or a distinctive pattern, readily visible from both directions of travel, to demarcate the leading edge of the tread and the leading edge of the landing, as well as the beginning and end of a *ramp*.

2) Treads and landings of exterior *exit* stairs more than 10 m high shall be designed to be free of ice and snow accumulations.

3.4.6.2. Minimum Number of Risers

1) Except as permitted by Sentence 3.3.2.15.(1), every *flight* of interior stairs shall have not less than 3 risers.

3.4.6.3. Maximum Vertical Rise of Stair Flights and Required Landings

1) No *flight* of stairs shall have a vertical rise of more than 3.7 m between floors or landings, except that a *flight* of stairs serving as an *exit* in a Group B, Division 2 *occupancy* shall have a vertical rise not more than 2.4 m between floors or landings.

2) Except as provided in Sentence (3), a landing shall be provided

a) at the top and bottom of each *flight* of interior and exterior stairs,

b) at the top and bottom of every section of *ramp*,

c) where a doorway opens onto a stair or *ramp*,

d) where a *ramp* opens onto a stair, and

e) where a stair opens onto a *ramp*.

3) A landing may be omitted at the bottom of an exterior stair or *ramp*, provided there is no gate, door or fixed obstruction within the lesser of

a) the width of the stair or *ramp*, or

b) 1 100 mm.

3.4.6.4. Dimensions of Landings

(See Note A-3.4.6.4.)

1) Except as provided in Sentence (2), a landing shall be at least as wide and as long as the width of the stairway in which it occurs.

2) In a straight stairway and in a stairway that turns less than 90°, the length of the landing need not be more than the lesser of

a) the required width of stair, or

b) 1 100 mm.

3) The length of a landing shall be measured perpendicular to the nosing of adjacent steps, at a distance equal to half the length required in Sentence (2), from the narrow edge of the landing.

4) Where a doorway or stairway empties onto a *ramp* through a side wall, there shall be a level area extending across the full width of the *ramp*, and for a distance of 300 mm on either side of the wall opening, except one side if it abuts on an end wall.

5) Where a doorway or stairway empties onto a *ramp* through an end wall, there shall be a level area extending across the full width of the *ramp* and along its length for not less than 900 mm.

3.4.6.5. Handrails

1) One handrail shall be provided on stairs that are less than 1 100 mm in width.

2) One handrail shall be provided on each side of

a) stairs that are 1 100 mm or more in width,

b) curved *flights* of any width, and

c) *ramps*.

3) In addition to Sentence (2), intermediate handrails shall be provided so that

a) a handrail is reachable within 750 mm of all portions of the required *exit* width,

b) at least one portion of the stair or *ramp* between two handrails is the minimum width required for stairways or *ramps* (see Sentences 3.4.3.2.(8) and 3.4.3.3.(4)), and

c) all other portions of the stair or *ramp* between two handrails have a clear width of 510 mm or more.

4) Where a stair or *ramp* is wider than its required *exit* width, handrails shall be located along the most direct path of travel. (See Note A-3.4.6.5.(4).)

5) Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have

a) a circular cross-section with an outside diameter not less than 30 mm and not more than 50 mm, or

b) a non-circular cross-section with a perimeter not less than 100 mm and not more than 160 mm and whose largest cross-sectional dimension is not more than 57 mm.

6) The height of handrails on stairs, on aisles with steps and on *ramps* shall be measured vertically from the top of the handrail to

a) a straight line drawn tangent to the tread nosings of the stair or aisle step served by the handrail (see Note A-9.8.7.4.), or

b) the surface of the *ramp*, floor or landing served by the handrail.

7) Except as provided in Sentence (8) and Clause 3.8.3.5.(1)(e), the height of handrails on stairs, on aisles with steps and on *ramps* shall be

a) not less than 865 mm, and

b) not more than 1 070 mm.

8) Handrails installed in addition to required handrails need not comply with Sentence (7).

9) Required handrails shall be continuously graspable throughout the length of

a) a *ramp*, and

b) a *flight* of stairs, from the bottom riser to the top riser.

(See Note A-9.8.7.2.)

10) Except where interrupted by doorways, at least one handrail shall be continuous throughout the length of a stairway or *ramp*, including at landings.

11) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See Note A-3.4.6.5.(11)).

12) At least one handrail at the side of a stairway or *ramp* shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or *ramp*.

13) The clearance between a handrail and any surface behind it shall be not less than

a) 50 mm, or

b) 60 mm if the surface behind the handrail is rough or abrasive.

14) Handrails and their supports shall be designed and constructed to withstand the loading values specified in Sentence 4.1.5.14.(7).

15) A *ramp* shall have handrails on both sides.

3.4.6.6. Guards

1) Every *exit* shall have a wall or a well-secured *guard* on each side, where

a) there is a difference in elevation of more than 600 mm between the walking surface and the adjacent surface, or

b) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2.

(See Note A-9.8.8.1.)

2) Except as required by Sentence (4), the height of *guards* for *exit* stairs and *exit ramps* as well as their landings shall be not less than 1 070 mm.

3) The height of *guards* shall be measured vertically to the top of the *guard* from

a) a line drawn through the outside edges of the stair nosings, or

b) the surface of the *ramp* or landing.

4) The height of *guards* for exterior stairs and landings more than 10 m above adjacent ground level shall be not less than 1 500 mm measured vertically to the top of the *guard* from the surface of the landing or from a line drawn through the outside edges of the stair nosings.

5) Except as provided in Sentence 3.3.1.18.(3) and Articles 3.3.4.7. and 3.3.5.10., *guards* in *exits* shall not have any openings that permit the passage of a spherical object whose diameter is more than 100 mm.

6) In a stairway, a window for which the distance measured vertically between the bottom of the window and a line drawn through the outside edges of the stair nosings is less than 900 mm, or a window that extends to less than 1 070 mm above the landing, shall

a) be protected by a *guard* that is

   i) located approximately 900 mm above a line drawn through the outside edges of the stair nosings, or

   ii) not less than 1 070 mm high measured to the top of the *guard* from the surface of the landing, or

b) be fixed in position and designed to resist the lateral design loads specified for *guards* and walls in Articles 4.1.5.14. and 4.1.5.16.

7) Except for *guards* conforming to Article 3.3.5.10., *guards* shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level being protected by the *guard* facilitates climbing. (See Note A-9.8.8.6.(1).)

3.4.6.7. Ramp Slope

(See also Article 3.8.3.5.)

1) Except as provided in Sentence (2) and (3) and as provided for aisles in Article 3.3.2.5., *ramps* shall have a uniform slope along their length and a maximum slope of 1 in 12.

2) Except as provided in Section 3.8., *ramps* in *industrial occupancies* shall have a uniform slope along their length and a maximum slope of

a) 1 in 6 for interior *ramps*, and

b) 1 in 10 for exterior *ramps*.

3) Curb ramps shall be designed in accordance with Clause 3.8.3.4.(1)(b).

3.4.6.8. Treads and Risers

(See Note A-9.8.4.)

1) Except as permitted for *dwelling units* and by Sentence 3.4.7.5.(1) for fire escapes, steps for stairs shall have a *run* of not less than 280 mm between successive steps.

2) Steps for stairs referred to in Sentence (1) shall have

a) a rise between successive treads not less than 125 mm and not more than 180 mm, and

b) a riser with either no rakeback or a rakeback of not more than 38 mm, or if nosing is provided, the underside of the nosing with an angle of not less than 60° from the horizontal.

3) Except as provided in Article 3.3.4.7. and except for fire escape stairs, stairs that are principally used for maintenance and service, and stairs that serve *industrial occupancies* other than *storage garages*, steps for stairs shall have no open risers.

4) Except in fire escape stairs and where an exterior stair adjoins a *walkway* as permitted in Sentence 3.4.6.3.(3), risers, measured as the vertical nosing-to-nosing distance, shall be of uniform height in any one *flight*, with a maximum tolerance of

a) 5 mm between adjacent treads or landings, and

b) 10 mm between the tallest and shortest risers in a *flight*.

5) Except in fire escape stairs, treads shall have a uniform *run* with a maximum tolerance of

a) 5 mm between adjacent treads, and

b) 10 mm between the deepest and shallowest treads in a *flight*.

6) Treads and risers shall not differ significantly in *run* and rise in successive *flights* in any stair system.

7) The slope of treads or landings shall not exceed 1 in 50.

8) Except as permitted by Sentence (10), the top of the nosing of stair treads shall have a rounded or beveled edge extending not less than 6 mm and not more than 13 mm measured horizontally from the front of the nosing.

9) The front edge of stair treads in *exits* and public *access to exits* shall be at right angles to the direction of *exit* travel.

10) If resilient material is used to cover the nosing of a stair tread, the minimum rounded or beveled edge required by Sentence (8) is permitted to be reduced to 3 mm.

3.4.6.9. Curved Flights in Exits

1) *Exit* stair *flights* shall consist solely of

a) straight *flights*, or

b) curved *flights* complying with Sentence (2).

2) A curved *flight* used as an *exit* shall have

a) a handrail on each side,

b) a minimum *run* of 240 mm,

c) a *run* that conforms to Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread, and

d) an inside radius that is not less than twice the stair width.

3) *Tapered treads* shall have a consistent angle and uniform *run* and rise dimensions in accordance with the construction tolerances stipulated in Article 3.4.6.8. when measured at a point 300 mm from the centre line of the handrail at the narrow end of the tread.

4) All *tapered treads* within a *flight* shall turn in the same direction.

3.4.6.10. Horizontal Exits

1) The *floor area* on each side of a *horizontal exit* shall be sufficient to accommodate the occupants of both *floor areas*, allowing not less than 0.5 m^2 of clear floor space per person, except that 1.5 m^2 shall be provided for each person in a wheelchair and 2.5 m^2 for each bedridden patient.

2) If vestibules, enclosed balconies or bridges are used as parts of a *horizontal exit*, their clear width shall be not less than that of the *exit* doorways opening into them, except that handrails are not permitted to project into this clear width more than 100 mm.

3) In a *horizontal exit* where there is a difference in level between the connected *floor areas*, slopes not more than those specified for *ramps* in Article 3.4.6.7. are permitted to be used.

4) No stairs or steps shall be used in a *horizontal exit*.

5) If 2 doors are provided in a *horizontal exit* that comprises a part of the required number of *exits* from the *floor areas* on both sides of the *exit*

a) the doors shall be mounted adjacent to each other with the door on the right side in the direction of travel through the *horizontal exit* swinging in the direction of travel through the *horizontal exit*, and

b) signs shall be provided on each side of the *horizontal exit* to indicate the door that swings in the direction of travel from that side.

(See Note A-3.4.6.10.(5).)

6) If a *horizontal exit* utilizes bridges between *buildings* or outside balconies, the bridges or balconies shall conform to Article 3.2.3.19.

3.4.6.11. Doors

(See also Sentence 3.8.3.6.(17).)

1) The distance between a stair riser and the leading edge of a door during its swing shall be not less than 300 mm.

2) Except as provided in Sentence (3) and where doorways are used to confine the spillage of *flammable liquids* within a *service room* or within a room in an *industrial occupancy*, a threshold for a doorway in an *exit* shall be not more than 13 mm higher than the surrounding finished floor surface.

3) Except for doors providing access to ground level as required by Clauses 11.3.8.3.(1)(d) and (e), an *exit* door is permitted to open onto not more than one step which shall be not more than 150 mm high where there is a risk of blockage by ice or snow.

4) *Exit* doors shall be clearly identifiable. (See Note A-3.4.6.11.(4).)

5) No door leaf in an *exit* doorway with more than one leaf shall be less than 610 mm wide.

6) Where an *exit* door leading directly to the outside is subject to being obstructed by parked vehicles or storage because of its location, a visible sign or a physical barrier prohibiting such obstructions shall be installed on the exterior side of the door.

3.4.6.12. Direction of Door Swing

1) Except for doors serving a single *dwelling unit* and except as permitted by Sentences (2) and (3), and Article 3.4.5.14. and 3.4.6.20., every *exit* door shall

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a) open in the direction of *exit* travel, and

b) swing on its vertical axis.

2) *Exit* doors need not conform to Sentence (1), where

a) they serve *storage garages* serving not more than one *dwelling unit*,

b) they serve accessory *buildings* serving not more than one *dwelling unit*,

c) they

i) serve storage *suites* not more than 28 m^2 in area that are on the *first storey* in warehousing *buildings*, and

ii) open directly outdoors at ground level, or

d) they serve individual self-service storage units referred to in Section 3.9.

3) Despite the provisions of Sentence (1), principal entrance doors opening to an *acceptable* open space at ground level are not required to swing in the direction of *exit* travel if

a) the *suite* is located at ground level,

b) the *suite* does not serve a Group F, Division 1 *occupancy*, and

c) the *occupant load* is not more than 60 persons.

3.4.6.13. Self-closing Devices

1) An *exit* door that is normally required to be kept closed

a) shall be provided with a self-closing mechanism, and

b) shall never be secured in an open position except as permitted by Sentence 3.1.8.14.(1).

3.4.6.14. Sliding Doors

1) Except as permitted by Sentences (2) and 3.4.6.12.(2), an *exit* door leading directly to outdoors at ground level is permitted to be a sliding door provided it conforms to Sentence 3.3.1.12.(1).

2) An *exit* door serving a Group B, Division 1 *occupancy*, or an *impeded egress zone* in other *occupancies*, is permitted to be a sliding door that does not conform to Sentence 3.3.1.12.(1) provided it is designed to be released in conformance with Article 3.3.1.13.

3.4.6.15. Revolving Doors

1) Except as permitted by Sentence (3), a revolving door, if used, shall

a) be collapsible,

b) have hinged doors providing equivalent exiting capacity located adjacent to it,

c) be used as an *exit* from the ground floor level only,

d) not be used at the foot of any stairway, and

e) have all glass in door leaves and enclosure panels conforming to

i) CAN/CGSB-12.1, “Safety Glazing,” or

ii) CAN/CGSB-12.11-M, “Wired Safety Glass.”

2) Except as permitted by Sentence (3), a revolving door shall not be considered to have an exiting capacity for more than 45 persons.

3) An electrically powered revolving door is not required to conform to Sentences (1) and (2) provided

a) the door leaves will collapse and stop automatic rotation of the door system and not obstruct the doorway if a force not more than that specified in Sentence 3.4.6.16.(2) is applied at the centre of a door leaf,

b) the door leaves are capable of being opened from inside the *building* without requiring keys, special devices, or specialized knowledge of the door opening mechanism,

c) the allowable exiting capacity is based on the clear width of passage through the door enclosure when the doors are fully collapsed,

d) a permanent sign, whose centre line is between 1 000 mm and 1 500 mm above the floor, is placed on each face of each door leaf indicating the method for collapsing the door leaf in an emergency, and

e) glass used for door leaves and enclosure panels is safety glazing conforming to

i) CAN/CGSB-12.1, "Safety Glazing," or

ii) CAN/CGSB-12.11-M, "Wired Safety Glass."

3.4.6.16. Door Release Hardware

1) Except for devices on doors serving a *contained use area* or an *impeded egress zone* designed to be remotely released in conformance with Article 3.3.1.13., and except as permitted by Sentences (5) and (6) and Article 3.4.6.17. and 3.4.6.20., locking, latching and other fastening devices on a principal entrance door to a *building* as well as those on every *exit* door shall include release hardware complying with Clause 3.8.3.8.(1)(b) to permit the door to be readily opened from the inside with not more than one releasing operation and without requiring keys, special devices or specialized knowledge of the door-opening mechanism. (See Note A-3.4.6.16.(1).)

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2) If a door is equipped with a latching mechanism, a device complying with Sentence (3) shall be installed on

a) every *exit* door from a *floor area* containing an *assembly occupancy* having an *occupant load* more than 100,

b) every door leading to an *exit* lobby from an *exit* stair shaft, and every exterior door leading from an *exit* stair shaft in a *building* having an *occupant load* more than 100, and

c) every *exit* door from a *floor area* containing a *high-hazard industrial occupancy*.

3) The device required in Sentence (2) shall

a) extend across not less than one half of the width of the door,

b) release the latch, and

c) allow the door to swing wide open when a force not more than that specified in Sentence 3.8.3.6.(8) is applied to the device in the direction of travel to the *exit*.

4) Except as required by Sentence 3.8.3.6.(8), every *exit* door shall be designed and installed so that, when the latch is released, the door will open under a force of not more than 90 N, applied at the knob or other latch releasing device.

5) Except as permitted in Sentence (8), electromagnetic locks that do not incorporate latches, pins or other similar devices to keep the door in the closed position are permitted to be installed on doors, other than those leading directly from a *high-hazard industrial occupancy*, provided

a) the *building* is equipped with a fire alarm system,

b) the locking device releases upon actuation of the *alarm signal* from the *building*'s fire alarm system,

c) the locking device releases immediately upon loss of power controlling the electromagnetic locking mechanism and its associated auxiliary controls,

d) except for locking devices installed in conformance with Sentence (6), the locking device releases immediately upon actuation of a manually operated switch readily accessible only to authorized personnel,

e) except as provided in Clause (l), a force of not more than 90 N applied to the door opening hardware initiates an irreversible process that will release the locking device within 15 s and not re-lock until the door has been opened,

f) upon release, the locking device must be reset manually by the actuation of the switch referred to in Clause (d),

g) a visual information sign complying with Subsection 3.8.3. is permanently mounted on the door to indicate that the locking device will release within 15 s of applying pressure to the door-opening hardware,

h) a tactile information sign complying with Subsection 3.8.3. is permanently mounted near the door to indicate that the locking device will release within 15 s of applying pressure to the door-opening hardware,

i) the total time delay for all electromagnetic locks in any path of egress to release is not more than 15 s,

j) where a bypass switch is installed to allow testing of the fire alarm system, actuation of the switch

   i) can prevent the release of the locking device by the fire alarm system, as stated in Clause (b), during the test, and

   ii) causes an audible and visible signal to be indicated at the fire alarm annunciator panel required by Article 3.2.4.9. and at the monitoring station specified in Sentence 3.2.4.8.(4),

k) emergency lighting complying with Sentence 3.2.7.3.(1) is provided, and

l) where they are installed on doors providing emergency crossover access to *floor areas* from *exit* stairs directly into a *public corridor*, or publicly accessed *floor area acceptable* to the *Chief Building Official*, in accordance with Article 3.4.6.18.,

   i) the locking device releases immediately upon the operation of a manual station for the fire alarm system located on the wall on the *exit* stair side not more than 600 mm from the door,

   ii) a visual information sign displaying the words “Re-entry door unlocked by fire alarm” that complies with Subsection 3.8.3. is permanently mounted on the door on the *exit* stair side, and

   iii) a tactile information sign displaying the words “Re-entry door unlocked by fire alarm” that complies with Subsection 3.8.3. is permanently mounted near the door on the exit stair side.

(See Notes A-3.4.6.16.(5) and A-3.3.1.13.(7).)

6) Electromagnetic locks that do not incorporate latches, pins or other similar devices to keep the door in the closed position are permitted to be installed on doors in Group B, Division 2 and Division 3 *occupancies*, provided

a) the *building* is

   i) equipped with a fire alarm system, and

   ii) *sprinklered*,

b) the electromagnetic lock releases upon

   i) actuation of the *alarm signal* from the *building*'s fire alarm system,

   ii) loss of its power supply and of power to its auxiliary controls,

   iii) actuation of a manually operated switch that is readily accessible at a constantly attended location within the locked space, and

   iv) actuation of the manual station installed within 0.5 m of each door and equipped with an auxiliary contact, which directly releases the electromagnetic lock,

c) upon release, the electromagnetic lock requires manual resetting by actuation of the switch referred to in Subclause (b)(iii),

d) a visual information sign complying with Subsection 3.8.3. that displays the words “Emergency exit unlocked by fire alarm” is permanently mounted on the door,

e) a tactile information sign complying with Subsection 3.8.3. that displays the words “Emergency exit unlocked by fire alarm” is permanently mounted near the door,

f) the operation of any by-pass switch, where provided for testing of the fire alarm system, sets off an audible signal and a visible signal at the fire alarm annunciator panel and at the monitoring station referred to in Sentence 3.2.4.7.(4), and

g) emergency lighting complying with Sentence 3.2.7.3.(1) is provided.

(See Note A-3.4.6.16.(6).)

7) Except as provided in Sentence 3.4.6.17.(9), door release hardware for the operation of the doors referred to in this Section shall be installed between 900 mm and 1 100 mm above the finished floor.

8) As an alternative to the requirements of Clauses (e), (f) and (g) in Sentence (5), *acceptable* door release hardware for an electromagnetic lock shall be located in close proximity to the egress door and shall be equipped with

a) a push button together with a motion sensor or a pressure sensitive pad that will immediately release the locking device,

b) a push button that is

i) directly connected to the electrical circuit that provides power to the locking device, without any intervening mechanism,

ii) embossed with the word “EXIT” on the activation surface in text with dimensions of no less than 25 mm,

iii) internally illuminated by a permanent LED type light source, and

iv) labeled “DOOR RELEASE” in plain and legible characters, and

c) an electromagnetic lock that

i) will reset automatically, except as provided in (c)(ii),

ii) has an automatic reset feature that is not activated for at least 15 seconds, and

iii) can only be reset by manual means after the activation of the fire alarm system.

(See Note A-3.4.6.16.(8).)

3.4.6.17. Security for Banks and Mercantile Floor Areas

1) If a *building* is *sprinklered* throughout, the requirements of Sentence 3.4.6.16.(1) are permitted to be waived for *exit* and egress doors complying with Sentences (2) to (9) that serve a *floor area* or part of a *floor area* used exclusively for

a) a bank, or

b) the sale of retail merchandise.

(See Note A-3.4.6.17.(1).)

2) *Exit* and egress doors referred to in Sentence (1) shall be designed to prevent locking at any time that the part of the *floor area* that they serve is open to the public.

3) A sign with the words “This door shall not be locked at any time that the public is present” in letters not less than 50 mm high shall be permanently affixed to both sides of doors referred to in Sentence (1).

4) *Exit* and egress facilities complying with Sentences (5) to (9) shall be incorporated for egress by persons other than the public from a *floor area* or a part of a *floor area* referred to in Sentence (1) during times when the public is neither present nor being admitted to the area that they serve.

5) In *exit* and egress facilities referred to in Sentence (4), at least one door at each *exit* and egress location shall

a) be operable in conformance with Sentence 3.4.6.16.(1), or

b) be equipped with locks conforming to Sentence 3.4.6.16.(5) that release immediately

i) if an *alert signal* or *alarm signal* is initiated in the fire alarm system, or

ii) the *sprinkler system* is actuated.

6) A door referred to in Sentence (5) shall be permanently and distinctly marked to indicate that it is an emergency *exit*.

7) *Exit* and egress facilities required for evacuation of persons other than the public from a *floor area* or a part of a *floor area* referred to in Sentence (1) shall have an aggregate width based on the maximum number of persons other than the public and determined in accordance with Articles 3.4.3.1. to 3.4.3.3.

8) Travel distance to an *exit* referred to in Sentence (7) shall not exceed the travel distance determined in accordance with Subsection 3.4.2.

9) *Exit* and egress doors serving a *floor area* or part of a *floor area* referred to in Sentence (1) are permitted to be equipped with locks that require keys, special devices or specialized knowledge of the door opening mechanism, provided

a) the doors do not lead into *exit* stairs,

b) the doors do not lead from *exit* stairs to the exterior of the *building*,

c) the doors do not serve any other *occupancy*,

d) the area served contains at least one telephone

i) that is accessible and in operation at all times,

ii) that is not coin or card operated, and

iii) marked to indicate that it is for emergency use,

e) the area served is illuminated by normal power or by emergency power when the doors are locked,

f) there are provisions that enable an announcement to be made throughout the area served before the locks are fastened, and

g) the locks are designed for use during times that the *building* is not occupied.

3.4.6.18. Emergency Crossover Access to Floor Areas

1) Except as permitted in Sentence (2) and as required by Sentence (6), doors providing access to *floor areas* from *exit* stairs shall not have locking devices to prevent entry into any *floor area* from which the travel distance up or down to an unlocked door is more than 2 *storeys.* #14576

2) Except as required by Sentence (6), doors referred to in Sentence (1) are permitted to be equipped with electromagnetic locks, provided they open directly into a *public corridor*, or publicly accessed *floor area acceptable* to the *Chief Building Official*, and comply with Sentences 3.4.6.16.(5) and (6). #14576

3) Doors referred to in Sentence (1) shall be identified by visual and tactile information signs complying with Subsection 3.8.3. mounted on the stairway side to indicate that they are openable from that side.

4) Except as required by Sentence (6), locked doors intended to prevent entry into a *floor area* from an *exit* stair shall #14576

a) be identified by visual and tactile information signs complying with Subsection 3.8.3. mounted on the stairway side to indicate the location of the nearest unlocked door in each direction of travel, and

b) be openable with a master key that fits all locking devices and is kept in a designated location accessible to firefighters or be provided with a wired glass panel not less than 0.0645 m^2 in area and located not more than 300 mm from the door opening hardware.

5) Where access to *floor areas* through unlocked doors is required by Sentence (1), it shall be possible for a person entering the *floor area* to have access through unlocked doors within the *floor area* to at least one other *exit*.

6) Where a *building* is designed with a single *exit* stair in accordance with Subsection 3.2.10., if a door is installed between the exterior *exit* stairway and the exterior *exit* passageway, the door shall not have locking devices to prevent entry onto the exterior *exit* passageway. #14576

3.4.6.19. Floor Numbering and Identification of Stair Shafts

1) Arabic numerals indicating the assigned floor number in both visual and tactile forms in accordance with Subsection 3.8.3. shall be mounted permanently on the wall on the stair side and on the floor side at the latch side of doors to *exit* stair shafts.

2) Upper case letters indicating the designation assigned to each *exit* stair shaft in both visual and tactile forms in accordance with Subsection 3.8.3. shall be mounted permanently on the wall on the stair side and on the floor side at the latch side of doors to *exit* stair shafts.

3.4.6.20. Security Gates and Doors for Non-Residential Floor Areas

1) This Article applies to building or parts of buildings classified as assembly occupancy, business and personal services occupancy, mercantile occupancy, medium hazard industrial occupancy, and low hazard industrial occupancy.

2) A security gate or security door is permitted to be installed in front of an exterior exit door of the building provided the installation and use conform to the Fire By-law #14688

3.4.7. Fire Escapes

3.4.7.1. Scope

1) Except as permitted by Sentence (2), fire escapes shall not be erected on a *building*.

2) If it is impracticable to provide one or more of the *exit* facilities listed in Article 3.4.1.4., fire escapes conforming to Articles 3.4.7.2. to 3.4.7.7. are permitted to serve *floor areas* in an existing *building* provided the *floor areas* served are not more than

a) 2 *storeys* above ground level in *care*, *treatment* or *detention occupancies*, and

b) 5 *storeys* above ground level in other *occupancies*.

3.4.7.2. Fire Escape Construction

1) Fire escapes shall be of metal or concrete, of the stair type extending to ground level, constructed throughout in a strong substantial manner and securely fixed to the *building*, except that wooden fire escapes are permitted to be used on *buildings* of *combustible construction* if all posts and brackets are not less than 89 mm in their least dimension and all other woodwork is not less than 38 mm in its least dimension.

3.4.7.3. Access to Fire Escapes

1) Access to fire escapes shall be from corridors through doors at floor level, except that access from a *dwelling unit* is permitted to be through a casement window having an unobstructed opening not less than 1 100 mm high by 550 mm wide with a sill height of not more than 900 mm above the inside floor.

2) The clear area of a fire escape balcony onto which a door opens, shall be not less than 1 m^2.

3.4.7.4. Protection of Fire Escapes

1) If a fire escape serves any *storey* above the second, openings located in a zone described in Sentence (2), including access doorways in the exterior walls of the *building* to which the fire escape is attached, shall be protected by *closures* conforming to Subsection 3.1.8.

2) The zone referred to in Sentence (1) extends from any balcony, platform or stairway of a fire escape to a distance

a) 3 m horizontally,

b) 10 m below, or

c) 1.8 m above.

3.4.7.5. Stairs

1) Stairs shall be inclined at an angle of not more than 45° with the horizontal, and their steps shall have risers not more than 210 mm high and treads not less than 220 mm wide exclusive of nosing.

2) Stairway headroom shall be not less than 1 950 mm plus the height of one riser measured vertically above the nosing of any tread or platform.

3) The width of a fire escape shall conform to Articles 3.4.3.1. to 3.4.3.3., except that the width is permitted to be reduced to 550 mm provided the fire escape serves

a) not more than 3 *storeys*, and

b) not more than 15 persons.

4) If a *flight* of stairs leading to the ground at the foot of a fire escape is not fixed in position, it shall be held in the raised position without a latch or locking device, and shall be fitted with a counterbalancing device that will permit it to be easily and quickly brought into position for use.

3.4.7.6. Guards and Railings

1) The open sides of every platform, balcony and stairway forming part of a fire escape shall be protected by *guards* not less than 920 mm high measured vertically above the nosing of any tread or platform.

2) The top rail of a *guard* is permitted to serve as a handrail if it is free from obstructions which could break a handhold.

3) A wall handrail shall be installed if the fire escape is more than 550 mm wide.

4) Unless it can be shown that the size of openings that exceed this limit does not present a hazard, there shall be no opening that permits the passage of a sphere whose diameter is more than 100 mm through a *guard* for a fire escape.

5) Unless it can be shown that the location and size of an opening do not present a hazard, a *guard* for a fire escape shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above a platform or the nosing of any tread will facilitate climbing.

3.4.7.7. Landings

1) Platforms for a fire escape shall be provided in conformance with the requirements for stair landings in Articles 3.4.6.3. and 3.4.6.4.

Section 3.5. Vertical Transportation

3.5.1. General

3.5.1.1. Scope

1) This Section applies to vertical transportation facilities installed in a *building*, including elevators, escalators and dumbwaiters.

2) Elevators in a *building* within the scope of Subsection 3.2.6. shall conform to Articles 3.2.6.4., 3.2.6.5. and 3.2.6.6.

3.5.2. Standards

3.5.2.1. Elevators, Escalators and Dumbwaiters

1) The design, construction, installation and *alteration* of every elevator, escalator and dumbwaiter shall conform to the Safety Standards Act and pursuant regulations.

(See Note A-3.5.2.1.(1).)

2) Before being placed in service, every elevator, escalator or dumbwaiter installation, including safety and control devices, shall be inspected and tested in accordance with the Safety Standards Act and pursuant regulations.

(See Note A-3.5.2.1.(1).)

3) Passenger elevators shall conform to Appendix E of ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

3.5.3. Fire Separations

3.5.3.1. Fire Separations for Elevator Hoistways

1) Except as permitted by Sentence (2), a *vertical service space* used as an elevator hoistway shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.5.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for

a) the floor assembly above the *storey*, or

b) the floor assembly below the *storey*, if there is no floor assembly above.

Table 3.5.3.1.
Fire Separation for Vertical Transportation Space
Forming Part of Articles 3.5.3.1. and 3.5.3.2.

***Fire-Resistance Rating* of *Fire Separation* Required for Floor Assembly**	**Minimum *Fire-Resistance Rating* of *Vertical Service Space* for Elevator Hoistway**	**Minimum *Fire-Resistance Rating* of *Vertical Service Space* for Dumbwaiters**
less than 45 min	45 min	—
45 min	45 min	45 min
1 h	1 h	45 min
1.5 h	1.5 h	1 h
2 h or more	2 h	1 h

2) Passenger elevators, other than those provided for firefighters in accordance with Article 3.2.6.5., are permitted to be located within *interconnected floor space* without being enclosed in a hoistway separated from the remainder of the *building*, provided the elevator machinery is located in a room separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required for hoistways by Sentence (1).

3.5.3.2. Vertical Service Spaces for Dumbwaiters

1) A *vertical service space* containing a dumbwaiter shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.5.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for

a) the floor assembly above the *storey* or

b) the floor assembly below the *storey*, if there is no floor assembly above.

3.5.3.3. Fire Separations for Elevator Machine Rooms

1) Except as permitted by Sentence (2), a room containing elevator machinery shall be separated from all other parts of the *building* by a *fire separation* having a *fire-resistance rating* not less than that required for the *vertical service space* containing the elevator hoistway.

2) A room containing elevator machinery need not be separated from the elevator hoistway that it serves provided the room and the hoistway are separated from all other parts of the *building* by a *fire separation*

having a *fire-resistance rating* not less than that required for the *vertical service space* containing the elevator hoistway.

3.5.4. Dimensions and Signs

3.5.4.1. Elevator Car Dimensions

1) Except as provided in Sentence (2), if one or more elevators are provided in a *building*, at least one elevator on each *storey* with access to an elevator shall have inside dimensions that will accommodate and provide adequate access for a patient stretcher 2 010 mm long and 610 mm wide in the prone position. (See Note A-3.5.4.1.(1).)

2) The inside dimensions stipulated in Sentence (1) do not apply to limited-use/limited-application elevators designed and installed in accordance with ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

3) An elevator satisfying the requirements of Sentence (1) shall be clearly identified on the main entrance level of the *building*.

3.5.4.2. Floor Numbering

1) Arabic numerals indicating the assigned floor number shall be mounted permanently on both jambs of passenger elevator hoistway entrances in conformance with Appendix E of ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators."

Section 3.6. Service Facilities

3.6.1. General

3.6.1.1. Scope

1) The provisions of this Section apply to *horizontal service spaces*, *vertical service spaces*, *attic or roof spaces*, ducts, crawl spaces, shaft spaces, *service rooms*, and mechanical penthouses, and facilities contained therein.

3.6.1.2. Electrical Wiring and Equipment

1) The installation of electrical wiring and electrical equipment shall conform to the requirements of the Safety Standards Act and pursuant regulations.

3.6.1.3. Lightning Protection Systems

1) A lightning protection system, when provided, shall conform to the requirements of CAN/CSA-B72-M, "Installation Code for Lightning Protection Systems."

3.6.1.4. Storage Use Prohibition

1) *Service spaces* shall not be designed to facilitate subsequent use as storage space.

3.6.1.5. Appliances Installed outside a Building

1) A fuel-fired *appliance* installed on the roof of a *building* or in another location outside the *building* shall be installed not less than

a) 1.2 m from a property line, measured horizontally, and

b) 3 m from an adjacent wall of the same *building* if that wall contains any opening within 3 *storeys* above and 5 m horizontally from the *appliance*, unless every opening within these limits is protected by

   i) a *closure* having a *fire-protection rating* not less than 45 min determined in accordance with Article 3.1.8.4., or

ii) a wired glass assembly permitted for use in a vertical *fire separation* and described in Article D-2.3.15. of Appendix D.

3.6.2. Service Rooms

3.6.2.1. Fire Separations around Service Rooms

1) Except as permitted by Sentences (2), (8), (9) and (10), fuel-fired *appliances* shall be installed in *service rooms* separated from the remainder of the *building* by *fire separations* having a *fire-resistance rating* not less than 1 h.

2) Except as required by Sentence (3), a fuel-fired *appliance* that serves only one room or *suite* is not required to be installed in a *service room* separated from the remainder of the *building*.

3) A solid-fuel-burning *appliance* shall not be located in a *repair garage*, a *storage garage*, or any other location where it could be exposed to flammable vapours or gases, unless

a) it is enclosed in a *service room* that is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h,

b) it is supplied with combustion air directly from outside the *building*, and

c) the heat that it generates is supplied indirectly to the space served by means of ducts or piping.

4) A *service room* containing an incinerator shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 2 h.

5) Equipment that uses a liquid having a *flash point* below 93.3°C shall be installed in a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

6) Electrical equipment that is required to be located in a *service room* according to the Safety Standards Act and pursuant regulations shall be installed in a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

7) Except as permitted by Sentence (8), in a *storey* that is not *sprinklered* throughout, a *service room* that contains service equipment other than that addressed by Sentences (1) to (6) shall be separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h.

8) Where a *service room* contains a limited quantity of service equipment, and the service equipment neither constitutes a fire hazard nor is essential to the operation of fire safety systems in the *building*, the requirements for a *fire separation* shall not apply.

9) A *fire separation* is not required between a fireplace and the space it serves.

10) A *fire separation* is not required between a rooftop *appliance* and the *building* it serves.

3.6.2.2. Service Rooms under Exits

1) A *service room* containing service equipment subject to possible explosion, such as *boilers* operating in excess of 100 kPa (gauge) and some types of refrigerating machinery and transformers, shall not be located directly under a required *exit*.

3.6.2.3. Service Equipment

1) A *service room* containing space heating, space cooling and service water heating *appliances* is permitted to contain other service equipment such as electrical service equipment.

3.6.2.4. Incinerator Rooms

1) A *service room* containing an incinerator shall not contain other fuel-fired *appliances*.

3.6.2.5. Storage of Combustible Refuse and Recycling

1) Except as required by Sentence 3.6.3.3.(9), a room for the temporary storage of *combustible* refuse and materials for recycling shall be

a) separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h, except that a *fire separation* with a *fire-resistance rating* not less than 45 min is permitted where the *fire-resistance rating* of the floor assembly is not required to exceed 45 min, and

b) *sprinklered*.

(See Note A-3.6.2.5.(1).)

3.6.2.6. Door Swing for Service Rooms

1) A swing-type door from a *service room* containing a *boiler* or incinerator shall swing outward from the room, except that the door shall swing inward if the door opens onto a corridor or any room used for an *assembly occupancy*. (See also Sentence 3.4.4.4.(7).)

3.6.2.7. Electrical Equipment Vaults

1) An electrical equipment vault required by the Safety Standards Act and pursuant regulations shall conform to Sentences (2) to (8).

2) An electrical equipment vault referred to in Sentence (1) shall be separated from the remainder of the *building* by a *fire separation* of *solid masonry* or concrete construction having a *fire-resistance rating* not less than

a) 3 h if the vault is not protected by an automatic fire extinguishing system, or

b) 2 h if the vault is protected by an automatic fire extinguishing system.

3) If a *building* is *sprinklered* throughout, an electrical equipment vault referred to in Sentence (1) need not be *sprinklered* provided

a) the vault is designed for no purpose other than to contain the electrical equipment, and

b) the vault contains a *smoke detector* which will actuate the *building* fire alarm system in the event of a fire in the vault.

4) Only pipes or ducts necessary for fire protection or the proper operation of the electrical installation shall penetrate the *fire separation* referred to in Sentence (2).

5) Explosion-relief devices and vents or other protective measures conforming to Sentence 3.3.1.21.(3) shall be provided for an electrical equipment vault referred to in Sentence (1) that contains dielectric-liquid-filled electrical equipment. (See Note A-3.6.2.7.(5).)

6) An electrical equipment vault referred to in Sentence (1) shall be provided with a ventilation system designed in conformance with Part 6 to prevent the ambient temperature in the vault from exceeding 40°C.

7) The ventilation system required by Sentence (6) shall be separate from the system for the remainder of the *building* and shall be designed so that it is automatically shut off in the event of a fire in the vault.

8) The floor of an electrical equipment vault referred to in Sentence (1) shall be liquid tight and surrounded by liquid tight walls and sills of sufficient height to confine within the vault all of the liquid from the largest item of electrical equipment, but to a height of not less than 100 mm.

9) Electrical equipment vaults shall be secured against unauthorized entry.

3.6.2.8. Emergency Power Installations

1) Where a generator intended to supply emergency power for lighting, fire safety and life safety systems is located in a *building*, except where such *building* is used solely for the purpose of housing the generator and its ancillary equipment, it shall be located in a room that

a) is separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 2 h, and

b) contains only the generating set and equipment related to the emergency power supply system.

3.6.3. Vertical Service Spaces and Service Facilities

3.6.3.1. Fire Separations for Vertical Service Spaces

1) Except as provided in Articles 3.6.3.3. and 3.6.3.5. and Section 3.5., a *vertical service space* shall be separated from all other portions of each adjacent *storey* by a *fire separation* having a *fire-resistance rating* conforming to Table 3.6.3.1. for the *fire-resistance rating* required by Subsection 3.2.2. for

a) the floor assembly above the *storey*, or

b) the floor assembly below the *storey*, if there is no floor assembly above.

(See Note A-3.6.3.1.(1).)

Table 3.6.3.1.
Fire Separations for Vertical Service Spaces
Forming Part of Sentence 3.6.3.1.(1)

***Fire-Resistance Rating* of *Fire Separation* Required for Floor Assembly**	**Minimum *Fire-Resistance Rating* of *Vertical Service Space***
less than 45 min	—
45 min	45 min
1 h	45 min
1.5 h	1 h
2 h or more	1 h

2) A *vertical service space* that does not extend through the roof of a *building* shall be enclosed at the top with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.

3) A *vertical service space* that does not extend to the bottom of a *building* shall be enclosed at the lowest level with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.

4) A vent from a *vertical service space* not extending to the roof shall be enclosed within the *building* with construction having a *fire-resistance rating* not less than that required for the *vertical service space* walls.

5) Only openings that are necessary for the use of the *vertical service space* shall be permitted through a *vertical service space* enclosure.

3.6.3.2. Foamed Plastic Protection

1) Foamed plastic insulation in a *vertical service space* shall be protected in conformance with Article 3.1.5.15.

3.6.3.3. Linen and Refuse Chutes

1) A linen chute or refuse chute shall

a) be impervious to moisture,

b) have a smooth internal surface,

c) be corrosion-resistant,

d) be constructed of *noncombustible* material, and

e) be located in a shaft in which there are no services other than *noncombustible* drain, waste and vent piping or *noncombustible* water piping.

2) A shaft containing a linen chute or refuse chute shall have a *fire-resistance rating* conforming to Sentence 3.6.3.1.(1), but not less than

a) 1 h if the chute outlet for the discharge room is protected by an automatic, self-latching *closure* held open by a fusible link, or

b) 2 h if no *closure* is provided at the chute outlet into the discharge room.

3) An interior linen chute or refuse chute shall extend not less than 1 m above the roof and shall be vented above the roof with a vent which

a) has an unobstructed area not less than the cross-sectional area of the chute, and

b) is equipped with a cover that will open automatically, or that can be opened manually, in the event of a fire in the chute.

4) Intake openings for a linen chute or a refuse chute shall

a) have an area not more than 60% of the cross-sectional area of the chute, and

b) be fitted with *closures* designed to close automatically and latch after use.

5) Intake openings for a linen chute or a refuse chute shall be located in rooms or compartments that

a) have no dimension less than 750 mm,

b) are separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 45 min,

c) are designed for no other purpose, and

d) do not open directly into an *exit*.

6) Sprinklers shall be installed at the top of each linen chute or refuse chute, at alternate floor levels and in the room or bin into which the chute discharges.

7) The room into which a linen chute discharges shall be separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h.

8) A refuse chute shall be equipped at the top with spray equipment for washing-down purposes.

9) A refuse chute shall discharge only into a room or bin separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 2 h.

10) The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying, be impervious to moisture and be equipped with a water connection and floor drain for washing-down purposes.

11) A room into which a refuse chute discharges shall contain no service equipment that is not related to refuse handling and disposal.

3.6.3.4. Exhaust Duct Negative Pressure

1) If a *vertical service space* contains an *exhaust duct* that serves more than one *fire compartment*,

a) the duct shall have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure, and

b) the individual *fire compartments* shall not have individual fans that exhaust directly into the duct in the *vertical service space*.

3.6.3.5. Grease Duct Enclosures

(See Note A-3.6.3.5.)

1) Except as provided in Sentence (2), *fire separations* enclosing grease ducts for commercial cooking operations shall conform to NFPA 96, “Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.”

2) The *fire-resistance rating* of field-applied and factory-built grease duct enclosure assemblies shall be determined in conformance with CAN/ULC-S144, "Standard Method of Fire Resistance Test – Grease Duct Assemblies."

3.6.4. Horizontal Service Spaces and Service Facilities

3.6.4.1. Scope

1) This Subsection applies to *horizontal service spaces* and service facilities, including ceiling spaces, duct spaces, crawl spaces and *attic or roof spaces*.

3.6.4.2. Fire Separations for Horizontal Service Spaces

1) Except as provided in Article 3.6.3.5., a *horizontal service space* that penetrates a required vertical *fire separation* shall be separated from the remainder of the *building* it serves in conformance with Sentence (2).

2) If a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, this space need not be divided at the *fire separation* as required by Article 3.1.8.3. provided the construction between this space and the space below is a *fire separation* with a *fire-resistance rating* equivalent to that required for the vertical *fire separation*, except that the *fire-resistance rating* is permitted to be not less than 30 min if the vertical *fire separation* is not required to have a *fire-resistance rating* more than 45 min. (See Note A-3.6.4.2.(2).)

3.6.4.3. Plenum Requirements

1) A concealed space used as a *plenum* within a floor assembly or within a roof assembly need not conform to Sentence 3.1.5.18.(1) and Article 3.6.5.1., provided

a) all materials within the concealed space have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50, except for

   i) tubing for pneumatic controls,

   ii) optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes that are used for the transmission of voice, sound or data and conform to Sentences 3.1.4.3.(2) and 3.1.5.21.(2), and

   iii) totally enclosed non-metallic raceways with an FT6 rating, when tested in accordance with Clause 3.1.5.23.(1)(a), in *buildings* required to be of *noncombustible construction* or in *buildings* or parts of *buildings* permitted to be of *encapsulated mass timber construction*, and

   iv) **Deleted**

b) the supports for the ceiling membrane are of *noncombustible* material having a melting point not below 760°C.

2) If a concealed space referred to in Sentence (1) is used as a return-air *plenum* and incorporates a ceiling membrane that forms part of the required *fire-resistance rating* of the assembly, every opening through the membrane shall be protected by a *fire stop flap* that

a) stops the flow of air into the concealed space in the event of a fire,

b) is supported in a manner that will maintain the integrity of the ceiling membrane for the duration of time required to provide the required *fire-resistance rating*,

c) conforms to CAN/ULC-S112.2, "Standard Method of Fire Test of Ceiling Firestop Flap Assemblies," and

d) activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the return-air *plenum*, whether the air duct system is operating or shut down.

3) Notwithstanding Sentence (1), all optical fibre cables and electrical wires and cables installed in a concealed space used as a plenum shall:

a) have a flame spread of no more than 1.5 m, a smoke density of not more than 0.5 at peak optical density and a smoke density not more than 0.15 at average optical density when tested in conformance

with the Horizontal Flame and Smoke Test referenced in Clause 4.11.6. of CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT6 Rating),

b) be located in totally enclosed noncombustible raceways (See Note A-3.1.4.3.(1)(b)(i).), or

c) be located in totally enclosed nonmetallic raceway conforming to Article 3.1.5.23.

4) Notwithstanding Clause (3)(a), minor components of wiring systems such as communication conductors no more than 9 m in length, including the drop down to floor level, that exhibit a vertical char of no more than 1.5 m when tested in conformance with the Vertical Flame Test - Cables in Cable trough in Clause 4.11.4. of the CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables" (FT4 Rating), may be installed in a concealed space used as a plenum.

3.6.4.4. Attic or Roof Space Access

1) An *attic or roof space* more than 600 mm high shall be provided with access from the floor immediately below by a hatchway not less than 550 mm by 900 mm or by a stairway.

3.6.4.5. Horizontal Service Space Access

1) A *horizontal service space*, consisting of ceiling and duct spaces, which is more than 1 200 mm high and 600 mm wide shall have inspection doors not less than 300 mm in both horizontal and vertical dimensions placed so that the entire interior of the duct or space can be viewed.

3.6.4.6. Crawl Space Access

1) A crawl space shall have at least one access opening not less than 550 mm by 900 mm.

3.6.5. Air Duct and Plenum Systems

3.6.5.1. Duct Materials

1) Except as permitted by Sentences (2) to (5) and Article 3.6.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay or other *noncombustible* material.

2) Except as permitted by Sentence (3), ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110, "Standard Methods of Test for Air Ducts,"

b) conform to Article 3.1.5.18. in a *building* required to be of *noncombustible construction* or in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,

c) conform to Subsection 3.1.9.,

d) are used only in horizontal runs in a *building* required to be of *noncombustible construction* or in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*,

e) are not used in vertical runs serving more than 2 *storeys* in a *building* permitted to be of *combustible construction*, and

f) are not used in air duct systems in which the air temperature could be more than 120°C.

3) *Combustible* ducts which are part of a duct system conveying only ventilation air and are contained entirely within a *dwelling unit* need not comply with the requirements of Sentences (1) and (2).

4) Duct sealants shall have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50.

5) Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units shall

a) conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110, "Standard Methods of Test for Air Ducts,"

b) be not more than 4 m long,

c) be used only in horizontal runs, and

d) not penetrate a required *fire separation*.

3.6.5.2. Vibration Isolation Connectors

1) Except as permitted by Sentence (2), vibration isolation connectors in air duct systems shall be *noncombustible*.

2) *Combustible* fabric vibration isolation connectors are permitted provided they

a) are not more than 250 mm long,

b) comply with the flame-resistance requirements of CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films," and

c) are not used in a location where they are exposed to heated air or radiation from heat sources that could cause the exposed surface temperature to be more than 120°C.

3.6.5.3. Tape

1) Tape used to seal joints in air ducts, *plenums* and other parts of air duct systems shall meet the flame-resistance requirements for fabric in CAN/ULC-S109, "Standard Method for Flame Tests of Flame-Resistant Fabrics and Films."

3.6.5.4. Coverings, Linings, Adhesives and Insulation

1) Coverings, linings and associated adhesives and insulation for air ducts, *plenums* and other parts of air duct systems that would have an exposed surface temperature more than 120°C when exposed to heated air or radiation from heat sources shall be of *noncombustible* material.

2) Except as permitted by Sentence (3), *combustible* coverings and linings, including associated adhesives and insulation, shall have

a) a *flame-spread rating* not more than 25 on any exposed surface, or any surface that would be exposed by cutting through the material in any direction, and

b) a smoke developed classification not more than 50.

3) The outer covering of ducts, *plenums* and other parts of air duct systems used within an assembly of *combustible construction* is permitted to have

a) an exposed surface *flame-spread rating* not more than 75, and

b) a smoke developed classification not more than 50.

4) *Combustible* coverings and linings referred to in Sentences (2) and (3) shall not flame, glow, smoulder or smoke when tested in accordance with the method of test in ASTM C411, "Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which the coverings and linings are to be exposed in service.

5) Except as permitted by Sentence (6), foamed plastic insulation shall not be used as part of an air duct system or for insulating an air duct.

6) Foamed plastic insulation is permitted to be installed in a ceiling space that is used as a return air *plenum* provided the foamed plastic insulation is protected from exposure to the *plenum* in accordance with Article 3.1.5.15.

7) *Combustible* coverings and linings of ducts, including associated adhesives and insulation, shall be interrupted where the duct penetrates a *fire separation* and at the immediate area of operation of heat sources in a duct system, including electric resistance heaters or fuel-burning heaters or *furnaces*.

3.6.5.5. Insulation and Coverings

1) Insulation and coverings on pipes in which the temperature of the fluid exceeds 120°C shall

a) be made of *noncombustible* material, or

b) not flame, glow, smoulder or smoke when tested in accordance with ASTM C411, "Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation," at the maximum temperature to which the insulation or covering is to be exposed in service.

2) Except as permitted by Sentence (5), where *combustible* insulation is used on piping in a *horizontal service space* or a *vertical service space*, the insulation and coverings on that piping shall have a *flame-spread rating*, on any exposed surface and on any surface that would be exposed by cutting through the material in any direction,

a) not more than 25 in a *building* required to be of *noncombustible construction* or in a *building* or part of a *building* permitted to be of *encapsulated mass timber construction*, or

b) not more than 75 in a *building* permitted to be of *combustible construction*.

3) Except as permitted by Sentence (5), insulation and coverings on piping located in rooms and spaces other than the *service spaces* described in Sentence (2) shall have a *flame-spread rating* not more than that required for the interior finish of the ceiling of the room or space.

4) Except as permitted by Sentence (5), *combustible* insulation and covering used on piping in a *building* within the scope of Subsection 3.2.6. shall have a smoke developed classification not more than 100.

5) No *flame-spread rating* or smoke developed classification limits are required for *combustible* insulation and coverings used on piping located within a

a) concealed space in a wall,

b) floor slab, or

c) *noncombustible* enclosure.

3.6.5.6. Clearance of Ducts and Plenums

1) The clearance of *furnace plenums* from *combustible* material shall conform to the requirements of the appropriate standards referenced in Sentence 6.2.1.5.(1).

2) If the *plenum* clearance required in accordance with Sentence (1) is not more than 75 mm, the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 450 mm from the *plenum*, and

b) 12 mm at a horizontal distance of 450 mm or more from the *plenum*, except that this clearance is permitted to be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(2).)

3) If the *plenum* clearance required in accordance with Sentence (1) is more than 75 mm but not more than 150 mm, the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 1 800 mm from the *plenum*, and

b) 12 mm at a horizontal distance of 1 800 mm or more from the *plenum*, except that this distance is permitted to be reduced to zero beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(3).)

4) If the *plenum* clearance required in accordance with Sentence (1) is more than 150 mm, the clearance between a *supply duct* and *combustible* material shall be not less than

a) the required *plenum* clearance within a horizontal distance of 1 000 mm from the *plenum*,

b) 150 mm within a horizontal distance between 1 000 mm and 1 800 mm from the *plenum*, and

c) 25 mm at a horizontal distance of 1 800 mm or more from the *plenum*, except that this distance is permitted to be reduced to 8 mm beyond a bend or offset in the duct sufficiently large to shield the remainder of the *supply duct* from direct radiation from the *furnace* heat exchanger.

(See Note A-3.6.5.6.(4).)

5) If a register is installed in a floor directly over a pipeless *furnace*, a double-walled register box with not less than 100 mm between walls, or a register box with the warm-air passage completely surrounded by the cold-air passage, shall be permitted instead of the clearances listed in Sentences (2) to (4).

3.6.5.7. Supply, Return, Intake and Exhaust-Air Openings

1) *Combustible* grilles, diffusers and other devices for supply, return, and exhaust-air openings in rooms shall conform to the *flame-spread rating* and smoke developed classification requirements for the interior finish of the surface on which they are installed.

3.6.5.8. Return-Air System

1) Except as required by Sentences (2) and (3), *return ducts* shall be constructed of material having a *flame-spread rating* not more than 150.

2) If any part of a *return duct* will be exposed to radiation from the *furnace* heat exchanger or other radiating part within the *furnace*, that part of a *return duct* directly above or within 600 mm of the outside *furnace* casing shall be *noncombustible*.

3) *Return ducts* serving solid-fuel-burning *furnaces* shall be constructed of *noncombustible* material.

4) *Combustible return ducts* shall be lined with *noncombustible* material

a) below floor registers,

b) at the bottom of vertical ducts, and

c) under *furnaces* having a bottom return.

3.6.5.9. Location of Exhaust Vents in a Building Containing not more than Two Principal Dwelling Units

1) Exhaust vents serving heating and air conditioning equipment and similar appliances, other than direct vented fireplaces, shall be directed

a) vertically through the roof of a *building*, with the discharge located at least 1.5 m away from any property line, or

b) horizontally through an exterior wall which faces a *street*, with the discharge located at least 3 m away from any property line.

Section 3.7. Health Requirements

3.7.1. Height of Rooms

3.7.1.1. Room and Space Height

1) The height of every room and space shall be sufficient so that the ceiling or ceiling fixtures do not obstruct movement or activities below.

2) The unobstructed height in *dwelling units* shall conform to Subsection 9.5.3.

3.7.2. Plumbing Facilities

3.7.2.1. Plumbing and Drainage Systems

1) Except as provided in Sentence (2) and Sentence (5), for the purpose of this Subsection, the *occupant load* shall be determined in accordance with Subsection 3.1.17.

2) For the purpose of this Subsection, the *occupant load* for *floor areas* that are classified as an *industrial occupancy* is permitted to be based solely on the total number of staff for which the *floor area* is designed, where the *floor area* is only intermittently occupied or where the presence of occupants is transitory.

(See Note A-3.7.2.1.(2).)

3) Except as permitted in Sentence (4), if the installation of a *sanitary drainage system* is not possible because of the absence of a water supply, sanitary privies, chemical closets or other means for the disposal of human waste shall be provided.

4) Waterless urinals are permitted to be used in *buildings* provided with a water supply.

5) For the purposes of this Subsection, an outdoor seating area is permitted to be exempt from the total *occupant load* calculation where:

a) the occupancy is served by at least 2 water closets, or

b) the number of outdoor seats does not exceed 10.

(See Note A-3.7.2.1.(5).)

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3.7.2.2. Water Closets

1) Except as permitted by Sentence (2) and 3.7.2.9., water closets shall be provided for each sex assuming that the *occupant load* is equally divided between males and females, unless the proportion of each sex expected in the *building* can be determined with reasonable accuracy.

2) Both sexes are permitted to be served by a single water closet if the *occupant load* in an *occupancy* referred to in Sentence (4), (8), (10), (11), (12) or (14) is not more than 25.

3) Urinals are permitted to be substituted for two thirds of the number of water closets required by this Article for males, except that if only 2 water closets are required for males, one urinal is permitted to be substituted for one of the water closets.

4) Except as permitted by Sentences (2), (5), (6), (15) and (16) the number of water closets required for *assembly occupancies* shall conform to Table 3.7.2.2.-A.

Table 3.7.2.2.-A
Water Closets for an Assembly Occupancy
Forming Part of Sentence 3.7.2.2.(4)

Number of Persons of Each Sex	Minimum Number of Water Closets	
	Male	Female
1 - 25	1	1
26 - 50	1	2
51 - 75	2	3
76 - 100	2	4
101 - 125	3	5
126 - 150	3	6
151 - 175	4	7
176 - 200	4	8
201 - 250	5	9
251 - 300	5	10
301 - 350	6	11

351 - 400	6	12
Over 400	7, plus 1 for each additional increment of 200 males in excess of 400	13, plus 1 for each additional increment of 100 females in excess of 400

5) The number of water closets required for primary schools and daycare facilities, including daycare facilities for children shall be at least one for each 30 males and one for each 25 females.

6) The number of water closets required for places of worship and undertaking premises shall be at least one for each 150 persons of each sex.

7) The number of water closets required for a *treatment* or *detention occupancy* shall be determined on the basis of the special needs of the *occupancy*.

8) Except as permitted by Sentences (2) and (5), the number of water closets required for a *care* or *residential occupancy* shall be at least one for each 10 persons of each sex.

9) At least one water closet shall be provided for each *dwelling unit*.

10) Except as permitted by Sentence (2) and (15), the number of water closets required for a *business and personal services occupancy* shall conform to Table 3.7.2.2.-B.

Table 3.7.2.2.-B
Water Closets for a Business and Personal Services Occupancy
Forming Part of Sentences 3.7.2.2.(10) and (14)

Number of Persons of Each Sex	Minimum Number of Water Closets for Each Sex
1 - 25	1
26 - 50	2
Over 50	3, plus 1 for each additional increment of 50 persons of each sex in excess of 50

11) Except as permitted by Sentences (2), (14), and (15), the number of water closets required for a *mercantile occupancy* shall be at least one for each 300 males and one for each 150 females.

12) Except as permitted by Sentence (2) and (15), the number of water closets required for an *industrial occupancy* shall conform to Table 3.7.2.2.-C.

Table 3.7.2.2.-C
Water Closets for an Industrial Occupancy
Forming Part of Sentence 3.7.2.2.(12)

Number of Persons of Each Sex	Minimum Number of Water Closets for Each Sex
1 - 10	1
11 - 25	2
26 - 50	3
51 - 75	4
76 - 100	5
Over 100	6, plus 1 for each additional increment of 30 persons of each sex in excess of 100

13) In a *building* whose *floor area* is more than 600 m^2 and that includes one or more individual tenant spaces for a *business and personal services occupancy* or *mercantile occupancy*, water closets shall be located so that they are accessible to the public when the *building* is occupied.

14) The number of water closets required in a *suite* of *mercantile occupancy* whose area is not more than 500 m^2 is permitted to be determined in accordance with Table 3.7.2.2.-B based solely on the total number of staff.

15) Two unisex toilet rooms may serve an *assembly occupancy*, a *business and personal services occupancy*, a *mercantile occupancy*, or an *industrial occupancy* provided

a) the *suite* area of the *occupancy* is not more than 200 m^2,

b) the total *occupant load* of the *occupancy* is no more than 60 persons,

c) each toilet room is fitted out with one water closet and one lavatory, and

d) at least one of the toilet rooms complies with the requirements of Article 3.8.3.13.

16) Three unisex toilet rooms are permitted to serve 61 to 100 persons in an *assembly occupancy* provided

a) each toilet room is fitted out with one water closet and one lavatory, and

b) at least one of the unisex toilet rooms complies with the requirements of Article 3.8.3.13.

3.7.2.3. Lavatories

1) Except as permitted by Sentence (2), at least one lavatory shall be provided in a room containing one or 2 water closets or urinals, and at least one additional lavatory shall be provided for each additional 2 water closets or urinals.

2) Wash fountains in circular form are permitted to be provided in lieu of lavatories required by Sentence (1) provided each 500 mm of circumference is considered to be the equivalent of one lavatory.

3) Any shelf or projection above a lavatory shall be located so that it will not be a hazard.

4) Lavatories required by Sentence (1) shall be equipped with faucets that

a) operate automatically, or

b) have a manual control that

i) complies with Clause 3.8.3.8.(1)(b),

ii) does not require the application of continuous force to maintain water flow, and

iii) where metered, provides at least 10 s of water flow.

3.7.2.4. Safety Glazing

1) Glazing used for a shower or bathtub enclosure shall conform to Class A of CAN/CGSB-12.1, "Safety Glazing."

3.7.2.5. Surface Protection

1) Wall and floor surfaces below the uppermost surfaces of a urinal shall be protected from deterioration by impervious and durable material for a distance from the urinal to a point not less than 900 mm from the projected outline of the urinal on to the wall or floor.

2) Floor surfaces around a water closet shall be protected from deterioration by an impervious and durable material for a distance not less than 900 mm from the projected outline of the water closet on the floor.

3.7.2.6. Floor Drain

1) A floor drain shall be installed in a washroom containing a urinal equipped with an automatic flushing device.

3.7.2.7. Grab Bars

1) Grab bars shall

a) be slip-resistant and free of any sharp or abrasive elements,

b) be mounted on surfaces that are free of any sharp or abrasive elements,

c) be able to resist a load of not less than 1.3 kN applied vertically or horizontally,

d) be 30 mm to 40 mm in diameter, and

e) where mounted on a wall, have a clearance of 35 mm to 45 mm from the wall.

3.7.2.8. Bathtubs and Showers

1) Where a bathtub is installed in a hotel or a motel, it shall

a) have a clear floor space at least 750 mm wide along its length, except that a water closet and a lavatory are permitted to project into this space provided they do not restrict access to the bathtub,

b) have faucets and other controls that conform to Clause 3.8.3.8.(1)(b),

c) have a slip-resistant bottom surface,

d) have grab bars that

i) conform to Sentence 3.7.2.7.(1),

ii) are not less than 1 200 mm long located vertically at the end of the bathtub that is adjacent to the clear floor space, with the lower end between 180 mm and 280 mm above the bathtub rim, and

iii) are not less than 1 200 mm long located horizontally along the length of the bathtub at 180 mm to 280 mm above the bathtub rim, and

e) be capable of being accessed along its full length with no tracks mounted on the bathtub rim.

2) A shower door that swings on a vertical axis shall be capable of opening outwards from a shower stall forming part of a site constructed fixture.

3.7.2.9. Gender Neutral Washroom Requirements

(See Note A-3.7.2.9.)

1) Except as permitted by Sentence (5), a *building* or non-residential *suite* with an occupant load exceeding 200 persons, at least one gender neutral washroom facility complying with Sentences (2) through (6) shall be provided for the *building* or *suite*, providing at least one *accessible* water closet, plus one additional water closet for each additional increment of 100 persons after the first 200 persons. (See Note A-3.7.2.9.(1)).

2) Waterclosets required by Article 3.7.2.2. may be substituted with individual toilet stalls in gender neutral washroom facilities that

a) have partition walls and doors that are full height with a minimum height of 2000 mm (6'-7") and clear space above of at least 50 mm,

b) have a locking devices equipped with

i) display mechanisms to indicates on the outside of the stall door if the stall is occupied, and

ii) means to enable the lock to be released from the outside in an emergency, and

c) have a duress alarm in the common area and within each stall in facilities intended for the use of the public.

3) The entrance serving the gender neutral washroom facilities shall have

a) no door, or

b) fully or partially glazed doors with an open transom or louvered grill.

4) A gender neutral washroom shall

a) provide a minimum 42" zone of circulation space in front of the sink area,

b) be provided with a minimum lighting level of 200 lx at the floor, and

c) be provided with appropriate signage identifying the washroom.

5) Individual self-contained washroom facilities provided with a water closet, lavatory, shelf and mirror may be substituted for gender neutral washroom stalls that would otherwise be required by Sentence (1) on an equal basis.

6) At least one stall or a self-contained washroom facility in a gender neutral washroom provided in accordance with this Article shall be designed to be accessible in conformance with Article 3.8.3.12. or 3.8.3.13. as applicable.

3.7.3. Medical Gas Piping Systems

3.7.3.1. Medical Gas Piping

1) If a non-flammable medical gas piping system is installed, it shall be installed in conformance with

a) CSA Z7396.1, "Medical gas pipeline systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anaesthetic gas scavenging systems," and

b) Part 3 of Division B of the Fire By-law.

Section 3.8. Accessibility

(See Note A-3.8.)

3.8.1. Scope

3.8.1.1. Scope

1) This Section is concerned with the design and construction of *buildings* and *occupancies* to make them *accessible*.

2) *Buildings* and facilities required to be *accessible* in accordance with Subsection 3.8.2. shall be designed in accordance with Subsection 3.8.3.

3) *Alterations* and additions to existing *buildings* shall be provided to the extent required in Division B, Part 11.

4) *Dwelling units* required to be *adaptable dwelling units* shall be designed in accordance with Subsection 3.8.5.

3.8.2. Application

3.8.2.1. Exceptions

(See Note A-3.8.2.1.)

1) Except as required by Sentence (2), the requirements of this Section apply to all *buildings* except

a) detached houses, semi-detached houses, duplexes, triplexes, townhouses, *row housing*, and boarding houses (see Note A-1.4.1.2.(1) of Division A, Secondary Suite),

b) *buildings* of Group F, Division 1 *major occupancy*, and

c) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

2) Adaptable *dwelling units* shall be designed and constructed in accordance with Subsection 3.8.5.

3.8.2.2. Entrances

(See Note A-3.8.2.2.)

1) Except for service entrances and entrances to *suites* described in Clause 3.8.2.3.(2)(l), all pedestrian entrances to an *accessible storey* of a *building* referred to in Sentence 3.8.2.1.(1) shall be *accessible* and shall connect to an *accessible* exterior path of travel complying with Sentence 3.8.2.5.(1).

2) An *accessible* entrance required by Sentence (1) shall be designed in accordance with Subsection 3.8.3.

3) At an *accessible* entrance that includes more than one doorway, only one of the doorways is required to be designed in accordance with Subsection 3.8.3.

4) If a *walkway* or pedestrian bridge connects two *accessible storeys* in different *buildings*, the path of travel from one *storey* to the other *storey* by means of the *walkway* or bridge shall be *accessible*.

3.8.2.3. Areas Requiring Access

(See Note A-3.8.2.3.)

1) Except as permitted by Sentence (2), an *accessible* path of travel from the entrances required by Sentence 3.8.2.2.(1) to be *accessible* shall be provided throughout the entrance *storey* and within all other normally occupied areas of *buildings*. (See Article 11.3.8.1. for additional requirements regarding *floor areas* which an *accessible* path of travel is required.)

2) *Access* is not required

a) to *service rooms*,

b) to elevator machine rooms,

c) to janitors' rooms,

d) to *service spaces*,

e) to crawl spaces,

f) to *attic or roof spaces*,

g) to the floor level above or below the entrance level in *suites* with more than one level, provided the floor level above or below (see Note A-3.8.2.3.(2)(g))

   i) is not served by a ramp, a passenger elevator, a platform-equipped passenger-elevating device, an escalator or an inclined moving walk,

   ii) is less than 600 m^2 in *floor area*,

   iii) contains only facilities that are also contained on the entrance level, and

   iv) does not contain an *assembly occupancy* more than 100 m^2 in *floor area*,

h) within a parking level with no *accessible* parking spaces,

i) within *high-hazard industrial occupancies*,

j) within portions of a *floor area* with fixed seats in an *assembly occupancy* where those portions are not part of the *accessible* path of travel to spaces designated for wheelchair use,

k) within floor levels of a *suite* of *residential occupancy* that are not at the same level as the entry level to the *suite*,

l) within a *suite* of *residential occupancy* that has not been designated by this By-law or an *authority having jurisdiction* to be *accessible* or designed and constructed as an *adaptable dwelling unit*, or

m) in a *building* of *residential occupancy* that is not more than two *storeys* that contains multiple *dwelling units* and common interior space served by a common *building* entrance, on a floor level that

i) is not served by a ramp, passenger elevator, a platform-equipped passenger-elevating device, an escalator or an inclined moving walk,

ii) is less than 600 m^2 in *floor area*,

iii) is not a *building* entrance level, and

iv) does not contain common facilities that are not also provided on an *accessible* level.

3) In an *assembly occupancy*, the number of spaces designated for wheelchair use within rooms or areas with fixed seats shall conform to Table 3.8.2.3. (See also Article 3.8.3.22. for additional requirements.)

4) The number of spaces designated for wheelchair use within waiting rooms or areas with fixed seats shall conform to Table 3.8.2.3. (See Note A-3.8.2.3.(4).) (See also Article 3.8.3.22. for additional requirements.)

5) Except as provided in Sentence (6), in an *assembly occupancy* with more than 25 fixed seats, each row of seats served by two aisles shall have one adaptable seat conforming to Subsection 3.8.3. located adjacent to one of the aisles. (See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

6) At least 5% of the adaptable seats required by Sentence (5) but no more than 20 adaptable seats shall adjoin an *accessible* path of travel. (See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

Table 3.8.2.3.
Designated Wheelchair Spaces
Forming Part of Sentences 3.8.2.3.(3) and (4)

Number of Fixed Seats in Seating Area	Number of Spaces Required for Wheelchairs
2 – 99	2
100 – 499	3, plus 1 for each additional increment of 70 seats in excess of 100
500 - 1 999	9, plus 1 for each additional increment of 80 seats in excess of 500
2 000 - 7 999	28, plus 1 for each additional increment of 95 seats in excess of 2 000
Over 7 999	91, plus 1 for each additional increment of 100 seats in excess of 8 000

3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

1) In a *building* in which a ramp, escalator or inclined moving walk provides access to any floor level, an interior *accessible* path of travel shall also be provided to that floor level. (See Note A-3.8.2.4.(1).)

2) The route from the ramp, escalator or inclined moving walk to the *accessible* path of travel that leads from floor to floor as required by Sentence (1) shall be clearly indicated by appropriate signs.

3.8.2.5. Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

(See Note A-3.8.2.5.)

1) A direct exterior *accessible* path of travel that complies with Subsection 3.8.3. shall be provided between an *accessible* entrance referred to in Article 3.8.2.2. and

a) a designated *accessible* parking area, where provided,

b) an exterior passenger-loading zone, where provided,

c) common ancillary *buildings* on the lot, and

d) a public thoroughfare.(See Note A-3.8.2.5.(1) and (2).)

2) In *storage garages*, an *accessible* path of travel that complies with Subsection 3.8.3. shall be provided between each parking level with parking spaces designated for *persons with disabilities* and all other parts of the *building* required to be provided with *access* in accordance with Subsection 3.8.2. that are served by that *storage garage*. (See Note A-3.8.2.5.(1) and (2).)

3) Exterior passenger-loading zones shall comply with Subsection 3.8.3.

3.8.2.6. Controls and Outlets

1) Except as provided in Sentence 3.5.2.1.(3), controls for the operation of *building* services or safety devices, including electrical switches, thermostats, faucets, door and window hardware and intercom systems and switches, that are intended to be operated generally by the occupant shall comply with Subsection 3.8.3. (See Note A-3.8.2.6.(1).)

2) Electrical outlets that are intended for general occupant use shall be located in conformance with Subsection 3.8.3. (See Note A-3.8.2.6.(2).)

3.8.2.7. Power Door Operators

1) Except as provided in Sentences (2) and (3), and except for doors provided with hold-open devices, doors equipped with a self-closing device shall be equipped with power door operators complying with Subsection 3.8.3. that allow persons to activate the opening of the doors in the intended direction of travel, where the doors are located

a) in an entrance referred to in Article 3.8.2.2., including the interior doors of a vestibule where provided,

b) in an *accessible* path of travel, between the entrance referred to in Clause (a) and the entrance doors to *suites* or rooms served by a *public corridor* or a corridor used by the public (see Note A-3.8.2.7.(1)(b)), and

c) in an entrance to an *accessible* washroom.

2) Only the active leaf in a multiple leaf door in an *accessible* path of travel need conform to the requirements of this Article.

3) Where more than one doorway is provided at an *accessible* entrance, only one of them is required to comply with this Article. (See Note A-3.8.2.7.(3).)

3.8.2.8. Plumbing Facilities

1) Except as permitted by Sentence (3) and (16), at each location where washrooms are provided in a *storey* to which an *accessible* path of travel is required in accordance with Article 3.8.2.3., at least one universal washroom complying with Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(1) to (4).)

2) Except as permitted by Sentence (3), where more than two water closets or a combination of more than one water closet and one urinal are provided in a washroom located in a *storey* to which an *accessible* path of travel is required in accordance with Article 3.8.2.3., at least one water-closet stall shall be *accessible* in accordance with Subsection 3.8.3. (See Note A-3.8.2.8.(1) to (4).)

3) Except as required by Article 3.8.2.13., washrooms located within a *suite* of *residential occupancy* or a *suite* of *care occupancy* need not conform to the requirements of Sentence (1) or (2). (See Note A-3.8.2.8.(1) to (4).)

4) In a *building* in which water closets are required in accordance with Subsection 3.7.2., at least one universal washroom shall be provided in the entrance *storey*, unless

a) an *accessible* path of travel is provided to a universal washroom elsewhere in the *building*, or

b) the water closets required by Subsection 3.7.2. are for *dwelling units* only.

(See Note A-3.8.2.8.(1) to (4).)

5) At least one water-closet stall or enclosure in a washroom required to be *accessible* shall comply with Subsection 3.8.3.

6) Where urinals are provided in an *accessible* washroom, at least one urinal for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 urinals.

7) Where water-closet stalls are provided in an *accessible* washroom, at least one stall for persons with limited mobility conforming to Subsection 3.8.3. shall be provided for every 10 stalls.

8) An *accessible* washroom shall be provided with a lavatory that complies with Subsection 3.8.3.

9) Where mirrors are provided in an *accessible* washroom, at least one mirror shall comply with Subsection 3.8.3.

10) At each location where one or more drinking fountains are provided, at least one of them shall comply with Subsection 3.8.3.

11) At each location where one or more water-bottle filling stations are provided, at least one of them shall comply with Subsection 3.8.3.

12) Except within a *suite* of *care occupancy* or a *suite* of *residential occupancy*, where showers are provided in a *building*, at least one shower stall in each group of showers shall comply with Subsection 3.8.3.

13) At each location where a showering facility is provided for use by the general public or customers, or as part of a common-use area for employees, at least one universal dressing and shower room conforming to Subsection 3.8.3. shall be provided. (See Note A-3.8.2.8.(13).)

14) Where a bathtub is installed in a *suite* of *residential occupancy* required to be *accessible*, it shall comply with Subsection 3.8.3.

15) In *buildings* containing Group A, Group B, Division 2 or Group E *major occupancies* where at least one of these *major occupancies* has an *occupant load* of more than 500, at least one universal washroom on the *storey* on which the main *accessible* entrance to the *building* is located shall incorporate an *accessible* change space conforming to Subsection 3.8.3. (See Note A-3.8.2.8.(15).)

16) In *occupancies* or parts of *occupancies* designed to be *accessible* and used predominantly by children, in patient areas in *treatment occupancies*, and in resident areas in *care occupancies*, it is permissible to design and locate plumbing fixtures and grab bars differently than described in Subsection 3.8.3. to accommodate the special needs of children, patients, residents, and *care* providers.

3.8.2.9. Assistive Listening Systems

1) In a *building* of *assembly occupancy*, all classrooms, auditoria, meeting rooms and *theatres* with an area of more than 100 m^2, including courtrooms of any size, shall be equipped with an assistive listening system complying with Subsection 3.8.3.

2) In each location where information, goods or services are provided to the public at service counters in *buildings* of *assembly occupancy*, at least one of the service counters shall be equipped with

a) an assistive listening system or adaptive technology conforming to Subsection 3.8.3., and

b) an amplification system, where there is a barrier to communication, such as a glass screen.

(See Note A-3.8.2.9.(2).)

3.8.2.10. Signs and Indicators

1) Unless the degree of *access* provided is such as to make these signs unnecessary, signs providing visual information in accordance with Subsection 3.8.3. shall be installed to indicate the location of

a) *accessible* entrances,

b) alternative *access* routes,

c) *accessible* spaces in seating areas,

d) *accessible* refreshment facilities,

e) *accessible* checkout lanes,

f) *accessible* public telephones,

g) *accessible* washrooms,

h) *accessible* showers,

i) *accessible* passenger-elevating devices,

j) *accessible* parking spaces,

k) *accessible* passenger loading zones, and

l) assistive listening systems or adaptive technologies.

2) Where a washroom is not designed to accommodate persons with physical disabilities in a *storey* to which an *accessible* path of travel is required, signs providing visual and tactile information in accordance with Subsection 3.8.3. shall be installed to indicate the location of *accessible* washrooms.

3) Except for doors that serve *service spaces* or are located within a *suite*, signs installed at or near doors shall provide the same information in both visual and tactile forms in accordance with Subsection 3.8.3.

4) Directional signs shall provide visual information in accordance with Subsection 3.8.3. (See Note A-3.8.2.10.(4).)

3.8.2.11. Counters

1) Where a service counter is provided, at least one section of it shall comply with Subsection 3.8.3. (See Note A-3.8.2.11.(1).) (See also Note A-3.8.2.3.)

3.8.2.12. Telephones

1) In each location where one or more public telephones are installed, at least one telephone shall comply with Subsection 3.8.3.

3.8.2.13. Sleeping Rooms and Bed Spaces

1) At least one for every 20 or part thereof of sleeping rooms or bed spaces shall conform to Subsection 3.8.3. where provided in

a) hotels and motels (see also Clause 3.2.4.19.(1)(g) and Sentences 3.2.4.20.(7) and (8)), and

b) not including apartments and condominiums and the *buildings* described in 3.8.2.1.(1)(a), other *buildings* or parts of *buildings* used for *residential major occupancies* (see also Sentence 3.2.4.20.(17)).

3.8.3. Design

3.8.3.1. Design Standards

1) *Buildings* or parts thereof and facilities that are required to be *accessible* shall be designed in accordance with

a) this Subsection, or

b) for each *accessible* application listed independent of other *accessible* applications, the applicable provisions of CSA B651, "Accessible design for the built environment," listed in Table 3.8.3.1..

(See Note A-3.8.3.1.(1).)

Table 3.8.3.1.
Accessible Design Provisions
Forming Part of Sentence 3.8.3.1.(1) and (2)

Accessible **Application (By-law References)**	**Applicable CSA B651 Provisions**
Interior accessible routes (3.8.3.2.)	4.3 and 5.1
Exterior accessible routes (3.8.3.3.)	8.2.1 to 8.2.5 and 8.2.7

Passenger pickup areas (3.8.3.4.)	9.3
Ramps (3.8.3.5.)	5.3 and 5.5
Doors and doorways (3.8.3.6.)	5.2
Passenger-elevating devices (3.8.3.7.)	5.6.2
Operating controls (3.8.3.8.)	4.2
Signage (3.8.3.9.)	4.5 and 9.4
Drinking fountains (3.8.3.10.)	6.1
Washroom facilities (3.8.3.12. to 3.8.3.16.)	6.2 and 6.3
Bathing facilities (3.8.3.17. and 3.8.3.18.)	6.5
Communication (3.8.3.19. and 3.8.3.21.)	6.6
Counters (3.8.3.20. and 3.8.3.21.)	6.7.1
Spaces in seating areas (3.8.3.22.)	6.7.3

2) The design of each accessible application listed in Table 3.8.3.1. shall comply entirely with Clause (1)(a) or Clause (1)(b).

3.8.3.2. Accessible Path of Travel

1) Except as required elsewhere in this Part or as permitted by Sentence (2) and Article 3.8.3.6. pertaining to doorways, the clear width of an *accessible* path of travel shall be not less than 1 000 mm.

2) The clear width of an *accessible* path of travel is permitted to be reduced to not less than 850 mm for a length of not more than 600 mm, provided the clear floor space at either end of the reduced-clear width section is level within a rectangular area

a) with a dimension parallel to each end of the reduced-clear width section is not less than 1 000 mm, and

b) with a dimension perpendicular to each end of the reduced-clear width section is not less than 1 500 mm.

(See Note A-3.8.3.2.(2).)

3) Interior and exterior walking surfaces that are within an *accessible* path of travel shall

a) have no opening that will permit the passage of a sphere more than 13 mm in diameter,

b) have any elongated openings oriented approximately perpendicular to the direction of travel,

c) be stable, firm and slip-resistant,

d) have a cross slope no steeper than 1 in 50,

e) be beveled at a maximum slope of 1 in 2 at changes in level between 6 mm and 13 mm,

f) be provided with sloped floors or *ramps* at changes in level more than 13 mm, and

g) be designed as a ramp complying with this Section where the path of travel has a slope steeper than 1 in 20.

(See Note A-3.8.3.2.(3).)

4) An *accessible* path of travel is permitted to include *ramps*, passenger elevators or other platform-equipped passenger-elevating devices to overcome a difference in level.

5) The width of an *accessible* path of travel that is more than 24 m long shall be increased to not less than 1 700 mm for a length of 1 700 mm at intervals not exceeding 24 m.

6) Where a section of an *accessible* path of travel is less than 1 500 mm wide for a distance of more than 12 m, it shall end in a clear floor space that is

a) not less than 1 700 mm in diameter,

b) not less than 1 700 mm by 1 500 mm, or

c) T-shaped with overall dimensions measuring 1 700 mm wide by 1 500 mm long, where the two arms of the "T" are not less than 1 000 mm wide and extend not less than 300 mm from each side of the base of the "T" and the base is not less than 1 000 mm wide and extends not less than 500 mm from each arm.

(See Note A-3.8.3.2.(6).)

7) An *accessible* path of travel shall be equipped to provide illumination in accordance with Sentences 3.2.7.1.(1) and (2). (See also Sentences 3.2.7.1.(3) and Article 9.34.2.7.)

8) An exterior mechanical lift and its controls provided in accordance with Sentence (4), shall only be provided

a) where existing exterior site constraints make use of a ramp or elevator infeasible, and

b) where sufficiently protected from inclement weather by

i) weather and moisture resistant construction, and

ii) sufficient cover or enclosure so as to ensure its continued safe operation.

(See Note A-3.8.3.2.(8)(a).)

3.8.3.3. Exterior Walks

1) Exterior walks that form part of an *accessible* path of travel shall

a) have a slip-resistant, continuous and even surface,

b) be not less than 1 600 mm wide,

c) have a level area conforming to Clause 3.8.3.5.(1)(c) adjacent to an entrance doorway, and

d) be designed in accordance with Clause 8.2.1 of CSA B651, "Accessible design for the built environment."

3.8.3.4. Passenger-Loading Zones and Parking Requirements

1) If a passenger-loading zone is provided, it shall have

a) an access aisle not less than 1 500 mm wide and 6 000 mm long adjacent and parallel to the vehicle pull-up space,

b) a curb ramp, designed in accordance with Clause 8.3.3. of CSA B651, "Accessible design for the built environment," where there are curbs between the access aisle and the vehicle pull-up space, and

c) a clear height of not less than 2 750 mm at the pull-up space and along the vehicle access and egress routes.

2) Parking stalls for *persons with disabilities* shall comply with the Parking By-law, and shall

a) have a firm, slip-resistant and level surface,

b) be located adjacent to an *accessible* path of travel, and

c) be marked with signage or symbols identifying such stalls as exclusively for the use of *persons with disabilities*.

3) Where parking stalls are provided for *persons with disabilities*, entry and *exit* controls, security controls, ticketing equipment, and pay stations serving such parking stalls shall be designed and installed so that all user functions are located no more than 1 200 mm above the finished paved area, and are *accessible*.

4) This Article does not apply to *existing buildings* except for spaces created by

a) an *addition*,

b) the reconstruction of an existing space, and

c) the conversion of an existing space into an *ancillary residential unit*.

3.8.3.5. Ramps and Stairs

1) Except when designed as a curb ramp in accordance with Clause 3.8.3.4.(1)(b), a *ramp* located in an *accessible* path of travel shall

a) have a clear width not less than 1 000 mm (see Note A-3.4.3.4.),

b) have a uniform slope along its length not more than 1 in 12 (see Note A-3.8.3.5.(1)(b)),

c) have a level area not less than 1 700 mm by 1 700 mm at the top and bottom and at intermediate levels of a *ramp* leading to a door, so that on the latch side the level area extends not less than

i) 600 mm beyond the edge of the door opening where the door opens towards the *ramp*, or

ii) 300 mm beyond the edge of the door opening where the door opens away from the *ramp*,

(see Note A-3.8.3.5.(1)(c)),

d) have a level area not less than 1 350 mm long and at least the same width as the *ramp*

i) at intervals not more than 9 m along its length, and

ii) where there is an abrupt change in the direction of the *ramp*, and

e) except as provided in Sentences (2) and (3), be equipped with handrails conforming to Article 3.4.6.5., except that they shall be not less than 865 mm and not more than 965 mm high, and

f) be equipped with *guards* conforming to Article 3.4.6.6.

2) Handrails installed in addition to required handrails need not comply with the height requirements stated in Clause (1)(e).

3) The requirement for handrails in Clause (1)(e) need not apply to a *ramp* serving as an aisle for fixed seating.

4) The surfaces of *ramps* and landings shall

a) be hard or resilient where the *ramp* is steeper than 1 in 15 (see Note A-3.8.3.5.(4)(a)),

b) have a cross slope no steeper than 1 in 50, and

c) where exposed to water, be designed to drain.

5) *Ramps* and landings not at ground level or adjacent to a wall shall have edge protection consisting of

a) a curb not less than 75 mm high, or

b) a raised barrier or rail located not more than 100 mm from the *ramp* or landing surface.

6) Interior and exterior stairs and ramps that are *accessible* to the public are to be provided with a colour contrast or distinctive pattern, visible from both directions of travel, demarcating the leading edge of treads.

3.8.3.6. Doorways and Doors

1) Except where stated otherwise, this Article applies to swinging and sliding doors.

2) Every doorway that is located in an *accessible* path of travel shall have a clear width not less than 850 mm

a) for swinging doors, when measured from the face of the active leaf, in the open position of 90° to the doorway, to the outside edge of the stop on the door frame, and

b) for sliding doors, when measured from the edge of the door, in the open position, to the outside of the stop on the door frame.

(See Note A-3.8.3.6.(2).)

3) Doorways in a path of travel to at least one bathroom within a *suite* of *residential occupancy* shall have a clear width not less than 850 mm when measured in accordance with Sentence (2). (See Note A-3.8.3.6.(3).)

4) Door-operating devices shall

a) comply with Clause 3.8.3.8.(1)(b), and

b) be operable at a height between 900 mm and 1 100 mm above the floor.

(See also Sentence 3.3.1.13.(4) regarding additional devices.)

(See Note A-3.8.3.6.(4).)

5) A threshold for a doorway referred to in Sentences (2) and (3) shall be not more than 13 mm higher than the finished floor surface and shall be beveled to facilitate the passage of wheelchairs.

6) Power door operators required by Sentence 3.8.2.7.(1) shall

a) activate automatically or through the use of controls that

i) are located in an *accessible* path of travel,

ii) are marked with the International Symbol of Access,

iii) are located clear of the door swing and not less than 600 mm and no more than 1 500 mm from that door swing,

iv) comply with Subclause 3.8.3.8.(1)(a)(iii),

v)are operable from a height between 150 mm and 300 mm as well as between 900 mm and 1 100 mm above the floor, and

vi) are operable by touching or approaching any part of their surface with a fist, arm or foot, and

b) unless equipped with safety sensors,

i) fully open the door in not less than 3 s, and

ii) require a force not more than 65 N to stop movement of the door.

(See Note A-3.8.3.6.(6) and (7).)

7) A cane-detectable *guard* shall be installed on the hinged side of power-assisted doors that swing open into the path of travel. (See Note A-3.8.3.6.(6) and (7).)

8) Except as provided in Sentence (9) and except for a door with a power door operator complying with Sentence (6), when unlatched, a door in an *accessible* path of travel shall open when the force applied to the handle, push plate or latch-releasing device is not more than

a) 38 N in the case of an exterior swinging door,

b) 22 N in the case of an interior swinging door, or

c) 22 N in the case of a sliding door.

9) Sentence (8) does not apply to a door at the entrance to a *dwelling unit*, or where greater forces are required in order to close and latch the door against the prevailing difference in air pressure on opposite sides of the door. (See Note A-3.8.3.6.(9).)

10) Except for a door at the entrance to a *dwelling unit*, a closer for an interior door in an *accessible* path of travel shall have a closing period of not less than 3 s measured from when the door is in an open position of 70° to the doorway, to when the door reaches a point 75 mm from the closed position, measured from the leading edge of the latch side of the door. (See Note A-3.8.3.6.(10).)

11) Unless equipped with a power door operator complying with Sentence (6), a swinging door in an *accessible* path of travel shall have a clear space on the latch side extending the height of the doorway and not less than

a) 600 mm beyond the edge of the door opening if the door swings toward the approach side, and

b) 300 mm beyond the edge of the door opening if the door swings away from the approach side.

(See Note A-3.8.3.6.(11).)

12) A vestibule located in an *accessible* path of travel shall be arranged to allow the movement of wheelchairs between doors and shall provide a distance between 2 doors in series of not less than 1 350 mm plus the width of any door that swings into the space in the path of travel from one door to another.

13) Only the active leaf in a multiple-leaf door in an *accessible* path of travel need conform to the requirements of this Article.

14) Except as provided in Clause 3.8.3.5.(1)(c) and Sentence (16), the clear floor space on the pull side of a swinging door in an *accessible* path of travel shall be level within a rectangular area of not less than 1 700 mm by 1 500 mm measured from the hinged side of the door. (See Note A-3.8.3.6.(14) to (16).)

15) Except as provided in Clause 3.8.3.5.(1)(c) and Sentence (16), the clear floor space on the push side of a swinging door and on each side of a sliding door in an *accessible* path of travel shall be level within a rectangular area

a) whose dimension parallel to the closed door is not less than 1 200 mm, and

b) whose dimension perpendicular to the closed door is not less than 1 500 mm.

(See Note A-3.8.3.6.(14) to (16).)

16) Where a door referred to in Sentences (14) and (15) is equipped with a power door operator complying with Sentence (6), the width of the clear floor space parallel to the closed door is permitted to be reduced to not less than 1 000 mm. (See Note A-3.8.3.6.(14) to (16).)

17) Except for facilities for persons with cognitive disabilities such as dementia, doorways leading from a *public corridor* or a corridor used by the public that provide access to a public area or an *exit* shall be provided with a door or door frame that has a readily apparent visual contrast with adjacent wall surfaces. (See Note A-3.8.3.6.(17).) (See also Note A-3.4.6.11.(4).)

3.8.3.7. Passenger-Elevating Devices

1) A passenger-elevating device referred to in Article 3.8.2.3. located in an *accessible* path of travel shall

a) conform to

i) Appendix E of ASME A17.1/CSA B44, “Safety Code for Elevators and Escalators,” or

ii) CSA B355, “Platform lifts and stair lifts for barrier-free access,”

b) have a clear floor space not less than 1 500 mm long by 1 000 mm wide, and

c) have entry doors or gates

i) providing a clear width not less than 850 mm in the open position if located on the short side of the passenger-elevating device, or

ii) providing a clear width not less than 1 000 mm in the open position if located at either end of the long side of the passenger-elevating device.

3.8.3.8. Controls and Outlets

1) Controls described in this Section shall

a) where located in a *storey* where an *accessible* path of travel is required and unless otherwise stated,

i) be in or adjacent to the *accessible* path of travel,

ii) be mounted 400 mm to 1 200 mm above the floor, and

iii) be adjacent to and centred on either the length or the width of a clear floor space of 1 350 mm by 800 mm,

b) be operable

i) with one hand in a closed fist position, without requiring tight grasping, pinching with fingers, or twisting of the wrist, and

ii) unless otherwise stated, with a force not more than 22 N, and

c) where controls provide a feedback signal to the user, it shall be both audible and visible (see Note A-3.8.3.8.(1)(c)).

2) Electrical outlets described in this Section shall be located in conformance with Subclause (1)(a)(ii).

(See Note A-3.8.2.6.(2).)

3.8.3.9. Accessible Signs

1) Visual information signs required by Subsections 3.4.5. and 3.4.6. and Article 3.8.2.10. shall comply with Clauses 4.5.1, 4.5.2, 4.5.3 and 4.5.4 of CSA B651, "Accessible design for the built environment." (See Note A-3.8.3.9.(1) and (2).)

2) Tactile information signs required by Subsections 3.4.5. and 3.4.6. and Article 3.8.2.10. shall

a) have Braille and tactile characters in accordance with Clauses 4.5.6.2 and 4.5.6.3 of CSA B651, "Accessible design for the built environment,"

b) be installed on the wall closest to the latch side of the door or on the nearest wall on the right side of the door, where there is no wall at the latch side, and

c) be centred 1 500 mm above the finished floor with the edge of the sign located not more than 300 mm from the door.

(See Note A-3.8.3.9.(1) and (2).)

3) Signs required by Article 3.8.2.10. shall incorporate the International Symbol of Access, Modified International Symbol of Access, or the International Symbol of Access for Hearing Loss and appropriate graphical or textual information that clearly indicates the type of facilities available. (See Note A-3.8.3.9.(3).)

3.8.3.10. Drinking Fountains

1) Drinking fountains required by Sentence 3.8.2.8.(10) shall be equipped with controls that

a) activate automatically, or

b) comply with Clause 3.8.3.8.(1)(b) and are located on the front or on both sides of the fountain.

2) Where drinking fountains referred to in Sentence (1) are located in a *storey* where an *accessible* path of travel is required, they shall

a) be located along the *accessible* path of travel,

b) have a minimum clear floor space of 800 mm by 1 350 mm in front of them,

c) where they have frontal access, provide a knee clearance in accordance with Clause 3.8.3.16.(1)(e), and

d) have a spout that

i) is located near the front of the unit, at a height between 750 mm and 915 mm above the floor, and

ii) directs water flow in a trajectory that is nearly parallel to the front of the unit, at a height not less than 100 mm.

(See Sentences 3.3.1.8.(2) and (3) on horizontal projections.)

3.8.3.11. Water-Bottle Filling Stations

1) Water-bottle filling stations required by Sentence 3.8.2.8.(11) shall be equipped with controls that

a) activate automatically, or

b) comply with Clause 3.8.3.8.(1)(b).

2) Water-bottle filling stations required by Sentence 3.8.2.8.(11) that are located in a *storey* where an *accessible* path of travel is required shall

a) be located along the *accessible* path of travel,

b) have a clear floor space of 800 mm by 1 350 mm in front of them (see Note A-3.8.3.11.(2)(b) and (d)),

c) where they have frontal access, provide a knee clearance in accordance with Clause 3.8.3.16.(1)(e),

d) be operable at a height of not more than 1 200 mm above the floor (see Note A-3.8.3.11.(2)(b) and (d)), and

e) be equipped with controls that

i) activate automatically, or

ii) comply with Sentence 3.8.3.8.(1).

(See Sentences 3.3.1.8.(2) and (3) on horizontal projections.)

3.8.3.12. Accessible Water-Closet Stalls

1) Water-closet stalls and enclosures required by Sentence 3.8.2.8.(5) shall

a) be not less than 1 500 mm wide by 1 500 mm deep,

b) have a clear lateral transfer space adjacent to the water closet that

i) is at least 1 500 mm long, measured from the wall behind the water closet, and

ii) is at least 900 mm wide, measured from the closest edge of the water closet seat,

(see Note A-3.8.3.12.(1)(b))

c) have a clear floor space of 1 700 mm by 1 700 mm in front of the accessible stall,

d) be equipped with a door that

i) can be latched from the inside with a mechanism located 900 mm to 1 100 mm above the floor that conforms to Clause 3.8.3.8.(1)(b),

ii) is aligned with either the transfer space adjacent to the water closet or with a clear floor space not less than 1 700 mm by 1 700 mm within the stall,

iii) provides a clear opening not less than 850 mm wide when it is open, measured in accordance with Sentence 3.8.3.6.(2),

iv) is self-closing so that, when at rest, the door is ajar by not more than 50 mm beyond the jamb,

v) swings outward, unless there is sufficient floor space within the stall for the door to swing inward in addition to a clear floor space of at least 800 mm by 1 350 mm (see Note A-3.8.3.12.(1)(d)(v)),

vi) where the door swings outward, is provided with a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the inside such that its midpoint is 200 mm to 300 mm from the hinged side of the door and 900 mm to 1100 mm above the floor (see Note A-3.8.3.12.(1)(d)(vi)), and

vii) is provided with a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the outside such that its midpoint is 120 mm to 220 mm from the latch side and 900 mm to 1100 mm above the floor,

e) have a water closet located so that the distance between the centre line of the fixture and the wall on one side is 460 mm to 480 mm,

f) be equipped with an L-shaped grab bar that

i) is mounted on the side wall closest to the water closet,

ii) has horizontal and vertical components not less than 760 mm long mounted with the horizontal component 750 mm to 850 mm above the floor and the vertical component 150 mm in front of the water closet (see Note A-3.8.3.12.(1)(f)(ii)), and

iii) complies with Article 3.7.2.7.,

g) be equipped with either one grab bar at least 600 mm long and centred over the water closet, or two grab bars at least 300 mm long and located either side of the flush valve, that

i) conform to Article 3.7.2.7.,

ii) are mounted on the rear wall, and

iii) are mounted at the same height as the grab bar on the side wall or 100 mm above the top of the attached water tank, if applicable,

h) be equipped with a coat hook mounted not more than 1 200 mm above the floor on a side wall and projecting not more than 50 mm from the wall, and

i) be equipped with a toilet paper dispenser mounted on the side wall closest to the water closet such that

i) the bottom of the dispenser is 600 mm to 800 mm above the floor, and

ii) the closest edge of the dispenser is not more than 300 mm from the front of the water closet.

3.8.3.13. Universal Washrooms

(See Note A-3.8.3.13.)

1) A universal washroom shall

a) be served by an *accessible* path of travel,

b) have a door complying with Article 3.8.3.6. that

i) has a latch-operating mechanism located 900 mm to 1 100 mm above the floor that complies with Clause 3.8.3.8.(1)(b) and is capable of being locked from the inside, and released from the outside in case of emergency, and

ii) if it is an outward swinging door that is not self-closing, has a horizontal, D-shaped, visually contrasting door pull not less than 140 mm long located on the inside so that its midpoint is not less than 200 mm and not more than 300 mm from the hinged side of the door and not less than 900 mm and not more than 1 100 mm above the floor (see Note A-3.8.3.12.(1)(d)(vi)),

c) have one lavatory conforming to Article 3.8.3.16.,

d) have one water closet conforming to Article 3.8.3.14. and Clause 3.8.3.12.(1)(e),

e) have a clear lateral transfer space adjacent to the water closet that conforms to Clause 3.8.3.12.(1)(b),

f) have grab bars conforming to Clauses 3.8.3.12.(1)(f) and (g),

g) have a coat hook conforming to Clause 3.8.3.12.(1)(h),

h) have a toilet paper dispenser conforming to Clause 3.8.3.12.(1)(i),

i) unless a counter space of not less than 200 mm by 400 mm is provided, have a shelf located not more than 1 200 mm above the floor with a useable surface of not less than 200 mm by 400 mm,

j) be designed to permit a wheelchair to turn in an open space not less than 1 700 mm in diameter, and

k) provide emergency lighting conforming to Article 3.2.7.3.

2) A universal washroom required to have an accessible change space as stipulated in Sentence 3.8.2.8.(15) shall

a) be equipped with an adult-sized change table that is

i) designed to carry a minimum load of 1.3 kN,

ii) impervious to water, and

iii) designed to be easily cleaned,

b) have a clear floor space to accommodate the adult-sized change table that is 810 mm wide by 1 830 mm long and does not overlap with the clear spaces required by Clauses (1)(e), (1)(j) and (c), and

c) have a clear transfer space of 900 mm by 1 350 mm adjacent to the long side of the clear floor space for the adult-sized change table.

3.8.3.14. Water Closets

1) A water closet for a person with physical disabilities shall

a) be equipped with a seat located 430 mm to 480 mm above the floor,

b) flush automatically or be equipped with a flushing control that

i) is located 500 mm to 900 mm above the floor,

ii) is located no more than 350 mm from the transfer side, and

iii) complies with Clause 3.8.3.8.(1)(b),

c) be equipped with a seat lid or other back support, and

d) where it has a tank, have a securely attached tank top.

(See Note A-3.8.3.14.(1).)

3.8.3.15. Water Closet Stalls and Urinals for Persons with Limited Mobility

1) Water-closet stalls for persons with limited mobility required by Sentence 3.8.2.8.(7) shall

a) be at least 1 500 mm deep and 890 mm to 940 mm wide,

b) be equipped with a door that

i) has a latch-operating mechanism conforming to Clause 3.8.3.8.(1)(b) that can be locked from the inside and released from the outside in the event of an emergency,

ii) provides a clear opening not less than 850 mm wide when it is open, measured in accordance with Sentence 3.8.3.6.(2),

iii) swings outward, unless the minimum dimensions required by Clause (a) do not overlap with the area of the door swing,

iv) is self-closing so that, when at rest, the door is ajar by not more than 50 mm beyond the jamb, and

v) has a horizontal, D-shaped, visually contrasting door pull on both sides of the door, near the latch side, located 900 mm to 1 100 mm above the finished floor,

c) have one water closet conforming to Article 3.8.3.14. centred within the stall,

d) have a horizontal grab bar conforming to Article 3.7.2.7. on each side of the water closet that

i) is located 750 mm to 850 mm above the floor,

ii) begins not more than 300 mm from the wall behind the water closet, and

iii) extends at least 450 mm in front of the toilet seat, and

e) be equipped with a coat hook mounted not more than 1 200 mm above the floor on a side wall and projecting not more than 50 mm from the wall.

2) Urinals described in Sentence 3.8.2.8.(6) shall

a) be wall-mounted, with the rim located not more than 430 mm above the floor,

b) be adjacent to an *accessible* route,

c) have a clear width of approach that is at least 800 mm wide by 1 350 mm long centred on the urinal and unobstructed by privacy screens,

d) have no step in front of it,

e) have a flush control that

i) is automatic, or

ii) complies with Clause 3.8.3.8.(1)(b) and is located 900 mm to 1 100 mm above the floor, and

f) have a vertically mounted grab bar installed on each side that

i) complies with Article 3.7.2.7.,

ii) is not less than 600 mm long, with its centre line 1 000 mm above the floor, and

iii) is located not more than 380 mm from the centre line of the urinal.

3.8.3.16. Lavatories and Mirrors

1) Lavatories required by Sentence 3.8.2.8.(8) shall

a) be equipped with faucets complying with Sentence 3.7.2.3.(4),

b) be located so that the distance between the centre line of the lavatory and any side wall is not less than 460 mm,

c) have a clear floor space in front of the lavatory that is at least

i) 800 mm wide, centred on the lavatory, and

ii) 1 350 mm long, of which no more than 430 mm is beneath the lavatory,

d) have a rim height not more than 865 mm above the floor,

e) have a clearance beneath the lavatory not less than

i) 800 mm wide, centred on the lavatory,

ii) 735 mm high at the front edge,

iii) 685 mm high at a point 200 mm back from the front edge, and

iv) 230 mm high over the distance from a point 280 mm to a point 430 mm back from the front edge,

(see Note A-3.8.3.16.(1)(e))

f) have insulated water supply and drain pipes where these pipes are exposed (see Note A-3.8.3.16.(1)(f)),

g) have a soap dispenser that

i) is automatic, or

ii) complies with Clause 3.8.3.8.(1)(b) and is located not more than 1 100 mm above the floor, within 500 mm from the front of the lavatory (see Note A-3.8.3.16.(1)(g)), and

h) have a towel dispenser or other hand-drying equipment located close to the lavatory, with operating controls not more than 1 200 mm above the floor in an area that is *accessible* to persons using wheelchairs.

2) Mirrors required by Sentence 3.8.2.8.(9) shall be

a) mounted with their bottom edge not more than 1 000 mm above the floor, or

b) fixed in an inclined position so as to be usable by a person using a wheelchair.

3.8.3.17. Showers

1) Showers required by Sentence 3.8.2.8.(12) shall

a) be not less than 1 500 mm wide and 900 mm deep,

b) have a clear floor space at the entrance to the shower that is not less than 900 mm deep and the same width as the shower, except that fixtures are permitted to project into that space provided they do not restrict access to the shower (see Note A-3.8.3.17.(1)(b)),

c) have no doors or curtains that obstruct the controls or the clear floor space at the entrance to the shower,

d) have a slip-resistant floor surface,

e) have a threshold not more than 13 mm higher than the finished floor, and where it is higher than 6 mm, beveled to a slope no steeper than 1 in 2,

f) have 2 grab bars

i) that conform to Sentence 3.7.2.7.(1),

ii) one of which is not less than 1 000 mm long and located vertically on the side wall 50 mm to 80 mm from the adjacent clear floor space, with its lower end 600 mm to 650 mm above the floor, and,

iii) one of which is L-shaped and located on the wall opposite the entrance to the shower, with a horizontal member not less than 1 000 mm long mounted 750 mm to 870 mm above the floor and a vertical member not less than 750 mm long mounted 400 mm to 500 mm from the side wall on which the other vertical grab bar is mounted,

(see Note A-3.8.3.17.(1)(f)),

g) have a hinged seat that is not spring-loaded or a fixed seat with a smooth, slip-resistant surface and no rough edges, the seat being

i) not less than 450 mm wide and 400 mm deep,

ii) mounted on the same side wall as the vertical grab bar, at 460 mm to 480 mm above the floor,

iii) designed to carry a minimum load of 1.3 kN,

iv) impervious to water, and

v) designed to be easily cleaned,

h) have a pressure-equalizing or thermostatic-mixing valve and other controls that

i) comply with Clause 3.8.3.8.(1)(b), and

ii) are mounted on the wall opposite the entrance to the shower at not more than 1 200 mm above the floor and within reach of the seat,

i) have a hand-held shower head with not less than 1 800 mm of flexible hose located so that it

i) can be reached from a seated position,

ii) can be used in a fixed position at a height of 1 200 mm and 2 030 mm, and

iii) does not obstruct the use of the grab bars, and

j) have recessed soap holders that can be reached from the seated position.

2) A universal dressing and shower room required by Sentence 3.8.2.8.(13) shall

a) be located in an *accessible* path of travel,

b) have a door capable of being locked from the inside and released from the outside in the event of an emergency,

c) have a lavatory and a mirror conforming to Article 3.8.3.16.,

d) have a shower conforming to Sentence (1),

e) have a bench that is

i) at least 1 830 mm long by 760 mm wide and 480 mm to 520 mm high,

ii) designed to carry a minimum load of 1.3 kN,

iii) impervious to water, and

iv) designed to be easily cleaned,

f) have a clear transfer space adjacent to the long side of the bench that is 900 mm wide and as long as the bench (see Note A-3.8.3.17.(2)(f)),

g) have a coat hook conforming to Clause 3.8.3.12.(1)(h), and

h) provide emergency lighting conforming to Article 3.2.7.3.

3.8.3.18. Accessible Bathtubs

1) A bathtub required by Sentence 3.8.2.8.(14) shall

a) be located in a room with a clear floor space not less than 1 700 mm in diameter,

b) be not less than 1 500 mm long,

c) have a clear floor space at the entrance to the bathtub that is not less than 900 mm deep and at least the same length as the bathtub, except that fixtures are permitted to project into that space provided they do not restrict access to the shower,

d) be capable of being accessed along its full length with no tracks mounted on its rim,

e) have a pressure-equalizing or thermostatic mixing valve and other controls that

i) conform to Clause 3.8.3.8.(1)(b), and

ii) are located on the centre line or between the centre line of the bathtub and the exterior edge of the bathtub rim, at a maximum height of 450 mm above the rim,

f) have three grab bars

i) that conform to Sentence 3.7.2.7.(1),

ii) that are not less than 1 200 mm long,

iii) two of which are located vertically at each end of the bathtub, set 80 mm to 120 mm in from the outside edge of the bathtub, with their lower end 180 mm to 280 mm above the bathtub rim, and

iv) one of which is located horizontally along the length of the bathtub at 180 mm to 280 mm above the bathtub rim,

g) have a slip-resistant bottom surface, and

h) be equipped with a hand-held shower head with not less than 1 800 mm of flexible hose that can be used in a fixed position at a height of 1 200 mm and 2 030 mm.

3.8.3.19. Assistive Listening Systems

(See Note A-3.8.3.19.)

1) Assistive listening systems required by Sentence 3.8.2.9.(1) shall encompass the entire seating area.

2) Assistive listening systems or adaptive technologies required by Sentence 3.8.2.9.(2) shall provide for the clear communication required for the exchange of information, goods and services.

3.8.3.20. Counters

1) A section of a service counter required to be *accessible* in accordance with Sentence 3.8.2.11.(1) shall

a) be not less than 800 mm long centred over a knee space conforming to Clause (c),

b) have a surface not more than 865 mm above the floor, and

c) where forward-facing interaction with a person or a device is required, have a knee space underneath it that is (see Note A-3.8.3.20.(1)(c))

i) not less than 800 mm wide,

ii) not less than 685 mm high, and

iii) not less than 485 mm deep.

3.8.3.21. Telephones

1) A telephone required to be *accessible* in accordance with Article 3.8.2.12. shall

a) be adjacent to and centred on either the length or the width of a clear floor space not less than 1 350 mm by 800 mm,

b) where a forward approach is provided, have a knee space underneath it conforming to Clause 3.8.3.20.(1)(c), and

c) be located so that its receiver and operable parts are not more than 1 200 mm above the floor.

2) Where provided, shelves or counters for public telephones shall

a) be level,

b) be not less than 305 mm deep,

c) have, for each telephone provided, a clear space not less than 250 mm wide having no obstruction within 250 mm above the surface, and

d) have a section with a surface not more than 865 mm above the floor serving at least one telephone.

(See Note A-3.8.3.21.(2).)

3.8.3.22. Spaces in Seating Area

1) Spaces designated for wheelchair use in *assembly occupancies* as required by Sentence 3.8.2.3.(3) shall conform to the following:

a) at least one designated space shall be clear and level for each increment of 200 seats and the remaining designated spaces shall be level and have removable seats,

b) they shall be not less than 900 mm wide and 1 700 mm long to permit a wheelchair to enter from a side approach and 1 350 mm long where the wheelchair enters from the front or rear of the space,

c) they shall be arranged so that

i) at least two designated spaces are located side by side, and

ii) at least one fixed seat is located beside each designated space,

d) they shall be located adjoining an *accessible* path of travel without infringing on egress from any row of seating or any aisle requirements, and

e) they shall be situated, as part of the designated seating plan, to provide a choice of viewing location and a clear view of the event taking place.

(See Note A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

2) Spaces designated for wheelchair use in waiting rooms or areas as required by Sentence 3.8.2.3.(4) shall

a) be clear and level, and

b) comply with Clauses (1)(b) and (d).

3) Adaptable seats required by Sentence 3.8.2.3.(5) shall

a) be located adjoining an aisle without infringing on egress from any row of seating or any aisle requirements,

b) be equipped with a movable or removable armrest on the side of the seat adjoining the aisle, and

c) be situated, as part of the designated seating plan, to provide a choice of viewing location and a clear view of the event taking place.

4) Storage spaces for mobility aids shall be provided in a location

a) that is on the same level as and in proximity to the adaptable seats required by Sentence 3.8.2.3.(5),

b) that is within the room side of the *fire separation* required by Article 3.3.2.2., and

c) where they will not infringe on egress.

(See Notes A-3.8.3.22.(4) and A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4).)

3.8.3.23. Sleeping Rooms and Bed Spaces

1) Sleeping rooms and bed spaces required by Sentence 3.8.2.13.(1) to be *accessible* shall have

a) a clear floor space that permits a turning area of not less than 1 700 mm in diameter, or not less than 1 700 mm by 1 500 mm, that could be adjacent a bed,

b) a pathway clearance of not less than 1 000 mm wide, that could be unobstructed by a bed, to allow functional use of the bedroom,

c) at least one closet that provides

i) a clear opening width of not less than 900 mm,

ii) a clear floor space, that need not be separate from the turning areas required in Clause (a), of not less than 1 700 mm by 1 500 mm on at least one side of the closet,

iii) clothes hanger rods capable of being lowered to a height of not more than 1 200 mm, and

iv) at least one shelf capable of being lowered to a height of not more than 1 200 mm,

d) when a balcony is provided, an *accessible* path of travel to an *accessible* balcony conforming to Sentence 11.3.8.1.(4),

e) except for dedicated electrical outlets for equipment and appliances, where controls, switches and outlets are intended for frequent operation, they shall conform to Subsection 3.8.3., and

f) a bathroom, where provided as part of the sleeping room or bed space, or *access* to a bathroom, where not provided as part of the sleeping room or bed space

i) conforming to Clauses 3.8.3.12.(1)(a), (b), (e), (f), (g), (h) and (i) with a water closet conforming to Article 3.8.3.14.,

ii) provided with a lavatory and mirror conforming to Article 3.8.3.16., and

iv) provided with a shower conforming to Article 3.8.3.17. or a bathtub conforming to Article 3.8.3.18., only to the extent of providing the same type of facilities provided in sleeping rooms and bed spaces where *access* is not required.

3.8.4. Deleted

3.8.5. Adaptable Dwelling Units

3.8.5.1. Application

1) Except as permitted by Sentences (2) and (3), this Subsection applies to

a) the design and construction of *dwelling units* in *residential occupancy buildings*, and

b) the interior paths of travel and common facilities intended for use by the residents.

2) This Subsection need not apply to

a) hotels, motels, *single room accommodation* and similar commercial occupancies,

b) boarding houses, lodging houses, dormitories and similar facilities, or

c) *dwelling units* subsidiary to non-residential uses.

3) This Subsection does not apply to *existing buildings*, except for *additions* or spaces created by

a) the reconstruction of an existing space, or

b) the conversion of an existing space into a new *dwelling unit*.

4) *Dwelling units* required by Article 3.8.5.1. to comply with this Subsection shall be considered *adaptable dwelling units*.

3.8.5.2. Construction Requirements

1) The construction of *adaptable dwelling units* and the *building* in which they are located shall conform to the requirements in this Subsection and to *access* requirements for *residential occupancy buildings* elsewhere in this By-law.

3.8.5.3. Entrance Doors to Dwelling Units

1) *Adaptable dwelling units* shall have at least one entrance door with a clear width of not less than 850 mm, equipped with

a) two peepholes, one located at 1067 mm above the floor and the other located at 1524 mm above the floor, or a glass sidelight or intercom security type system (See Note A-3.8.5.3.(1).),

b) a beveled threshold not more than 13 mm above the floor level, except for entrance doors serving balconies and basements, and

c) door opening hardware that does not require a tight grasp or twisting action of the wrist, and can be opened with a force of not more than 38 N.

3.8.5.4. Interior Doors, Corridors, and Stairs in Dwelling Units

1 Doorways in *adaptable dwelling units* shall have

a) a clear width of least 800 mm,

b) door opening hardware that does not require a tight grasp or twisting action of the wrist and can be opened with a force of not more than 22 N, and

c) beveled thresholds no more than 13 mm above the floor.

2) Corridors in *adaptable dwelling units* shall have a clear width of at least 900 mm.

3) Except for interior stairs within *laneway houses*, at least one staircase within a *adaptable dwelling unit* shall have a minimum width of 915 mm.

4) *Dwelling unit* entry doors shall conform with the requirements of Article 3.8.3.6.(11), except that they may have a clear space on the latch side on the in swing side of not more than 450 mm beyond the edge of the door opening, notwithstanding the requirements of Clause 3.8.3.6.(11)(a).

5) Doorways provided with power door operators, or provided with a special outlet box and cover plates that are designed, located and wired specifically to accommodate the future installation of a power door operator, may provide the clear floor space described in Sentence 3.8.3.6.(16).

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3.8.5.5. Adaptable Dwelling Unit Bathrooms

(See Note A-3.8.5.5.)

1) At least one bathroom in an *adaptable dwelling unit* that includes a floor level exceeding 40 m^2 shall

a) have a washbasin,

b) have a toilet,

c) have either a bathtub, shower, or be configured to accommodate the future installation of a low barrier shower and shall be constructed with

i) the addition of structural reinforcement of framed construction to accommodate the subsequent change in load, or the removal or reduction of the capacity of structural elements to facilitate the future installation of a low barrier shower,

ii) pre-plumbing of a drain connection to the greatest extent permitted by this By-law to facilitate the future installation of a low barrier shower where it passes through a concrete floor or floor topping, or

iii) alternative measures to the satisfaction of the *Chief Building Official* where it can be demonstrated that the future installation of a low barrier shower can be installed without substantial changes to the *building* structure or layout,

d) be arranged so as to provide a minimum clear floor space of 750 mm by 1200 mm in front of a washbasin, toilet, bathtub or shower required by Clause (c),

e) be located on

i) the principal floor exceeding 40 m^2 contain living space with level access to an entry at the adjacent ground level, or

ii) a floor provided with features that in the opinion of the *Chief Building Official* can readily be modified to facilitate future use by persons with limited mobility (see Note A-3.8.5.5.(1)).

2) Walls adjacent to the water closet and bathtub or shower shall accommodate the future installation of grab bars conforming to

a) Clauses 3.8.3.12.(1)(f) and (g) for water closets, and

b) Clause 3.8.3.17.(1)(f) for showers or 3.8.3.18.(1)(f) for bathtubs.

(See Note A-3.8.5.5.(2).)

3) All bath and shower controls in *adaptable dwelling units* shall be

a) easily accessible from an open floor space which does not require entry into the bath or shower to operate, and

b) equipped with lever-type controls or hardware that does not require a tight grasp or twisting action of the wrist.

4) All washbasins in *adaptable dwelling units* shall be equipped with lever-type faucets or hardware that does not require a tight grasp or twisting action of the wrist.

3.8.5.6. Adaptable Dwelling Unit Kitchens

1) The kitchen in an *adaptable dwelling unit* shall be designed so that the *cooktop* and sink are adjacent or can have a continuous counter between them.

2) Kitchen sinks in *adaptable dwelling units*, shall use lever-type faucets or hardware that does not require a tight grasp or twisting action of the wrist.

3) All waste pipes running from under-sink “P” traps to drain stacks shall be installed no higher than 305 mm above the finished floor.

3.8.5.7. Controls, Switches, Outlets and Signalling Devices

1) Controls and switches in an *adaptable dwelling unit* intended for regular occupant use, including electrical, telephone, cable and data outlets shall be mounted 455 mm to 1 200 mm above the floor, except where

a) in the opinion of the *Chief Building Official*, a different height is necessary to accommodate appliances or equipment, or

b) otherwise required for safety or other regulatory enactments.

2) Controls for the operation of *building* services or safety devices, electrical switches, thermostats and intercoms in a *adaptable dwelling unit* shall be located no more than 1 200 mm above the finished floor, except where, in the opinion of the *Chief Building Official*, a different height is necessary for safety reasons.

3) At least one electrical receptacle shall be provided in the vicinity of the stair required by Sentence 3.8.5.4.(3).

4) Except as permitted by Sentence (5), each adaptable dwelling unit shall be provided with special outlet boxes and cover plates as described in Sentence 3.2.4.19.(6). (See also Sentence 3.2.4.19.(7).)

5) Where a building is provided with an addressable fire alarm system, a special outlet box described in Sentence (4) is not required provided that

a) the dwelling unit has been designed with fire alarm signaling devices located in accordance with Clause 3.2.4.19.(6)(c), and

b) the fire alarm system and the signaling devices in clause (a) can accommodate the future replacement of audible signaling devices with combination audible visual signaling devices.

3.8.5.8. Living Room Window Requirements

1) In an *adaptable dwelling unit*, at least one window in a living room shall have a window sill no higher than 800 mm above the finished floor.

Section 3.9. Self-service Storage Buildings

3.9.1. General

3.9.1.1. Definition

1) For the purpose of this Section, the term “self-service storage *building*” shall mean a *building* that is open to the public for the sole purpose of providing individual self-service storage units.

3.9.1.2. Application

1) This Section applies to self-service storage *buildings* that

a) are not more than one *storey* in *building height*,

b) do not contain a *basement* or *mezzanine*,

c) consist of individual self-service storage units with external access only,

d) are used for no purpose other than storage, and

e) except as provided in Sentences 3.9.3.1.(2) and (4), contain no other *major occupancy*.

2) Where there is a conflict between the requirements of this Section and other requirements in Part 3, this Section shall govern.

3) The requirements in Part 3 regarding *occupant load* shall not apply to self-service storage *buildings*.

3.9.1.3. Occupancy Classification

1) Self-service storage *buildings* shall be classified as Group F, Division 2 *major occupancies*.

3.9.2. Building Fire Safety

3.9.2.1. Building Area

1) For the purpose of applying the requirements of Subsections 3.2.1. and 3.2.2. to self-service storage *buildings*, *building area* shall mean

a) the *building area* of each *building*, or

b) the total of the *building areas* of all *buildings* as a group.

(See Note A-3.9.2.1.(1).)

3.9.2.2. Spatial Separation

(See Note A-3.9.2.2.)

1) Except as provided in Sentence (3), the spatial separation requirements in Subsection 3.2.3. shall apply to self-service storage *buildings*.

2) The distance between each group of self-service storage *buildings* shall be not less than 9 m.

3) Subsection 3.2.3. need not apply between *buildings* within a group of self-service storage *buildings*, where the distance between these *buildings* is at least 6 m.

3.9.2.3. Access Route

1) Where Clause 3.9.2.1.(1)(b) is applied to a group of *buildings*, Article 3.2.5.4. and Sentence 3.2.5.5.(1) shall apply to that group of *buildings* as if they were a single *building*.

3.9.3. Floor Areas

3.9.3.1. Safety Requirements Within Floor Areas

1) Except as provided in Sentences (2) to (6), the requirements of Section 3.3. shall apply. (See Note A-3.9.3.1.(1).)

2) Not more than one *dwelling unit* is permitted to be contained within one of the self-service storage *buildings* on a property.

3) A *dwelling unit* referred to in Sentence (2) shall be separated from individual self-service storage units by a *fire separation* having a *fire-resistance rating* not less than 2 h.

4) Where an office not more than 50 m^2 in area is adjacent to a *dwelling unit* referred to in Sentence (2), it shall be considered as part of the *dwelling unit*.

5) *Fire separations* required by Sentences 3.3.1.1.(1) and 3.3.5.9.(1) need not be provided between individual self-service storage units.

6) The *floor area* of self-service storage *buildings* shall be

a) subdivided into compartments not more than 500 m^2 in area by a *fire separation* having a *fire-resistance rating* not less than 1 h, or

b) *sprinklered*.

(See also Sentence 3.4.6.12.(2) for the exemption applying to *exit* doors of individual self-service storage units.)

3.9.3.2. Sanitary Facilities

1) Except as provided in Sentence 3.7.2.1.(3), two public washrooms, each containing a water closet and a lavatory, shall be provided within one of the self-service storage *buildings* on the property. (See Note A-3.9.3.2.(1).)

Section 3.10. Objectives and Functional Statements

3.10.1. Objectives and Functional Statements

3.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 3.10.1.1. (See Note A-1.1.2.1.(1).)

Table 3.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 3
Forming Part of Sentence 3.10.1.1.(1)

Provision	Functional Statements and Objectives[1]
3.1.2.8. Daycare Facilities for Children	
(1)	[F02,F03,F05-OS1.2,OS1.3] Applies to the requirement for sprinklers.
	[F11-OS1.5] Applies to fire alarm.
	[F11-OS1.5] Applies to smoke and CO alarm.
	[F03, F10-OS1.5] Applies to fire separations from the remainder of the building.
	[F10-OS1.5] Applies to emergency lighting.
3.1.3.1. Separation of Major Occupancies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
(3)	[F02,F03,F06-OS1.2] [F10,F05-OS1.5]
	[F02,F03,F06-OP1.2]
3.1.3.2. Prohibition of Occupancy Combinations	
(1)	[F02,F03-OS1.2] [F10-OS1.5]
(2)	[F02,F03-OS1.2]
3.1.3.3. Artist Live/Work – Class A Artist Studio	
(1)	[F03, F20-OS1.2, OS2.2, OP1.2]
3.1.3.4. Artist Live/Work – Class B Artist Studio	
(1)	[F02, F03, F11, F12, F20, F73, F81-OS1.2, OS2.2, OA1, OP1.2, OP2.2]
3.1.3.5. Training School	
(1)	[F02-OS3.7]
3.1.3.5. Industrial Flex Space	
(1)	[F02, F03, F11-OS1.2, OS3.7]

3.1.4.1. Combustible Materials Permitted	
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.4.2. Protection of Foamed Plastics	
(1)	[F01-OS1.1] [F02-OS1.2]
	[F01-OP1.1] [F02-OP1.2]
(2)	[F01-OS1.1] [F02-OS1.2]
	[F01-OP1.1] [F02-OP1.2]
3.1.4.3. Wires and Cables	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	**Deleted.**
	Deleted.
3.1.4.5. Fire-Retardant-Treated Wood	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.4.8. Exterior Cladding	
(1)	[F02,F03-OP3.1]
(2)	[F02,F03-OP3.1]
3.1.5.1. Noncombustible Materials	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.5.5. Combustible Cladding on Exterior Walls	
(2)	[F03,F02-OP3.1]
3.1.5.21. Wires and Cables	
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	**Deleted.**
	Deleted.
3.1.5.23. Non-metallic Raceways	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]

	[F02-OP1.2]
3.1.5.25. Di-electric Liquid Filled Equipment	
(1)	(a) [F31-OS1.2] (b) [F02, F03-OS1.1, 1.2, OP1.1, 1.2] (c) [F03-OS1.2.
3.1.6.2. Materials Permitted	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.3. Structural Mass Timber Elements	
(2)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.4. Encapsulation of Mass Timber Elements	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.6.5. Determination of Encapsulation Ratings	
(1)	[F02-OS1.2]
	[F04-OS1.3]
	[F02-OP1.2]
	[F04-OP1.3]
3.1.6.9. Exterior Cladding	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F02,F03-OP3.1]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.6.17. Penetration by Outlet Boxes	
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.7.1. Determination of Ratings	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]

3.1.7.5. Rating of Supporting Construction	
(1)	[F04-OS1.3]
	[F04-OP1.3]
(3)	[F04-OS1.3]
	[F04-OP1.3]
3.1.8.1. General Requirements	
(1)	(a) [F03-OS1.2]
	(a) [F03-OP1.2]
(2)	[F03-OS1.2] Applies to the requirement that openings in *fire separations* be protected with *closures*, shafts or other means.
	[F03-OP1.2] Applies to the requirement that openings in *fire separations* be protected with *closures*, shafts or other means.
3.1.8.2. Combustible Construction Support	
(1)	[F04-OS1.2]
	[F04-OP1.2]
3.1.8.3. Continuity of Fire Separations	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.4. Determination of Ratings and Classifications	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.5. Installation of Closures	
(2)	[F03-OS1.2]

	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F81-OS1.2]
	[F81-OP1.2]
(5)	[F81-OP1.2]
	[F81-OS1.2]
(6)	[F03-OS1.2]
	[F03-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.6. Maximum Openings	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.7. Location of Fire Dampers and Smoke Dampers	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.10. Installation of Fire Dampers	
(1)	[F04-OS1.2]
	[F04-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F82-OS1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper …”
	[F82-OP1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each *fire damper* to provide access for the inspection of the damper …”
	[F82-OH1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each *fire damper* to provide access for … the resetting of the release device.”

3.1.8.11. Installation of Smoke Dampers	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F82-OS1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each smoke damper ... to provide access for ... inspection …”
	[F82-OH1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each smoke damper ... to provide access for ... inspection …”
	[F82-OP1.2] Applies to portion of By-law text: “A tightly fitted access door shall be installed for each ... *fire damper* to provide access for … the resetting of the release device.”
3.1.8.12. Twenty-Minute Closures	
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.13. Self-closing Devices	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.14. Hold-Open Devices	
(1)	[F03-OS1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.15. Door Latches	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.8.16. Wired Glass and Glass Block	

(3)	[F04-OS1.2] Applies to portion of By-law text: “Glass blocks permitted by Sentence (1) shall be … reinforced with steel reinforcement in each horizontal joint.”
	[F04-OP1.2] Applies to portion of By-law text: “Glass blocks permitted by Sentence (1) shall be … reinforced with steel reinforcement in each horizontal joint.”
3.1.8.17. Temperature Rise Limit for Doors	
(1)	[F03,F31-OS1.2] [F05-OS1.5]
	[F03-OP1.2]
3.1.8.18. Area Limits for Wired Glass, Glass Block and Safety Glazing	
(1)	[F05-OS1.5] [F31-OS1.2]
	[F30-OS3.1]
(2)	[F05-OS1.5] [F31-OS1.2]
3.1.9.1. Firestops	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
(2)	[F03-OS1.2]
	[F03-OP3.1]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(6)	[F03-OS1.2]
	[F03-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.3. Penetration by Outlet Boxes	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.9.4. Combustible Piping Penetrations	
(3)	[F03-OS1.2] [F02,F04-OS1.3]
	[F03-OP1.2] [F02,F04-OP1.3]
(7)	[F03-OS1.2] [F02-OS1.3] [F04-OS1.3]
	[F03-OP1.2] [F02-OP1.3] [F04-OP1.3]

3.1.9.5. Openings through a Membrane Ceiling	
(1)	[F04-OS1.3]
	[F04-OP1.3]
3.1.10.1. Prevention of Firewall Collapse	
(1)	[F04-OP1.2]
	[F04-OS1.2]
	[F04-OP3.1]
(2)	[F03,F04-OP1.2]
	[F03,F04-OS1.2]
	[F03,F04-OP3.1]
(4)	[F04-OS1.2]
	[F04-OP1.2]
	[F04-OP3.1]
3.1.10.2. Rating of Firewalls	
(1)	[F03-OS1.2] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
	[F03-OP1.2] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
	[F03-OP3.1] Applies to portion of By-law text: "A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h …"
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
(3)	[F80,F04-OP1.2]
	[F80,F04-OS1.2]
	[F80,F04-OP1.3]
(4)	[F80,F04-OP1.2]
	[F80,F04-OS1.2]
	[F80,F04-OP3.1]
3.1.10.3. Continuity of Firewalls	
(1)	[F03-OS1.2] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"
	[F03-OP1.2] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"

	[F03-OP3.1] Applies to portion of By-law text: "A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated …"
3.1.10.4. Parapets	
(1)	[F03-OP1.2]
	[F03-OS1.2]
	[F03-OP3.1]
3.1.10.5. Maximum Openings	
(2)	[F03-OP1.2]
	[F03-OS1.2]
	[F03-OP3.1]
3.1.10.7. Combustible Projections	
(1)	[F03-OP1.2] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
	[F03-OS1.2] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
	[F03-OP3.1] Applies to portion of By-law text: "*Combustible* material shall not extend across the end of a *firewall* …"
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
3.1.11.1. Separation of Concealed Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.2. Fire Blocks in Wall Assemblies	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.3. Fire Blocks between Nailing and Supporting Elements	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.4. Fire Blocks between Vertical and Horizontal Spaces	

(1)	[F03-OS1.2]
	[F03-OP1.2]
3.1.11.5. Fire Blocks in Horizontal Concealed Spaces	
(1)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(2)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
(3)	[F02,F03-OP1.2] [F04-OP1.3]
	[F02,F03-OS1.2] [F04-OS1.3]
(4)	[F02,F03-OS1.2]
	[F04-OS1.3]
	[F02,F03-OP1.2]
	[F04-OP1.3]
3.1.11.6. Fire Blocks in Crawl Spaces	
(1)	[F03,F04-OS1.2]
	[F03,F04-OP1.2]
3.1.11.7. Fire Block Materials	
(1)	[F04-OS1.2]
	[F04-OP1.2]
(6)	[F04-OP1.2]
	[F04-OS1.2]
(7)	[F03-OP1.2]
	[F03-OS1.2]
3.1.12.1. Determination of Ratings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.2. Flame-Spread Rating	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.5. Skylights	
(1)	[F02-OS1.5]
3.1.13.6. Corridors	
(1)	[F02-OS1.2,OS1.5]

	[F02-OP1.2]
(5)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
(6)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.7. High Buildings	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.13.9. Underground Walkways	
(1)	[F02-OS1.2]
	[F02-OP3.1]
3.1.13.10. Exterior Exit Passageway	
(1)	[F02-OS1.5]
3.1.13.11. Elevator Cars	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.1.14.1. Fire-Retardant-Treated Wood Roof Systems	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.3,OS1.2]
	[F02-OP1.3]
3.1.14.2. Metal Roof Deck Assemblies	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.1.14.3. Overhead Skylight Glazing	
(1)	[F20, F21, F23, F30-OS2.1, OS2.2, OS2.4, OS3.1]
3.1.14.4. Vegetated Roof Assemblies	
(1)	[F02, F03, F61-OS1.1, OP1.1, OP2.3]
3.1.15.1. Roof Covering Classification	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.1.15.2. Roof Coverings	

(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
(3)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
(4)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.1.16.1. Fabric Canopies and Marquees	
(1)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
3.1.17.1. Occupant Load Determination	
(1)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
(2)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
(4)	[F10-OS3.7]
	[F72-OH2.1] [F71-OH2.3]
3.1.18.2. Restrictions	
(1)	[F10,F12,F36-OS3.7]
	[F20-OS2.2]
(2)	[F10,F36-OS3.7] Applies to portion of By-law text: "An *air-supported structure* shall not be used for Groups B, C, … *major occupancies* or for classrooms."
	[F01,F02,F36-OS1.5] Applies to portion of By-law text: "An *air-supported structure* shall not be used for … Group F, Division 1 *major occupancies* …"
(3)	[F10-OS3.7]
3.1.18.3. Clearance to Other Structures	
(2)	(a) [F03-OS1.2]
	(b) [F10-OS3.7]
	(a) [F03-OP3.1]
3.1.18.4. Clearance to Flammable Material	
(1)	[F01-OS1.1] [F03-OS1.2]
	[F01-OP1.1] [F03-OP1.2]
3.1.18.5. Flame Resistance	

(1)	[F02-OS1.2]
3.1.18.6. Emergency Air Supply	
(1)	[F20-OS3.7]
3.1.18.7. Electrical Systems	
(1)	[F34-OP1.1]
	[F34-OS3.3]
	[F34-OS1.1]
(2)	[F81-OP1.1]
	[F81-OS1.1]
3.2.1.2. Storage Garage Considered as a Separate Building	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
3.2.1.4. Floor Assembly over Basement	
(1)	[F03-OS1.2] [F04-OS1.3]
	[F03-OP1.2] [F04-OP1.3]
(2)	[F04-OS1.2,OS1.3]
	[F04-OP1.2,OP1.3]
3.2.1.5. Fire Containment in Basements	
(1)	[F02-OS1.2,OS1.3]
	[F02-OP1.2,OP1.3]
3.2.1.7. Containment in Group C Combustible Buildings Greater than 2 Storeys	
(1)	[F02, F03, F10-OS1.2, OS1.5]
(3)	[F05, F10-OS1.2, OS1.5]
(4)	[F02, F03-OS1.2]
	[F05, F10-OS1.2, OS1.5]
3.2.2.2. Special and Unusual Structures	
(1)	[F02,F03,F04-OS1.2,OS1.3]
	[F02,F03,F04-OP1.2,OP1.3]
3.2.2.6. Multiple Major Occupancies	
(1)	[F02,F03,F04-OS1.2,OS1.3]
	[F02,F03,F04-OP1.2,OP1.3]

3.2.2.10. Streets	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
3.2.2.15. Storeys below Ground	
(2)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
	(b),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.18. Automatic Sprinkler System Required	
(2)	[F02,F04-OS1.2,OS1.3]
	[F02,F04-OP1.2,OP1.3]
(3)	[F02-OS1.2, OP1.2]
(4)	[F02-OS1.2, OP1.2]
3.2.2.20. Group A, Division 1, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.21. Group A, Division 1, One Storey, Limited Area, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "… (a) floor assemblies shall be *fire separations* … (a)(i) with a *fire-resistance rating* not less than 45 min …" and to Clause (b).

	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… (a) floor assemblies shall be *fire separations*… (a)(i) with a *fire-resistance rating* not less than 45 min …" and to Clause (b).
3.2.2.22. Group A, Division 1, One Storey, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.23. Group A, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: " … the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.24. Group A, Division 2, up to 6 Storeys, Any Area, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.25. Group A, Division 2, up to 2 Storeys	

(2)	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.26. Group A, Division 2, up to 2 Storeys, Increased Area, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.27. Group A, Division 2, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
3.2.2.28. Group A, Division 2, One Storey	
(2)	[F03-OP1.2]
	[F03-OS1.2]
3.2.2.29. Group A, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"

	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.30. Group A, Division 3, up to 2 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clauses (c) and (d), the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall (c)(i) have a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall (c)(i) have a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
(3)	[F02-OS1.2] [F04-OS1.3]
	[F02-OP1.2] [F04-OP1.3]
3.2.2.31. Group A, Division 3, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) … the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "Except as permitted by Clause (c) … the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.32. Group A, Division 3, One Storey, Increased Area	
(2)	(a),(c) [F04-OS1.3]
	(a),(c) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… (b) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (c).

	[F04-OP1.3] Applies to portion of By-law text: "… (b) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
(3)	[F02-OS1.2] [F04-OS1.3]
	[F02-OP1.2] [F04-OP1.3]
3.2.2.33. Group A, Division 3, One Storey, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
3.2.2.35. Group A, Division 4	
(1)	[F02-OS1.2] Applies to portion of By-law text: "… a *building* classified as Group A, Division 4 shall be of *noncombustible construction*."
	[F02-OP1.2] Applies to portion of By-law text: "… a *building* classified as Group A, Division 4 shall be of *noncombustible construction*."
(4)	[F02,F04-OS1.2,OS1.3]
	[F02,F04-OP1.2,OP1.3]
3.2.2.36. Group B, Division 1, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.37. Group B, Division 1, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]

	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.38. Group B, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.39. Group B, Division 2, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.40. Group B, Division 2, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]

3.2.2.41. Group B, Division 2, One Storey, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
3.2.2.42. Group B, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.43. Group B, Division 3, up to 3 Storeys (Noncombustible), Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.44. Group B, Division 3, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]

	(b),(c) [F04-OP1.3]
3.2.2.45. Group B, Division 3, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.46. Group B, Division 3, One Storey, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
3.2.2.47. Group C, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.48. Group C, up to 12 storeys, Sprinklered	
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.49. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"

(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.50. Group C, up to 3 Storeys, Noncombustible Construction	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separation* with a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… (a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.51. Group C, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (e).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… (a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, …" and to Clause (e).
	(b),(d),(e) [F04-OS1.3]
	(b),(d),(e) [F04-OP1.3]
	(c) [F04-OS1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ..."
	(c) [F04-OP1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ..."
3.2.2.52. Group C, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"

(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.53. Group C, up to 3 Storeys, Increased Area	
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (d).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h, ..." and to Clause (d).
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.54. Group C, up to 3 Storeys	
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, ..." and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.55. Group C, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: " … the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3] Applies to portion of By-law text: "... (a) ... floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
	[F03-OP1.2] [F04-OP1.2,OP1.3] Applies to portion of By-law text: "… (a) … floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 45 min, …" and to Clause (c).
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.56. Group D, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"

	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.57. Group D, up to 12 storeys, Sprinklered	
(2)	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.58. Group D, up to 6 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have a *fire-resistance rating* not less than 1 h …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, …" and to Clause (d).
3.2.2.59. Group D, up to 6 Storeys, Sprinklered, Noncombustible Construction	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]

	(b),(c) [F04-OP1.3]
3.2.2.60. Group D, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3]
	(a) [F02,F04-OP1.2,OP1.3]
(2)	(a),(e) [F03-OS1.2] [F04-OS1.3,OS1.2]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d),(e) [F04-OS1.3]
	(b),(d),(e) [F04-OP1.3]
	(c) [F04-OS1.3] Applies to portion of By-law text: "... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ..."
	(c) [F04-OP1.3] Applies to portion of By-law text: ".... the roof assembly shall be constructed of *noncombustible construction* or *fire-retardant-treated wood* conforming to Article 3.1.4.5., ..."
3.2.2.61. Group D, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.62. Group D, up to 3 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.63. Group D, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: " … the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.

	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.64. Group D, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.65. Group D, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.66. Group E, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.67. Group E, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]

	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.68. Group E, up to 3 Storeys	
(2)	(a),(e) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.69. Group E, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.70. Group E, up to 2 Storeys	
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(b) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.71. Group E, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(b) [F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.72. Group F, Division 1, up to 4 Storeys, Sprinklered	
(2)	(c),(d) [F04-OP1.3]
	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"

	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
3.2.2.73. Group F, Division 1, up to 3 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.74. Group F, Division 1, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to portion of By-law text: "... [*noncombustible*] floor assemblies shall be *fire separations* …"
	(a) [F03-OP1.2] Applies to portion of By-law text: "... [*noncombustible*] floor assemblies shall be *fire separations* …"
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.76. Group F, Division 2, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]

	(c),(d) [F04-OP1.3]
3.2.2.77. Group F, Division 2, up to 4 Storeys, Increased Area, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.78. Group F, Division 2, up to 3 Storeys	
(2)	(a),(e) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(e) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
3.2.2.79. Group F, Division 2, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.80. Group F, Division 2, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.81. Group F, Division 2, up to 2 Storeys, Sprinklered	

(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.82. Group F, Division 3, Any Height, Any Area, Sprinklered	
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* shall be *sprinklered* throughout …"
	(b),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(b),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.83. Group F, Division 3, up to 6 Storeys	
(2)	[F02-OS1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction*…"
	[F02-OP1.2] Applies to portion of By-law text: "The *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
	(c),(d) [F04-OS1.3]
	(c),(d) [F04-OP1.3]
3.2.2.84. Group F, Division 3, up to 6 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	[F02-OS1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"

	[F02-OP1.2] Applies to portion of By-law text: "… the *building* referred to in Sentence (1) shall be of *noncombustible construction* …"
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.85. Group F, Division 3, up to 4 Storeys	
(2)	[F04-OS1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min …" and to Clause (d).
	[F04-OP1.3] Applies to portion of By-law text: "… (c) roof assemblies shall have, if of *combustible construction*, a *fire-resistance rating* not less than 45 min, …" and to Clause (d).
	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(d) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(d) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(d) [F04-OS1.3]
	(b),(d) [F04-OP1.3]
3.2.2.86. Group F, Division 3, up to 4 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a),(c) [F03-OS1.2] [F04-OS1.2,OS1.3]
	(a),(c) [F03-OP1.2] [F04-OP1.2,OP1.3]
	(b),(c) [F04-OS1.3]
	(b),(c) [F04-OP1.3]
3.2.2.87. Group F, Division 3, up to 2 Storeys	
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.88. Group F, Division 3, up to 2 Storeys, Sprinklered	
(1)	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"

	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
(2)	(a) [F03-OS1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	(a) [F03-OP1.2] Applies to the requirement that *noncombustible* floor assemblies be *fire separations*.
	[F03-OS1.2] [F04-OS1.2,OS1.3]
	[F03-OP1.2] [F04-OP1.2,OP1.3]
3.2.2.89. Group F, Division 3, One Storey	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
3.2.2.90. Group F, Division 3, One Storey, Sprinklered	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	[F02-OP1.2] Applies to portion of By-law text: "A *building* classified as Group F, Division 3 is permitted to be of *heavy timber construction* or *noncombustible construction* used singly or in combination …"
	(a) [F02,F04-OS1.2,OS1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
	(a) [F02,F04-OP1.2,OP1.3] Applies to portion of By-law text: "… the *building* is *sprinklered* throughout …"
3.2.2.91. Group F, Division 3, One Storey, Any Area, Low Fire Load Occupancy	
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.2.2.92. Group F, Division 3, Storage Garages up to 22 m High	
(1)	[F02-OS1.2] Applies to portion of By-law text: "A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor, wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is (a) of *noncombustible construction* …"
	[F02-OP1.2] Applies to portion of By-law text: "A *building* used as a *storage garage* with all *storeys* constructed as *open-air storeys* and having no other *occupancy* above it is permitted to have its floor,wall, ceiling and roof assemblies constructed without a *fire-resistance rating* provided it is (a) of *noncombustible construction* …"
3.2.2.93. Encapsulated Mass Timber Construction, Various Heights and Occupancies, Sprinklered	
(2)	(b), (c) [F04 – OS1.3]
	(b), (c) [F04 – OP1.3]
	(a), (c) [F03 – OS1.2][F04 – OS1.2, OS1.3]
	(a), (c) [F03 – OP1.2][F04 – OP1.2, OP1.3]
3.2.3.1. Limiting Distance and Area of Unprotected Openings	
(1)	[F03-OP3.1]

(5)	[F03-OP3.1]
(6)	[F03-OP3.1]
(8)	[F03-OP3.1]
(9)	[F03-OP3.1]
(10)	[F03-OP3.1]
3.2.3.4. Party Wall	
(1)	[F03-OP3.1]
3.2.3.5. Wall with Limiting Distance Less Than 1.2 m	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
3.2.3.6. Combustible Projections	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
(3)	[F03-OP3.1]
(5)	[F03-OP3.1]
3.2.3.7. Construction of Exposing Building Face	
(1)	[F03,F02-OP3.1]
(2)	[F03,F02-OP3.1]
(3)	[F02,F03-OP3.1]
(4)	[F03,F02-OP3.1]
3.2.3.8. Protection of Exterior Building Face	
(1)	[F03,F02-OP3.1]
3.2.3.9. Protection of Structural Members	
(1)	[F04-OS1.3]
	[F04-OP1.3]
3.2.3.10. Unlimited Unprotected Openings	
(1)	[F03-OP3.1]
(2)	[F03-OP3.1]
3.2.3.11. Low Fire Load, One Storey Building	
(1)	(b) [F03-OP3.1]
	(a) [F04-OP3.1]
3.2.3.12. Area Increase for Unprotected Openings	
(1)	[F03-OP3.1]
3.2.3.13. Protection of Exit Facilities	
(4)	[F06-OS1.2] [F05-OS1.5]

	[F06-OP1.2]
(5)	[F10-OS1.5, OS3.7]
3.2.3.14. Wall Exposed to Another Wall	
(1)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
(2)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
3.2.3.15. Wall Exposed to Adjoining Roof	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.2.3.16. Protection of Soffits	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
3.2.3.17. Canopy Protection for Vertically Separated Openings	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.2.3.18. Covered Vehicular Passageway	
(1)	[F03-OP3.1]
(2)	[F02-OP3.1]
3.2.3.19. Walkway between Buildings	
(1)	[F03-OP3.1]
(2)	[F02-OP3.1]
(3)	[F02-OP3.1]

(4)	[F02,F12-OP3.1]
3.2.3.20. Underground Walkway	
(1)	[F01,F02-OP3.1]
(2)	[F03-OP3.1]
(3)	[F02-OP3.1] Applies to portion of By-law text: "An underground *walkway* shall be of *noncombustible construction* …"
	[F80-OP2.3] Applies to portion of By-law text: "An underground *walkway* shall be … suitable for an underground location."
(4)	(a) [F05-OS1.5] [F06-OS1.2]
	(b) [F10-OS1.5] [F12-OS1.2]
3.2.3.22. Installation of Service Lines Under Buildings	
(1)	[F01-OS1.1]
	[F01-OP1.1]
3.2.4.1. Determination of Requirement for a Fire Alarm System	
(1)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F11-OS1.5]
(7)	[F11-OS1.5] [F13-OS1.2,OS1.5]
	[F13-OP1.2]
3.2.4.2. Continuity of Fire Alarm System	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F10-OS1.5] [F03-OS1.2]
(5)	[F11,F13-OS1.2]
(6)	[F11-OS1.5]
3.2.4.3. Types of Fire Alarm Systems	
(1)	(a) [F11-OS1.5]
	(b) [F11-OS1.4] [F13-OS1.5]
	(c),(d) [F11-OS1.5]
3.2.4.4. Description of Fire Alarm Systems	
(1)	[F11-OS1.5]
(2)	(a) [F11-OS1.4] [F13-OS1.5]
	(b),(c) [F11-OS1.5]
(3)	[F13-OS1.5]

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(4)	[F13-OS1.5]
3.2.4.5. Installation and Verification of Fire Alarm Systems	
(1)	[F11,F81-OS1.5] [F13,F12,F81-OS1.5,OS1.2]
	[F12,F11-OS3.7] Applies to voice communication systems.
(2)	[F82-OS1.5]
3.2.4.6. Silencing of Alarm Signals	
(1)	[F11-OS1.5]
(2)	[F81,F34-OS1.5]
(3)	[F12-OS3.5]
3.2.4.7. Signals to Fire Department	
(1)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(2)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(3)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F81,F13-OS1.5,OS1.2]
	[F81,F13-OP1.2]
(5)	[F13-OS1.5,OS1.2]
	[F13-OP1.2]
(6)	[F13-OP1.2]
	[F13-OS1.2]
3.2.4.8. Annunciator and Zone Indication	
(1)	[F12-OS1.5,OS1.2]
(2)	[F12-OS1.5,OS1.2]
(4)	[F12-OS1.2,OS1.5]
(7)	[F12-OS1.5,OS1.2]
(8)	[F12-OS1.5,OS3.7]
(9)	[F12-OS1.5,OS3.7]
(11)	[F12-OS1.2. OS1.5]
3.2.4.9. Electrical Supervision	
(1)	[F82-OS1.5,OS1.2]
(2)	[F82-OS1.2]
	[F82-OP1.2]
(3)	(a),(d),(e),(f),(g) [F82-OS1.2]

	(a),(d),(e),(f),(g) [F82-OP1.2]
	(b),(c) [F82-OS1.5]
(4)	[F81-OP1.2]
	[F82-OS1.2]
(5)	[F81-OP1.2]
	[F82-OS1.2]
(6)	[F82-OS1.2]
	[F82-OP1.2]
(7)	[F82-OS1.2,OP1.2]
(8)	[F82-OS1.2,OP1.2]
(9)	[F82-OS1.2,OP1.2]
3.2.4.10. Fire Detectors	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F02-OS1.2] [F11-OS1.5]
(4)	[F11-OS1.5]
3.2.4.11. Smoke Detectors	
(1)	[F11-OS1.5]
(3)	[F12-OS1.5]
(4)	[F10-OS1.5]
(5)	[F11-OS1.5]
(7)	[F11-OS1.4,OS1.5]
3.2.4.12. Prevention of Smoke Circulation	
(1)	[F03-OS1.2]
3.2.4.13. Vacuum Cleaning System Shutdown	
(1)	[F03-OS1.2]
3.2.4.14. Deleted.	
3.2.4.15. System Monitoring	
(1)	[F11-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
3.2.4.16. Manual Stations	

(1)	[F11-OS1.5]
(2)	[F02-OS1.2] [F12-OS1.2,OS1.5] [F10-OS1.5]
(3)	[F02-OS1.2] [F12-OS1.2,OS1.5] [F10-OS1.5]
(4)	[F11-OS1.5]
(5)	[F11-OS1.5]
3.2.4.17. Alert and Alarm Signals	
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
3.2.4.18. Audibility of Alarm Systems	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F33-OS3.5]
(5)	[F11-OS1.5]
(6)	[F11-OS1.5]
(7)	[F11-OS1.5]
(8)	[F11,F81-OS1.5]
(9)	[F11,F81-OS1.5]
(10)	[F11,F81-OS1.5]
(11)	[F11-OS1.5]
(13)	[F11-OS1.5]
3.2.4.19. Visible Signals	
(1)	[F11-OS1.5]
(3)	[F11-OS1.5]
3.2.4.20. Smoke Alarms	
(2)	[F81,F11-OS1.5]
(3)	[F11-OS1.5]
(4)	[F11-OS1.5]
(5)	[F11-OS1.5]
(6)	[F11-OS1.5]
(7)	[F11-OS1.5]
(8)	[F11-OS1.5]
(9)	[F11,F81-OS1.5]
(10)	[F11,F81-OS1.5]
(12)	[F11-OS1.5]

(13)	[F81,F11-OS1.5]
(14)	[F11,F81-OS1.5]
(16)	[F11-OS1.5]
3.2.4.21. Residential Fire Warning Systems	
(1)	[F11,F81-OS1.5]
3.2.4.22. Voice Communication Systems for High Buildings	
(1)	[F12,F11-OS3.7]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5] [F13-OS1.4,OS1.5]
(4)	[F11-OS1.5]
(5)	[F12-OS3.7]
(6)	[F11-OS1.5]
(7)	[F11-OS1.5]
3.2.4.23. One-Way Voice Communication Systems	
(1)	[F11-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]
3.2.5.1. Access to Above-Grade Storeys	
(1)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(3)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(4)	[F12-OS1.2, OS1.5, OS3.7]
3.2.5.2. Access to Basements	
(1)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.5.3. Roof Access	
(1)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.4. Access Routes	
(1)	[F12-OS1.5,OS1.2]

	[F12-OP1.2]
3.2.5.5. Location of Access Routes and Path of Travel	
(1)	[F12-OS1.5,OS1.2] [F06-OS1.1]
	[F12-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
(3)	[F12-OS1.2]
	[F12-OP1.2]
(4)	[F12-OS1.2]
	[F12-OP1.2]
(5)	[F12-OS1.2]
	[F12-OP1.2]
(6)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.6. Access Route Design	
(1)	[F12-OS1.2]
	[F12-OP1.2]
(2)	[F02,F12-OS1.2]
	[F02,F12,F03-OP1.2]
	[F02,F12,F03-OP3.1]
(3)	[F12-OS1.5, OS3.1, OS3.7]
3.2.5.7. Water Supply	
(1)	[F02-OS1.2]
	[F02-OP1.2]
	[F02-OP3.1]
3.2.5.8. Standpipe Systems	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.2.5.9. Standpipe System Design	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]

(5)	[F12-OS1.2]
	[F12-OP1.2]
(6)	[F12-OS1.2,OP1.2]
(7)	[F12-OS1.2,OP1.2]
3.2.5.10. Hose Connections	
(1)	[F03-OS1.2] [F05,F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F12-OS1.2]
	[F12-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
3.2.5.11. Hose Stations	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
(3)	[F02,F12-OS1.2]
	[F02,F12-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F10-OS1.5]
(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F01-OS1.1]
3.2.5.12. Automatic Sprinkler Systems	
(1)	[F02,F81,F82-OS1.2]
	[F02,F81,F82-OP1.2]
(2)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
(3)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
(4)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F81-OS1.2]
	[F81-OP1.2]

(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
	[F03-OP3.1]
(8)	[F81-OS3.3,OS3.6]
(11)	[F03-OS1.2]
(12)	[F03-OS1.2]
3.2.5.13. Combustible Sprinkler Piping	
(2)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
(3)	[F06-OS1.2]
	[F06-OP1.2]
(4)	[F06-OS1.2]
	[F06-OP1.2]
3.2.5.14. Sprinklered Service Space	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
(3)	[F11-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.5.15. Fire Department Connections	
(1)	[F12-OS1.2]
	[F12-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.16. Portable Fire Extinguishers	
(1)	[F02,F12,F81-OS1.2]
	[F02,F12,F81-OP1.2]
(2)	[F12-OS1.2]
	[F12-OP1.2]
3.2.5.17. Protection from Freezing	
(1)	[F81-OS1.2]
	[F81-OP1.2]

3.2.5.18. Fire Pumps	
(1)	[F02,F81-OS1.2] [F81-OS1.4]
	[F02,F81-OP1.2] [F81-OP1.4]
3.2.5.19. Location of Building Safety Facilities for Firefighters	
(1)	[F03-OS1.2,OP1.2]
3.2.5.20. Radio Antenna Systems	
(1)	[F12, F13 – OS1.2,OS1.5] [F12,F13 – OS3.7]
	[F12,F13-OP1.2
3.2.6.2. Limits to Smoke Movement	
(1)	[F02-OS1.2,OS1.5]
	[F02-OP1.2]
(2)	[F06-OS1.2,OS1.5] [F05-OS1.5]
	[F06-OP1.2]
(3)	[F06-OS1.5,OS1.2] [F05-OS1.5]
	[F06-OP1.2]
(4)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
(5)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
(6)	[F03,F12-OS1.2,OS1.5]
	[F03,F12-OP1.2]
3.2.6.3. Connected Buildings	
(1)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
	[F03-OP3.1]
3.2.6.4. Emergency Operation of Elevators	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(4)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F12-OS3.4]

(6)	[F12-OS3.4]
(7)	[F12-OS3.4]
3.2.6.5. Elevator for Use by Firefighters	
(1)	[F12,F06-OS1.2,OS1.5]
	[F12,F06-OP1.2]
(2)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(3)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(4)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(6)	**Deleted.**
	Deleted.
3.2.6.6. Venting to Aid Firefighting	
(1)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(2)	[F30-OS3.1]
(3)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(4)	[F03-OS1.2] [F12-OS1.2,OS1.5]
3.2.6.7. Central Alarm and Control Facility	
(1)	[F12-OS1.2,OS1.5]
	[F12-OP1.2]
(2)	[F12-OS1.2,OS1.5] [F11-OS1.5]
	[F12-OP1.2]
3.2.6.8. Voice Communication System	
(1)	[F12,F11-OS3.7]
3.2.6.9. Testing	
(1)	[F82-OS1.2,OS1.5]
	[F82-OP1.2]
3.2.7.1. Minimum Lighting Requirements	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]

(4)	[F30-OS3.1]
(5)	[F74-OA2]
(6)	[F74-OA2]
(7)	[F10-OS3.7]
	[F74-OA2]
	[F30-OS3.1]
3.2.7.2. Recessed Lighting Fixtures	
(1)	[F01-OS1.1,OS1.2]
	[F01-OP1.1,OP1.2]
3.2.7.3. Emergency Lighting	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
3.2.7.4. Emergency Power for Lighting	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30,F81-OS3.1] [F10,F81-OS3.7]
3.2.7.5. Emergency Power Supply Installation	
(1)	[F81,F06,F11,F02,F03,F10,F12-OS1.2,OS1.5]
	[F81,F06,F02,F03-OP1.2]
	[F81,F06,F02-OP3.1]
	[F81,F30-OS3.1] [F81,F11,F10,F12-OS3.7]
3.2.7.6. Emergency Power for Treatment Occupancies	
(1)	[F81,F06,F11,F02,F03,F10,F12-OS1.2,OS1.5]
	[F81,F06,F02,F03-OP1.2]
	[F81,F06,F02-OP3.1]
	[F81,F30-OS3.1] [F81,F11,F10,F12-OS3.7]
3.2.7.7. Fuel Supply Shut-off Valves	
(1)	[F12-OS1.1,OS1.2] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F12-OP1.2] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F12-OH5] Applies to the requirement for a suitably identified shut-off valve outside the *building*.
	[F81-OS1.2,OS1.5] Applies to the requirement for a suitably identified separate shut-off valve.
	[F81-OS3.1,OS3.7] Applies to the requirement for a suitably identified separate shut-off valve.
3.2.7.8. Emergency Power for Fire Alarm Systems	

(1)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2] Applies to the requirement for fire alarm systems, including those with a voice communication system, to be provided with an emergency power supply.
(2)	[F11-OS1.5] [F13-OS1.2,OS1.5]
	[F13-OP1.2]
(3)	[F11-OS1.5] [F13-OS1.5,OS1.2]
	[F13-OP1.2]
(4)	[F13-OP1.2]
	[F11-OS1.5] [F13-OS1.2,OS1.5]
3.2.7.9. Emergency Power for Building Services	
(1)	[F12,F02,F03-OS1.5,OS1.2]
	[F12,F02,F03-OP1.2]
	(b) [F02-OP3.1]
	(a) [F36-OS3.6] [F12,F10-OS3.7]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
	[F36-OS3.6] [F12-OS3.7]
3.2.7.10. Protection of Electrical Conductors	
(2)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(3)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(4)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(6)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(8)	[F06-OS1.2,OS1.5]
	[F06-OP1.2]
(10)	[F06-OS1.4]
	[F06-OP1.2]
	[F10-OS3.7]
3.2.8.1. Application	
(1)	[F03,F06-OS1.2] [F05-OS1.5]
	[F03,F06-OP1.2]
3.2.8.2. Exceptions to Special Protection	

(3)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
3.2.8.3. Sprinklers	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F02-OS1.2] [F11-OS1.5] [F13-OS1.5,OS1.2]
	[F02,F13-OP1.2]
3.2.8.4. Vestibules	
(1)	[F06-OS1.2] [F05-OS1.5]
	[F06,F03-OP1.2]
3.2.8.5. Protected Floor Space	
(1)	[F05-OS1.2] [F06-OS1.5]
3.2.8.6. Draft Stops	
(1)	[F02-OS1.2] [F11-OS1.5] [F13-OS1.5,OS1.2]
	[F02,F13-OP1.2]
3.2.8.7. Mechanical Exhaust System	
(1)	[F03-OS1.5,OS1.2]
	[F03-OP1.2]
(2)	[F12-OS1.5,OS1.2]
	[F12-OP1.2]
3.2.8.8. Combustible Content Limits	
(1)	[F02-OS1.2]
	[F02-OP1.2]
3.2.9.1. Testing	
(1)	[F02,F81,F82-OS1.2,OS1.5]
	[F02,F81,F82-OP1.2]
3.2.10.1. Application	
(1)	(e) [F10-OS3.7]
3.2.10.2. Building Construction	
(1)	[F02,F04-OS1.2, OS1.3]
	[F02,F04-OP1.2, OP1.3]
(2)	[F03-OS1.2]
	[F03-OP1.2]

	[F03-OP3.1]
(3)	[F02-OS1.2]
	[F02-OP1.2]
	(a) [F05-OS1.5] [F06-OS1.2,OS1.5] [F03-OS1.2]
	(a) [F03,F06-OP1.2]
	(b) [F10-OS3.7]
	(c) [F05,F06,F10,F12-OS1.5]
	(d) [F01,F02-OS1.1, OS1.2]
	(d) [F01,F02-OP1.1, OP1.2]
(4)	[F06-OS1.1] [F12-OS1.2,OS1.5]
	[F12-OP1.2]
(5)	[F06-OS1.1] [F12-OS1.2,OS1.5]
	[F12-OP1.2]
(6)	[F06-OS1.1] [F12-OS1.2,OS1.5]
	[F12-OP1.2]
3.3.1.1. Separation of Suites	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
(5)	[F03-OS1.2, OP1.2]
3.3.1.2. Hazardous Substances, Equipment and Processes	
(1)	[F01,F02,F03-OS1.1,OS1.2]
	[F01,F02,F03-OP1.1,OP1.2]
	[F43-OS3.4]
(3)	[F43-OS3.7]
	[F05-OS1.5]
3.3.1.3. Means of Egress	
(3)	[F10-OS3.7]
(4)	[F10,F12,F05,F06-OS3.7]
(5)	[F10,F12-OS3.7]
(6)	[F10,F12,F05,F06-OS3.7]
(7)	[F10,F12,F05,F06-OS3.7]
(8)	[F05-OS1.5]
(9)	[F10,F12,F05,F06-OS3.7]

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3.3.1.4. Public Corridor Separations	
(1)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(2)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F03,F05-OS1.5] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]
(4)	(a),(b) [F03,F05,F10-OS1.5] [F06,F12-OS1.2,OS1.5] (c) [F03,F05-OS1.5] [F03,F06-OS1.5,OS1.2]
	(a),(b) [F03,F06,F12-OP1.2] (c) [F03,F06-OP1.2]
3.3.1.5. Egress Doorways	
(1)	[F10,F05-OS1.5]
(2)	[F05,F10-OS1.5]
3.3.1.6. Travel Distance	
(1)	[F10-OS1.5]
3.3.1.7. Deleted	
3.3.1.8. Headroom and Protruding Objects	
(2)	[F30,F73-OS3.1]
3.3.1.9. Corridors	
(1)	[F10,F12-OS3.7]
(2)	[F10,F12-OS3.7]
(3)	[F10,F12-OS3.7]
(4)	(a) [F10,F12-OS3.7]
	(b) [F05-OS1.5] [F06-OS1.5,OS1.2]
3.3.1.11. Door Swing	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
3.3.1.12. Sliding Doors	
(1)	(b) [F10-OS3.7]
3.3.1.13. Doors and Door Hardware	
(1)	(a),(b) [F10,F12-OS3.7] [F30-OS3.1]
	(c) [F10-OS3.7] [F30-OS3.1]

	(d) [F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10-OS3.7]
	[F73-OA1]
(8)	[F12-OS3.7]
(9)	[F12-OS3.7]
(10)	[F12-OS3.7]
(11)	[F10-OS3.7]
3.3.1.16. Tapered Treads in a Curved Flight	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
3.3.1.17. Capacity of Access to Exits	
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(6)	[F10-OS3.7]
3.3.1.18. Guards	
(1)	[F30-OS3.1]
(2)	[F30-OS3.1]
(3)	[F30-OS3.1]H
(4)	[F30-OS3.1]
(6)	[F30-OS3.1]
3.3.1.19. Tactile Walking Surface Indicators	
(1)	[F30-OS3.1]
3.3.1.20. Transparent Doors and Panels	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F20-OS3.1]
(4)	[F30-OS3.1] [F10-OS3.7]
(6)	[F30-OS3.1] [F10-OS3.7]
(8)	[F30-OS3.1]
(9)	[F30-OS3.1]

3.3.1.21. Exhaust Ventilation and Explosion Venting	
(1)	[F01-OS1.1]
(2)	(a) [F02-OS1.2]
	(a) [F02-OP1.2]
(3)	[F02-OS1.3] Applies to the requirement for explosion-relief devices and vents.
	[F02-OP1.3] Applies to the requirement for explosion-relief devices and vents.
3.3.1.22. Janitors' Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.23. Common Laundry Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F02-OS1.2]
	[F02-OP1.2]
3.3.1.24. Obstructions	
(1)	[F10-OS3.7]
3.3.1.25. Signs in Service Spaces	
(1)	[F10-OS3.7]
3.3.1.26. Welding and Cutting	
(1)	[F03,F02-OS1.2]
	[F03,F02-OP1.2]
3.3.2.1. Scope	
(2)	[F30-OS3.1] [F10-OS3.7]
(3)	[F30-OS3.1] [F10-OS3.7]
3.3.2.2. Fire Separations	
(1)	[F03-OS1.2]
(3)	[F03-OS1.2] Applies where space under tiers of seats is not *sprinklered*.
	[F03-OS1.2] Applies where space under tiers of seats is *sprinklered*.
3.3.2.4. Fixed Seats	
(1)	[F30-OS3.1] [F10-OS3.7]
(3)	[F10-OS3.7]
3.3.2.5. Aisles	
(2)	[F10-OS3.7]

(4)	[F10-OS3.7]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
(8)	[F10-OS3.7] [F30-OS3.1]
(9)	[F10-OS3.7] [F30-OS3.1]
(10)	[F10-OS3.7] [F30-OS3.1]
(11)	[F10-OS3.7] [F30-OS3.1]
(12)	[F10-OS3.7] [F30-OS3.1]
(13)	[F10-OS3.7] [F30-OS3.1]
(14)	[F10-OS3.7] [F30-OS3.1]
(15)	[F10-OS3.7] [F30-OS3.1]
(16)	[F10-OS3.7] [F30-OS3.1]
3.3.2.6. Corridors	
(1)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F03,F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(4)	[F10-OS3.7]
3.3.2.7. Doors	
(1)	[F10-OS3.7]
3.3.2.8. Fixed Bench-Type Seats without Arms	
(1)	[F10-OS3.7]
	[F10-OS3.7]
3.3.2.10. Handrails in Aisles with Steps	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
3.3.2.11. Outdoor Places of Assembly	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(5)	[F10-OS3.7]
3.3.2.12. Bleachers	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]

(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1]
3.3.2.13. Libraries	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F02-OS1.2]
	[F02-OP1.2]
3.3.2.14. Stages for Theatrical Performances	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F02-OS1.2] [F06-OS1.2,OS1.5]
	[F02,F06-OP1.2]
(6)	[F03-OS1.2,OS1.5]
	[F03-OP1.2]
3.3.2.15. Risers for Stairs	
(1)	[F30-OS3.1]
3.3.2.16. Storage Rooms	
(1)	[F12-OS1.2]
	[F12-OP1.2]
3.3.2.17. Safety Glazing	
(1)	[F20,F30-OS3.1]
(2)	[F20,F30-OS3.1]
3.3.2.18. Daycare Facilities with Children under 30 Months	
(1)	(a) [F02,F03,F05-OS1.2,OS1.3]
	(b) [F10-OS1.5]
(2)	[F11-OS1.5]
(3)	[F11-OS1.5]

(4)	[F11-OS1.5]
	[F81-OS1.4]
(5)	[F11-OS1.5]
	[F81-OS1.4]
3.3.3.2. Separations between Care, Treatment or Detention Occupancies and Repair Garages	
(1)	[F44-OS3.4]
	[F03-OS1.2]
3.3.3.3. Corridors	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10,F12-OS3.7]
(4)	(a) [F10-OS3.7]
	(b) [F10,F12-OS3.7]
3.3.3.4. Doorway Width	
(1)	[F10,F12-OS3.7]
(2)	[F10,F12-OS3.7]
3.3.3.5. Compartments and Fire Separations	
(2)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(4)	[F05-OS1.2] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]
(6)	[F10-OS1.5]
(7)	[F10-OS1.5]
(8)	[F03,F05-OS1.2] [F06-OS1.5]
(12)	[F03,F05-OS1.2] [F06-OS1.5]
(16)	[F02,F03-OS1.2] [F44-OS1.1]
	[F02,F03-OP1.2]
(17)	[F03-OS1.2]
3.3.3.6. Areas of Refuge	
(1)	[F03-OS1.2]
3.3.3.7. Contained Use Areas	
(2)	[F03-OS1.2] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(3)	[F02-OS1.2] [F06-OS1.5,OS1.2]

	[F02,F06-OP1.2]
(4)	[F02-OS1.2] [F06-OS1.5,OS1.2]
	[F02,F06-OP1.2]
(5)	[F10-OS3.7]
3.3.4.2. Fire Separations	
(1)	[F03-OS1.2] [F05-OS1.5] [F06-OS1.5,OS1.2]
	[F03,F06-OP1.2]
(4)	[F02,F03-OS1.2] [F44-OS1.1]
	(a),(b) [F02,F03-OP1.2]
(5)	[F03-OS1.2] [F01-OS1.1]
	(a) [F03-OP1.2]
	[F44-OS3.4]
3.3.4.3. Storage Rooms	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F12-OS1.2]
	[F12-OP1.2]
3.3.4.4. Egress from Dwelling Units	
(2)	[F10,F05-OS3.7]
(3)	[F10-OS3.7]
(4)	[F05-OS1.2,OS1.5]
(5)	[F10,F05-OS3.7]
(6)	[F10,F05-OS3.7]
(7)	[F10-OS3.7]
3.3.4.5. Automatic Locking Prohibition	
(1)	[F10-OS3.7]
3.3.4.8. Protection of Openable Windows	
(1)	[F30-OS3.1]
3.3.5.2. Fire Extinguishing Systems	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.3. Basements	
(1)	[F12-OS1.2,OS1.5] [F01-OS1.1]

	[F12-OP1.2]
(2)	[F06-OS1.5,OS1.2] Applies to the separation of entrances to *basements* and to rooms containing *building* services from the remainder of the *building*.
	[F06-OP1.2] Applies to the separation of entrances from the remainder of the *building*.
	[F05-OS1.5] [F06-OS1.2,OS1.5] Applies to the separation of *exits* from the remainder of the *building*.
	[F06-OP1.2] Applies to the separation of *exits* from the remainder of the *building*.
(3)	[F44-OS1.1]
3.3.5.4. Repair and Storage Garages	
(2)	[F30-OS3.1] [F10,F12-OS3.7]
(5)	[F30-OS3.1]
(6)	[F30-OS3.1]
3.3.5.5. Repair Garage Separation	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.6. Storage Garage Separation	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.5.7. Vestibules	
(4)	[F44-OS3.4]
	[F44-OS1.1]
3.3.5.8. Dispensing of Fuel	
(1)	[F01-OS1.1]
(2)	[F01-OS1.1]
3.3.5.9. Multiple-Tenant Self-Storage Warehouses	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.6.2. Storage of Dangerous Goods	
(1)	[F03-OP1.2]
	[F03-OS1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F01,F02,F03,F81-OS1.1,OS1.2]
	[F01,F02,F03,F81-OP1.1,OP1.2]
(4)	[F01-OS1.1]
	[F01-OP1.1]

3.3.6.3. Indoor Storage of Anhydrous Ammonia and Flammable, Toxic and Oxidizing Gases	
(1)	(a) [F03-OS1.2] [F44-OS1.1]
	(a) [F03-OP1.2]
	(a) [F44-OS1.2,OS1.5,OS1.1] Applies to gas-tight *fire separations*.
	(b) [F12-OS1.2] [F01-OS1.1] [F02-OS1.3]
	(b) [F02-OP1.3]
	(c) [F12-OS1.1]
	(d) [F44-OS1.1]
(2)	(a) [F03-OP1.2]
	(a) [F03-OS1.2] [F44-OS1.1]
	(a) [F44-OS1.2,OS1.5,OS1.1] Applies to gas-tight *fire separations*.
	(b) [F12-OS1.2] [F01-OS1.1]
	(c) [F12-OS1.1]
	(d) [F44-OS1.1]
3.3.6.4. Storage and Dispensing Rooms for Flammable Liquids and Combustible Liquids	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F02-OS1.3]
	[F02-OP1.3]
3.3.6.5. Tire Storage	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.3.6.6. Ammonium Nitrate Storage	
(2)	[F01-OS1.1] [F02,F12-OS1.2]
	[F01-OP1.1] [F02,F12-OP1.2]
(3)	[F03-OS1.2] [F01-OS1.1]
	[F03-OP1.2] [F01-OP1.1]
(4)	[F12,F02-OS1.1]
	[F12,F02-OP1.2]
(5)	[F44-OH5]
	[F01-OS1.1] [F02-OS1.2]
	[F43-OS3.4]
(6)	[F01,F81-OS1.1]
3.3.6.7. Flooring Materials	
(1)	[F43-OS3.4]

	[F44-OH5]
	[F01-OS1.1]
3.3.6.8. Fire Separations in Process Plants	
(1)	[F03-OP1.2]
	[F03-OS1.2]
3.3.6.9. Basements and Pits	
(1)	[F01-OS1.1]
	[F01-OP1.1]
3.3.7.2. Skylights	
(1)	[F34-OS4.1]
(2)	[F34-OS4.1]
3.3.7.5. Exterior Sliding Windows	
(1)	[F34-OS4.1]
3.3.7.6. Security Gates for Storage Garages	
(1)	[F36-OS3.6]
3.3.7.7. Security for Storage Garages	
(1)	[F34, F35-OS4.1]
(2)	[F34, F35-OS4.1] [F30-OS4.2]
(3)	[F34, F35-OS4.1] [F30-OS4.2]
(4)	[F34, F35-OS4.1] [F30-OS4.2]
(5)	[F34, F35-OS4.1] [F30-OS4.2]
(6)	[F34, F35-OS4.1] [F30-OS4.2]
(7)	[F34, F35-OS4.1]
(8)	[F30-OS4.2] [F35-OS4.2]
3.3.7.9. Mailbox Construction in Multi-Family Buildings	
(1)	[F34-OS4.3]
3.3.8.1. Public Storage Facilities	
(1)	[F10-OS3.7]
3.4.1.2. Separation of Exits	
(1)	[F10,F12,F05,F06-OS3.7]
	[F12,F06-OP1.2]
	[F12,F06-OS1.5,OS1.2]
(2)	[F10-OS3.7]
(3)	[F10, F12, F05, F06-OS3.7]
	[F12, F06-OP1.2]

	[F12, F06-OS1.5, OS1.2]
3.4.1.5. Exterior Exit Passageways	
(1)	[F10-OS3.7]
3.4.1.6. Restricted Use of Horizontal Exits	
(1)	[F10-OS3.7]
(2)	[F10,F05-OS3.7]
3.4.1.7. Slide Escapes	
(1)	[F10-OS3.7]
3.4.1.9. Mirrors near Exits	
(1)	[F10-OS3.7] [F30-OS3.1]
3.4.1.10. Combustible Glazing in Exits	
(1)	[F05-OS1.2] [F06-OS1.2,OS1.5]
	[F03,F06-OP1.2]
3.4.2.1. Minimum Number of Exits	
(1)	[F10,F12,F05,F06-OS3.7]
	[F12,F06-OS1.2]
	[F12,F06-OP1.2]
(3)	[F10-OS3.7]
3.4.2.2. Means of Egress from Mezzanines	
(1)	[F05-OS1.5]
3.4.2.3. Distance between Exits	
(1)	[F10,F05-OS1.5]
(4)	[F10-OS3.7]
3.4.2.4. Travel Distance	
(3)	[F10-OS3.7]
3.4.2.5. Location of Exits	
(1)	[F10-OS3.7]
(3)	[F10-OS3.7]
3.4.2.6. Principal Entrances	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
3.4.3.1. Exit Width Based on Occupant Load	
(2)	[F10-OS3.7]
3.4.3.2. Exit Width	
(1)	[F10-OS3.7]

(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
(8)	[F12,F10-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.3.3. Exit Width Reduction	
(1)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2]
(2)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(3)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(4)	[F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.3.4. Headroom Clearance	
(1)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(4)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
(5)	[F30-OS3.1] [F10,F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.4.1. Fire-Resistance Rating of Exit Separations	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F06,F03-OP1.2]
3.4.4.2. Exits through Lobbies	
(1)	[F05,F06-OS1.5]

(2)	[F12,F10,F05,F06-OS1.5]
3.4.4.3. Exterior Passageway Exceptions	
(1)	[F05,F06,F10-OS1.5]
3.4.4.4. Integrity of Exits	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F06,F03-OP1.2]
(2)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(3)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(4)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
	[F43-OS3.7]
(5)	[F05-OS1.5] [F06-OS1.5,OS1.2] [F03-OS1.2]
	[F03,F06-OP1.2]
(6)	[F10,F12-OS3.7] [F30-OS3.1] [F31-OS3.2] [F32-OS3.3] [F43-OS3.4]
	[F10,F05-OS1.5] [F12-OS1.5,OS1.2]
	[F12-OP1.2]
(7)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
	[F43-OS3.7]
(8)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
(9)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06-OP1.2]
3.4.5.1. Exit Signs	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10,F81-OS3.7]
(4)	[F10,F81-OS3.7]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
(7)	[F10-OS3.7]
3.4.5.2. Exit Signs with Tactile Information	
(1)	[F10-OS3.7]

3.4.5.3. Signs for Stairs and Ramps at Exit Level	
(1)	[F10-OS3.7]
3.4.6.1. Slip Resistance of Ramps and Stairs	
(1)	(a) [F10-OS3.7] [F30-OS3.1]
	(b) [F10-OS3.7] [F30-OS3.1]
(2)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
3.4.6.2. Minimum Number of Risers	
(1)	[F30-OS3.1]
3.4.6.3. Maximum Vertical Rise of Stair Flights and Required Landings	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10,F12-OS3.7] [F30-OS3.1]
3.4.6.4. Dimensions of Landings	
(1)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(2)	[F10,F12-OS3.7] [F30-OS3.1]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(4)	[F10,F12-OS3.7] [F30-OS3.1]
(5)	[F10,F12-OS3.7] [F30-OS3.1]
3.4.6.5. Handrails	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(9)	[F10-OS3.7] [F30-OS3.1]
(10)	[F30-OS3.1] [F10-OS3.7]
	[F73-OA1]
(11)	[F30-OS3.1] [F10-OS3.7]
(12)	[F30-OS3.1] [F10-OS3.7]

	[F73-OA1]
(13)	[F30-OS3.1] [F10-OS3.7]
(15)	[F30-OS3.1] [F10-OS3.7]
3.4.6.6. Guards	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F30-OS3.1] [F10-OS3.7]
(4)	[F30-OS3.1] [F10-OS3.7]
(5)	[F30-OS3.1]
(6)	[F30-OS3.1]
(7)	[F30-OS3.1]
3.4.6.7. Ramp Slope	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
3.4.6.8. Treads and Risers	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
	[F73-OA1]
(4)	[F10-OS3.7] [F30-OS3.1]
(5)	[F30-OS3.1] [F10-OS3.7]
(6)	[F30-OS3.1] [F10-OS3.7]
(7)	[F30-OS3.1] [F10-OS3.7]
(8)	[F30-OS3.1]
(9)	[F10-OS3.7] [F30-OS3.1]
(10)	[F30-OS3.1]
3.4.6.9. Curved Flights in Exits	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F30-OS3.1] [F10-OS3.7]
3.4.6.10. Horizontal Exits	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(4)	[F10,F73-OS3.7]
(5)	[F10-OS3.7]

3.4.6.11. Doors	
(1)	[F30-OS3.1] [F10-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F30-OS3.1] [F10-OS3.7]
	[F81,F10-OS3.7] Applies where there is a danger of blockage from ice or snow.
(4)	[F10-OS3.7]
(5)	[F10,F12-OS3.7]
(6)	[F10-OS3.7]
3.4.6.12. Direction of Door Swing	
(1)	[F10-OS3.7]
3.4.6.13. Self-closing Devices	
(1)	[F05-OS1.5] [F06-OS1.5,OS1.2]
	[F06,F03-OP1.2]
3.4.6.14. Sliding Doors	
(2)	[F12-OS3.7]
3.4.6.15. Revolving Doors	
(1)	(a) [F30-OS3.1] [F10-OS3.7]
	(b) [F10,F12-OS3.7]
	(c) [F10-OS3.7]
	(d) [F30-OS3.1] [F10-OS3.7]
	(e) [F20-OS3.1]
(2)	[F10-OS3.7]
(3)	(a),(b),(d),(e) [F10,F81-OS3.7] [F20,F30-OS3.1]
3.4.6.16. Door Release Hardware	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
(5)	[F10,F81-OS3.7]
(6)	[F10,F81-OS3.7]
(8)	[F10-OS3.7]
	[F73-OA1]
3.4.6.17. Security for Banks and Mercantile Floor Areas	
(1)	[F02-OS1.2] Applies to *sprinklered buildings*.
	[F10,F81-OS3.7] Applies to *exit* and egress doors that comply with the stated Sentences.

(2)	[F10-OS3.7]
(3)	[F81-OS3.7]
(5)	[F10-OS1.5]
(6)	[F10-OS3.7]
(9)	[F10,F81-OS3.7]
3.4.6.18. Emergency Access to Floor Areas	
(1)	[F10-OS3.7]
(3)	[F10-OS3.7]
(4)	[F10-OS3.7]
	[F12-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2,OS1.5]
(5)	[F10-OS3.7]
(6)	[F10-OS3.7]
3.4.6.19. Floor Numbering and Identification of Stair Shafts	
(1)	[F10,F12,F73-OS3.7]
	[F73-OA1]
	[F12-OP1.2]
	[F12-OS1.2]
(2)	[F10,F12,F73-OS3.7]
	[F12-OP1.2]
	[F12-OS1.2]
3.4.7.1. Scope	
(1)	[F10,F12-OS3.7]
(2)	[F10-OS3.7] [F30-OS3.1]
	[F10-OS1.5] [F12-OS1.2]
3.4.7.2. Fire Escape Construction	
(1)	[F05-OS1.5] [F06-OS1.2] Applies to the combustibility of materials used in the construction of fire escapes.
	[F10,F12-OS3.7] [F20-OS3.1] Applies to the type and construction of fire escapes.
	[F20-OS2.1] Applies to the type and construction of fire escapes.
3.4.7.3. Access to Fire Escapes	
(1)	[F10-OS3.7] Applies to portion of By-law text: “Access to fire escapes shall be from corridors through doors at floor level …”
(2)	[F30-OS3.1] [F10-OS3.7]

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3.4.7.4. Protection of Fire Escapes	
(1)	[F05,F06-OS1.5]
3.4.7.5. Stairs	
(1)	[F10-OS3.7]
(2)	[F10-OS3.7]
(3)	[F10-OS3.7] Applies to the reduction in width permitted under certain conditions.
(4)	[F10-OS3.7] [F30-OS3.1]
3.4.7.6. Guards and Railings	
(1)	[F10-OS3.7] [F30-OS3.1]
(2)	[F10-OS3.7] [F30-OS3.1]
(3)	[F10-OS3.7] [F30-OS3.1]
(4)	[F30-OS3.1]
(5)	[F30-OS3.1]
3.5.2.1. Elevators, Escalators and Dumbwaiters	
(1)	[F30,F81-OS3.1] [F32,F81-OS3.3] [F36,F81-OS3.6]
(2)	[F82-OS3.1,OS3.3,OS3.6]
(3)	[F73-OA1]
3.5.3.1. Fire Separations for Elevator Hoistways	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.5.3.2. Vertical Service Spaces for Dumbwaiters	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.5.3.3. Fire Separations for Elevator Machine Rooms	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.5.4.1. Elevator Car Dimensions	
(1)	[F12-OS3.7]
(3)	[F12-OS3.7]
3.5.4.2. Floor Numbering	
(1)	[F73-OA1]
3.6.1.2. Electrical Wiring and Equipment	
(1)	[F01-OS1.1] [F02,F03-OS1.2] [F81-OS1.4]

	[F01-OP1.1] [F02,F03-OP1.2] [F81-OP1.4]
	[F32-OS3.3]
3.6.1.3. Lightning Protection Systems	
(1)	[F01,F81-OS1.1]
	[F01,F81-OP1.1]
3.6.1.4. Storage Use Prohibition	
(1)	[F01-OS1.1] [F02-OS1.2]
3.6.1.5. Appliances Installed outside a Building	
(1)	[F03-OS1.2]
	(b) [F03-OP1.2]
	(a) [F03-OP3.1]
3.6.2.1. Fire Separations around Service Rooms	
(1)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(3)	[F01-OS1.1] [F03-OS1.2]
	[F01-OP1.1] [F03-OP1.2]
(4)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(5)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(6)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(7)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
3.6.2.2. Service Rooms under Exits	
(1)	[F06,F05-OS3.7]
	[F02-OS1.2]
3.6.2.4. Incinerator Rooms	
(1)	[F02-OS1.2]
3.6.2.5. Storage of Combustible Refuse and Recycling	
(1)	[F03-OS1.2]
	[F03-OP1.2]
3.6.2.6. Door Swing for Service Rooms	
(1)	[F10-OS1.5] Applies to portion of By-law text: “A swing-type door from a *service room* containing a *boiler* or incinerator shall swing outward from the room …”

	[F30-OS3.1] Applies to portion of By-law text: "A swing-type door from a *service room* containing a *boiler* or incinerator shall swing … inward if the door opens onto a corridor or any room used for an *assembly occupancy*."
3.6.2.7. Electrical Equipment Vaults	
(2)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(3)	[F02-OS1.2] [F11-OS1.5] [F03-OS1.4]
	[F02-OP1.2] [F03-OP1.4]
(4)	[F03-OS1.2,OS1.4]
	[F03-OP1.2,OP1.4]
(6)	[F81-OS1.1]
(7)	[F03-OS1.2]
(8)	[F44-OS1.1] [F03-OS1.2]
(9)	[F34-OS1.1]
	[F34-OS3.3]
	[F34-OP1.1]
3.6.2.8. Emergency Power Installations	
(1)	[F03-OS1.2,OS1.4] [F06-OS1.2,OS1.5]
	[F03-OP1.2,OP1.4] [F06-OP1.2]
3.6.3.1. Fire Separations for Vertical Service Spaces	
(1)	[F03-OS1.2]
	[F03-OP1.2]
(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(4)	[F03-OS1.2]
	[F03-OP1.2]
(5)	[F03-OS1.2]
	[F03-OP1.2]
3.6.3.2. Foamed Plastic Protection	
(1)	[F02-OS1.2]
3.6.3.3. Linen and Refuse Chutes	
(1)	(d),(e) [F02-OS1.2]
	(a),(b),(c) [F41-OH2.4,OH2.5]

(2)	[F03-OS1.2]
	[F03-OP1.2]
(3)	[F03-OS1.2]
(4)	(b) [F03-OS1.2]
	(a) [F41-OH2.4,OH2.5]
(5)	(a) [F81,F03-OS1.2]
	(a) [F81,F41-OH2.4,OH2.5]
	(a) [F81,F03-OP1.2]
	(b) [F03-OS1.2]
	(b) [F03-OP1.2]
	(c) [F01,F02-OS1.2]
	(c) [F01,F02-OP1.2]
	(d) [F05-OS1.5] [F06-OS1.5,OS1.2]
	(d) [F06-OP1.2]
(6)	[F02-OS1.2]
	[F02-OP1.2]
(7)	[F03-OS1.2]
	[F03-OP1.2]
(8)	[F02-OS1.2]
	[F41-OH2.4,OH2.5]
(9)	[F03-OS1.2]
	[F03-OP1.2]
(10)	[F81,F03-OS1.2] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying …”
	[F81,F41-OH2.4,OH2.5] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying …”
	[F41-OH2.4,OH2.5] Applies to portion of By-law text: “The room or bin into which a refuse chute discharges shall be … impervious to moisture and be equipped with a water connection and floor drain for washing-down purposes.”
(11)	[F01,F02-OS1.2]
3.6.3.4. Exhaust Duct Negative Pressure	
(1)	[F03-OS1.2]
3.6.3.5. Grease Duct Enclosures	
(1)	[F02,F03-OS1.2]
	[F02,F03-OP1.2]
(2)	[F02,F03-OS1.2]

	[F02,F03-OP1.2]
3.6.4.2. Fire Separations for Horizontal Service Spaces	
(2)	[F03-OS1.2]
	[F03-OP1.2]
3.6.4.3. Plenum Requirements	
(1)	[F02-OS1.2]
(2)	[F03-OS1.2,OS1.3]
	[F03-OP1.2,OP1.3]
(3)	[F02, F03-OS1.2.,OS3.4]
3.6.4.4. Attic or Roof Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.4.5. Horizontal Service Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.4.6. Crawl Space Access	
(1)	[F01,F02,F12-OS1.2]
	[F01,F02,F12-OP1.2]
3.6.5.1. Duct Materials	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
(4)	[F02-OS1.2]
(5)	[F02-OS1.2]
3.6.5.2. Vibration Isolation Connectors	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
3.6.5.3. Tape	
(1)	[F02-OS1.2]
3.6.5.4. Coverings, Linings, Adhesives and Insulation	
(1)	[F02-OS1.2]
(2)	[F02-OS1.2]
(3)	[F02-OS1.2]
(4)	[F02-OS1.2]
(5)	[F02-OS1.2]
(6)	[F02-OS1.2]

(7)	[F01,F02-OS1.2]
3.6.5.5. Insulation and Coverings	
(1)	[F01,F02-OS1.2]
(2)	[F02-OS1.2]
(3)	[F02-OS1.2]
(4)	[F02-OS1.2]
3.6.5.6. Clearance of Ducts and Plenums	
(2)	[F01-OS1.2]
(3)	[F01-OS1.2]
(4)	[F01-OS1.2]
(5)	[F01-OS1.2]
3.6.5.7. Supply, Return, Intake and Exhaust-Air Openings	
(1)	[F02-OS1.2]
3.6.5.8. Return-Air System	
(1)	[F02-OS1.2]
(2)	[F01,F02-OS1.2]
(3)	[F01,F02-OS1.2]
(4)	[F01,F02-OS1.2]
3.6.5.9. Location of Exhaust Vents in a Building Containing not more than Two Principal Dwelling Units	
(1)	[F50-OH5]
	[F56-OH3.1]
3.7.1.1. Room and Space Height	
(1)	[F30-OS3.1]
3.7.2.1. Plumbing and Drainage Systems	
(3)	[F72-OH2.1]
(4)	[F72-OH2.1]
3.7.2.2. Water Closets	
(1)	[F72-OH2.1] Applies to portion of By-law text: "... water closets shall be provided ..."
(4)	[F72-OH2.1]
(5)	[F72-OH2.1]
(6)	[F72-OH2.1]
(7)	[F72-OH2.1]
(8)	[F72-OH2.1]
(9)	[F72-OH2.1]
(10)	[F72-OH2.1]

(11)	[F72-OH2.1]
(12)	[F72-OH2.1]
(13)	[F72-OH2.1]
(14)	[F72-OH2.1]
(15)	[F72-OH2.1]
(16)	[F72-OH2.1]
3.7.2.3. Lavatories	
(1)	[F71-OH2.3]
(3)	[F30-OS3.1]
(4)	[F71-OH2.3]
3.7.2.4. Safety Glazing	
(1)	[F20-OS3.1]
3.7.2.5. Surface Protection	
(1)	[F72-OH2.1] [F40-OH2.4]
(2)	[F72-OH2.1] [F40-OH2.4]
3.7.2.6. Floor Drain	
(1)	[F40-OH2.4]
	[F30-OS3.1]
3.7.2.7. Grab Bars	
(1)	[F20-OS3.1]
3.7.2.8. Bathtubs	
(1)	[F74-OA2]
	(b) [F31-OS3.2]
	(d) [F30-OS3.1]
(2)	[F31-OS3.7]
	[F36-OS3.6]
3.7.2.11. Gender Neutral Washroom Requirements	
(1)	[F30,F34,F35-OS4.2]
(2)	[F30,F34-OS3.1]
3.7.3.1. Medical Gas Piping	
(1)	[F43,F81,F82-OS3.4]
	(b) [F01,F02-OS1.1]
	(b) [F01,F02-OP1.1]
3.8.2.2. Entrances	
(1)	[F73-OA1]

(4)	[F73-OA1]
3.8.2.3. Areas Requiring a Barrier-Free Path of Travel	
(1)	[F73-OA1]
(3)	[F74-OA2]
(4)	[F74-OA2]
(5)	[F74-OA2]
	[F10-OS3.7] Applies to portion of By-law text: "... each row of seats served by two aisles shall have one adaptable seat conforming to Subsection 3.8.3. located adjacent to one of the aisles."
(6)	[F74-OA2]
3.8.2.4. Access to Storeys Served by Escalators and Moving Walks	
(1)	[F73-OA1]
(2)	[F73-OA1]
3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones	
(1)	[F73-OA1]
(2)	[F73-OA1]
3.8.2.7. Power Door Operators	
(1)	[F73-OA1]
3.8.2.8. Plumbing Facilities	
(1)	[F74-OA2]
	[F72-OH2.1] [F71-OH2.3]
(2)	[F74-OA2]
	[F72-OH2.1] [F71-OH2.3]
(4)	[F72-OH2.1]
	[F73-OA1]
(13)	[F74-OA2]
(15)	[F74-OA2]
3.8.2.9. Assistive Listening Systems	
(2)	[F74-OA2]
3.8.2.10. Signs and Indicators	
(1)	[F74-OA2]
(2)	[F74-OA2]
(3)	[F74-OA2]
(4)	[F74-OA2]
3.8.2.11. Counters	
(1)	[F74-OA2]

3.8.2.12. Telephones	
(1)	[F74-OA2]
3.8.3.2. Barrier-Free Path of Travel	
(1)	[F73-OA1]
(3)	(a),(b) [F30-OS3.1]
	(a),(b) [F73-OA1]
	(c),(d) [F73-OA1]
	(e),(f) [F73-OA1]
	(e),(f) [F30-OS3.1]
	(c),(d) [F30-OS3.1]
(5)	[F73-OA1]
(6)	[F73-OA1]
(8)	[F80, F82-OA1]
3.8.3.3. Exterior Walks	
(1)	(a) [F73-OA1]
	(a) [F30-OS3.1]
	(b) [F73-OA1]
	(d) [F30-OS3.1]
3.8.3.4. Exterior Passenger-Loading Zones	
(1)	(a) [F74-OA2], [F30-OS3.1]
	(b) [F73-OA1]
	(c) [F74-OA2]
(2)	[F73, F74-OA1, OA2]
(3)	[F73, F74-OA1, OA2]
3.8.3.5. Ramps	
(1)	(b),(e) [F73-OA1]
	(d) [F30-OS3.1]
	(c) [F73-OA1]
	(d) [F73-OA1]
	(b),(e) [F30-OS3.1]
	(c) [F30-OS3.1]
(4)	(a) [F73-OA1]
	(b),(c) [F30-OS3.1]
(5)	[F30-OS3.1]
(6)	[F73-OA1]

3.8.3.6. Doorways and Doors	
(2)	[F73-OA1]
(3)	[F74-OA2]
	[F30-OS3.1]
(4)	[F74-OA2]
	[F10-OS3.7]
(5)	[F74-OA2]
	[F10-OS3.7]
(6)	[F73-OA1]
(7)	[F30-OS3.1]
(8)	[F73-OA1]
(10)	[F30-OS3.1]
	[F73-OA1]
(11)	[F73-OA1]
(12)	[F30-OS3.1]
	[F73-OA1]
(14)	[F73-OA1]
(15)	[F73-OA1]
(17)	[F74-OA2]
	[F10-OS3.7]
3.8.3.7. Passenger-Elevating Devices	
(1)	[F73-OA1]
	[F74-OA2]
	[F30-OS3.1] [F10-OS3.7]
3.8.3.8. Controls	
(1)	[F74-OA2]
	[F10-OS3.7]
3.8.3.9. Accessible Signs	
(1)	[F74-OA2]
	[F73-OA1]
(2)	[F74-OA2]
	[F73-OA1]
(3)	[F74-OA2]
	[F73-OA1]
3.8.3.10. Drinking Fountains	

(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.11. Water-Bottle Filling Stations	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.12. Accessible Water-Closet Stalls	
(1)	[F74-OA2]
	[F72-OH2.1]
	(d)(i) [F74-OA2]
	(f),(g) [F30,F20-OS3.1]
	(h) [F30-OS3.1] Applies to portion of By-law text: "… be equipped with a coat hook … projecting not more than 50 mm from the wall …"
3.8.3.13. Universal Washrooms	
(1)	[F74-OA2]
	(b) [F10-OS3.7]
	(g) [F30-OS3.1] Applies to the requirement for a coat hook.
	(i) [F74-OA2] Applies to the requirement for a shelf.
	[F72-OH2.1] [F71-OH2.3]
	(b) [F74-OA2] Applies to portion of By-law text: "… a door ... capable of being locked from the inside …"
(2)	[F72-OH2.1] [F71-OH2.3]
3.8.3.14. Water Closets	
(1)	[F74-OA2]
	[F72-OH2.1]
3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility	
(1)	[F74-OA2]
	(d) [F30-OS3.1]
(2)	[F74-OA2]
	(f) [F30-OS3.1]
3.8.3.16. Lavatories and Mirrors	
(1)	[F74-OA2]
	[F71-OH2.3]
	(f) [F31-OS3.2]
(2)	[F74-OA2]
3.8.3.17. Showers	
(1)	[F74-OA2]

	(d),(e) [F30-OS3.1]
	(f) [F30-OS3.1]
	(h) [F31-OS3.2]
(2)	[F74-OA2]
	[F71-OH2.3]
	(a) [F73-OA1]
	(b) [F10-OS3.7]
	(b) [F74-OA2]
	(g) [F74-OA2]
3.8.3.18. Accessible Bathtubs	
(1)	[F74-OA2]
3.8.3.19. Assistive Listening Systems	
(1)	[F74-OA2]
	[F11-OS3.7]
(2)	[F74-OA2]
3.8.3.20. Counters	
(1)	[F74-OA2]
3.8.3.21. Telephones	
(1)	[F74-OA2]
(2)	[F74-OA2]
3.8.3.22. Spaces in Seating Area	
(1)	[F74-OA2]
	[F30-OS3.1] Applies to portion of By-law text: "… level ... level and have removable seats, …"
	(d) [F10-OS3.7] Applies to portion of By-law text: "… without infringing on egress from any row of seating or any aisle requirements …"
(2)	[F74-OA2]
	[F30-OS3.1] Applies to portion of By-law text: "… level, ..."
(3)	(a) [F10-OS3.7] Applies to portion of By-law text: "… without infringing on egress from any row of seating or any aisle requirements …"
	[F74-OA2]
(4)	[F10-OS3.7]
3.9.1.2. Application	
(1)	(d) [F02-OS1.1]
3.9.2.2. Spatial Separation	
(2)	[F12-OP3.1]

(3)	[F56-OH3.1]
3.9.3.1. Safety Requirements Within Floor Areas	
(2)	[F02-OS1.2]
(3)	[F03-OS1.2]
	[F03-OP1.2]
(6)	[F02-OP1.2]
3.9.3.2. Sanitary Facilities	
(1)	[F72-OH2.1]
	[F71-OH2.3]

Notes to Table 3.10.1.1.:

(1) See Parts 2 and 3 of Division A.

Notes to Part 3
Fire Protection, Occupant Safety and Accessibility

A-3 Application of Part 3. In applying the requirements of this Part, it is intended that they be applied with discretion to buildings of unusual configuration that do not clearly conform to the specific requirements, or to buildings in which processes are carried out which make compliance with particular requirements in this Part impracticable. The definition of “building” as it applies to this By-law is general and encompasses most structures, including those which would not normally be considered as buildings in the layman's sense. This occurs more often in industrial uses, particularly those involving manufacturing facilities and equipment that require specialized design that may make it impracticable to follow the specific requirements of this Part. Steel mills, aluminum plants, refining, power generation and liquid storage facilities are examples. A water tank or an oil refinery, for example, has no floor area, so it is obvious that requirements for exits from floor areas would not apply. Requirements for structural fire protection in large steel mills and pulp and paper mills, particularly in certain portions, may not be practicable to achieve in terms of the construction normally used and the operations for which the space is to be used. In other portions of the same building, however, it may be quite reasonable to require that the provisions of this Part be applied (e.g., the office portions). Similarly, areas of industrial occupancy which may be occupied only periodically by service staff, such as equipment penthouses, normally would not need to have the same type of exit facility as floor areas occupied on a continuing basis. It is expected that judgment will be exercised in evaluating the application of a requirement in those cases when extenuating circumstances require special consideration, provided the occupants' safety is not endangered.

The provisions in this Part for fire protection features installed in buildings are intended to provide a minimum acceptable level of public safety. It is intended that all fire protection features of a building, whether required or not, will be designed in conformance with good fire protection engineering practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the By-law requirements will not be reduced by a voluntary installation.

Firefighting Assumptions

The requirements of this Part are based on the assumption that firefighting capabilities are available in the event of a fire emergency. These firefighting capabilities may take the form of a paid or volunteer public fire department or in some cases a private fire brigade. If these firefighting capabilities are not available, additional fire safety measures may be required.

Firefighting capability can vary from municipality to municipality. Generally, larger municipalities have greater firefighting capability than smaller ones. Similarly, older, well established municipalities may have better firefighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal firefighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the By-law, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local firefighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this By-law, may be necessary to compensate for this deficiency. Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its firefighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with the local firefighting service, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate firefighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by firefighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, "Recommended Practice for Protection of Buildings from Exterior Fire Exposures," provides additional information on the possibility of fire spread at building exteriors.

The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

A-3.1.2. Use Classification. The purpose of classification is to determine which requirements apply. This By-law requires classification in accordance with every major occupancy for which the building is used or intended to be used. Where necessary, an application clause has been inserted in this Part to explain how to choose between the alternative requirements which multiple occupancy classification may present.

A-3.1.2.1.(1) Major Occupancy Classification. The following are examples of the major occupancy classifications described in Table 3.1.2.1.:

Group A, Division 1

Motion picture theatres

Opera houses

Television studios admitting a viewing audience

Theatres, including experimental theatres

Group A, Division 2

Art galleries

Auditoria

Bowling alleys

Churches and similar places of worship

Clubs, nonresidential

Community halls

Courtrooms

Dance halls

Daycare Facilities for Children

Exhibition halls (other than classified in Group E)

Gymnasia

Lecture halls

Libraries

Licensed beverage establishments

Museums

Passenger stations and depots

Recreational piers

Restaurants

Schools and colleges, nonresidential

Undertaking premises

Group A, Division 3

Arenas

Indoor swimming pools, with or without spectator seating

Rinks

Group A, Division 4

Amusement park structures (not elsewhere classified)

Bleachers

Grandstands

Reviewing stands

Stadia

Group B, Division 1

Jails

Penitentiaries

Police stations with detention quarters

Prisons

Psychiatric hospitals with detention quarters

Reformatories with detention quarters

Group B, Division 2

Care facilities with treatment

Convalescent /recovery/rehabilitation centres with treatment

Hospices with treatment

Hospitals

Infirmaries

Nursing homes with treatment

Psychiatric hospitals without detention quarters

Respite centres with treatment

Group B, Division 3

Assisted/supportive living facilities

Care facilities without treatment

Children's custodial homes

Convalescent/recovery/rehabilitation centres without treatment

Group homes

Hospices without treatment

Nursing homes without treatment

Reformatories without detention quarters

Respite centres without treatment

Group C

Apartments

Boarding houses

Clubs, residential

Colleges, residential

Convents

Dormitories

Hotels

Houses

Lodging houses

Monasteries

Motels

Schools, residential

Group D

Banks

Barber and hairdressing shops

Beauty parlours

Dental offices

Dry cleaning establishments, self-service, not using flammable or explosive solvents or cleaners

Laundries, self-service

Medical offices

Offices

Police stations without detention quarters

Radio stations

Small tool and appliance rental and service establishments

Group E

Department stores

Exhibition halls

Markets

Shops

Stores

Supermarkets

Group F, Division 1

Bulk plants for flammable liquids

Bulk storage warehouses for hazardous substances

Cereal mills

Chemical manufacturing or processing plants

Distilleries

Dry cleaning plants

Feed mills

Flour mills

Grain elevators

Lacquer factories

Mattress factories

Paint, varnish and pyroxylin product factories

Rubber processing plants

Spray painting operations

Waste paper processing plants

Group F, Division 2

Aircraft hangars

Box factories

Candy plants

Cold storage plants

Dry cleaning establishments not using flammable or explosive solvents or cleaners

Electrical substations

Factories

Freight depots

Helicopter landing areas on roofs

Laboratories

Laundries, except self-service

Mattress factories

Planing mills

Printing plants

Repair garages

Salesrooms

Service stations

Storage rooms

Television studios not admitting a viewing audience

Warehouses

Wholesale rooms

Woodworking factories

Workshops

Group F, Division 3

Creameries

Factories

Laboratories

Light-aircraft hangars (storage only)

Power plants

Salesrooms

Sample display rooms

Storage garages, including open air parking garages

Storage rooms

Warehouses

Workshops

A-3.1.2.3.(1) Arena Regulation. The use of an arena is regulated in the Fire By-law.

A-3.1.2.7. Group A, Division 2, Low Occupant Load. A suite of Group A, Division 2 assembly is permitted to be classified as a Group D business and personal services occupancy provided the requirements of Article 3.1.2.6. are complied with. This re-classification will permit the suite to be located in a building to which Part 9 of the By-law is applicable, or when the suite is located in a building where the adjoining occupancy is a Group F, Division 1 high hazard occupancy.

A-3.1.2.8. Daycare Facilities for Children. A daycare facility for children is typically occupied for a period of less than 24 hours each day (i.e., is not a residential facility). The term "daycare" is not meant to exclude facilities that provide short term care during the night for a period of less than 24 hours each day. (See also A-3.3.2.18.)

A-3.1.3.5. Industrial Flex Space. The provisions of 3.1.3.5. for industrial flex spaces are intended to provide ground floor tenant spaces with flexibility to support small lower risk industrial type uses permissible under the applicable development regulations, such as artist studios or light manufacturing, in addition to the other use that the building supports. These provisions allow for the introduction of limited amounts of self-contained Group F, Division 2 major occupancies in buildings of combustible or noncombustible construction, and containing residential occupancies based on the presence of a durable and substantial separation to other spaces in the building and a full separation of building services and facilities.

A-3.1.4.1.(1) Combustible Construction and Materials Permitted. The permission to use combustible construction or combustible materials stated in Articles 3.1.4.1., 3.1.5.5., 3.1.5.14. and 3.1.5.15. does not waive the requirements regarding construction type and cladding stated in Article 3.2.3.7.

A-3.1.4.2. Protection of Penetrations. Where foamed plastics are required to be protected from adjacent spaces within a building, the protection should be continuous so as to cover the foamed plastics so they are not exposed to the interior of the building. However, minor penetrations of the protective covering by small electrical and mechanical components, such as electrical outlets and fixtures, sprinkler piping, and mechanical vents, are acceptable because the penetrant and associated fittings and seals will prevent the small amount of foamed plastic surrounding the penetration from being exposed to the interior of the building.

Foamed plastics that are penetrated by larger components or assemblies, such as windows, are unlikely to be exposed to the interior of the building as they are protected by associated framing and finishes and/or the installation of a closure.

Small amounts of foamed plastics, such as air sealants used between major components of exterior wall construction, are not required to be protected (see Sentence 3.1.5.2.(1)).

Penetrations of a fire separation or of a membrane forming part of an assembly required to have a fire-resistance rating are nevertheless required to be provided with a firestop in accordance with Subsection 3.1.9.

A-3.1.4.2.(1) Concealed Space. The term "concealed space" includes any space that is not visibly apparent and that is provided with an opening to allow access for repair and periodic inspections.

A-3.1.4.2.(1)(c) Thermal Barrier in Combustible Construction. Any thermal barrier that is accepted under the requirements of Sentence 3.1.5.15.(2) for noncombustible construction is also acceptable for combustible construction.

A-3.1.4.2.(2) and 3.1.5.7.(3) Walk-in Coolers and Freezers. Sentences 3.1.4.2.(2) and 3.1.5.7.(3) are intended to apply to walk-in coolers and freezers that are constructed as stand-alone structures within a building.

A-3.1.4.3.(1)(b)(i) Raceway Definition. The term raceway is defined in CSA C22.1, "Canadian Electrical Code, Part I," and includes both rigid and flexible conduit.

A-3.1.4.3.(1) Wire and Cable Equivalence. Electrical wires and cables that conform to the requirements of Sentence 3.1.5.21.(1) are deemed to satisfy the requirements of Sentence 3.1.4.3.(1).

A-3.1.4.8.(1) Exterior Cladding. The requirements in Sentence 3.1.4.8.(1) are intended to limit the potential for fire spread on the exterior cladding of buildings of combustible construction through the use of noncombustible finishes on the exterior of the wall assembly or the use of a cladding/wall assembly that has been assessed with regard to its ability to resist flame propagation up the outside of a building. These cladding and wall assembly combinations can be used as infill or panel-type walls between structural elements, or attached directly to a loadbearing structural system. Note that these requirements apply independently of the provisions contained in Subsection 3.2.3. regarding spatial separation and exposure protection.

A-3.1.5.4.(1) Skylight Spacing. The minimum spacing dimensions for skylight assemblies are based on the distance that flame must travel along a flat ceiling surface. If ceilings have projecting beams or other features that would increase the distance the flame would have to travel along the surface, the distances specified may be measured accordingly.

A-3.1.5.5.(1)(b) Combustible Cladding on Exterior Walls. The performance of the wall assembly is assessed with regard to its ability to resist flame propagation up the outside of a building.

A-3.1.5.5.(1)(b)(i) Flame-Spread Distance. The maximum flame-spread distance referred to in Subclause 3.1.5.5.(1)(b)(i) means the distance between the top of the opening and the highest observable instance of flaming along the wall assembly; thus, intermittent flaming to a height of 5 m above the opening is acceptable.

A-3.1.5.5.(1)(b)(ii) Heat Flux Measurement. The heat flux to the assembly referred to in Subclause 3.1.5.5.(1)(b)(ii) is the maximum one-minute averaged heat flux measured by transducers located 3.5 m above the top of the opening. The intent of this criterion is to limit the spread of fire on the wall assembly to a height of 3.5 m above the opening.

Fire tests have shown that flame does not spread on the exterior surface of a wall assembly where the heat flux is less than 35 kW/m^2 above the opening.

A-3.1.5.14.(5)(d) Foamed Plastic Insulation Protection. The standard fire exposure temperature in CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," is the same as in CAN/ULC-S124, "Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic." A thermal barrier that, when tested in conformance with CAN/ULC-S101, does not exceed an average temperature rise of 140°C on its unexposed face after a period of 10 min satisfies this requirement.

A-3.1.5.21.(1) Wire and Cable Flammability. In regulating the flammability characteristics of electrical wires and cables installed in a building, it is intended that the requirements of this Sentence and of other similar Sentences in the By-law apply to wires and cables that are essentially a part of the distribution systems for power or communications. These distribution systems will normally include branch circuits that terminate at an outlet box in the space to be served and at that location cable terminators or plugs for individual items of equipment will be plugged in.

A-3.1.5.25. Di-electric Liquid Filled Equipment. The Canadian Electric Code includes requirements in Rule 26-014, that require the protection of a building from dielectric liquid-filled equipment. Where the limits of Rule 26-014 cannot be satisfied, certain construction requiring noncombustable material and protection of openings are identified, but without specifying what is considered acceptable. The requirements 3.1.5.25. provide a solution acceptable to the Chief Building Official. However, this is not to suggest that other solutions are not acceptable. If an alternative approach is desired, then documentation support such an approach and demonstrating that the intents of the CEC have been satisfied should be submitted to the Chief Building Official for consideration.

A-3.1.6. Encapsulated Mass Timber Construction and Materials Permitted. The permission to use encapsulated mass timber construction and other combustible materials stated in Articles 3.1.6.2., 3.1.6.3., 3.1.6.9. and 3.1.6.10. does not waive the requirements regarding types of construction and cladding stated in Article 3.2.3.7.

A-3.1.6.3. Structural Mass Timber Elements. Structural timber elements may consist of any number of large cross-section timber products, such as solid-sawn timber, glued-laminated timber (glulam), structural composite lumber (SCL), cross-laminated timber (CLT), and nail-laminated timber (NLT).

The minimum dimensions required for structural timber elements in encapsulated mass timber construction were established so that such elements will exhibit the fire performance characteristics of mass timber rather than those of lightweight, small-dimensioned wood elements (e.g., lumber), including reduced-ignition propensity and reduced average rate of fuel contribution. Note that the dimensions stated in Table 3.1.6.3. do not reflect a specific fire-resistance rating; larger dimensions may be required to satisfy fire-resistance rating requirements.

The reference to Article 3.2.2.16. means that heavy timber construction is permitted to be used for the roof assembly (and its supports) in buildings of encapsulated mass timber construction that are sprinklered and not more than 2 storeys in building height. It follows that the minimum dimensions stated in Table 3.1.4.7. would apply to those elements rather than the ones stated in Table 3.1.6.3. Furthermore, the roof elements and supports made of heavy timber construction do not need to conform to the encapsulation requirements of Article 3.1.6.4., nor are they limited by the flame-spread rating or maximum thickness or cut-through requirements of Article 3.1.6.14.

A-3.1.6.4.(1) Encapsulation of Mass Timber Elements. The general intent of Sentence 3.1.6.4.(1), which generally applies for any building where a 50- or 70-minute encapsulation rating is otherwise required, is that all exposed surfaces of the mass timber elements be encapsulated, including the upper surface of a mass timber floor assembly. However, for some buildings, depending on the building height and occupancy, portions of mass timber elements are permitted to be exposed to varying degrees in accordance with the permissions stated in Sentences 3.1.6.4.(3) to (8). Also, the exposed surfaces in certain concealed spaces formed by or contained within mass timber elements are exempted from complying with this Sentence (see Sentences 3.1.6.3.(4), 3.1.6.16.(2) and 3.1.6.17.(2), and Articles 3.1.6.7. and 3.1.6.12.). Moreover, the upper surface of a mass timber roof assembly need not be encapsulated where there is no concealed space above it. As well, the exterior side of a mass timber exterior wall assembly need not be encapsulated; however, the provisions of Article 3.1.6.9. and Subsection 3.2.3. for exterior walls still need to be considered.

A-3.1.6.4.(3) to (8) Fire-Resistance Rating of Mass Timber with Exposed Surfaces. Portions of mass timber elements required to have a fire-resistance rating are permitted to be exposed in accordance with the permissions stated in Sentences 3.1.6.4.(3) to (~~6~~8); however, it is important to note that applying those permissions does not waive the requirement for these elements to have a fire-resistance rating.

In the calculation of the total wall area of the perimeter of a suite or fire compartment in Sentences 3.1.6.4.(3), (5) and (7), the area of any wall openings, such as doors or windows, is included.

A-3.1.6.4.(4) Exposed Surfaces of Mass Timber Walls. The primary objective of encapsulating mass timber elements is to limit the probability that these elements will significantly contribute to fire spread and fire duration in the event of a fire. Since thick wood members require a source of imposed heat flux to burn, Clause 3.1.6.4.(4)(a) stipulates that, for any building where a 50-minute encapsulation rating is required, any portions of the exposed surfaces of different mass timber walls within a suite either face the same direction or have a minimum horizontal distance between one another. If the sprinkler system fails to operate or to control the fire, this directional orientation or minimum distance is intended to avoid or reduce the potential ~~of~~ for re-radiation between portions of burning mass timber surfaces on different walls, and particularly those that either face or are in close proximity to one another, which could sustain flaming combustion into the decay phase of a fire. Additionally, if the sprinkler system fails to operate or to control the fire, the maximum percentage of exposed surface areas and maximum flame-spread ratings stated in Article 3.1.6.4. are intended to be insufficient to sustain a ventilation-controlled fire that might provide the radiation required to sustain flaming combustion into the decay phase of a fire.

A-3.1.6.6. Encapsulation Materials. Research has been conducted on different types of encapsulation materials, such as gypsum board, gypsum concrete and cement board. The results of tests using an intermediate-scale furnace and of cone calorimeter tests indicate that a combustible timber element protected with a 38 mm thick layer of gypsum-concrete topping or with one (25 min), two (50 min) or three (80 min) layers of 12.7 mm Type X gypsum board or two layers (70 min) of 15.9 mm Type X gypsum board will not ignite or contribute significant heat to a fire until the time at which average temperatures of 325°C to 380°C are attained at the interface between the encapsulation material or assembly of materials and the combustible substrate. These temperatures are consistent with the ignition temperatures of wood-based materials.

A-3.1.6.6.(6) Protection of Gypsum Board from Foot Traffic. Where gypsum board is used as the encapsulation material on the top of a mass timber floor assembly, it should be protected from physical impact arising from normal pedestrian traffic that could damage it and possibly compromise its encapsulation rating.

A-3.1.6.9.(1), (2), (4) and (6) Exterior Cladding. The requirements in Sentences 3.1.6.9.(1), (2), (4) and (6) are intended to reduce the potential for fire spread on the exterior cladding of buildings of encapsulated mass timber construction through the use of noncombustible finishes on the exterior of the wall assembly or the use of a cladding/wall assembly that has been proven to resist flame propagation as a function of increasing building height, including provisions to allow 100% combustible cladding where the height does not exceed 4 storeys. These cladding/wall assembly combinations can be used as infill or panel-type walls between structural elements, or attached directly to a loadbearing structural system. Note that the requirements in Article 3.1.6.9. do not supersede the provisions in Subsection 3.2.3. regarding spatial separation and exposure protection.

A-3.1.8.1.(1)(b) Barrier to Control Smoke Spread. Although a fire separation is not always required to have a fire-resistance rating, the fire separation should act as a barrier to the spread of smoke and fire until some response is initiated.

When choosing products for firestopping, the physical characteristics of the material used at the joints as well as the nature of the assembly and its potential movement should be taken into consideration.

If the fire-resistance rating of a fire separation is waived on the basis of the presence of an automatic sprinkler system, it is intended that the fire separation will be constructed so that it will remain in place and act as a barrier against the spread of smoke for a period of time until the sprinklers have actuated and controlled the fire.

A-3.1.8.1.(2) Installation of Closures. Although there is no explicit performance statement in the Building By-law that means of egress should be free of smoke, it is the intent that during the period when occupants are using a means of egress to evacuate from a floor area, the smoke contamination should not reach levels that would inhibit movement to the exit. This is particularly critical for persons with disabilities, who may not move at the same rate as other persons and who could be more susceptible to the effects of smoke contamination. NFPA 80, "Standard for Fire Doors and Other Opening Protectives," requires that a fire door protecting a means of egress be designed to minimize the possibility of smoke passing through the opening.

Although self-closing devices are not required for all doors in a fire separation (see Article 3.1.8.13.), it is assumed that in a fire situation every door in a fire separation is closed. Article 3.3.3.5. prohibits grilles and similar openings for certain doors in hospitals and nursing homes with treatment.

Although fire dampers that release on the fusion of a fusible link will help to control the spread of fire, a substantial quantity of smoke could have passed through the opening before that event. They are frequently located below the upper levels of a room and so the release of the fusible link of the fire damper that protects an opening will be delayed until the temperature at the level of the opening becomes high enough to fuse the link.

Similar concern has to be considered for other closure devices that are permitted to remain open on fusible links, and their location should be restricted in accordance with NFPA 80 and the Building By-law, except where their installation in another location will not allow the products of combustion to spread into means of egress.

A-3.1.8.3.(2) Fire Separation Continuity. The continuity of a fire separation with a fire-resistance rating is maintained by installing a firestop system at the juncture where it abuts against another fire separation, a floor, a ceiling or a roof assembly. The continuity of a fire separation without a fire-resistance rating that abuts another fire separation is maintained by filling all openings at the juncture of the assemblies with a fire-resistance-rated joint firestop system that will ensure the integrity of the fire separation at that location.

Test methods for the evaluation of joint systems are described in CAN/ULC-S115, "Standard Method of Fire Tests of Firestop Systems," which covers joint systems between adjacent fire-resistance-rated assemblies and between a fire-resistance-rated floor and a non-fire-resistance-rated exterior wall. ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-storey Test Apparatus," is a test method applicable to joint systems between a fire-resistance-rated floor and a non-fire-resistance-rated exterior wall.

Fire-resistance-rated joint firestop systems can be tested and listed as either static or dynamic. Dynamic joint firestop systems are subjected to movement cycling prior to undergoing fire testing at maximum joint extension. This approach ensures that the fire-resistance rating of the joint firestop system will be maintained even after the joint has cycled through its anticipated range of movement over the service life of the building. Most joints between fire-resistance-rated assemblies, other than those between loadbearing elements, experience some movement over the service life of the building.

A-3.1.8.3.(5) Joints. Firestops need not be installed between joints of interior finish materials that are arranged so as to create a smoke-tight joint.

A-3.1.8.10.(1) Combination Smoke/Fire Dampers. A combination smoke/fire damper may be used in lieu of a fire damper to meet the requirement of Sentence 3.1.8.10.(1).

A-3.1.8.10.(5) Damper Access. It is intended that an access door be provided in the duct and, if the duct is enclosed with an architectural finish, that a second access door be provided through that finish.

A-3.1.8.18.(1) Wired Glass and Glass Block. The permission to include wired glass and glass block in doors and fire separations between an exit and the adjacent floor area does not permit the inclusion of those items in fire separations between exits and other parts of the building that are not included in the floor area. Examples include other exit facilities and vertical service spaces, including those used for building services and elevator hoistways.

A-3.1.8.19.(1) Fire-Protection Rating for Doors. The provisions in Articles 3.1.8.17., 3.1.8.18. and 3.1.8.19. do not waive a requirement for a door to have a fire-protection rating. To achieve this rating in a door test, it may be necessary to limit the area of glass in the door. If this area is less than the area limits of Article 3.1.8.18., it is the governing criterion. Conversely, if the area limits of Article 3.1.8.18. are less than the area required to achieve a fire-protection rating, then the area limits of this Article govern.

A-3.1.9. Penetrations. In the application of Subsection 3.1.9., a building service or structural element is considered to penetrate an assembly if it passes into or through the assembly. In some situations a service item enters an assembly through a membrane at one location, runs within the assembly, and then leaves the assembly through a membrane at another location.

The term “membrane penetration” usually designates an opening made through one side (wall, floor or ceiling membrane) of an assembly, whereas the term “through-penetration” designates an opening that passes through an entire assembly. Firestopping of membrane penetrations and through-penetrations involves installing an assemblage of specific materials or products that are designed, tested and fire-resistance-rated to resist for a prescribed period of time the spread of fire through the penetrations.

Products for firestopping within a barrier are required to address movement of the assembly and to control smoke spread; as such, the flexibility of the material used at the flexible joints as well as the nature of the assembly and its potential movement must be taken into consideration.

A-3.1.9.1.(1)(b) Penetration. The intention behind the use of the term “cast in place” is to reinforce that there are to be no gaps between the building service or penetrating item and the membrane or assembly it penetrates. The term ”cast in place” describes a typical means of firestopping for a service penetration through a concrete slab or wall.

A-3.1.9.2.(1) Service Equipment Penetrations. The provisions dealing with outlet boxes assume size, quantities and concentrations of partial depth penetrations that would not significantly affect the fire resistance of the assembly, including the temperature rise on the unexposed side of a wall. Sentence 3.1.9.2.(1) is not intended to allow large electrical distribution and control boxes to be recessed into an assembly required to have a fire-resistance rating unless they are firestopped as described in Sentence 3.1.9.3.(1).

The installation of fire dampers, smoke dampers or combination smoke/fire dampers is intended to comply with Subsection 3.1.8. and Sentence 3.1.9.1.(5), and the conditions of their listing and labeling, which may or may not permit the installation of firestopping around the duct.

A-3.1.9.3. Outlet Boxes. For the purposes of Article 3.1.9.3., outlet boxes include, but are not limited to, electrical boxes, junction boxes, high and low voltage outlets, switches, enclosures for electrical equipment, laundry boxes, and shower diverters.

A-3.1.9.4.(8) Combustible Branches. Combustible branches for drain, waste and vent piping are permitted to be used to connect to a plumbing fixture within a fire compartment. The integrity of the fire separation is maintained through the use of a firestop system where the vertical stack piping penetrates the fire separation.

A-3.1.10.2.(4) Firewall Construction. Inherent in the use of a firewall is the intent that this specialized wall construction provide the required fire-resistance rating while also being designed to resist physical damage—arising out of normal use—that would compromise the rating of the assembly. Traditionally, this has been accomplished by prescribing the use of noncombustible materials, which was in fact restricted to concrete or masonry. Sentences 3.1.10.2.(3) and (4) are intended to retain both of the characteristics of firewalls, while permitting greater flexibility in the use of materials and designs. The fire-resistance rating and damage protection attributes of a firewall may be provided by a single fire- and damage-resistant material

such as concrete or masonry, by a fire- and damage-resistant membrane on a structural frame, or by separate components—one that provides the fire-resistance rating and another one that protects the firewall against damage.

If the firewall is composed of separate components, the fire-resistance rating of the fire-resistive component needs to be determined for this assembly on its own. In addition, if the damage protection component is physically attached to the fire-resistive component (for example, as a sacrificial layer), then for the purposes of determining the overall performance of the assembly, it is also necessary to determine through testing whether failure of the damage protection component during a fire affects the performance of the fire-resistive component.

A-3.1.11.3.(3) Fire Blocks between Nailing and Supporting Elements. Sentence 3.1.11.3.(3) applies to the portion of the combustible ceiling finish that is attached using nailing elements and constructed in accordance with Sentence 3.1.6.14.(3), which permits 10% of the ceiling finish within a fire compartment to have a flame-spread rating not more than 150. Where this portion of ceiling finish creates a concealed space above it, exposed combustible elements within that space require fire blocks to limit the spread of fire.

A-3.1.11.5.(1) Fire Blocks in Combustible Construction. Combustible construction referred to in Sentence 3.1.11.5.(1) includes all types of construction that do not comply with the requirements for noncombustible construction or encapsulated mass timber construction. All the elements within the concealed space can be combustible, unless required to be of noncombustible materials (e.g., certain categories of pipework and ducts), but the value of the flame-spread rating of the combustible materials determines the permitted extent of the concealed space between fire blocks. The materials to be considered include all construction materials regulated by this By-law, including the framing and building services that are located in the concealed space. When designing fire blocking, consideration should be given to avoid restricting venting capabilities within concealed spaces. (See also Note A-5.6.2.1.)

A-3.1.11.5.(3) and (4) Fire Blocks in Concealed Spaces. To reduce the risk of fire spread in combustible concealed spaces within the types of buildings referred to in Sentences 3.1.11.5.(3) and (4), fire blocking is required regardless of whether the horizontal concealed space is protected by sprinklers or not, unless the space is filled with noncombustible insulation so that any air gap at the top of the insulation is very small. (See also Note A-3.1.11.5.(1) for roof venting.)

A 5- or 6-storey building constructed in accordance with Article 3.2.2.51. and buildings constructed in accordance with Article 3.2.2.48., 3.2.2.57., 3.2.2.60., or 3.2.2.93. are required to be sprinklered in accordance with NFPA 13, “Standard for the Installation of Sprinkler Systems” (see Article 3.2.5.12.). NFPA 13 generally requires sprinklering of any concealed spaces of combustible construction or where large amounts of combustibles are present. However, NFPA 13 allows combustible concealed spaces not to be sprinklered in certain cases, including where concealed spaces are filled almost entirely with noncombustible insulation, where spaces contain only materials with a low flame-spread rating, and where limited access or the size of the space makes it impractical to install sprinklers. For certain types of construction in combustible concealed spaces that are not sprinklered, NFPA 13 mandates fire blocking beyond the minimum specified in Sentence 3.1.11.5.(3).

A-3.1.11.7.(7) Integrity of Fire Blocks. Sentence 3.1.11.7.(7), together with Article 3.1.9.1., is intended to ensure that the integrity of fire blocks is maintained at areas where they are penetrated. This requirement is satisfied by the use of generic firestops such as mineral wool, gypsum plaster or Portland cement mortar, or by the use of sealants that form part of a firestop tested in accordance with CAN/ULC-S115, “Standard Method of Fire Tests of Firestop Systems.”

A-3.1.11.7.(8) Fire Blocks. Figure A-3.1.11.7.(8) shows the location of the semi-rigid fibre insulation board at the intersection between walls and floors in wood-frame construction. The figure is intended to illustrate the fire block detail and not a design of a fire separation.

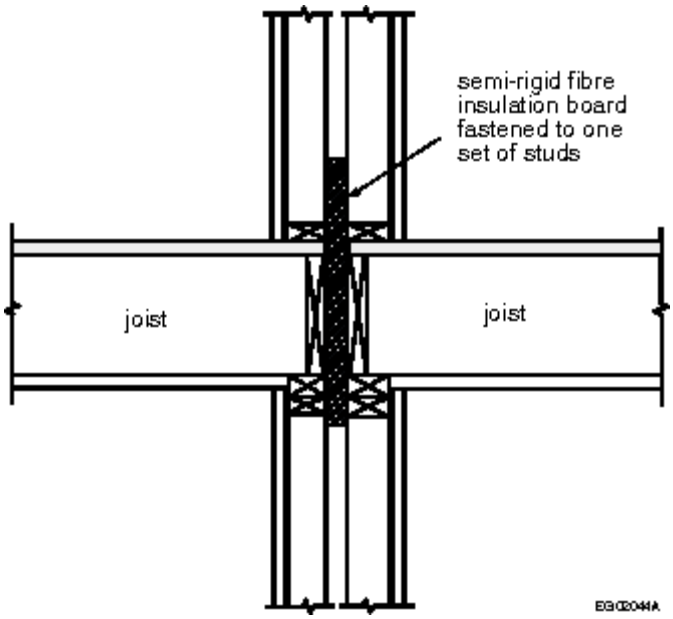


Figure A-3.1.11.7.(8)
Fire block

A-3.1.13.2.(2) Folding Partition. Folding partitions used to divide a space into separate rooms are not considered as doors for the purposes of this Sentence.

A-3.1.14.3. Skylight Glazing. This sentence requires glazing to remain in place when fractured and when subject to impact by flying objects for conditions not regulated elsewhere in this By-law. Other types of glazing such as tempered, annealed or heat strengthened glass have long been recognized as a potential hazard when located overhead and normally requires protective screens to protect occupants below from injury caused by falling glass.

A-3.1.17.1. Exercise Rooms. Fitness centres, yoga studios, tai-chi studios, martial arts training centres and other similar uses are considered exercise rooms. Where an exercise room, without equipment, is exclusively used as a yoga studio, a tai-chi studio or a martial arts training centre an occupant load factor of 4.6m^2 per person is permitted.

A-3.1.18. Tents and Air-Supported Structures. The requirements in this Subsection are intended to be limited to certain types of structure. For instance, the word "tent" as used in the By-law is intended to refer to a temporary shelter which is used at an open air event such as a fair or an exhibition. A tent will normally be constructed of a fabric held up by poles and attached to the ground by ties. The requirements for tents, however, are not intended to be applied to fabric structures located on buildings.

The term "air-supported structure," as used in the By-law, refers to an envelope which is held up by air pressure alone and which is erected on the ground or above a basement. The structure will usually require ballast or a positive ground anchorage system around the entire perimeter to secure it to the ground or basement. To reinforce this intent, the By-law prohibits the location of an air-supported structure above the first storey of any building.

The requirements of Subsection 3.1.18. are not intended to apply to air-supported roof assemblies on buildings, such as domed stadia, or to other types of air-supported structures, such as those over swimming pools situated on the roofs of buildings, which would not be anchored at or near ground level. These assemblies or structures are normally designed and evaluated on the basis of alternative solutions as permitted by Article 1.2.1.1. of Division A.

A-3.2.1.1.(3)(a) Mezzanine Area. The permitted area of the mezzanine for the purposes of determining the allowable percentage is to be based on the open area of the floor of the space in which the mezzanine is located. The By-law does not restrict the enclosing of space below the mezzanine but the enclosed area must be deducted from the area of the overall space before applying the percentage allowance.

A-3.2.1.1.(8) Accessible Service Space. These service spaces are often referred to as interstitial spaces and are designed to allow service personnel to enter and undertake maintenance or installation within the space. Catwalks or flooring are usually included to provide a walking or access surface. Even when flooring is included, it is not intended that the interstitial space

should be considered as a storey for the purposes of the By-law unless the space is used for purposes other than servicing or the storage of materials and equipment to be used for building services within that space.

A-3.2.1.7.(4) Major Occupancies Other than Group C or D in 6 Storey Combustible Buildings. The requirements of 3.2.2.51. and 3.2.2.60. enable the introduction of major occupancies into buildings of predominantly residential or office occupancy that exceed the normal size limits permitted under the present construction requirements of Subsection 3.2.2. In order to provide an appropriate level of fire and life safety and facilitate changes in the mixed occupancies over time, additional fire compartmentation and protection of floor areas above the 3rd storey is required by this By-law.

The requirements of 3.2.1.7.(4) are intended to supplement the requirements of 3.2.1.7.(1) by creating further compartmentation by subdividing a building into floor areas not exceeding 1,000 m^2. The terminology "horizontal fire compartment on each storey" is intended to require that floor areas on each storey be individually broken up into fire compartments that are both horizontally and vertically separated from each other. Furthermore, each compartment thus created is required to have direct access to at least one exit in addition to the applicable requirements of Sections 3.3. and 3.4. of this By-law. In the case of ground level suites, this may be achieved by exits directly to the exterior, in addition to protected exits as otherwise required by this By-law.

A-3.2.2.2.(1) Special and Unusual Structures. Examples of structures which cannot be identified with the descriptions of buildings in Articles 3.2.2.20. to 3.2.2.92. include grain elevators, refineries and towers. Publications that may be consulted to establish good engineering practice for the purposes of Article 3.2.2.2. include the NFPA "Fire Protection Handbook," Factory Mutual Data Sheets, and publications of the Society for Fire Protection Engineering.

A-3.2.2.7.(2) Fire Separations and Fire-Resistance Ratings. Fire separations and their corresponding fire resistance rating if required may or may not be governed by the structural fire requirements under Subsection 3.2.2. In establishing the fire separation and fire-resistance rating requirements the practitioner must remember to consult all requirements for fire separations and fire resistance ratings as detailed in Division B Sections 3.1, 3.2, 3.3, 3.4, and 3.5. (See Article 3.1.3.1.)

A-3.2.2.15.(2) Storeys below Ground. Occupancies located below grade represent an unusual level of challenge for both occupant egress and emergency response since the availability of paths of travel to enter or leave the underground space is usually limited. This may subject occupants to a greater risk of exposure to untenable conditions during evacuation. Similarly, emergency responders must share limited means of egress with occupants which could further impact occupant evacuation, impede an effective response, or expose first responders to unsafe conditions.

It is not the intent of the Building By-law to limit the inclusion of occupancies below grade where they can be shown to demonstrate an appropriate level of fire and life safety. Rather the intent of this requirement is to cause a conscientious review of certain underground occupancies to confirm that they are sufficiently protected, and that the arrangement can provide an acceptable level of emergency response for a variety of conditions. The measures described in Sentence 3.2.2.15.(2) provide a minimum for fire safety under many circumstances, but may not be sufficient to address all potential uses or occupancies below grade. It should be confirmed that the proposed use and building design is acceptable to the Chief Building Official.

A-3.2.2.17.(1) Roof Assemblies in Gymnasiums, Swimming Pools, Arenas and Rinks. The permission to waive the fire-resistance rating requirements for roof assemblies over gymnasiums, swimming pools, arenas and rinks that meet the conditions of Sentence 3.2.2.17.(1) includes the permission to waive the requirements relating to minimum size and construction details stated in Article 3.1.4.7. for wood elements in roof assemblies of heavy timber construction on buildings conforming to Articles 3.2.2.25. and 3.2.2.32. However, wood elements in roof assemblies of heavy timber construction on buildings conforming to Article 3.2.2.30. must nevertheless meet the requirements of Article 3.1.4.7.

A-3.2.2.18.(2) Sprinkler Extent. A literal interpretation of Article 3.2.2.6. and Sentences 3.2.2.4.(1) and (2) could require installation of an automatic sprinkler system throughout all storeys of a building regardless of options in Articles 3.2.2.20. to 3.2.2.92. to construct one or more storeys without installation of sprinklers. It is the intent of the By-law that all storeys below a storey in which an automatic sprinkler system is installed should also be protected by an automatic sprinkler system to ensure that a fire in a lower storey does not incapacitate the automatic sprinkler system or overwhelm an automatic sprinkler system in an upper storey. Persons in an upper storey in which waivers or reductions of other fire safety systems are permitted would be exposed to an increased risk from a fire on a lower storey. This concept also applies to situations in which an automatic sprinkler system has been installed within a floor area in order to modify other safety requirements applying within the floor area. If the uppermost storey or storeys of a building can be constructed without the installation of an automatic sprinkler system it is not necessary that an automatic sprinkler system required in a lower storey be extended into the upper storey or storeys.

A-3.2.2.35.(4) Sprinkler Requirements. Spaces in a building of Group A, Division 4 occupancy that are intended to be equipped with sprinklers include, but are not limited to, dressing and changing rooms, concession stands and areas, toilet rooms, locker rooms, storage areas, service rooms, offices and other spaces that provide service to the building. The enclosure of

seating areas with glazing needs special consideration in determining the requirements for sprinklers. For example, if the enclosed area is used for the consumption of food and beverages, it should be classified as Group A, Division 2 and the appropriate requirements of that classification applied. Enclosure of limited spaces above seating areas for press and media purposes is not considered to require the installation of sprinklers.

A-3.2.2.48.(4), 3.2.2.57.(3) and 3.2.2.93.(5) to (7) Occupancy Combinations in Buildings of Mixed Construction. Buildings conforming to the building height and area limits and the other fire protection requirements of Article 3.2.2.48., 3.2.2.57. or 3.2.2.93. may be entirely constructed of encapsulated mass timber construction and incorporate the occupancies specifically permitted by Sentence 3.2.2.48.(4), 3.2.2.57.(3) or 3.2.2.93.(5) to (7): e.g., Group A, Division 2 major occupancies on the first to third storeys, Group E major occupancies on the first and second storeys, and a parking garage on the first to fourth storeys.

Alternatively, the requirements of Articles 3.2.2.4. to 3.2.2.8. for superimposed major occupancies can be applied, resulting in buildings of mixed construction conforming to the building height and area limits for encapsulated mass timber construction and in which the lower storeys are of noncombustible construction and the upper storeys are of encapsulated mass timber construction. For example, a Group A, Division 2 or Group B, Division 3 major occupancy could be located on the first 4 storeys of a 12-storey Group C building constructed in accordance with Article 3.2.2.48., as long as these first 4 storeys were constructed of noncombustible construction in accordance with Article 3.2.2.23. or 3.2.2.42., as applicable. (See also Articles 3.2.2.6. and 3.2.2.7.)

A-3.2.2.51.(5) and 3.2.2.60.(4) Occupancy Combinations in Buildings of Mixed Construction. Buildings conforming to the building height and area limits and the other fire protection requirements of Article 3.2.2.51. or 3.2.2.60. are permitted to be entirely constructed of combustible construction and incorporate the occupancies specifically permitted by Sentence 3.2.2.51.(5) or 3.2.2.60.(4): for example, Group A, Division 2 and Group E major occupancies on the first and second storeys, and a parking garage on the first to third storeys.

Alternatively, the requirements of Articles 3.2.2.4. to 3.2.2.8. for superimposed major occupancies can be applied, resulting in buildings of mixed construction conforming to the building height and area limits of Article 3.2.2.51. or 3.2.2.60. and in which the lower storeys are of noncombustible construction and the upper storeys are of combustible construction. For example, a Group A, Division 2 or Group B, Division 3 major occupancy could be located on the first 4 storeys of a 6-storey Group C building constructed in accordance with Article 3.2.2.51., as long as these first 4 storeys were constructed of noncombustible construction in accordance with Article 3.2.2.23. or 3.2.2.42., as applicable. (See also Articles 3.2.2.6. and 3.2.2.7.)

A-3.2.2.93.(1) and Table 3.2.2.93. Occupancy Combinations in Buildings of Mixed Encapsulation Ratings. Buildings conforming to the building height and minimum encapsulation rating requirements and the other fire protection requirements of Article 3.2.2.93. may be entirely constructed of encapsulated mass timber construction and incorporate the multiple major occupancies otherwise permitted by Articles 3.2.2.4. to 3.2.2.6. This would also include permitting mixing of major occupancies that require different levels of encapsulation for structural mass timber elements in accordance with Table 3.2.2.6.

A-3.2.3. Fire Protection Related to Limiting Distance versus Separation Between Buildings. By-law provisions that address protection against fire spread from building to building use the limiting distance (see the definition in Article 1.4.1.2. of Division A) for a building rather than using the distance between adjacent buildings on separate properties, since this would result in situations where the design and construction of a building on one property affects the design and construction of a building on an adjacent property.

The By-law requirements that deal with reducing the probability of building-to-building fire spread were originally developed based on the assumption that the exposing building faces of adjacent buildings are of similar size and configuration, and are equidistant from the shared property line. Where buildings are of different sizes, the smaller building may be subject to a higher heat flux in the event of a fire compared to the larger building. Where buildings are closely spaced and not equidistant from the property line, the construction of the building with the greater limiting distance does not recognize the proximity of the building with the lesser limiting distance.

The By-law has more stringent requirements for buildings with lesser limiting distance as regards the maximum area and spacing of unprotected openings, and the construction, cladding and fire resistance of walls. This increased stringency recognizes that the fire hazard is greater where buildings are closer together and that adjacent buildings may have exposing building faces of different sizes, configurations or limiting distances, which could further increase the hazard.

The authority having jurisdiction may also address limiting distances through legal agreements with the parties involved that stipulate that the limiting distance be measured to a line that is not the property line. Such agreements would normally be registered with the titles of both properties.

A-3.2.3.1.(4) Spatial Separation Design. In the application of Sentences 3.2.3.1.(3) and (4), it is intended that Sentence (3) be used first to establish the basic requirements for the exterior wall in terms of fire-resistance rating, type of construction and type of cladding. The percentage of unprotected openings determined from the application of Sentence (3) would be unnecessarily restrictive if the actual unprotected openings occur in a plane that is set back from the front of the building face.

Sentence (4) applies to the calculation of the allowable percentage of unprotected openings based upon projection onto a plane that is in front of all unprotected openings. The application of these two Sentences is shown in Figure A-3.2.3.1.(4). The modifications permitted by Article 3.2.3.12. would be applied, if applicable, to the area of unprotected openings derived from Sentence (4).

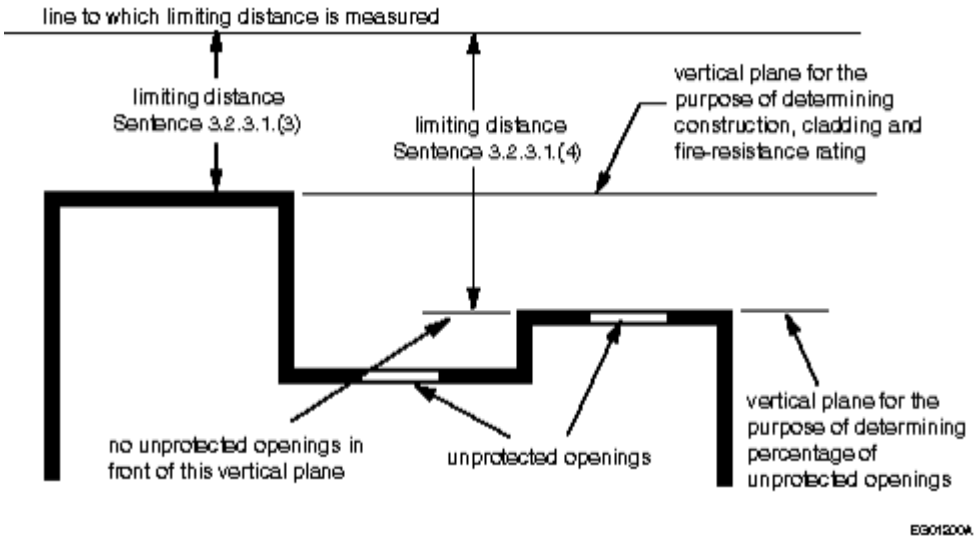


Figure A-3.2.3.1.(4)
Spatial separation design

A-3.2.3.1.(8) Intervention Time and Limiting Distance. The total time from the start of a fire until fire suppression by the fire department depends on the time taken for a series of actions. Sentence 3.2.3.1.(8) is only concerned with the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the building. It specifies a 10-min time limit which must be met in more than 90% of the calls to the building served by the fire department. This reliability level and provision for flexibility is essentially consistent with NFPA 1710, "Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments."

Clause 4.1.2.1 of NFPA 1710 establishes "time objectives" for fire incidents as follows:

- 1 min (60 s) for turn-out of responders after receipt of notification of a fire, and
- 4 min (240 s) or less for arrival of the first arriving engine company at a fire suppression incident and/or 8 min (480 s) or less for the deployment of a full first alarm assignment at a fire suppression incident.

The standard requires that the fire department establish a "performance objective" of not less than 90% for each response time objective. This reliability level is referred to in NFPA 1710 as a "performance objective."

Where the 10-min limit cannot be met by the fire department at least 90% of the time, Sentence 3.2.3.1.(8) specifies that a value corresponding to half the actual limiting distance be used in requirements that depend on limiting distance to define other criteria.

For new subdivisions, legal agreements may be made for the construction of fire stations to serve those areas. The fire department response time in those subdivisions may temporarily exceed 10 min until the fire station is constructed.

See also Sentences 9.10.14.3.(1) and 9.10.15.3.(1).

A-3.2.3.4.(1) Party Walls. By definition, a party wall is a wall jointly owned and used by two parties under easement agreement or by right in law, and is erected at or upon a line that separates two parcels of land that are, or are capable of being, separate real estate entities. With the exception of some Part 9 residential occupancies, both Part 3 and Part 9 of the By-law require that,

where party walls are constructed on property lines, they be constructed as a 2- or 4-hour firewall (see also Article 9.10.11.1.). Buildings on each side of a party wall that is constructed as a firewall are considered as separate buildings (see Article 1.3.3.4. of Division A).

In a Part 9 residential building that has no dwelling unit above another, a party wall constructed on a property line between two dwelling units need not be constructed as a firewall, but must be constructed as a continuous fire separation that extends from the top of the footings to the underside of the roof, with a fire-resistance rating of at least 1 hour (see Article 9.10.11.2.). These party walls do not create separate buildings.

Where two parties share a party wall on a property line, each party is responsible for fire safety in their unit, but is still subject to possible fire risks from activities in the adjoining units. The separating party wall is intended to provide a significant degree of fire protection between the adjacent units, often exceeding even that required between suites in multiple-unit residential and non-residential occupancies.

When a building spans a property line, constructing a party wall on the property line is not mandated by the By-law, but subdividing the building at the property line is an option the owner can consider. The By-law permits a building constructed on more than one property to be designed as a single undivided building, whether the properties have a common owner or not. However, if a subdividing wall is constructed on the property line within the building for the purpose of separating the two real estate entities and is shared by two different owners, the wall would, by definition, be deemed a party wall. As such, this party wall would need to meet the construction requirements described above, depending on the building's occupancy classification and size.

A building that spans two or more properties, but that does not have a party wall at the property line, may need to address the By-law requirements for party walls in the future.

A-3.2.3.6.(2) Protection of Roof Soffits Near Property Lines. Sentences 3.2.3.6.(2) to (5) and parallel Sentences 9.10.14.5.(5) to (7) and 9.10.15.5.(5) to (7) provide requirements for the protection of soffits where the soffit of the subject building is located close to the property line or to an imaginary line between two buildings on the same property. Fire from inside the roof space of the subject building can exit unprotected soffits and expose the adjacent building to flames.

A-3.2.3.7.(4)(d)(iv) Thickness of Cladding. In the case of insulated vinyl siding, the maximum 2 mm thickness stated in Subclause 3.2.3.7.(4)(d)(iv) refers to the total thickness of the siding and the insulation, not of the siding alone.

A-3.2.3.14.(1) Wall Exposed to Another Wall. The requirements of Article 3.2.3.14. are to ensure that the control of fire spread by the interior fire separations between fire compartments is not defeated through the spread of fire by thermal radiation outside the building. Minimum spatial separations are specified between the openings in separate fire compartments where the exterior faces of these compartments are deemed to expose each other to a thermal radiation hazard. This situation may arise where the angle, θ, between the intersecting planes of the exposing building faces is 135° or less. Examples of situations that would be addressed by this Article are shown in Figures A-3.2.3.14.(1)-A, A-3.2.3.14.(1)-B and A-3.2.3.14.(1)-C.

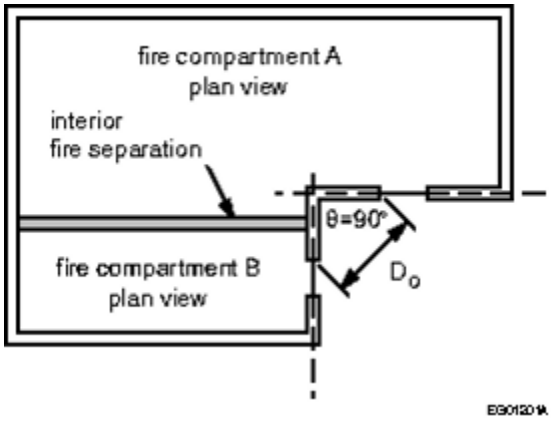


Figure A-3.2.3.14.(1)-A
Openings in walls at a right-angle corner

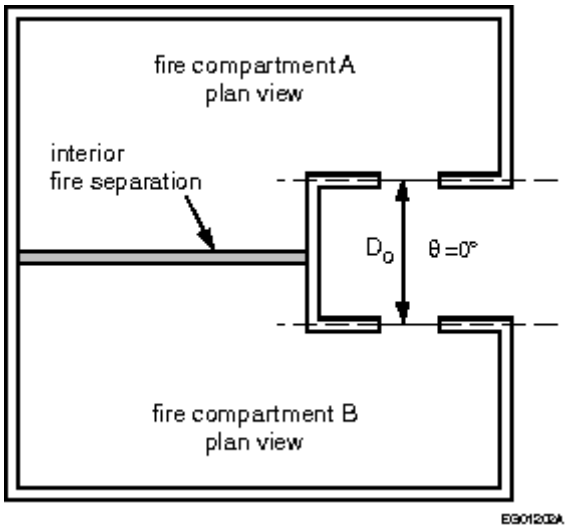


Figure A-3.2.3.14.(1)-B
Openings in walls that are parallel to one another

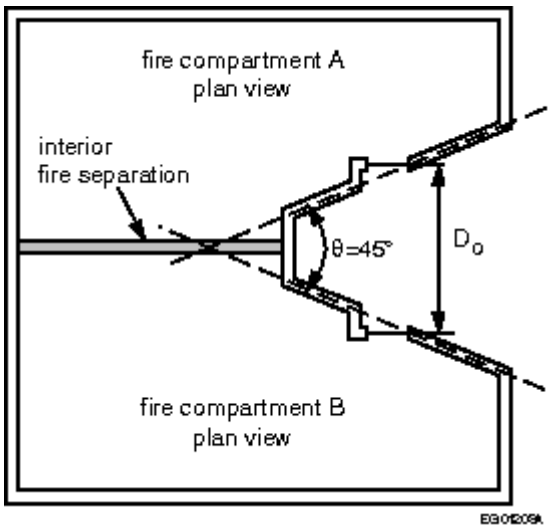


Figure A-3.2.3.14.(1)-C
Openings in walls with an included angle of 45°

A-3.2.4. Fire Alarm System. The term “fire alarm system” used in this Subsection applies to fire alarm systems with or without voice communication capability.

A-3.2.4.4.(1) Single Stage Fire Alarm System. This requirement, in combination with Article 3.2.4.22., is intended to allow for the provision of voice communication capability as an integral part of a single stage fire alarm system.

A-3.2.4.4.(2)(c) Fire Alarm Alert Signal. In a 2-stage fire alarm system described in Sentence 3.2.4.4.(2), the alert signal may be transmitted to audible signal devices in designated locations or to audible signal devices throughout the building. If actuated, the second stage alarm signal in a 2-stage fire alarm system may sound throughout all zones in the building. All manual station key switches would typically initiate the alarm signal.

Sentence 3.2.4.4.(2) also allows the implementation of a “zoned 2-stage” sequence of operation, whereby the alarm signal sounds in the zone of key switch actuation (and perhaps in the adjacent zones, which may be the storey above and the storey below) and the alert signal sounds throughout the rest of the building. This sequencing would be created automatically by the fire alarm control unit.

The key or special device referred to in Clause 3.2.4.4.(2)(c) should be immediately available to all persons on duty who have been given authority to sound an alarm signal.

A-3.2.4.4.(2) Two-Stage Fire Alarm System. Sentence 3.2.4.4.(2), in combination with Article 3.2.4.22. or 3.2.4.23., is intended to allow for the provision of voice communication capability as an integral part of a 2-stage fire alarm system.

A-3.2.4.6.(2) Access to Silencing Switches. This requirement is intended to prevent easy access to silencing switches. The satisfactory operation of a fire alarm system to alert the occupants of a building to an emergency is predicated on the assumption that the alarm signal will be silenced only after responsible staff have verified that no emergency exists. Details on the emergency procedures to be used in case of fire are contained in the Fire By-law.

A-3.2.4.6.(3) Silencing Alarms. This requirement is intended to provide the Vancouver Fire Department and building management the ability to silence the fire alarm at the main annunciator (in addition to the main control panel). A special keyed switch is considered to meet the intent of this requirement.

A-3.2.4.7.(4) Design and Installation of Fire Department Notification. In some jurisdictions, the fire department may utilize, or have available, a municipal fire alarm system or equipment intended for receiving notification by means of a direct connection. If used, it is expected that these systems and installations conform to the requirements of Sentence (4) so as to achieve and provide a uniform and reliable level of service. It is also intended that a proprietary central station as well as a fire brigade used by a large corporation, university campus or similar site comply with Sentence (4).

CAN/ULC-S561, "Standard for Installation and Services for Fire Signal Receiving Centres and Systems," which is referenced in Sentence 3.2.4.7.(4), and CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," which is referenced in Sentence 3.2.4.5.(1), go hand-in-hand: conformity to CAN/ULC-S561 entails conformity with the fire alarm system components required in that standard, which include the fire alarm transmitter (signal transmitting unit), the interconnections, and the communication path.

A-3.2.4.7.(5)(b) Emergency Telephone Number. In many municipalities an emergency telephone number, for example 911, is used for all emergency services and it is preferable to post that number.

A-3.2.4.8.(2) Fire Alarm Zones. Alarm initiating devices referred to in this Sentence include fire detectors, waterflow switches and manual stations. If a room or space in a building extends through more than one storey of the building, as in the case of multi-level dwelling units and machinery rooms, judgment must be exercised in the zoning and annunciation of the fire detectors in that room or space. In general, the lowest storey on which access is provided into the room or space should be indicated on the annunciator to avoid unnecessary delays for the responding firefighters.

Consideration should also be given to the use of numbers or letters on the annunciator that correspond to:

- those used in the building elevators
- signage used on exit stairways and service rooms as required by the Fire By-law (see Fire By-law A-2.8.2.1.(3)(d)).

A-3.2.4.8.(11) Annunciator Zone Indication. Although an alphanumeric display can identify any specific alarm initiating device that is activated or requires maintenance service, an annunciator panel provided with an alphanumeric display only is not acceptable to the fire department in emergency situations. In emergency situations, indicator lamps provide status information of all zones at a single glance without having to scroll through the information provided by an alphanumeric display.

A-3.2.4.9.(3)(f) Supervision for Fire Pumps. Specific electrical supervision for fire pumps is stated in NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection," which is referenced in NFPA 13, "Standard for the Installation of Sprinkler Systems."

A-3.2.4.11.(1) Smoke Detector Location. In the design and installation of the smoke detection system, consideration must be given to all features which could have a bearing on the location and sensitivity of the detectors, including ceiling height, sloped ceilings, diffusion from air conditioning and ventilating currents, obstructions, baffles, and other pertinent physical configurations that might interfere with the proper operation of the system.

A-3.2.4.11.(3) Visible Signals. If staff located in each zone or compartment can see each sleeping room door, visible signals may be located above each door. If staff cannot see every door, it is intended that the visible signals be provided at the location where the staff are normally in attendance. The audible signal is intended to alert staff of the need to check the visible signals.

A-3.2.4.16.(1) Manual Station. Only one manual station need be provided near a group of doors serving as a principal entrance or as a single exit facility. Egress facilities that are provided for convenience and that do not include all the features of required exits need not be provided with a manual pull station.

A-3.2.4.18. Acoustic Measurement and Terminology. The following notes on acoustic measurement and terminology are intended to assist in the application of the requirements for audibility of fire alarm system sounding devices.

The background or ambient measurement should be a spatial averaged A-weighted equivalent sound level measured for 60 s. This can be obtained using an integrating sound level meter with the integration time set to 60 s. During the measurement period the meter should be slowly moved about so as to sample the space uniformly but coming no closer than 0.5 m from any solid wall, floor or ceiling. Alternatively, measurements can be made at 3 or more positions throughout the space and an energy average calculated.

The measurement of the alarm level depends on the type of alarm signal. If the signal is a continuous signal from a bell or siren, the spatial averaged A-weighted equivalent sound level should be obtained. The integration time should be long enough to obtain a reasonable spatial average of the space, but not less than 10 s.

If the alarm has a temporal pattern, then the A-weighted sound level should be measured using the 'fast' time constant during the 'on' part of the cycle. In this situation it is not appropriate to use an integrating sound level meter. Since the duty cycle of the alarm is only 37.5% at best, that type of meter would give a reading that is 4 or more decibels lower than the level while the alarm is 'on.' A number of measurements should be made about the space in question and the average value used to obtain a good spatial representation. Strictly speaking, the energy average of the measurements should be used; however, the frequency spectrum associated with most alarms is of a type that should give little variation about the space. If the measured levels don't vary by more than 2 to 3 dB, then an arithmetic average rather than an energy average can be used.

Effect of Furnishings

The final inspection of a fire alarm system is seldom made when the building is furnished and ready for occupancy. This results in measured levels which may be several decibels higher than will be found in the occupied building. The importance of this difference depends on the situation.

If the building is complete except for furnishings, so that the sources of ambient noise are present, then the amount by which the alarm signal exceeds the ambient level will not change appreciably with the introduction of furnishings. In this case both levels will be reduced by about the same amount.

If the primary source of ambient noise will be office equipment and workers, as would be expected in an open plan office, then measurements made prior to occupancy may differ substantially from those made afterwards. This may be true for both the absolute sound levels and the difference between the alarm level and the ambient.

A problem arises in trying to estimate what the absolute sound levels will be after the building is occupied.

In general, if the measurement is made in a totally bare room then the level will be about 3 dB higher than if the room were carpeted, assuming a reasonable carpet with an underlay. In most cases this will account for most of the absorption in the room and no further correction will be necessary. Adding heavy drapes and absorptive furnishings to a carpeted room can reduce the sound level by a further 2 to 3 dB.

Commercial buildings are more problematic. For example, if an open plan office is measured before any office screens are installed, there could be a substantial difference in the before and after levels, depending on the distance to the nearest alarm device.

Glossary of Acoustical Terms

Audible: A signal is usually considered to be clearly audible if the A-weighted sound level exceeds the level of ambient noise by 15 dB or more.

Awakening threshold: The level of sound that will awaken a sleeping subject 50% of the time.

A-weighted: A frequency weighting network which emphasizes the middle frequency components similar to the response of the human ear. The A-weighted sound level correlates well with subjective assessment of the disturbing effects of sounds. The quantity is expressed in dBA.

Masked threshold: The level of sound at which a signal is just audible in ambient noise.

Sound level: A sound pressure level obtained using a signal to which a standard frequency-weighting has been applied.

Sound pressure: A fluctuating pressure superimposed on the static pressure by the presence of sound. The unqualified term means the root-mean-square sound pressure. In air, the static pressure is barometric pressure.

Sound pressure level: Ten times the common logarithm of the ratio of the square of the sound pressure under consideration to the square of the standard reference pressure of 20 mPa. The quantity obtained is expressed in decibels.

A-3.2.4.18.(1) Alert and Alarm Signals. Alert signals are part of a 2 stage fire alarm system. The intent of the first, alert, stage is to notify persons in authority of a potential threat to building occupants. If a continuously staffed location is available, the alert signal can be restricted to that location.

A-3.2.4.18.(2) Alarm Signal Temporal Pattern. The temporal pattern of an alarm signal relates to the time during which the signal is produced and the intervals between the individual signal pulses. The international standard ISO 8201, "Acoustics – Audible emergency evacuation signal," includes a pattern that is becoming widely used in different countries and it is appropriate for this pattern to be adopted in Canada. The temporal pattern can be produced on most signalling devices. Most existing alarm systems can be modified, and this pattern could be phased in when the systems require modification. The characteristic of the pattern is a 3-pulse phase followed by an off phase. The 3 pulses each consist of an on phase lasting for 0.5 ± 0.05 s followed by an off phase lasting for 0.5 ± 0.05 s sounded for 3 successive on periods and then followed by an off phase lasting for 1.5 ± 0.15 s. Figure A-3.2.4.18.(2)-A indicates the pattern that is intended.

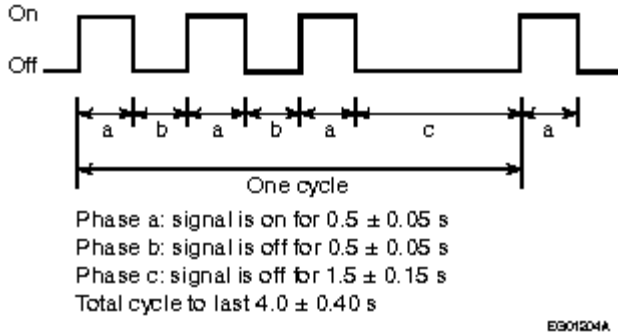


Figure A-3.2.4.18.(2)-A
Temporal pattern for fire alarm signal

Although the diagram shows a square wave form, the wave can have other shapes that produce a similar effect.

If single stroke bells are to be used, the temporal pattern can be produced by having the bell struck three times at a rate of one stroke per second followed by an interval of 2 s of silence. Figure A-3.2.4.18.(2)-B shows the pattern that results.

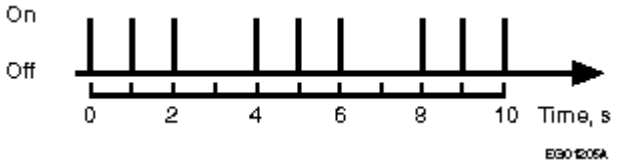


Figure A-3.2.4.18.(2)-B
Temporal pattern imposed on a single stroke bell or chime

Note to Figure A-3.2.4.18.(2)-B:
(1) The on phase represents the time that the striker mechanism is actuated. The sound produced by the bell or chime will continue at a level that decreases until the striker mechanism is re-actuated.

A-3.2.4.18.(3) Audibility of Alarm Systems. It is very difficult to specify exactly what types of sound patterns are considered to be "significantly different" from one another. The intent is to ensure that there is a noticeable or measurable difference between the alert signals and the alarm signals such that it reduces the possibility of confusion.

A-3.2.4.18.(4) Sound Pressure Level. For the purposes of this requirement, an audible signalling device should not produce a sound pressure level more than 110 dBA when measured at a distance of 3 m.

A-3.2.4.18.(5) Residential Sound Level. In a building in which corridors or hallways serve more than one suite or dwelling unit, there will be situations in which an audible signal device cannot be placed in the corridor or hallway to alert persons sleeping in suites and dwelling units, because the sound level in the vicinity of the device would exceed that permitted by Sentence 3.2.4.18.(4). In these situations it will be necessary to supplement the building fire alarm system with an audible signal

device in the suite or dwelling unit. These devices could be piezoelectric devices similar to the sounding units in many smoke alarms, subject to the device emitting the appropriate temporal pattern required by Sentence 3.2.4.18.(2).

A-3.2.4.18.(6) Low Frequency Signal. Audible signal devices that emit a low frequency signal in the range of 470 Hz to 570 Hz have been shown to be more effective in waking people.

A-3.2.4.18.(8) Disconnect Device for Dwelling Units. In order to minimize the annoyance caused by false and unwanted alarms, the disconnect will permit a person to silence the local audible device within the dwelling unit. At that time the person would be aware of sounds from devices in common spaces and could plan appropriate action. The disconnect will reduce the possibility of tampering with the audible devices.

A-3.2.4.18.(9) and (10) Signal Circuits. Clause 3.2.4.18.(9)(a) permits Class A wiring, or Class B wiring with signal circuit isolators located outside of the suites, to serve audible signal devices within residential suites.

Clause 3.2.4.18.(9)(b) permits a separate signal circuit to serve each suite without the need for signal circuit isolators or Class A wiring.

Open circuits and Class A and Class B wiring circuits are terms defined in CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."

A-3.2.4.18.(14) Deck and Balcony Audible Signal Devices. Deck and balcony spaces are dependent upon the building egress system. If occupants are not provided with adequate notification of conditions within the building, then the safe and orderly egress of persons from these spaces may be compromised be evolving conditions. This By-law require that provisions for notification of the occupants of these spaces be provided.

Because these are areas exterior to the building envelope, establishing an ambient level of sound for the purposes of satisfying the sound pressure requirements of Article 3.2.4.18. will challenging at best. Therefore, the provisions of Sentence 3.2.4.18.(14) address this only generally, by requiring audible notification devices be provided in a location proximate to deck or balcony so that occupants will be able to distinguish an alarm signal under reasonably expected conditions. It is not intended that a specific sound pressure level be achieved for the deck or balcony occupants, only that good design practices be followed and that minimum measures to facilitate the timely notification of persons on a deck or balcony be provided.

A-3.2.4.19.(1)(g) Visible Alarm Signals in Hotels and Motels. Visible signal devices should be installed in a combination of regular suites and designated accessible suites in hotels and motels so that people who are deaf or hard of hearing can safely occupy either type of suite.

Visible signal devices are not required to be installed in all the rooms of the suite. The signal should be visible from any room in the suite, which can be accomplished by installing glazing panels between the rooms or additional visible signal devices.

In addition, CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems," requires that high-intensity strobes be used in sleeping rooms.

A-3.2.4.19.(3) Visible Alarm Signal. CAN/ULC-S526, "Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories," applies to visible signalling units. This document is referenced by the most recent standard for the installation of fire alarm systems and would automatically apply. Current Canadian technology does not integrate visible and audible alarms to have the same temporal pattern. Visible and audible alarms should have as close a temporal pattern as possible but without interference beats that might have a deleterious effect on some persons. Visible signalling devices with the same temporal pattern as required for audible devices are available from some sources and they should become available in Canada. Not all units that comply with the ULC standard will have sufficient power to adequately cover large areas; care will have to be taken to specify units with adequate power when large spaces are being designed.

A-3.2.4.20.(9)(a) Smoke Alarm Installation. CSA C22.1, "Canadian Electrical Code, Part I," which is adopted by the Electrical Safety Regulation, permits a smoke alarm to be installed on most residential circuits that carry lighting outlets and receptacles. It is the intent of the Building By-law that any other item on a circuit with a smoke alarm should be unlikely to be overloaded and trip the breaker with a resultant loss of power that is not sufficiently annoying for the breaker to be restored to the on position. It is considered that an interior bathroom light or a kitchen light fulfills this intent, but that circuits restricted to receptacles do not fulfill this intent.

A-3.2.4.20.(10) Smoke Detectors in lieu of Smoke Alarms. It is intended that the smoke detector in this application will function as per the requirements of a smoke alarm; specifically, it will be a localized alarm to that suite. The advantage of this

type of installation is that the detector would be monitored by the fire alarm panel, which would provide notification to supervisory personnel and be inspected as per CAN/ULC-S524, "Standard for Installation of Fire Alarm Systems."

A-3.2.4.22.(1)(b) Voice Messages. The concept of intelligibility expressed in Clause 3.2.4.22.(1)(b) is intended to mean that a person with average hearing and cognitive abilities is able to understand the messages that are transmitted into the space occupied by the person. There is no absolute measure to predetermine the effect of loudspeakers and it may be necessary, once the building has been furnished and occupied, to increase the number of loudspeakers to improve the quality of the messages.

The intelligibility of the message depends on the speech level, the background level, and the reverberation time of the space. ISO 7731, "Ergonomics – Danger signals for public and work areas – Auditory danger signals," addresses audibility. The standard suggests that an A-weighted sound level at least 15 dBA above the ambient is required for audibility, but allows for more precise calculations using octave or 1/3 octave band frequencies to tailor the alarm signal for particular ambient noise conditions. Design of the alarm system is limited to ensuring that all areas receive an adequately loud alarm signal.

If a public address system is to be used to convey instructions during an emergency, then the requirements of the system are less straightforward. In general, however, a larger number of speakers operating at lower sound levels would be required.

Additional guidance on how to design and evaluate the intelligibility of a communication system can be found in the following documents:

- IEC 60268-16, "Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index"
- ISO 7240-19, "Fire detection and alarm systems – Part 19: Design, installation, commissioning and service of sound systems for emergency purposes"
- NEMA SB 50, "Emergency Communications Audio Intelligibility Applications Guide"
- Annex D of NFPA 72, "National Fire Alarm and Signaling Code"

A-3.2.5.4.(1) Fire Department Access for Detention Buildings. Buildings of Group B, Division 1 used for housing persons who are under restraint include security measures that would prevent normal access by local fire departments. These security measures include fencing around the building site, exterior walls without openings or openings which are either very small or fitted with bars, and doors that are equipped with security hardware that would prevent easy entry. These buildings would have firefighting equipment installed and the staff would be trained to handle any small incipient fires. It is expected that appropriate fire safety planning would be undertaken in conjunction with local fire departments in order that special emergencies could be handled in a cooperative manner.

A-3.2.5.5. Location of Access Routes and Paths of Travel. The national building code and the provincial building code prescriptive requirements for access routes, paths of travel and hydrant locations, currently, do not reflect the operational requirements of the Vancouver Fire and Rescue Services nor the existing City of Vancouver fire hydrant locations. Therefore, the VBBL has been modified from the national and provincial building codes to reflect the unique to Vancouver requirements.

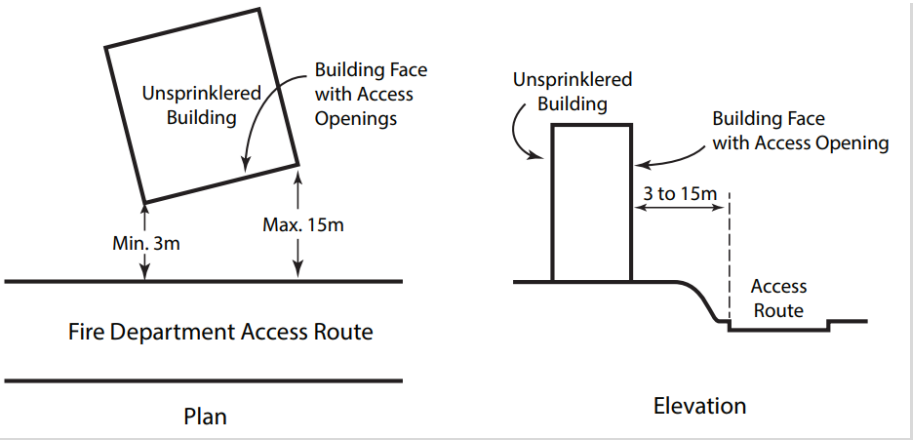


Figure A-3.2.5.5.-A

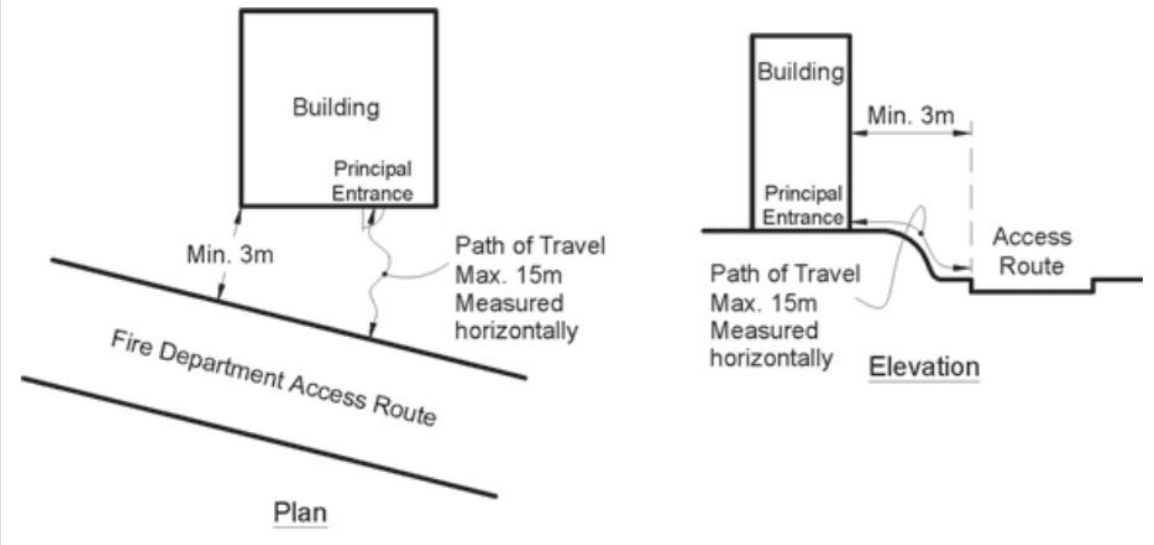
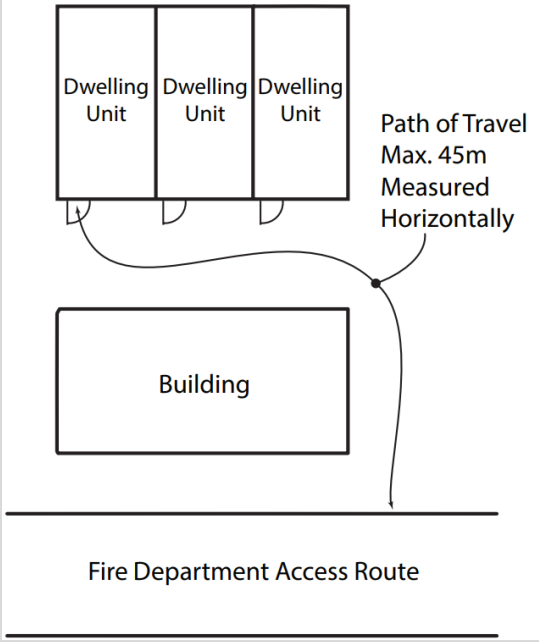


Figure A-3.2.5.5.-B



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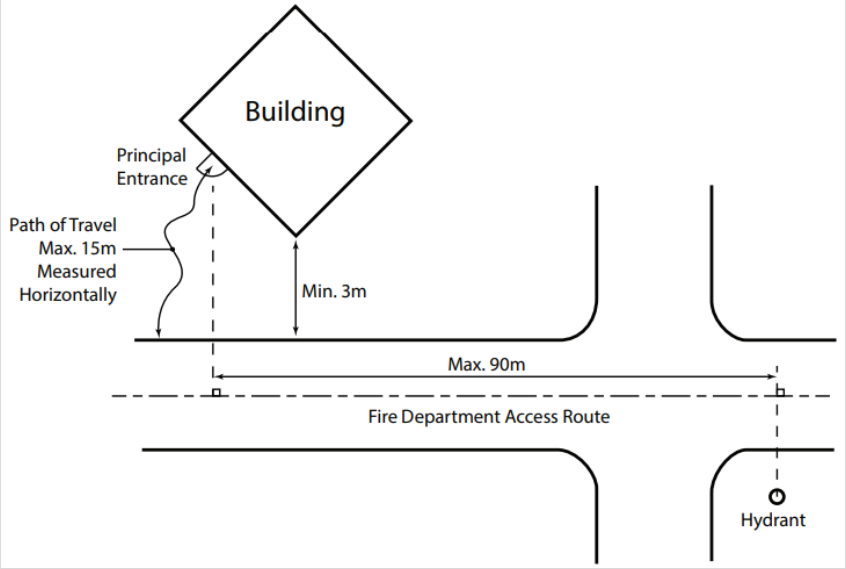

Figure A-3.2.5.5.-D

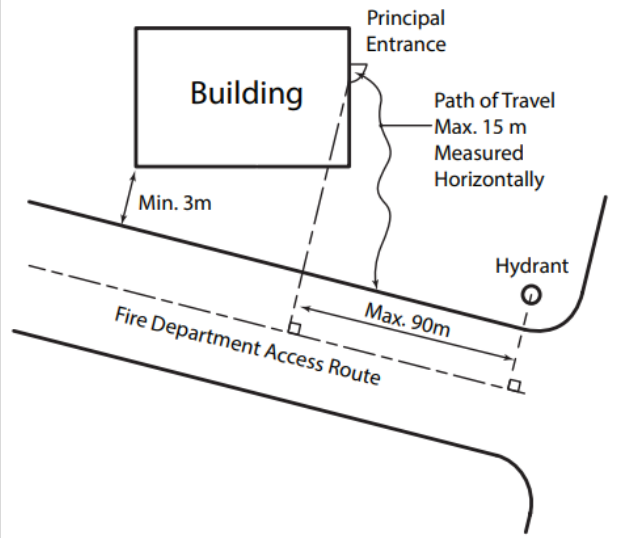

Figure A-3.2.5.5.-E

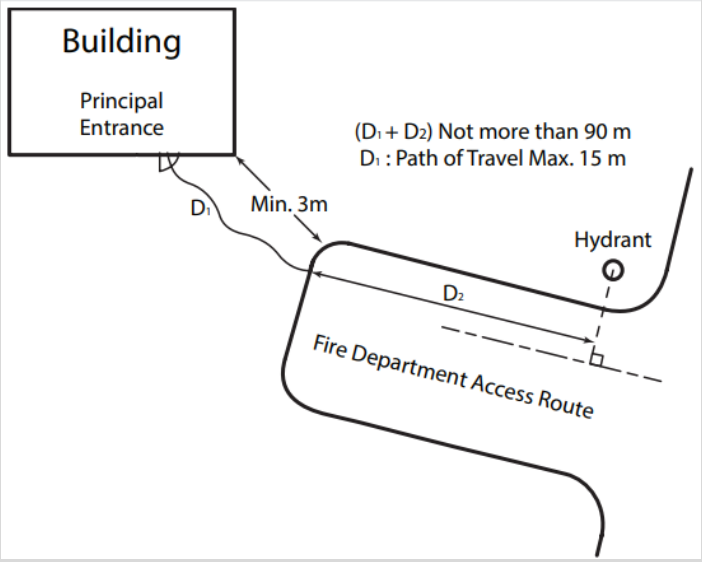

Figure A-3.2.5.5.-F

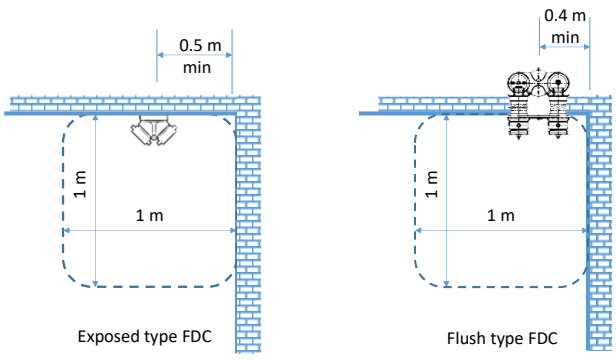

Figure 1. Working Space for FDC

Figure A-3.2.5.5.-G

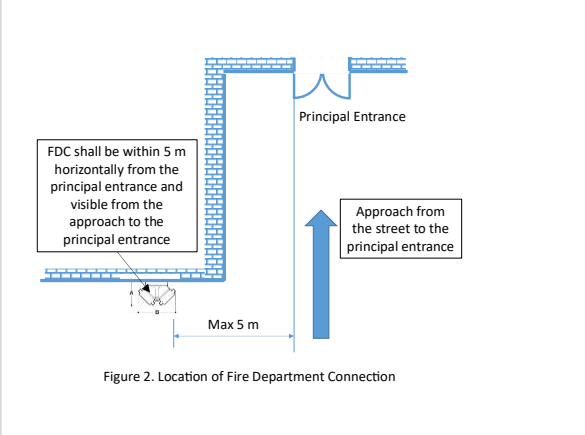

Figure A-3.2.5.5.-H

A-3.2.5.6.(1) Fire Department Access Route. The design and construction of fire department access routes involves the consideration of many variables, some of which are specified in the requirements in the By-law. All these variables should be considered in relation to the type and size of fire department vehicles available in the municipality or area where the building will be constructed. It is appropriate, therefore, that the local fire department be consulted prior to the design and construction of access routes.

A-3.2.5.6.(3) Width of Fire Department Access Path. The required unobstructed width of the fire department access path assumes that the access path serving one or more dwelling units may be shared. Portions of a path serving only one dwelling unit (whether principal or ancillary) may be 900 mm in width, but where those path are conjoined thereby serving more than one dwelling unit, the path is to be increased from that point to a minimum 1200 mm until it reaches the curb of the access route.

A-3.2.5.7.(1) Water Supply. The intent of Sentence 3.2.5.7.(1) is that an adequate water supply for firefighting be readily available and of sufficient volume and pressure to enable emergency response personnel to control fire growth so as to enable the safe evacuation of occupants and the conduct of search and rescue operations, prevent the fire from spreading to adjacent buildings, and provide a limited measure of property protection.

The water supply requirements for buildings containing internal fire suppression systems, including sprinkler systems and standpipe systems, are contained in specific standards referenced in the By-law. Compliance with the referenced standard, including any variations made by this By-law, is deemed to satisfy the intent of Sentence 3.2.5.7.(1). However, it will be necessary to verify that an adequate source of water is available at the building site to meet the required quantities and pressures.

For a building with no internal fire suppression system, the determination of the minimum requirements applicable to the water supply for firefighting is relevant mainly to building sites not serviced by municipal water supply systems. For building sites serviced by municipal water supply systems, where the water supply duration is not a concern, water supply flow rates at minimum pressures is the main focus of this provision. However, where municipal water supply capacities are limited, it may be necessary for buildings to have supplemental water supplies on site or readily available.

The sources of water supply for firefighting purposes may be natural or developed. Natural sources may include ponds, lakes, rivers, streams, bays, creeks, and springs. Developed sources may include aboveground tanks, elevated gravity tanks, cisterns, swimming pools, wells, reservoirs, aqueducts, artesian wells, tankers, hydrants served by a public or private water system, and canals. Consideration should be given to ensuring that water sources will be accessible to fire department equipment under all climatic conditions.

The volume of on-site water supply is dependent on the building size, construction, occupancy, exposure and environmental impact potential, and should be sufficient to allow at least 30 minutes of fire department hose stream use.

For the purposes of calculating adequate water supply requirements for fire fighting, the following documents may be useful:

- Insurance Services Office (ISO), “Needed Fire Flow Guide,”

- NFPA 1142, “Standard on Water Supplies for Suburban and Rural Fire Fighting,” and
- American Water Works Association, “Distribution Requirements for Fire Protection.”

A-3.2.5.9.(4)(c) Fire Department Pumping Equipment. Availability of appropriate pumping equipment from the local fire department or, in the case of industrial plants or complexes, from their fire brigade, is considered sufficient to meet the intent of this requirement.

A-3.2.5.11.(2) Hose Stations. A building that is partially sprinklered may have some floor areas where local sprinklers are installed that do not cover the entire floor area. It is intended that hose stations be provided in these floor areas to allow emergency responders to fight fires that cannot be controlled by local sprinklers.

A-3.2.5.12.(1) Sprinkler System Design. In NFPA 13, “Standard for the Installation of Sprinkler Systems,” reference is made to other NFPA standards that contain additional sprinkler design criteria. These criteria apply to industrial occupancies with high fire loads and industrial occupancies intended for the use, manufacture or storage of highly flammable materials. Therefore, while only NFPA 13 is called up directly by Sentence 3.2.5.12.(1), the additional criteria in the other NFPA standards are included automatically.

In some NFPA standards, certain aspects of sprinkler protection are dependent on the fire-resistance rating of the vertical structural members. In these cases, the sprinkler system design options can be affected by the fire-resistance rating of these elements. For example, in buildings used for the storage of rubber tires, sprinklers directed at the sides of a column are required if the column does not have the required fire-resistance rating.

Other NFPA standards may require that certain occupancies be sprinklered in conformance with NFPA 13, as in the case of some garages. These requirements do not supersede the requirements in the By-law. An occupancy is required to be sprinklered only when this is specified in the By-law, but when it is so required, it must be sprinklered in conformance with NFPA 13 and its referenced standards.

Additionally, while Part 4 contains seismic force provisions that apply to the design of sprinklers, NFPA 13 contains other structural requirements for sprinklers that are also required to be met.

A-3.2.5.12.(2) Sprinklering of Residential Buildings above a Storage Garage Considered as a Separate Building. For the purpose of determining whether NFPA 13R, “Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies,” applies to a residential building constructed over a storage garage, it is not intended that a storage garage constructed as a separate building in accordance with Article 3.2.1.2. be considered as a storey when determining the building height of the residential building. Similarly, this would not preclude the use of NFPA 13D, “Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” for any one- or two-family home constructed above such a storage garage.

A-3.2.5.12.(3) Superimposed Residential Suites. Sentence 3.2.5.12.(3) provides for the application of NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” where a residential building contains not more than two principal dwelling units or row housing. However, designers should recognize that the provisions of NFPA 13D are based in fire testing of conventional single dwelling arrangements of the 1970’s and U.S. NFIRS statistical data through to 2009 for conventional single dwellings, duplex, and mobile home arrangements as evidenced in the Annex notes to NPFA 13D. They are therefore intended only to allow for arrangements where dwelling units are located in a side-by-side (horizontally connected) configuration.

Residential arrangements wherein which dwelling units are superimposed above another unit (residential or commercial) are to be designed to NFPA 13 or 13R as permitted by Article 3.2.5.12. Ancillary Residential Units are the notable exception to these requirements and are addressed separately in Section 9.37.

A-3.2.5.12.(6) Sprinklering of Roof Assemblies. Sprinkler protection for roof assemblies in lieu of fire resistance is based on the assumption that the sprinklers will protect the roof assembly from the effects of fire in spaces below the roof. If a ceiling membrane is installed, the sprinklers would have to be located below the membrane in order to react quickly to the fire. In certain instances, however, sprinklers may be required within the concealed spaces as well as below the membrane. NFPA 13, “Standard for the Installation of Sprinkler Systems,” requires sprinklers in certain concealed spaces.

According to NFPA 13 and 13R, some small rooms and closets within a dwelling unit in a sprinklered building, including those that may be in the storey immediately below the roof assembly, do not require sprinklers. However, the Building By-law requires sprinkler protection within all rooms and closets immediately below the roof so as to control any fire that might start in that space and thereby limit the probability of the fire spreading into the roof assembly.

Moreover, NFPA 13D, “Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” also allows the omission of sprinklers in such rooms and closets under certain circumstances, provided the building is sprinklered in conformance with this standard. In this case, the Building By-law concurs with the provisions of the NFPA 13D standard.

A-3.2.5.12.(7) Balconies and Decks. The intent of Sentence 3.2.5.12.(7) is to suppress or control the spread of a fire originating from a balcony or deck to the roof assembly or other parts of the building.

A-3.2.5.12.(8) Sprinkler Rating. The requirements of this Sentence can be met by using sprinklers with a rating of 79°C to 107°C.

A-3.2.5.12.(10) Fast-Response Sprinklers. Several types of sprinkler will respond to a fire faster than a conventional standard response sprinkler. The Response Time Index (RTI) is used to quantify the sensitivity of the sprinkler link for any given sprinkler. The RTI for the group of fast-response sprinklers described below will on average range from 22 s0.5•m0.5 to 33 s0.5•m0.5. RTI values for standard response sprinklers will typically be in the range of 83 s0.5•m0.5 to 110 s 0.5•m0.5.

Any confusion as to the appropriate type of fast-response sprinkler for different types of building should be alleviated by considering the testing criteria described below and the reference to the appropriate NFPA installation standards.

Although the By-law specifies where fast-response sprinklers are required, it does not prevent the appropriate use of fast-response sprinklers in other occupancies.

Residential sprinklers are tested in accordance with ANSI/UL-1626, “Residential Sprinklers for Fire-Protection Service.” They are installed in accordance with NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,” with NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” and with Section 5-4.5 of NFPA 13, “Installation of Sprinkler Systems,” for residential occupancies and for dwelling units.

Quick-response sprinklers are tested in accordance with ANSI/UL-199, “Automatic Sprinklers for Fire-Protection Service.” They are installed in accordance with NFPA 13, “Installation of Sprinkler Systems,” for spacing, density and location. They are acceptable for limited use as described in NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,” but are not permitted for use under NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.”

Early-suppression fast-response sprinklers are tested in accordance with FM Approvals Class Number 2008, “Approval Standard for Quick Response Storage Sprinklers for Fire Protection.” They are installed in accordance with NFPA 13, “Installation of Sprinkler Systems,” but are not accepted for use under either NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,” or NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.”

Quick-response extended-coverage sprinklers are tested in accordance with ANSI/UL 199, “Automatic Sprinklers for Fire-Protection Service.” They are installed in accordance with NFPA 13, “Installation of Sprinkler Systems,” for spacing, density and location. They are acceptable for limited use as permitted by NFPA 13R, “Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,” but are not permitted for use under NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.”

A-3.2.5.13.(1) Hazard Classification for Sprinkler Selection. The reference to light hazard occupancies is based on the descriptions of these occupancies given in NFPA 13, “Standard for the Installation of Sprinkler Systems,” and is intended only for use in the design of sprinkler systems. These descriptions should not be confused with the occupancy classifications in the By-law.

In NFPA 13, a light hazard occupancy is one in which the quantity or combustibility of contents is low and fires with relatively low rates of heat release are expected. Typical buildings or parts of buildings include: churches; clubs; eaves and overhangs, if of combustible construction with no combustibles beneath; educational buildings; hospitals; institutional buildings; libraries, except very large stack rooms; museums; nursing or convalescent homes; offices, including data processing rooms; residential buildings; restaurant seating areas; theatres and auditoria, excluding stages and proscenia; and unused attics.

Although NFPA 13R, “Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies,” and NFPA 13D, “Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,” as referenced by NFPA 13, are concerned with specific types of residential occupancy, namely apartment buildings up to four storeys, one and

two family dwellings, and mobile homes, for the purpose of acceptance of combustible sprinkler piping these occupancies are considered to be included in the category of residential buildings under light hazard occupancies.

A-3.2.5.18.(1) Fire Pumps. In order to ensure an adequate water supply, it may be necessary to install a fire pump for a building that has either a standpipe system or an automatic sprinkler system installed.

A-3.2.5.20. Radio Antenna System. Buildings of noncombustible construction or buildings that have glazing with a low emissivity rating can cause interference with radio signals that are necessary for emergency, firefighting and rescue operations. The installation of a radio antenna system should be shown on drawings submitted for building permit, and related permits. A complete design of the radio antenna system will be required on plans to be submitted for the building permit and should be design in accordance with the general specification provided by Vancouver Fire and Rescue Services. See Fire Department publication "Vancouver Fire Rescue Services Specifications for Radio Antenna System Design, Installation and Acceptance Testing" as updated from time to time. By-law users are advised to keep up-to-date. The technical specifications as of May 2019 are reproduced here for convenience.

Specifications for Radio Antenna System - Design, Installation and Acceptance Testing (May 2019)

1. SCOPE

1.1. This Specification describes the requirements for the design, installation, and acceptance testing of a radio antenna system in a building.

1.2. The installation of radio antenna system equipment and devices not covered by this Specification shall be in accordance with good engineering practice and the manufacturer's installation instructions.

1.3. The work in this section shall be performed under the supervision of a registered professional engineer in British Columbia

2. REQUIREMENTS OF RADIO ANTENNA SYSTEMS

2.1. GENERAL

2.1.1. Radio antenna systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.

2.1.2. Provide an in-building radio antenna system to provide coverage in the building for the public safety agencies as required by the local fire department and other agencies and authorities having jurisdiction. System users shall receive and transmit radio broadcasts from their portable radio units within the building. This shall be accomplished utilizing the following components, which if applicable shall conform to UL 2524 "Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems":

a) Bi Directional Amplifiers (Signal Boosters)
b) Coaxial Cable
c) Frequency filters
d) Donor and discrete antennas
e) Other components and interconnecting circuitry as required

2.1.3. Radio antenna systems shall not rely on mobile repeaters installed on fire department apparatus.

2.1.4. The entire system shall meet with approval of the Fire Chief, Chief Building Official, and Director of Planning for the City of Vancouver (the authorities having jurisdiction, AHJ).

2.1.5. All permits necessary for the installation of the work shall be obtained from the AHJ prior to the commencement of the work. All permit costs and inspection fees shall be included as the part of the required work.

2.2. FEDERAL LICENSE

2.2.1. All active systems shall be licensed by the federal regulator, Innovation, Science & Economic Development Canada (ISED), and shall comply with the applicable Standard Radio Systems Plan (SRSP).

2.2.2. The installing contractor shall arrange to obtain the federal license to operate on behalf of the owner.

2.2.3. The installing contractor shall be responsible for any fees and costs to obtain the federal license for the first year of operation.

2.2.4. Any license required shall be renewed annually by the building owner and the cost of the licensing borne solely by the building owner.

3. PLANS AND SUPPORTING DOCUMENTS

3.1 The plans and supporting documents for the radio antenna system shall include a complete and detailed description of the following:

a) Installation instructions
b) Location of in-building antenna
c) Location of donor antenna
d) Location of riser and trunk on each floor

e) Location of amplifier, repeater, and head-end equipment
f) Connection to the fire alarm system for a common trouble zone
g) Critical locations requiring coverage
h) Method of Acceptance Testing

4. INSTALLATION OF RADIO ANTENNA EQUIPMENT

4.1 AMPLIFIERS, REPEATERS AND HEAD-END EQUIPMENT

4.1.1. Amplifiers, repeaters, and head-end equipment shall be located in a service room that is provided with not less than 1 h fire-resistance rating.

4.1.2. All amplifiers, repeaters, and head-end equipment required by the radio antenna system shall be protected by enclosures rated CSA Type 3 or higher.

4.1.3. All amplifiers, repeaters and head-end equipment shall be provided with drip shield to guard against water spray from fire sprinklers located in the room unless the enclosures are rated CSA Type 4 or higher.

4.2 DISTRIBUTED ANTENNA SYSTEM

4.2.1. One in-building antenna shall be located within 20 m of the elevator door opening at each odd-numbered storey.

4.2.2. One in-building antenna shall be located inside each exit stair shaft at the landing of each even numbered storey.

4.2.3. Additional in-building antennas shall be installed to provide 98 percent radio coverage inside each critical area as described in the Vancouver Building By-law. 4.2.4. Sufficient antenna isolation shall be maintained between the donor antenna and all in-building antenna (D.A.S.) under all operating conditions 4.3 WIRING 4.3.1. Cables and wires shall be FT-4 rated, and where installed inside plenums, cables and wires shall be FT-6 rated. 4.3.2. Except within service rooms containing the amplifiers, repeaters and head-end equipment, cables and wires installed in the risers shall be mechanically protected per the Electrical Code. 4.4 CONNECTION TO THE FIRE ALARM SYSTEM 4.4.1. The radio antenna system shall be monitored by the building fire alarm system for common trouble 4.5 PROVISION FOR RADIO ANTENNA SYSTEM EXPANSION 4.5.1. Raceways shall be installed to allow installation of future in-building antenna in the floor area of each storey not
already provided with wiring or horizontal distribution.

5. ACCEPTANCE TESTING

5.1 Adequate Radio Coverage

5.1.1. The intent is to achieve -95 dBm on the current public safety bands. Good design should provide a margin of not less than 10 dB to allow for uncontrolled variables. Based on the foregoing, the design target for indoor coverage should be -85 dBm.

5.1.2. The radio frequency range to be supported shall be any frequencies used by the public safety communications service provider's network. If signal amplifiers are used, they shall include filters that will protect the amplifiers from overload and the system from interference by out-of-band signals.

5.1.3. In the event that active amplification is required to meet the foregoing communication quality requirements in the building, coordination with the public safety communications service provider is required to confirm that its outdoor radio communication performance is not degraded. If there is a trade-off to be made between maintaining the public safety communications service provider's outdoor radio communication performance and restoration of signal strength in the building, the trade-off decision shall be made by the public safety communications service provider and communicated to the Fire Chief by the building owner.

5.2 System Verification Procedures

5.2.1. Tests shall be performed by RF technicians under supervision of a professional engineer registered in the Province of British Columbia. Test reports shall bear the seal of the engineer.

5.2.2. If required by the engineer, during the engineer's acceptance test, portable handheld radios used for speech and coverage acceptance shall be the same type used by Vancouver Fire and Rescue Services.

5.2.3. Acceptance tests and measurements shall be performed after completion of installation of the Radio Antenna System. Tests shall be performed using radio frequencies assigned by the public safety communications service provider, after proper coordination with an authorized representative of that system and with the Fire Chief.

5.2.4. Where the floor area of a critical location is greater than 4,500 m² the area shall be divided into a uniform grid of not more than 15 m on a side, or if the floor area is smaller than 4,500 m² it shall be divided into a uniform grid of approximately 20 equal areas, to a minimum of 9 m², and measurements shall be taken in each grid area. The size of the grids shall also be reduced, or the number of grids increased, upon recommendation of the Fire Chief or inspector in areas where special construction or other obstruction may significantly affect communications.

5.2.5. If the Radio Antenna System fails to provide acceptable communication in any of the critical locations as stipulated in the Building By-law, the building owner shall have the system rectified to meet the 98% coverage requirement for these areas; otherwise the Radio Antenna System will not be accepted.

5.3 Tests for Optimization

5.3.1. The radio antenna system shall be optimized to provide maximum coverage of the remainder of the floor areas while providing 98 % coverage in the critical locations.

5.4 Tests of Power Supply

5.4.1. Backup batteries and power supplies shall be tested under full load using a minimum of a 90% duty cycle for a period of at least one hour. If within the one-hour period, the battery shows no symptom of failure or impending failure, the test shall be continued for additional one-hour periods to determine the integrity of the battery. The battery shall not fail within a four-hour continuous test period.

5.4.2. Alternatively, the power supply may be connected to the building emergency generator with the backup batteries to supply a four-hour continuous power supply.

6. DOCUMENTATION

6.1 DOCUMENTATION REQUIRED 6.1.1. The documentation required by this section shall be maintained on site in a box located in a location acceptable to the Fire Chief.

6.1.2. Documentation for the radio antenna system shall include the following description of the radio antenna system:

a) Instructions for resetting the system
b) Equipment operating instructions or manuals
c) Equipment maintenance instructions
d) Equipment testing instructions
e) Optimization tests
f) Signal strength tests at critical locations
g) Results of battery test
h) Results of testing of connection to the fire alarm system

6.1.3. The designer of the radio antenna system shall prepare the Health SC6 report which certifies the system meets Safety Code 6.

6.1.4. After installation of the radio antenna system is completed, the designer shall provide confirmation that the radio antenna system meets Safety Code 6.

6.1.5. A copy of the annual operating licence issued by Federal communications agency shall be included in the fire safety plan for the building

A-3.2.6. Smoke Control for High Buildings. Experience with high buildings has shown that the time required for complete evacuation can exceed that which is considered necessary for the safe egress of all occupants. Studies of the “chimney effect” and observations of smoke movement in actual fires have shown that fire compartmentation to contain a fire on any one storey will not usually prevent the movement of smoke through elevator, stair and other vertical shafts to the upper floors of a high building. Occupants of a high building in which an automatic sprinkler system is not installed, and particularly those on upper storeys, could be faced with severe smoke conditions from fires occurring in storeys below them before their own evacuation is possible. The requirements of Subsection 3.2.6. are intended to maintain safe conditions for occupants of a high building who may have to remain in the building during a fire, and to assist the firefighters by providing efficient access to the fire floor. The Notes for Subsection 3.2.6. are intended to assist a designer in complying with the requirements of Subsection 3.2.6. The knowledge requirements are well within the capabilities of a competent designer. The designer should appreciate, however, that successful application requires a clear understanding of the principles that govern smoke movement. Subsection 3.2.6. contains only those items that relate to the design and construction of a building; operation of the facilities and recommended actions to be taken by the building owner, occupant and fire department are covered by the Fire By-law.

The designer is cautioned that the tabular and graphical information in the Notes for Subsection 3.2.6. was developed for buildings having conventional configurations. The designer has to judge the extent to which the building under consideration has characteristics that will allow the application of this information; this is particularly true of designs employing air-handling systems for which a realistic assessment of the leakage characteristics of the enclosures of spaces may be critical.

It is assumed that buildings regulated by Subsection 3.2.6. will be in an area served by a fire department capable of an early response and that all firefighting and rescue situations will be under the direct control of the officer-in-charge of the fire department responding to the emergency. It is important that firefighters be provided with a smoke-free access to fire floors below grade. Provisions are included to separate exit stairways serving storeys above grade from those serving storeys below grade, and to limit entry of smoke into these shafts. Similarly, elevator hoistways and service shafts are required to be provided with a separation near grade, or be designed to limit their functioning as paths of smoke movement into upper floor areas from storeys below grade.

It is assumed that in the event of fire, occupants of the floor on which the fire occurs will leave by exit stairs immediately following the sounding of a fire alarm, and that occupants of the floor immediately above the floor on which the fire occurs will be advised to leave by the first fire department officer on the scene or other person assigned this responsibility. Occupants of all other floors may remain on their floors unless otherwise directed. It is also assumed that the owner of the building has complied with the Emergency Planning Section of the Fire By-law by preparing a comprehensive fire safety plan to safeguard the building occupants and that the building supervisory staff are familiar with the requirements of Subsection 3.2.6. and with their responsibilities under the fire safety plan.

The Building By-law requires that a check be made of the smoke control and mechanical venting systems. Testing will indicate deficiencies caused by inexact estimates of the leakage characteristics or of air supply requirements and, in all but the most extreme cases, will provide an opportunity for appropriate adjustments before the system is put into service.

A-3.2.6.1.(2) Six Storey Buildings. One of the key concerns for high-buildings is the potential for increased smoke movement in a fire as a consequence of stack-effect. One of the provisions of 3.2.6.1.(2) is to prohibit stairs or elevators from directly connecting more than 6 storeys consecutively. This prohibition is intended to limit the potential for smoke to enter the stairs or elevator shafts and contaminate floor areas above. However, this prohibition is not intended to restrict the potential for stairs or elevators to serve other floors or levels as long as they are provided with acceptable measures to limit the uncontrolled movement of smoke between floor levels. Designers may wish to consider the use of vestibules or other measures described in note A-3.2.6.2.(4) as part of a design solution to control smoke movement.

A-3.2.6.1.(2)(c) Principal Entry for Firefighting. The limitation on vertical travel of 18 m describes the acceptable travel from the principal entry to the uppermost floor area. However this does not account for changes of height or specific entry arrangements outside of the building. In order to accommodate the potential need to set up hoses and other fire fighting equipment, or the movement of stretchers or other equipment, the route from the designed fire department route to the principal entry assumes a clear and relatively level entry with only modest change in elevation throughout. The acceptability of complicated entry arrangements, or of significant slopes or changes in grade should be discussed with the fire department and other first responders in applying the provision of this Article.

A-3.2.6.2.(2) Stairway Protection Below Lowest Exit Level. A stairway serving floors below the lowest exit level is considered to comply with the intent of Sentence 3.2.6.2.(2) if the following conditions are satisfied.

1) The stairway has a vent or door to the outdoors at or near the top of the stair shaft that has an openable area of not less than 0.1 m^2 for each storey served by the stairway, less 0.01 m^2 for each weatherstripped door and 0.02 m^2 for each door that is not weatherstripped opening into the stairway.

2) The stairway is enclosed in a shaft that

a) does not pass through the floor above the lowest exit level and is separate from a shaft that contains a stairway serving upper storeys, or

b) contains a stairway serving upper storeys, but is separated from that stairway at the lowest exit level by a fire separation having a fire-resistance rating not less than that required for the shaft enclosure.

3) The stairway is provided with equipment capable of maintaining a flow of air introduced at or near the bottom of the stair shaft, at a rate equal to 0.47 m^3/s for each storey served by the stairway.

A-3.2.6.2.(3) Pressurization of Stair Shafts. The purpose of providing open doors and vents at the bottom of a stair shaft is to create a positive pressure in the shaft relative to adjacent floor areas and thus keep it free of smoke. The pressure depends on the temperature differential between the interior and the exterior of the building which is most pronounced during winter months when stack effect is greatest. If a shaft does not have a direct opening to the exterior, alternative means must be provided to achieve smoke control. If a corridor or vestibule is used as a link between the exit level of an interior stair shaft and the outdoors to provide a venting system, it will be necessary to assess the reliability of the overall system. The probability of all doors or closures being opened at the same time has to be addressed, as well as the size of the vestibule and its impact on the overall smoke control system.

If mechanical methods are used to develop a positive pressure in a stair shaft, a minimum pressure differential of 12 Pa is recommended to prevent smoke migration from floor areas in a sprinklered building where fire temperatures are controlled and smoke movement may be dominated by stack effect in a stair shaft. During a fire emergency, persons will be entering and exiting a stair shaft as they move to a place of safety and under these conditions the number of doors open to the stair shaft cannot be predetermined. The number will vary depending on the occupancy of the building, population density and the evacuation plan for

the building. It should be assumed that two doors are open. This is based in part as a practical level for most buildings and considers the positive fire experience in sprinklered buildings.

The maximum pressure differential created by a mechanical system should not prevent doors to the stair shafts from being opened. A specific maximum value cannot be given, as this value will depend on the door opening force and size of the door. These values should be calculated for each specific case. Although a maximum value of 130 N is suggested by research as the force that can be opened by the majority of people in most occupancies, this value is above the maximum value of 90 N generally specified in this By-law. The use of values below 130 N can create a practical problem in achieving effective smoke control as it is difficult to design for the acceptable minimum and maximum pressure differential range. Special consideration may need to be given for doors located in an accessible path of travel.

Care should be taken by designers and by building and fire officials in implementation of these requirements. Assumptions involved in the design of a smoke control system may be different from final construction conditions. For this reason each system should be tested after installation to ensure that the design intent is met. The minimum pressure differential is not intended to apply to locations in stair shafts when doors in their proximity are open to adjacent floor areas.

A-3.2.6.2.(4) Limiting Smoke Movement. Measures to prevent the migration of smoke from floor areas below the lowest exit storey into upper storeys include the following.

1) An elevator hoistway that passes through the floor above the lowest exit storey should not penetrate the floor of the storey immediately below the lowest exit storey, unless there is a vestibule between the shaft and each floor area below the lowest exit storey that

a) has a fire separation, with a fire-resistance rating not less than 45 min, between the vestibule and any public corridor,

b) has a fire separation, with a fire-resistance rating not less than that required for an exit by Article 3.4.4.1., between the vestibule and any stair or elevator enclosure or any part of a floor area, other than a public corridor, and

c) except for elevator hoistway entrances, has a self-closing device on any door through the fire separation required by Clauses (a) and (b), with the door opening in the direction of travel from the floor area to the exit stairway.

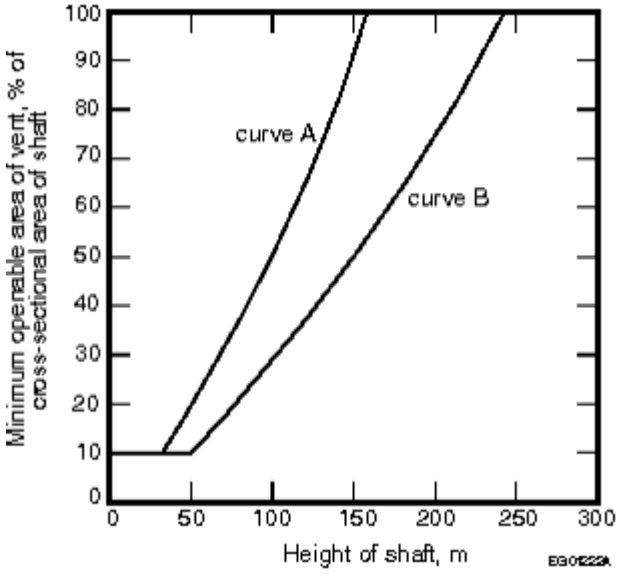

Figure A-3.2.6.2.(4)-A
Vent to a vertical service space with no other pressurized shaft in the building

Notes to Figure A-3.2.6.2.(4)-A:

(1) Curve A applies to a vertical service space that is enclosed by unplastered unit masonry or by plaster and steel stud construction with all openings in the shaft sealed to the degree required by Articles 3.1.9.1. to 3.1.9.4.

(2) Curve B applies to a vertical service space that is enclosed by monolithic concrete or by plastered unit masonry with all openings in the shaft sealed tightly to minimize air leakage.
(3) A shaft having a vent that is 100% of the cross-sectional area of the shaft is acceptable for buildings up to 1.5 times the height shown by the appropriate curve in Figures A-3.2.6.2.(4)-A and A-3.2.6.2.(4)-B.
(4) The total leakage area, based on measurements in typical high buildings, is assumed to be 0.025 m^2 for every 10 m^2 of shaft wall area in the case of Curve A and 0.015 m^2 for every 10 m^2 of shaft wall area in the case of Curve B.

2) A vertical service space, other than an elevator hoistway, that passes through the floor assembly above the lowest exit storey, should be provided with a tight-fitting noncombustible seal or firestop at the floor assembly of the storey immediately below the lowest exit storey, unless

a) the vertical service space is vented to the outdoors at the top and the vent has an openable area that is not less than

   i) that obtained from Figure A-3.2.6.2.(4)-A if the vertical service space is in a building in which other shafts are not mechanically pressurized, or

   ii) that obtained from Figure A-3.2.6.2.(4)-B if the vertical service space is in a building in which other shafts are mechanically pressurized,

b) for a shaft that serves floor areas above the lowest exit storey, a vent is located

   i) at or near the top of the shaft if the shaft is above the mid-height of the building, or

   ii) at or near the foot of the shaft at or near the exit level if the top of the shaft is below the mid-height of the building, or

c) for a shaft that serves floor areas below the lowest exit storey, a vent is located at or near the top of the shaft.

3) Any closure provided for a vent opening referred to in Sentence (2) must be openable:

a) manually,

b) on a signal from a smoke detector located at or near the top of the shaft, and

c) by a control device located at the central alarm and control facility.

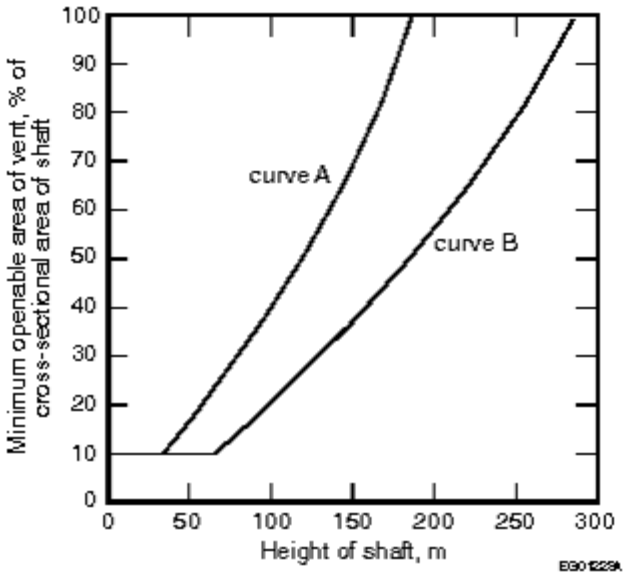

Figure A-3.2.6.2.(4)-B
Vent to a vertical service space with other pressurized shafts in the building
Notes to Figure A-3.2.6.2.(4)-B:

(1) Curve A applies to a vertical service space that is enclosed by unplastered unit masonry or by plaster and steel stud construction with all openings in the shaft sealed to the degree required by Articles 3.1.9.1. to 3.1.9.4.
(2) Curve B applies to a vertical service space that is enclosed by monolithic concrete or by plastered unit masonry with all openings in the shaft sealed tightly to minimize air leakage.
(3) A shaft having a vent that is 100% of the cross-sectional area of the shaft is acceptable for buildings up to 1.5 times the height shown by the appropriate curve in Figures A-3.2.6.2.(4)-A and A-3.2.6.2.(4)-B.
(4) The total leakage area, based on measurements in typical high buildings, is assumed to be 0.025 m^2 for every 10 m^2 of shaft wall area in the case of Curve A and 0.015 m^2 for every 10 m^2 of shaft wall area in the case of Curve B.

A-3.2.6.3.(1) Connected Buildings. The measures described here are intended to prevent movement of smoke from one building to another. They are of particular significance for two buildings of unequal height that are joined together. The techniques suggested are the provision of a large opening to the outdoors in a connecting vestibule so that smoke entering through leakage areas around doors will be vented to the outdoors, or pressurization to maintain a higher pressure in the vestibule than in adjacent spaces, as illustrated in Figures A-3.2.6.3.(1)-A, A-3.2.6.3.(1)-B and A-3.2.6.3.(1)-C.

The provisions for protection of openings are described in terms appropriate to a doorway. Openings other than doorways should be avoided if possible. Openings should be protected by an airlock that gives the same standard of protection as the vestibule referred to below.

The requirement of Article 3.2.6.3. that limits movement of smoke from one building to another may be met by incorporating in the link between the buildings the provisions of Sentences (1) and (2).

1) A firewall conforming to Subsection 3.1.10. is constructed between one building and the other with any opening in the firewall protected against the passage of smoke by a vestibule that has

a) a fire separation between the vestibule and a public corridor with a fire-resistance rating not less than 45 min,

b) a fire separation between the vestibule and the remainder of the floor area, other than a public corridor, with a fire-resistance rating not less than that required by Article 3.4.4.1. for an exit,

c) a fire separation between the vestibule and a stair enclosure or elevator hoistway with a fire-resistance rating not less than that required by Article 3.4.4.1. for an exit, and

d) any door in the fire separation required by Clause (a), (b) or (c), except for an elevator entrance, provided with a self-closing device as required by Article 3.1.8.13. and opening in the direction of travel from the floor area to the exit stairway.

2) The vestibule referred to in Sentence (1) should have

a) a vent to the outdoors that has a net area of $10(0.023\ d + 0.00045\ a)\ m^2$, where 'd' is the number of doors having a perimeter not more than 6 m that open into the vestibule, or if the perimeter of doors exceeds 6 m, the value 'd' is increased in direct proportion to the increase in the perimeter, and 'a' is the area in square metres of enclosing walls, floors and ceilings whose outer face is in contact with the outside air, except that where the outer face of a wall is in contact with the ground or fill, it is assumed that there is no leakage through that portion, and the value of 'a' is assumed to be zero, or

b) equipment capable of maintaining a supply of air into the vestibule sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than that in adjacent floor areas when the outdoor temperature is equal to the January design temperature on a 2.5% basis.

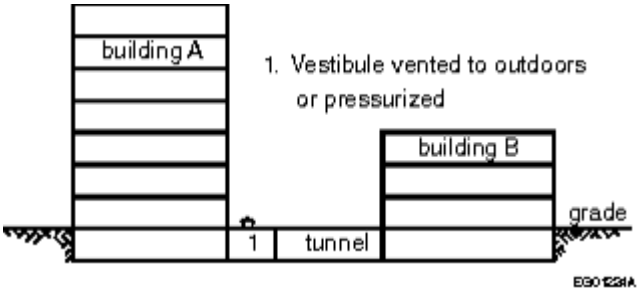

Figure A-3.2.6.3.(1)-A

Buildings connected by a tunnel

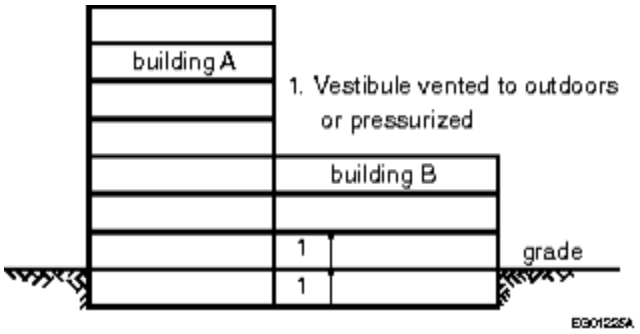

Figure A-3.2.6.3.(1)-B

Buildings connected at a firewall

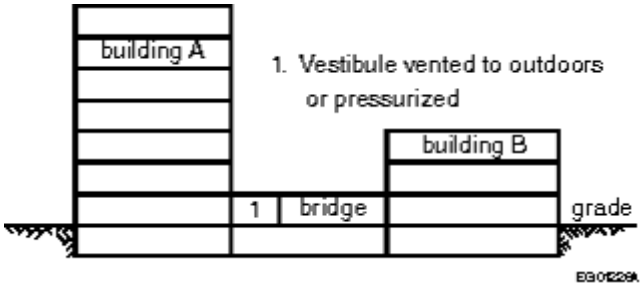

Figure A-3.2.6.3.(1)-C

Buildings connected by a bridge

A-3.2.6.5.(6)(b) Protection of Electrical Conductors. Electrical conductors are part of a system that includes, among other components, raceways, conduits, splices, couplings, vertical supports, grounds and pulling lubricants. When selecting electrical conductors to provide a circuit integrity rating, it is important to understand how they will be installed and to know if the fire performance of the system as a whole was tested.

A-3.2.6.6.(1) Venting to Aid Firefighting. The requirements of Sentence 3.2.6.6.(1) are met by incorporating in a floor area windows or wall panels, as described in Sentence (1), by smoke shafts as described in Sentences (2) to (8), or by the use of building exhaust systems as described in Sentence (9).

1) If windows or wall panels are used for venting, they must

a) be uniformly distributed along the exterior wall of each storey,

b) have a total area not less than 1% of the exterior wall area of each storey,

c) be readily openable from the interior without the use of wrenches or keys,

d) be readily identified from the interior, and from the exterior where they are accessible to firefighters, and

e) be designed so that when opened they will not endanger persons outside the building during a fire.

2) If one or more smoke shafts or vertical service spaces are used for venting, they must

a) have an opening or openings into each storey with an aggregate area not less than that obtained from Table A-3.2.6.6.(1)-A for the height of the building and the area of the largest floor area served by the

smoke shaft, and the leakage characteristics of the shaft wall and closures obtained from Tables A-3.2.6.6.(1)-B and A-3.2.6.6.(1)-C,

b) have an aggregate unobstructed cross-sectional area equal to that required by Clause (a), and

c) be designed to comply with the requirements of Sentence (3).

3) Each smoke shaft or vertical service space described in Sentence (2) must

a) be separated from the remainder of the building by a fire separation that has a fire-resistance rating not less than that required for the floor assembly through which it passes, or be designed as a chimney conforming to Part 6, except that flue liners need not be provided,

b) have an opening to the outdoors at the top that has an area not less than the cross-sectional area of the shaft, with the opening protected from the weather,

c) terminate not less than 900 mm above the roof surface where it penetrates the roof, and

d) contain no combustible material, fuel lines or services that are required for use in an emergency.

4) Each opening required by Clause (2)(a) must be located so that the top of the opening is not more than 250 mm below the ceiling, except that the opening may be above the ceiling if the ceiling freely allows passage of air.

5) The opening into the smoke shaft must be provided with a closure that

a) has a fire-protection rating conforming to Sentence 3.1.8.4.(2), except that the temperature on the unexposed face of the closure shall be not more than 250 °C after 30 min during the fire test used to determine its rating,

b) is no closer to combustible material, except for paint or tightly-adhering paper covering not more than 1 mm thick applied to a noncombustible backing, than the distances described in Table A-3.2.6.6.(1)-D,

c) can be opened from a remote location such as a stair shaft, the storey immediately below, or the central alarm and control facility, and

d) does not open automatically on any floor, other than the fire floor, when smoke and hot gases pass through the shaft.

6) Closures for openings described in Clause (3)(b) must

a) be openable from outside the shaft, and

b) open automatically

i) on a signal from a smoke detector in the shaft,

ii) by operation of the fire alarm system, and

iii) when the closure required by Sentence (5) opens.

7) A smoke shaft opening referred to in Sentence (2) that is less than 1 070 mm above the floor must conform to Article 3.3.1.18.

8) If a closure is required to comply with Sentence (5), the leakage area between closure components and between closure and frame must not be more than 3% of the openable area of the closure.

9) The building air handling system may be used for smoke venting, provided

a) the system can maintain an exhaust to the outdoors at the rate of 6 air changes per hour from any floor area, and

b) emergency power to the fans providing the exhaust required by Clause (a) is provided as described in Article 3.2.7.9.

Table A-3.2.6.6.(1)-A

Minimum Size of Vent Openings into Smoke Shafts from Each Floor Area, m^2[1][2]

Forming Part of Note A-3.2.6.6.(1)

Floor Area, m^2	Leakage Area, %[3]	Building Height, m								
		18	37	73	110	146	183	220	256	293
200		0.10	0.11	0.13	0.15	0.16	0.18	0.19	0.20	0.22
500		0.22	0.25	0.29	0.32	0.36	0.37	0.39	0.41	0.43
1 000		0.43	0.48	0.53	0.59	0.63	0.67	0.71	0.75	0.77
2 000		0.83	0.91	1.01	1.08	1.16	1.22	1.29	1.34	1.39
3 000	0	1.21	1.33	1.46	1.55	1.67	1.75	1.82	1.90	1.97
4 000		1.62	1.75	1.90	2.02	2.15	2.25	2.35	2.44	2.53
5 000		2.01	2.17	2.34	2.46	2.63	2.74	2.86	2.88	3.07
6 000		2.39	2.57	2.76	2.91	3.10	3.23	3.37	3.47	3.58
200		0.10	0.12	0.15	0.19	0.22	0.27	0.35	0.43	0.55
500		0.23	0.27	0.35	0.40	0.49	0.57	0.69	0.83	1.04
1 000		0.44	0.50	0.71	0.72	0.86	1.01	1.19	1.43	1.73
2 000		0.85	0.97	1.15	1.33	1.56	1.81	2.10	2.48	2.95
3 000	1	1.26	1.42	1.67	1.91	2.23	2.56	2.97	3.47	4.08
4 000		1.66	1.88	2.18	2.49	2.37	3.28	3.79	4.40	5.16
5 000		2.07	2.32	2.69	3.05	3.51	3.99	4.60	5.32	6.21
6 000		2.47	2.76	3.18	3.59	4.14	4.68	5.37	6.20	7.23
200		0.10	0.13	0.18	0.24	0.37	0.61	1.28	4.60	89.57
500		0.24	0.29	0.39	0.52	0.75	1.13	2.10	6.11	94.50
1 000		0.46	0.55	0.72	0.94	1.30	1.90	3.27	8.29	102.11
2 000		0.88	1.05	1.34	1.73	2.32	3.28	5.36	12.14	116.80
3 000	2	1.31	1.53	1.95	2.47	3.29	4.58	7.28	15.63	130.83
4 000		1.73	2.01	2.55	3.20	4.23	5.83	9.12	19.97	144.03
5 000		2.15	2.49	3.13	3.92	5.15	7.05	10.90	22.15	157.05
6 000		2.57	2.96	3.73	4.63	6.07	8.26	12.65	25.39	169.29
200		0.11	0.14	0.21	0.37	0.88	2.06			
500		0.25	0.31	0.47	0.76	1.58	9.00			
1 000		0.47	0.59	0.86	1.33	2.60	11.99			
2 000		0.91	1.12	1.60	2.41	4.47	17.46			

3 000	3	1.35	1.64	2.31	3.43	5.21	22.48			
4 000		1.79	2.17	3.02	4.43	7.91	27.29			
5 000		2.22	2.68	3.71	5.42	9.55	31.95			
6 000		2.65	3.20	4.40	6.39	11.18	36.47			
200		0.11	0.15	0.28	0.70	24.83				
500		0.25	0.34	0.58	1.33	29.18				
1 000		0.49	0.63	1.06	2.27	36.07				
2 000		0.95	1.21	1.97	3.99	48.56				
3 000	4	1.41	1.78	2.84	6.63	60.15				
4 000		1.86	2.34	3.70	7.22	71.15				
5 000		2.21	2.90	4.55	8.79	81.81				
6 000		2.75	3.46	5.40	10.33	90.05				
200		0.11	0.16	0.36	3.33					
500		0.28	0.36	0.76	5.09					
1 000		0.50	0.69	1.37	7.67					
2 000		0.99	1.31	2.54	12.35					
3 000	5	1.46	1.94	3.65	16.75					
4 000		1.92	2.55	4.75	20.99					
5 000		2.40	3.16	5.84	25.11					
6 000		2.87	3.74	6.92	29.11					

Notes to Table A-3.2.6.6.(1)-A:

(1) The minimum size of a vent opening into a smoke shaft is obtained from Table A-3.2.6.6.(1)-A and is dependant on the floor area and total leakage area of the smoke shaft walls and closures. This total leakage area may be estimated by adding the leakage areas for the shaft wall obtained from Table A-3.2.6.6.(1)-B and for the dampered openings obtained from Table A-3.2.6.6.(1)-C, provided the cross-sectional area of the smoke shaft, the opening into the shaft and the opening to the outdoors at the top of the shaft are equal.

(2) The size of the vent opening refers to the free or unobstructed area of the opening.

(3) Leakage area is the total of the leakage area of smoke shaft wall obtained from Table A-3.2.6.6.(1)-B and the leakage area of openings in smoke shafts obtained from Table A-3.2.6.6.(1)-C.

Table A-3.2.6.6.(1)-B

Leakage Area of Smoke Shaft Wall

Forming Part of Note A-3.2.6.6.(1)

Wall Construction	Leakage Area as % of Wall Area
Monolithic concrete	0.5
Masonry wall unplastered	1.5
Masonry wall plastered	0.5
Gypsum board on steel studs	1.0

Table A-3.2.6.6.(1)-C
Leakage Area of Closures in Openings into Smoke Shaft
Forming Part of Note A-3.2.6.6.(1)

Type of Closure	Leakage Area as % of Closure Area(1)(2)
Curtain fire damper	2.5
Single-blade fire damper	3.5
Multi-blade fire damper	4.5

Notes to Table A-3.2.6.6.(1)-C:
(1) Values include allowance for 0.5% leakage between frame and wall construction.
(2) These leakage data are based on clearances applicable to closures that have been tested in accordance with CAN/ULC-S112, "Standard Method of Fire Test of Fire Damper Assemblies."

Table A-3.2.6.6.(1)-D
Minimum Distance from Closure to Combustible Material
Forming Part of Note A-3.2.6.6.(1)

Area of Closure(1), m^2	Minimum Distance in Front of or Above Closure, m	Minimum Distance to the Sides or Below Closure, m
0.5	0.35	0.20
1.0	0.50	0.25
1.5	0.60	0.30
2.0	0.70	0.35
2.5(2)	0.80	0.40

Notes to Table A-3.2.6.6.(1)-D:
(1) For closure areas between those given in Table A-3.2.6.6.(1)-D, interpolation may be used to determine the appropriate distances.
(2) For closure areas greater than 2.5 m^2, the minimum distance in front of or above the closure shall be one half of the square root of the closure area, and the minimum distance to the sides or below the closure shall be one quarter of the square root of the closure area.

A-3.2.6.7.(1) Protection of Central Control Room. The design of a room provided for a central alarm and control facility should take into account the nature and sensitivity of the electronic components of the equipment and the room should be adequately protected from fire and smoke. The room should be ventilated with a supply of fresh air so that it has a clean environment and should be provided with adequate lighting.

A-3.2.6.7.(2) Central Control Room Air Control. Depending on the method of mechanical venting and air control that is selected for the building, additional controls may be required at the central alarm and control facility. These additional controls include those with a capability of opening closures to vents in shafts, stopping air-handling systems, and initiating mechanical air supply to stair shafts.

A-3.2.6.9.(1) Testing for Smoke Control. The efficiency of a smoke control system may be checked by measuring pressure differences and the directions of airflow around doors and through separating walls of compartments. A pressure meter can be used to measure pressure differences on either side of a door or partition. Where this is impracticable, a punk stick held near a crack will indicate the direction of airflow. Measurements of airflow may be taken on the intake side of supply fans or in supply ducts to determine whether the specified airflow is being provided. In general, airflow should be from the spaces which may be occupied for various lengths of time during a fire emergency (e.g., vestibules, stair shafts, and elevator hoistways) toward the space in which the fire is assumed to have occurred. Measurements may be taken at certain critical locations to check the overall efficiency of the smoke control system.

In buildings where protection is obtained by venting corridors or vestibules to the outdoors, inspection of the building to determine whether the requirements have been met should be sufficient. Where service shafts are vented to the outdoors at the top, a check may be made of the wall between the shaft and the uppermost occupied floor areas, to ensure that the direction of flow is from each floor area into the shaft, when the vent to the outside is open and the outdoor air temperature is significantly less than that indoors. Where mechanically pressurized vestibules are used, a check may be made to ensure that the pressure in each vestibule or area of refuge is greater than that in the adjacent floor areas at each floor level.

Doors to stair shafts, elevator hoistways and vestibules in locations subject to pressure differences that may interfere with normal opening should be checked when the outdoor temperature is near the January design temperature, with the air injection system operating and a number of windows open to the outdoors on each floor in turn.

A-3.2.7.4.(1) Emergency Power Reliability. In some areas power outages are frequent and may be of long duration. These local conditions should be taken into account in determining the type of system for supplying emergency power for lighting. This should be studied at the planning stage of a building project in conjunction with the local fire safety and building officials.

A-3.2.7.6.(1) Emergency Power for Treatment Occupancies. CSA Z32, "Electrical safety and essential electrical systems in health care facilities," contains requirements for three classes of health care facilities—Class A, Class B and Class C. The intent of Article 3.2.7.6. is to apply specific requirements to emergency equipment for Class A facilities, which are designated as hospitals by the authorities having jurisdiction and where patients are accommodated on the basis of medical need and are provided with continuing medical care and supporting diagnostic and therapeutic services.

A-3.2.7.8.(3) Emergency Power Duration. The times indicated in this Sentence are the durations for which emergency power must be available for a building under fire emergency conditions. Additional fuel for generators or additional battery capacity is required to handle normal testing of the equipment, as indicated in the NFC. If the operation of emergency generators or batteries is intended for other than fire emergency conditions, such as power failures, fuel supplies or battery capacity must be increased to compensate for that use.

A-3.2.7.9.(1) Emergency Power Reliability. In some areas power outages are frequent and may be of long duration. These local conditions should be taken into account in determining the type of system for supplying emergency power for building services. This should be studied at the planning stage of a building project in conjunction with the local fire safety and building officials.

A-3.2.7.10.(1) Electrical Conductors. The intent of this Sentence is to provide protection of riser conductors serving components of a building fire alarm and voice communication system and equipment required for smoke control and smoke venting such as fans and dampers. Conductors supplying fire alarm and voice communication system devices, smoke control and smoke venting equipment on individual floors are not intended to be protected in conformance with this requirement.

Conductors supplying fire-fighters' elevators and fire pumps are intended to be protected in accordance with this requirement from the source of the emergency power supply (emergency generator) to the terminals of the equipment (fire pump or elevator motors).

The following issues for conductor protection are required to be considered:

1. A list of emergency equipment served by the protected conductors,

2. Specific methods of the conductor protection utilized for the project. (See note (a).)

3. Electrical plans indicating the routes for protected conductors from the emergency power supply to the equipment served.

4. The satisfactory operation of electrical equipment supplied by the protected conductors while operating at elevated temperatures (more than 30° C).

5. The protection of riser conductors from potential pressurized hot gases which could travel inside the electrical conduits originating from the fire floor. (See note (b).)

6. Access to electrical riser conductor junctions for maintenance or testing. (See notes (a) & (c).)

(a) Acceptable protection methods for electrical conductors to maintain the operation of equipment for a period of at least one (1) hour are illustrated in the table below.

(b) Derating of a conductors' ampacity may be required. Where conductors are protected in accordance with methods B to F, as illustrated in the table below and where the conductors are sized to accommodate 110% of the rated load current, then no additional derating of conductors is required. Where conductors are protected in accordance with method A, an assessment of the conductors performance (MI cables) under exposure to fire, would need to be provided by an electrical engineer.

(c) Location of riser conductor junctions in exit stairwells is not acceptable. Submission of the chosen methods of compliance and the submission of a Schedule B Letter of Assurance needs to be provided by the professional electrical engineer responsible for the project at the design stage. Upon completion of the installation, a Schedule C-B Letter of Assurance would be required. Acceptable methods for the protection of electrical conductors from fire exposure to maintain operation of the emergency equipment for a period of at least one (1) hour (based on a sprinklered building) are illustrated in the table below.

Table A-3.2.7.10.

	Method of Protection
A	Provide mineral insulated cables or other cables that conform with the ULC S139 circuit integrity test and are marked “ULC S139 2 hr fire rated” cables
B	Provide a minimum cover over the conduit of at least 100 mm in concrete. Floor slabs or walls that form part of fire separations. Cover from the ends of slabs or walls that form part of the fire separations shall be at least 125 mm.
C	Provide a minimum cover over the conduit of at least 125 mm in concrete columns, beams or walls that are not forming part of a fire separation.
D	Enclose conductors in a shaft enclosure of at least two hour fire resistance construction. These shaft enclosure walls can be of concrete or any ULC, cUL or WH listed wall or shaft wall assembly.
E	Any junction boxes or access points required for the protected conductors shall be protected with listed access panels which have been tested to limit the temperature rise on unexposed side to less than 90° C for one (1) hour. An air space shall be provided between the access panel and the conductors, to limit the risk of any contact.
F	Conduits leading from protected enclosures to branch circuits must be protected at junction boxes at both ends of the connecting conduit. This protection will consist of plugging the conduits to a depth of at least 12 mm with an approved firestop caulking. An acceptable alternative to the above is to use an EYS fitting at the protected enclosure end

The above provides options for the protection of electrical conductors. Other solutions may be proposed by a Fire Protection Engineer retained to analyze the arrangement and develop a solution on an equivalency basis for acceptance by the Chief Building Official.

A-3.2.7.10.(2)(a) and (3)(a) Protection of Electrical Conductors. It is important to understand that electrical conductors are part of a system that includes—among other components—raceways, conduits, splices, couplings, vertical supports, grounds and pulling lubricants. When selecting electrical conductors to provide a circuit integrity rating, it is therefore important to understand how they will be installed and to know if the fire performance of the system as a whole was tested.

A-3.2.7.10.(5)(b) Electrical Conductors in the Same Room. If the distribution panel and the equipment it serves are within the same room, only the electrical conductors leading up to the distribution panel need to be protected. It is assumed that the distribution panel and the equipment it serves are within sufficient proximity to each other such that a fire in the same area of origin would affect both.

A-3.2.7.10.(7) Fire Alarm Branch Circuits. In order to ensure continuous operation of the fire alarm and voice communication systems in a high-rise building for a sufficient duration of time to control and direct the evacuation of building occupants, a level of protection is required by Sentence 3.2.7.10.(2) for those electrical conductors interconnecting the major elements of the fire alarm system. Sentence 3.2.7.10.(7) permits the protection of electrical conductors to be waived for portions connecting a transponder or fault isolation device to fire alarm input devices (fire detectors, manual stations, etc.) or a voice communication transponder to a fire alarm audible signalling device, provided all circuits or portions of the circuits are contained within the same storey.

A-3.2.8.2.(3) Special Protection of Opening. In manufacturing operations involving the use of conveyor systems to transport material through fire separations, it may not be possible to use standard closure devices. NFPA 80, “Standard for Fire Doors and Other Opening Protectives,” includes appendix information concerning protection of openings through vertical fire separations. NFPA 13, “Standard for the Installation of Sprinkler Systems,” includes methods of protecting openings through floor assemblies, however, it is assumed by that standard that the remainder of the building would be sprinklered. Combinations of methods may be required to ensure that the level of safety inherent in the requirements of the By-law is maintained.

A-3.2.8.2.(6)(b) Restriction on Size of Openings Through Floors. The phrase “used only for stairways, escalators or moving walks” is intended to restrict the size of a floor opening to what is necessary to accommodate the stairway, escalator or moving walk.

A-3.2.8.2.(6)(c) Waiver of Occupancy Separation Continuity. The typical application of this Sentence is to buildings with a mixture of occupancies that are randomly located throughout the building. Examples include shopping centres, podia of large commercial and business complexes, and recreational buildings that are combined with mercantile and business operations. A shopping mall with two interconnected storeys is an example that is frequently encountered in many jurisdictions. The permission to breach the floor assembly between the storeys does not override requirements for separation of specific suites or occupancies. For instance, although storage garages are Group F, Division 3 occupancies, the requirement in Article 3.3.5.6. for the storage garage to be separated from other occupancies by a fire separation with at least a 1.5 h fire-resistance rating must be observed. In a similar manner, a theatre or cinema (Group A, Division 1 occupancy) must be separated from other occupancies in accordance with Sentence 3.3.2.2.(1) and seats in an arena-type building (Group A, Division 3) must be separated from space below in accordance with Sentence 3.3.2.2.(3).

A-3.2.8.4.(1)(c) Contamination of Vestibule. The vestibule should have equipment capable of maintaining a supply of air into the vestibule that is sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than the air pressure in the adjacent floor areas when the outdoor temperature is equal to the January design temperature on a 2.5% basis.

A-3.2.8.7.(1) Smoke Exhaust System. The mechanical exhaust system is intended as an aid to firefighters in removing smoke and is to be designed to be actuated manually by the responding fire department. Although smoke is normally removed from the top of the interconnected floor space, exhaust outlets at other locations may be satisfactory.

A-3.2.9.1.(1) Testing of Fire Protection and Life Safety Systems. Building owners should verify that fire protection and life safety systems and their components (i.e. fire alarm systems, sprinklers, standpipes, smoke control, ventilation, pressurization, door hold-open devices, elevator recalls, smoke and fire shutters and dampers, emergency power, emergency lighting, fire pumps, generators, etc.), including their interconnections with other building systems, are functioning according to the intent of their design. CAN/ULC-S1001, "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems," provides the methodology for verifying and documenting that interconnections between building systems satisfy the intent of their design and that the systems function as intended by the By-law.

Clause 6.1.5 of CAN/ULC-S1001 allows the Integrated Testing Coordinator to accept documented evidence of any tests that have been performed on a system as part of its acceptance testing for the purpose of demonstrating compliance with the integrated testing requirements of that standard, so as to avoid duplication of work.

A-3.2.10. Fire Protection and Firefighting Assumptions for Residential Buildings with a Single Exterior Exit Stair. The firefighting assumptions discussed in Note A-3 raise circumstances where additional firefighting capabilities and additional building protection measures may be required. The provisions in Subsection 3.2.10. for residential buildings with a single exit were developed with the expectation of a high level of capacity of the local fire department for fire prevention activities, fire suppression activities, the ability of the fire department to assist in egress of occupants in the event of an emergency, as well as a secure water supply for the function of the automatic sprinkler system and the manual fire suppression activities of a responding fire department.

Fire Prevention

Maintenance of fire safety systems is essential for all buildings but becomes increasingly important when redundancies, such as a second and separate exit, are reduced or eliminated. The provisions for residential buildings with single exit stairs were developed with the expectation that fire officials routinely enforce the Fire Bylaw to ensure that the inspection intervals specified within are carried out, and that follow up inspections resulting from observed non-compliances occur at expedited intervals.

Building owners and managers are required to be actively involved in carrying out the maintenance and upkeep of the building's fire safety systems. Residential buildings with a single exit should not be located in jurisdictions where a high level 6 of fire prevention oversight cannot be maintained

Fire Suppression

The provisions for residential buildings with single exit stairs were developed with the expectation that a permanent, paid the fire department is available to respond to a fire event twenty-four hours a day, every day. Firefighting personnel are expected to have a high level of training and the fire department is expected to be suitably equipped to provide fire suppression activities appropriate to the buildings and developments in their jurisdiction within tight response times. Residential buildings with a single exit should not be located in jurisdictions where a high level of fire suppression activities cannot be maintained.

Egress and Safety of Occupants

The premise of egress in the Building By-law is that occupants of residential buildings receive early notification of a fire event, and occupants are able to respond unassisted in such an event. Early notification however does not guarantee occupant self-evacuation and when redundancies, such as a second and separate exit, are reduced or eliminated, occupant response options are likewise reduced. The provisions for residential buildings with single exit stairs were developed with the expectation that the local fire department has a service level that can coordinate and assist occupants with moving to a safe place in a fire event. Building owners and managers must be actively involved in fire safety planning in conjunction with the local fire department. Residential buildings with a single exit should not be located in jurisdictions where a service level that includes search and rescue by firefighting personnel cannot be maintained.

Water Supply

The Building By-law requires an adequate water supply for firefighting be readily available and of sufficient volume and pressure to enable emergency response personnel to control fire growth so as to enable the safe evacuation of occupants and the conduct of search and rescue operations, prevent the fire from spreading to adjacent buildings, and provide a limited measure of property protection. As for any water-based fire protection systems or suppression activities, the water supply serving the building needs to be dependable over the life of the building through seasonal droughts and other eventualities. The provisions for residential buildings with single exit stairs were developed with the expectation of a highly dependable water supply would be available during construction and throughout the lifecycle of the building. Redundancies such as secondary or back up water supplies should to be considered to limit the probability that the water supply may become insufficient for an extended or even temporary period.

A-3.2.10.1.(4) Residential Buildings Not Permitted. The residential uses described in Sentence 3.2.10.1.(4) include short term as well as long term accommodations where Subsection 3.2.10. is not permitted to apply. For example, longer-term hotels and rooming houses sometimes referred to as single room occupancy hotels or single room accommodations with or without private bathrooms or kitchens are not permitted to apply Subsection 3.2.10.

A-3.2.10.2.(1) and (2) Automatic Sprinkler Systems. Automatic sprinkler systems serving a building to which Subsection 3.2.10. applies must be sprinklered in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems," regardless of the permissions for other buildings to follow the NFPA 13R, "Standard for the Installation of 7 Sprinkler Systems in low-Rise Residential Occupancies," or the NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes," standards. All balconies and decks regardless of depth must be sprinklered. The requirement for sprinklers conforming to NFPA 13, "Standard for the Installation of Sprinkler Systems," means that a fire alarm system described in Subsection 3.2.4. is also required.

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A-3.2.10.2.(3) Exit Facility. The single exit facility serving a building to which Subsection 3.2.10. applies shall be of noncombustible construction, EMTC, or heavy timber construction. The requirement applies to the construction of the passageway and the staircase and not to fire separations to the adjacent floor areas.

The design of the exit facility must also consider misuse and proactively deter the storage or collection of materials so as not to obstruct passage and to minimize fuel load. For example, excess landing areas and alcoves in all exits (not limited to residential buildings with single exit stairs) must be carefully designed to deter any activities other than exiting and accessing floor areas as per Sentence 3.4.4.4.(6). Void spaces underneath stairs should be avoided. Landings must have signage to remind occupants that storage is not permitted in exit facilities.

To minimize accumulation of snow on an exterior exit stairway and exit passageway, a permanently installed canopy may be constructed, and solid construction instead of pickets could be used for guards.

The exterior exit passageway and exterior exit stair is intended to be at least 50% open on its exterior sides in a manner similar to the exterior exit passageway exceptions described in Article 3.4.4.3. The intent of the 50% openness is to provide a substantially open stair and passageway with cross-ventilation capable of ventilating smoke in order to maintain tenable conditions for occupants to shelter or escape until the fire department is able to respond.

A-3.2.10.2.(4) Exit Facility Discharge. Fire department access to buildings to which Subsection 3.2.10. applies must be provided to the principal entrance as well as to access point most directly connected to the exit facility. As such, the exit facility discharge must be located to coordinate with the fire department access route described in Subsection 3.2.5.

Designers should consider locating the exit facility discharge in close proximity to the principal entrance for the benefit of coordinating multiple access points with the fire department access route but also to avoid unintended use of the exit facility for package delivery or other material drop-off. There should be clear distinction between the principal building entrance (likely connecting to a lobby and elevator) and the exit facility discharge so that activities such as deliveries can be intuitively completed in the safe and intended manner. Locating the exit facility discharge in close proximity to the principal building entrance also reduces the potential that an access point is located in an isolated location of the building which could increase building and occupant security concerns.

It is acceptable, for example, for the exit stair facility to include a doorway that adjoins a lobby. Such a door is required to have the appropriate fire-protection rating for the fire separation of the exit stair facility. It is critical, as with all exits, that the exit stair facility and the egress routes connected to it are kept clear of hazards and obstructions. Design of the lobby, for example, must consider realities, such as the delivery of packages, so that the probability of misuse of the exit stair facility is minimized.

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A-3.3. Safety Within Floor Areas. Section 3.3. regulates safety within floor areas including rooms and other spaces within a building. The requirements are grouped according to the occupancy of the floor area, room or space, which is not necessarily the same as the major occupancy for which the building is classified. For example, a building may be classified by major occupancy as an office building: therefore, the provisions for structural fire protection and fire protection equipment for office buildings prescribed in Section 3.2. apply. However, within that building, a room or floor area may be used for mercantile, care, treatment, detention, business, residential, industrial or other occupancy.

Life safety for the occupants of any floor area depends in the first instance on the use or occupancy of that floor area. The risks to the occupants occur in the early stages of a fire. These special life risks differ from one occupancy to another and, consequently, must be regulated differently. Section 3.3. regulates risks within floor areas: these requirements apply regardless of the major occupancy of the building that contains the floor areas. For example, an assembly room must comply with the requirements for assembly occupancy whether it is contained in an office building, hospital, hotel, theatre, industrial building or other major occupancy.

Since this By-law regulates new construction, alterations and changes of occupancy, the construction of kiosks and similar structures in public corridors must take into consideration all the requirements that apply to the remainder of the building, including structural fire protection, construction type, finish materials, egress widths and sprinkler installations. Special activities of an occasional nature that were not contemplated in the original design of a public corridor and that represent only a temporary change in occupancy are regulated by the NFC. These regulations include maintaining egress paths clear of obstructions, controlling combustible contents and providing measures to ensure quick response for firefighting.

A-3.3.1.2.(1) Hazardous Substances. The term “hazardous substances” refers to dangerous goods that are regulated by “Transportation of Dangerous Goods Regulations (TDGR)” or that are classified as “controlled products” under the “Workplace Hazardous Materials Information System (WHMIS)” established to meet the requirements of HC SOR/2015-17, “Hazardous Products Regulations.” It also refers to materials and products that are not regulated by the TDGR or WHMIS, but that pose a fire or explosion hazard due to their own properties or because of the manner in which they are stored, handled or used. These include combustible products, rubber tires, combustible fibres, combustible dusts, products producing flammable vapours or gases, etc.

A-3.3.1.2.(2) Cooking Equipment Ventilation. Cooking equipment manufactured for use in dwelling units and other residential suites is often installed in buildings used for assembly and care, treatment or detention purposes. It is not obvious from the By-law requirements or those of NFPA 96, “Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations,” whether a ventilation and grease removal system is required in all assembly and care, treatment or detention uses. If the equipment is to be used in a manner that will produce grease-laden vapours that are substantially more than would be produced in a normal household environment, then it would be appropriate to apply the requirements of NFPA 96. If the equipment is used primarily for reheating food prepared elsewhere or is used occasionally for demonstration or educational purposes, there would be no expectation of applying the requirements of NFPA 96. In all cases the circumstances should be reviewed with the authority having jurisdiction.

A-3.3.1.3 Means of Egress Serving Podiums and Terraces. The requirements for podiums and terraces in Sentence 3.3.1.3.(2) and (3) are intended for areas situated on a level that is not at the highest elevation in a building, and where the area can be

accessed by a storey of the building. The requirements of Sentence 3.3.1.3.(4) to (9) are intended for roof-top areas, including "terraces" where the area is at the highest elevation of the building, and there is no access to a storey of the building at that level.

A-3.3.1.7.(1) Temporary Refuge for Persons with Disabilities. These measures are intended to provide temporary refuge for persons with disabilities. It is acknowledged, however, that the measures cannot provide absolute safety for all occupants in the fire area. It may, therefore, be necessary to develop special arrangements in the fire safety plan to evacuate persons with disabilities from these areas. Details for a suitable plan are contained in the Fire By-law.

The protected elevator referred to in Clause 3.3.1.7.(1)(a) is intended to be used by firefighters as a means for evacuating persons with disabilities. It is not intended that this elevator be used by persons with disabilities as a means of egress without the assistance of firefighters.

If an estimate is to be made of the number of persons with disabilities in a floor area who can be accommodated in each zone in Clause 3.3.1.7.(1)(b), this estimate may be based on Table 3.8.2.3., which is used to determine the minimum number of spaces to be provided for persons using wheelchairs in fixed seating areas. If more precise information is available, it should be used for sizing the zones.

For residential occupancies, the choice of protection include the option to provide an accessible balcony, but it is not required that balconies be the chosen means of protection.

A-3.3.1.8.(2) and (3) Protruding Building Elements in Paths of Travel. The term "protruding building elements" refers to elements regulated by this By-law that are permanently affixed to the building and protrude into the path of travel.

The sweep of a cane normally detects protruding building elements that are within 680 mm of the floor. Any protruding element above this height would not normally be detected and can, therefore, create a hazard if it projects more than 100 mm into the path of travel.

A-3.3.1.12.(3) Movable Partitions. Should an emergency situation arise outside of normal working hours but when occupants are still in the space, they could be left without a clear way out. This could occur during inventory or after closing time when all occupants have not yet left, but staff close the door to prevent other persons from entering. In many small tenant areas, the movable partitions (store fronts) provide the only way out. There should always be a second way out or a swinging door within or adjacent to the sliding partitions.

A-3.3.1.13.(4) Door Hardware. The permission to have additional door releasing devices is intended to allow the use of a security chain, night latch or dead bolt to supplement the normal door latching device. These are permitted for dwelling units and locations where guests in a hotel or motel require additional security. The height of these items is also governed by the maximum height stipulated in Sentence 3.3.1.13.(5) to ensure that they can be operated by persons with physical disabilities. This additional hardware should not require appreciable dexterity by the user and the general requirements on the ability to operate the device without the use of keys, special tools or specialized knowledge still apply.

A-3.3.1.13.(6) Controlled Egress Doors. It is intended that Sentence 3.3.1.13.(6) apply to doors used at the perimeter of a contained use area or an impeded egress zone. If the contained use area consists of a single room, the requirements would apply to that room. In the case of individual cells within a contained use area, exterior keyed locks could be used on the cell doors consistent with the fire safety plan and continuous supervision by staff who can release the doors in an emergency.

A-3.3.1.13.(7) Electromagnetic Locking Devices. Electromagnetic locks and similar door control security devices are not intended to be used indiscriminately as alternative to proper security design. Where improperly designed or installed, these may inadvertently entrap or delay persons during an emergency as a result of physically impeding egress or confining egress to high traffic areas. Designers and installers wishing to install electromagnetic locking devices are to demonstrate that the requirements of the By-law have been met. This demonstration is to include a sequence of operation for the installation of any new maglocks and similar security devices that could singly or in combination, prevent, impede, or otherwise delay occupant egress or emergency responder access. This is to be provided to the Chief Building Official for acceptance, along with any necessary supporting documentation to demonstrate by-law compliance. (See also note A-3.4.6.16.(4).)

A-3.3.1.13.(11) Access to Exit from Elevator Lobbies. The intent of Sentence 3.3.1.13.(11) is to address frequent requests by building owners and tenants to secure the suite entry doors on a floor of office occupancy, which contains at least one exit which is not directly accessible from the common corridor system outside of the regular hours of business operations.

Conceptually, the public corridor and lobby are a floor areas containing only a transitory occupancy, and not otherwise occupied after hours. However, because operating hours for a given business may vary or change over time, signage and other measures

to limit the probability of the doors in the means of egress leading to an exit must be provided by the owner/operator. Significant discretion may be required on the part of the Chief Building Official to assess the reliability of such measures.

Owner/operators should expect to demonstrate how the locking system occupancy will be controlled during and after hours of operation so that unimpeded egress to two exit is provided when occupant are expected to be present on the storey. This may be difficult to achieve in a practical manner where a storey includes more than one suite.

A-3.3.1.19.(1) Tactile Attention Indicators at Unenclosed Stairs and at Drop-off Edges. Stairs in open spaces, stairs from mezzanines, and stairs that are not separated from the floor area by an element, such as a door or gate, are examples of stairs that are unenclosed. Transit platforms and the edges of a reflecting pool are examples of locations with drop-off edges where tactile attention indicators should be installed.

A-3.3.1.24.(1) Obstructions in Means of Egress. Obstructions including posts, counters or turnstiles should not be located in a manner that would restrict the width of a normal means of egress from a floor area or part of a floor area unless an alternative means of egress is provided adjacent to and plainly visible from the restricted means of egress.

A-3.3.2.1.(2) Use of NFPA 101. The intention of Sentence (2) is to allow By-law users the option of using NFPA 101, "Life Safety Code," to address the following issues: means of egress; egress routes within assembly occupancies; aisles and access serving seating not at tables; guards and railings; life safety evaluation; and smoke-protected assembly seating. However, opting to use NFPA 101 under this application entails adherence to all the provisions listed in Sentence (2): it is not intended that By-law users randomly select and apply a mix of provisions from both the Building By-law and the NFPA.

A-3.3.2.4.(2) Tablet Arms. Although it is intended that the motion to raise the tablet arm be essentially a single fluid motion, it is acceptable that the motion be a compound motion of raising the tablet arm and including an articulation to allow the tablet to fall back alongside the arm rest.

A-3.3.2.10. Installation Configurations of Handrails in Aisles with Steps. Figure A-3.3.2.10. illustrates possible installation configurations of handrails serving aisles with steps.

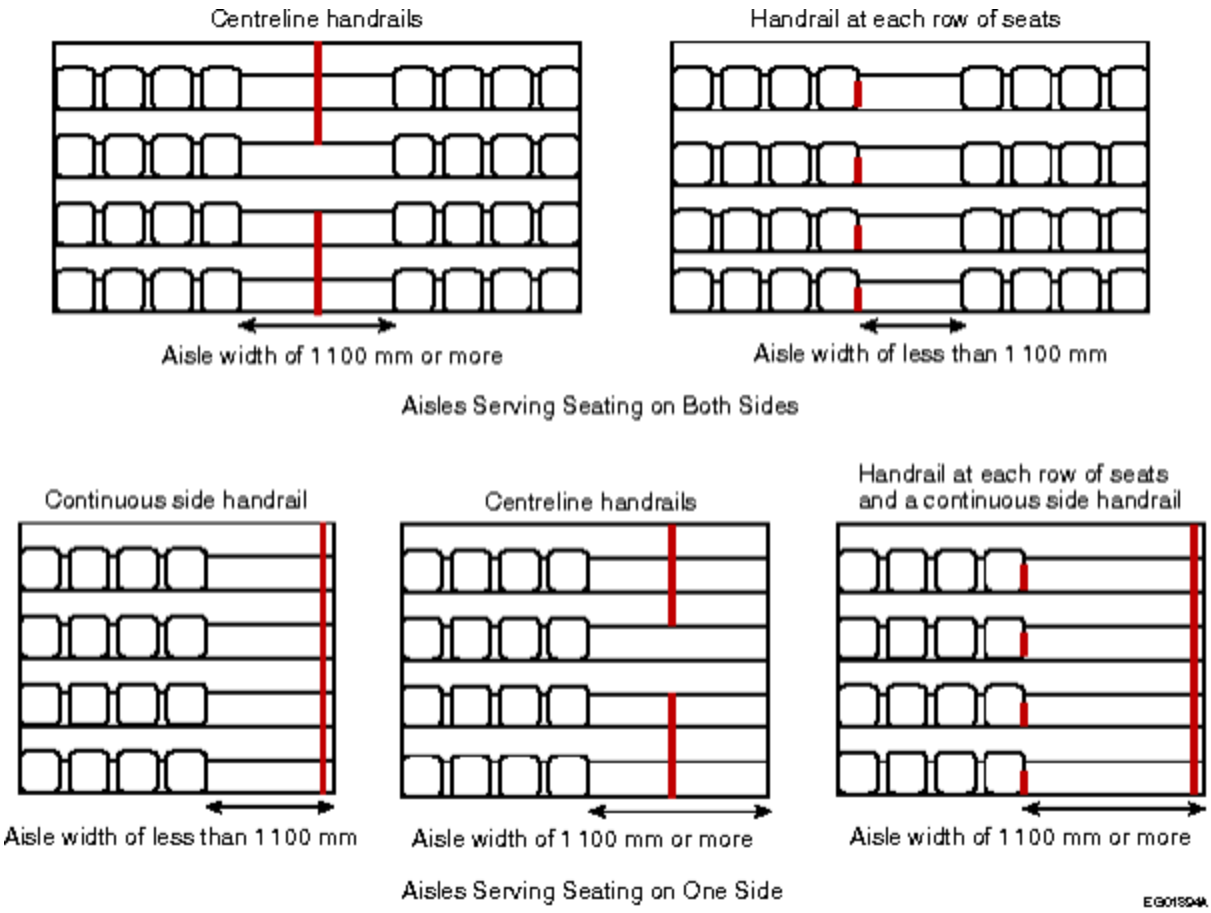

Figure A-3.3.2.10.

Handrail installation configurations

A-3.3.2.18. Daycare Facilities for Children under 30 Months. These daycare facilities are subject to additional requirements to address the unique profile of the occupants. The Community Care and Assisted Living Act and pursuant regulations establish care programs and prescribes the ages for children in those various programs. The By-law's requirements for daycare facilities for children under 30 months is intended to coordinate with those care programs, which inform the intended use and applicable By-law requirements, but the By-law does not regulate the actual ages of children in those care programs or in the facility (See Note A-3.1.2.8.)

A-3.3.3.1.(1) Safety in Care, Treatment and Detention Occupancies. Fire safety for patients in bedroom areas in hospitals and nursing homes with treatment is predicated on the ability of staff to carry out at all times essential life safety functions in accordance with the fire safety plan. Details for a plan are contained in the Fire By-law.

Many factors may affect the ability of staff to carry out life safety functions, including the mobility of patients who cannot fend for themselves and the built-in protection for patients who cannot be moved except under exceptional circumstances.

Should a patient area in a hospital or nursing home with treatment contain factors which would increase the time normally required for staff to evacuate patients or to undertake other life safety measures, consideration should be given to providing additional fire protection measures to ensure that equivalent safety is available.

A-3.3.3.4.(2) Doorway Width. The 1 050 mm minimum clear width of doorways accounts for door stops and, thus, is intended to allow for the use of 1 100 mm doors.

A-3.3.3.5.(9) Intercommunicating Rooms. Rooms that are interconnected can include more than one sleeping room, together with ensuite toilet rooms, shower rooms, and storage closets used for the storage of personal items of the persons occupying the sleeping rooms. It is not intended that storage rooms for other purposes be included within the group of interconnected rooms.

A-3.3.3.5.(13) Grilles and Louvres. In order to permit the supply of make-up air to compensate for the removal of exhaust air from these toilet rooms, shower rooms and similar spaces, it is permitted to incorporate grilles and louvres for the transfer of air provided the air movement cannot allow smoke to pass through these spaces to other parts of the building. It is considered that in normal designs the air is exhausted directly to the exterior and is not circulated. If air is to be circulated back to other parts of the building, smoke operated dampers should be included in the air circulating system.

A-3.3.3.5.(17) Fire Damper Activation. This requirement is to ensure that fire dampers are activated by any smoke detector in either zone or fire compartment.

A-3.3.4.2.(6) Floor Fire Separations in Dwelling Units. The provision of 3.3.4.2.(6) are intended to provide an alternative to the provisions of Clauses 3.3.4.2.(3)(a) and (b) that addresses complex residential building forms on sloped sites. Due to urban densification efforts, residential development is now occurring on denser and larger sites, the form of residential units are changing and they are frequently higher above adjacent ground surfaces due to stacked dwelling unit arrangements and sloped sites.

Because the establishment of a fire separation within a dwelling unit is generally impractical and unreliable, Sentence 3.3.4.2.(6) provides for the design of a protected balcony or deck to act as an area of refuge for occupants in the event they are cut-off from the means of egress by a rapidly developing fire.

The means of egress from a dwelling unit provided with a balcony or deck meeting Sentence 3.3.4.2.(6) is required to both be directly to the exterior and comply with Article 3.3.4.4., this may constrain the set of egress solution available under Article 3.3.4.4. In most cases, this will be an exterior door directly at the adjacent ground level or may include a set of stairs discharging directly to the adjacent ground level. The adjacent ground level, as referred to in this Article and in 3.3.4.4. is not necessarily the same as grade, and may be an exterior hardscaped surface designed to be suitable for unimpeded occupant egress to a street, lane, or other public throughfare.

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A-3.3.4.4.(1) Landing in Egress Stairway. A landing level used in an egress stairway from a dwelling unit is not considered to be a storey of that dwelling unit if the landing is used only for pedestrian travel purposes.

A-3.3.4.4.(7) Travel Distance in a Dwelling Unit. The egress requirements of 3.3.4.4.(7)(a) are limited by the total travel distance within the dwelling unit. For the purposes of determining this travel distance, only the horizontal component of the travel of travel within the exterior envelope, including any stairs, need be considered.

A-3.3.4.5.(1) Automatic Locking Prohibited. Doors that must be manually reset to lock them when they are opened from the inside meet the intent of this requirement.

A-3.3.6.1.(1) Design of Buildings Containing Dangerous Goods. Subsection 3.3.6. applies to the short- or long-term storage of products, whether raw or waste materials, goods in process, or finished goods.

This Subsection does not deal with products or materials that are directly supplied to appliances, equipment or apparatus through piping, hose, ducts, etc. For example, the gas cylinders that are mounted on propane barbecues are not covered by Subsection 3.3.6.; they are considered to be “in use” as opposed to “in storage” and are not intended to be regulated by the storage requirements stated in the Fire By-law.

A-3.3.6.2.(2) Storage of Reactive Materials. Reactive materials include various classes of unstable or reactive dangerous goods, such as flammable solids, pyrophoric materials, oxidizers, corrosives, water-reactive substances and organic peroxides.

In general, it is unsafe to store highly reactive oxidizers close to liquids with low flash points, combustible products or chemically incompatible products. Quantities of oxidizers or other dangerously reactive materials should therefore be limited and the storage area should be constructed of noncombustible materials, should be kept cool and ventilated, and should not impede egress.

In some cases, depending on the quantity and nature of the oxidizing agent, normal fire protection measures (e.g. sprinklers, fire hose and extinguishers) are ineffective due to the self-yielding of oxygen by the oxidizing agent.

When containers of highly reactive oxidizers become damaged or are exposed to excessive heat, humidity or contamination (e.g. sawdust, petroleum products, or other chemicals), a very violent fire or explosion can result.

The following oxidizing substances, among others, are known to supply oxygen: organic and inorganic peroxides; pool chemicals (e.g. calcium hypochlorite, sodium dichloroisocyanurate); oxides; permanganates; perrhenates; chlorates; perchlorates; persulfates; organic and inorganic nitrates; bromates; iodates; periodates; perselenates; chromates, dichromates; ozone; perborates.

When containers of dangerously reactive materials become damaged or are exposed to water or humidity, a flammable gas (such as hydrogen, ammonia or methane) or a toxic gas (such as hydrogen chloride, hydrogen bromide or phosphine) can be released.

The following dangerously reactive materials, among others, are known to release a flammable gas in reaction to contact with water or humidity: alkali metals (e.g. sodium, potassium, cesium); reactive metals (e.g. zinc, aluminum, magnesium); metallic hydride (e.g. sodium borohydride, germanium tetrahydride, calcium hydride).

The following dangerously reactive materials, among others, are known to release a toxic gas in reaction to contact with water or humidity: organic and inorganic chloride (e.g. phosphorus trichloride, phosphorus oxide trichloride, acetyl chloride); organic and inorganic bromide (e.g. phosphorus tribromide, aluminum tribromide, acetyl bromide).

A-3.3.6.2.(4) Wiring and Electrical Equipment in Hazardous Locations. In addition to the general requirements of CSA C22.1, "Canadian Electrical Code, Part I," special attention must be given to Sections 18, 20 and 22: Section 18 specifies wiring requirements for Class I, II and III hazardous locations; Section 20 provides specific requirements for areas where flammable or combustible liquids are stored or dispensed; Section 22 specifies wiring requirements for areas where corrosive liquids or vapours or excessive moisture are present.

A-3.3.6.4.(2) Explosion Venting in Hazardous Locations. When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a predetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.

The major parameters to be considered in designing an explosion venting system for a building are:

- the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressure rise,
- the concentration and dispersion of the flammable mixture in the room,
- the turbulence and physical obstructions in the room,
- the size and shape of the room, the type of construction and its ability to withstand internal pressures, and
- the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to people in the immediate vicinity of the panels.

A-3.3.6.5.(1) Measurement of Tire Storage Volume. The volume of tires in a storage area can be determined by measuring to the nearest 0.1 m the length, width and height of the piles or racks intended to contain the tires. In racks, the top shelf is assumed to be loaded to maximum possible height, while observing required clearances between structural elements and sprinklers.

A-3.3.6.6.(6) Products Stored with Ammonium Nitrate. Copper and its alloys should not be used where they can come into contact with ammonium nitrate. The presence of copper represents the single biggest hazard with respect to the accidental detonation of ammonium nitrate during a fire.

Steel and wood can be protected with special coatings such as sodium silicate, epoxy, or polyvinyl chloride.

Asphalt and similar hydrocarbon-based roof coverings should not be used. Stored ammonium nitrate may become sensitized during a fire if such roof coverings melt and leak into the interior of the building, causing burning droplets to fall on the stored product.

A-3.3.7.7.(2) Security for Storage Garage. The requirements of Sentence 3.3.7.7.(2) are intended to provide improved visibility into or out of a stair tower or vestibule which might otherwise occlude the line of sight of building occupants as a result of intervening construction. Glazing must provide the maximum practical improvement to visibility to improve occupant safety. The term 'stair tower' used in this Sentence is intended to apply to vertical stair enclosures connecting more than one floor or containing superimposed flights of stairs.

A-3.3.7.7.(3) and (4) Security for Storage Garage. The provision of Sentence 3.3.7.7.(3) and (4) are to intended restrict access from the parking storeys to adjacent non-parking storeys of the building by mandating that the exits serving a parking storeys discharge directly to the exterior.

Clause (4)(b) is intended to provide a relaxation for mixed use buildings where reasonable security features have been implemented to limit the risk that occupants are subject to an unacceptable risk of physical assault. Occupants may be made aware of conditions in the exit by means of increased glazing and clear lines of sight, and can remain in a place of safety until they exit. In situation where direct lines of sight cannot be maintained, mirrors or other means to increase visibility for occupants are to be implemented.

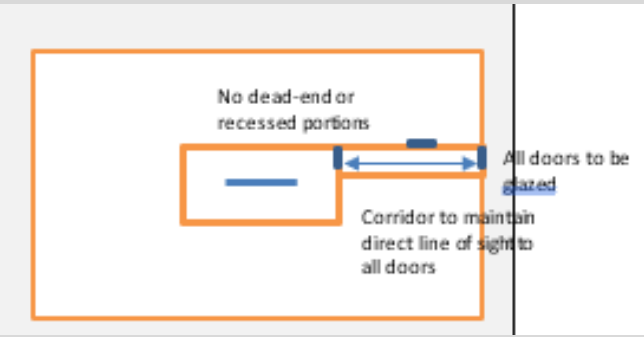

Figure A-3.3.7.7.(3) & (4)

A-3.4.1.1.(1) Type of Exit Facility. The requirements for exits in Section 3.4. were developed for new construction. If alterations are made to an existing building or changes of occupancy occur, other design solutions than those in Section 3.4. may have to be developed to maintain an acceptable level of safety if it is not practicable to fully conform to the requirements of this Section. In some cases the use of fire escapes to supplement the existing exit facilities may be the only practicable solution. Because of the variety of conditions that may be encountered in existing buildings, it is difficult to standardize or codify such requirements. Alternative means of providing acceptable levels of safety may have to be tailored to the particular building design. In all cases, however, the requirements described in Section 3.4. are intended to provide the level of safety to be achieved. If alternative measures are used, they should develop the level of safety implied in these requirements.

A-3.4.1.6.(2) Sleeping Area. Areas serving patients' sleeping rooms include sleeping areas and areas where patients are taken for treatment.

A-3.4.2.3.(1) Least Distance Between Exits. The least distance measurement does not apply to each combination of exits on a multi-exit storey. It only applies to at least 2 of the required exits from that storey.

The intent of this Sentence is to permit a reduced distance between exits where a public corridor exists. However in some buildings, due to prevailing business conditions the entire floor area of a storey may be converted into a full storey tenant space.This may be challenging when the location of the existing exits have been established based on the presumption that a public corridor remains in place. Provided that the existing corridor arrangement is maintained in its current state, it is considered reasonable to maintain the existing condition as a corridor used by the public for the purposes of determining compliance with this Sentence as this can readily be shown not to reduce the existing level of performance.

A-3.4.2.3.(5) Distance Between Exits for Small Residential Buildings. The provision to decrease the minimum distance between exits for small residential buildings to 4.5 m is intended to facilitate construction of buildings with space efficient egress using scissor stairs. The 4.5 m distance takes into consideration the geometry of scissor stairs and floor to floor elevation differences in a typical residential building. See also Note A-3.2.10 for fire protection and firefighting assumptions in the development of this code provision. The intent is all existing code provisions for a building with scissor stairs remain unchanged except for the relaxation of distance between exit doors from a floor area, and their discharge points, for small buildings of residential occupancy only.

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A-3.4.3.2.(6) Evacuation of Interconnected Floor Space. This Sentence ensures that egress facilities allow for the simultaneous evacuation of all portions of an interconnected floor space. It does not contemplate the phased evacuation of occupants; thus in buildings where that type of evacuation is intended, fire protection requirements in addition to those prescribed in the By-law may be necessary.

In the first instance, this Sentence provides for cumulative exiting that can accommodate the efficient movement of all occupants in the exit stairs. Clause 3.4.3.2.(6)(a) permits an alternative approach that will accommodate all the occupants in the stairs but will restrict the egress flow rate. Clause 3.4.3.2.(6)(b) provides a second alternative that assumes the occupants must queue before entering the stair. A "protected floor space" conforming to Article 3.2.8.5. is intended to provide an intermediate area of safety that is protected from the hazards of the interconnected floor space. It does not provide a holding or refuge area for all occupants of a floor area for an extended period of time.

To ensure that evacuation is not unduly delayed and that queuing of the occupants in the protected floor space can be accommodated, requires careful consideration in the design of the interface between the interconnected floor space/protected floor space/exit.

It is not appropriate, for example, to share a common vestibule in complying with Sentences 3.2.8.4.(1) and 3.2.8.5.(1). Under evacuation conditions, occupants entering the vestibule would flow towards the exit, as opposed to the protected floor space, thus resulting in queuing outside the vestibule and potential exposure to fire. To comply with the intent, it is necessary to design the egress path such that the occupants enter the protected floor space through a vestibule, then in turn enter the exit stair from the protected floor space. In addition, sufficient space should be provided between the vestibule and the exit to allow for the queuing of occupants in the protected floor space.

A-3.4.3.2.(6)(a) Temporary Safety Area. The objective of Clause 3.4.3.2.(6)(a) is to provide an area of temporary safety in the exit stair shafts for the occupants of the interconnected floor space. This requirement is considered to be met if 0.3 m^2 per person is provided in the stair shaft between the floor level served and the floor level immediately beneath it.

A-3.4.3.4. Clear Height and Width. Clear height is intended to be measured from a line tangent to the nosings extended to the underside of the lowest element above the walking surface, over the clear width of the exit (see Figure A-3.4.3.4.). Examples of low elements above the walking surface include light fixtures or sprinkler heads and piping.

Clear width is intended to be measured from a line tangent to horizontal protrusions such as handrails.

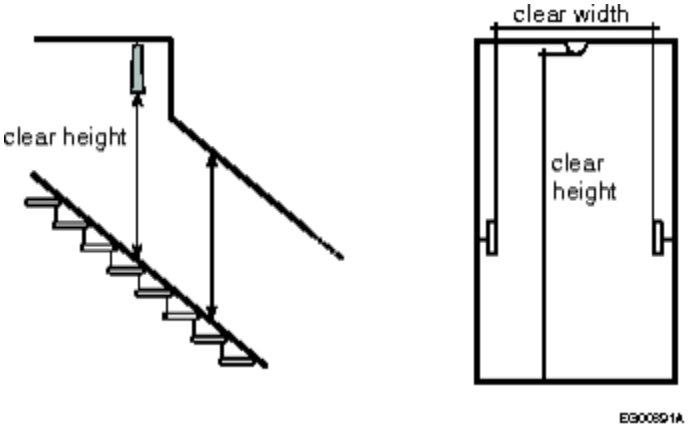

Figure A-3.4.3.4.

Measuring clear height

A-3.4.4.2.(2)(e) Requirements for Lobby. If an exit is permitted to lead through a lobby, the lobby must provide a level of protection approaching that of the exit. As well as meeting the width and height requirements for exits, the lobby must be separated from the remainder of the building by a fire separation having a fire-resistance rating at least equal to that required for the exit, unless one of the exceptions in this Clause is applied.

A-3.4.5.1.(2)(c) Graphical Symbols for Exit Signs. ISO 7010, "Graphical symbols – Safety colours and safety signs – Registered safety signs," identifies the following internationally recognized symbols for use at required exits.

Figure A-3.4.5.1.(2)(c)-A

"E001 Emergency exit (left hand)" symbol from ISO 7010

Figure A-3.4.5.1.(2)(c)-B

"E005 Direction, arrow (90º increments), safe condition" symbol from ISO 7010

A-3.4.5.1.(3) Internally Illuminated Signs. Photoluminescent signs are not internally illuminated and therefore must conform to Sentence 3.4.5.1.(4).

A-3.4.5.1.(4) Externally Illuminated Signs. An external lighting source is required to properly charge photoluminescent signs. In addition to being continuously illuminated as required by Sentence 3.4.5.1.(4), these types of signs must be lit in conformance with the charging requirements indicated on the exit signs in accordance with CAN/ULC-S572, "Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems."

A-3.4.6. Application to Means of Egress. The requirements in Subsection 3.4.6. apply to interior and exterior exits, as well as to ramps, stairways and passageways used by the public as access to exit. The treads, risers, landings, handrails and guards for the latter access to exit facilities must thus be provided in conformance with the appropriate requirements for exit facilities.

A-3.4.6.4. Dimensions of Landings. A landing is a floor area provided at the top or bottom of a flight of stairs or a ramp, or a platform built as part of a stairway or ramp. Landings provide a safe surface for users to rest upon, allow design flexibility, and facilitate a change in direction.

Figure A-3.4.6.4. illustrates how to measure the length of a landing for various landing configurations turning less than 90°, including straight landings.

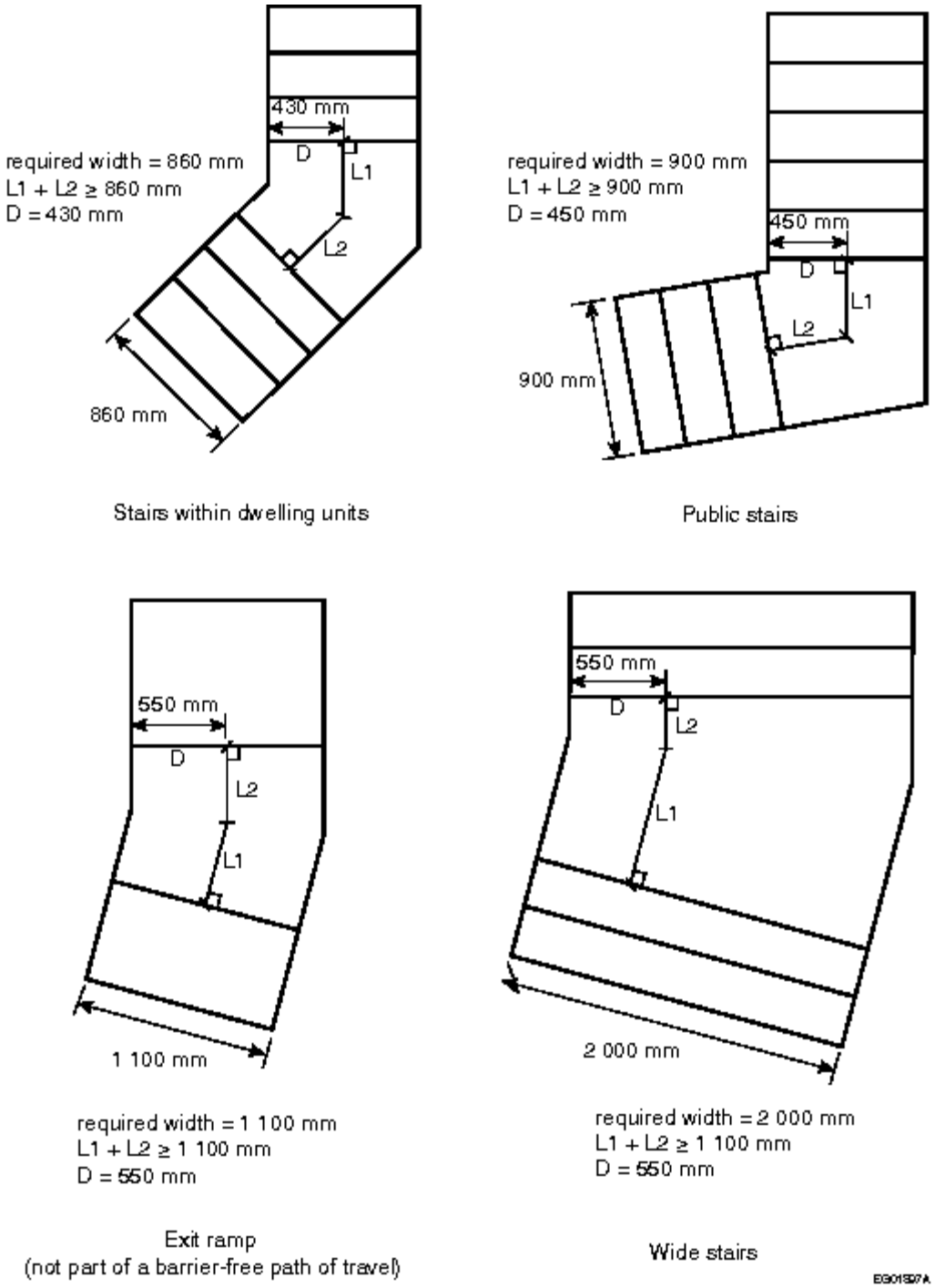

Figure A-3.4.6.4.

Landing configurations

Notes to Figure A-3.4.6.4.:
(1) L1 + L2 = length of the landing
= the lesser of the required width of the stair or ramp, or 1 100 mm
See Sentences 3.4.6.4.(2) and 9.8.6.3.(2).
(2) D = distance from the narrow edge where the length of the landing is measured
= half the required length of the landing

See Sentences 3.4.6.4.(3) and 9.8.6.3.(3).

A-3.4.6.5.(4) Wider Stairs than Required. The intent of Sentence 3.4.6.5.(4) is that handrails be installed in relation to the required exit width only, regardless of the actual width of the stair and ramp. The required handrails are provided along the assumed natural path of travel to, from, and within the building.

A-3.4.6.5.(11) Termination of Handrails. Handrails should terminate at the wall, floor or post so as not to constitute a hazard to persons.

A-3.4.6.10.(5) Door Swing. Although it is required that the door on the right hand side of a pair of doors shall swing in the direction of travel through the exit, the direction of swing of the door on the left side will depend on the function of the horizontal exit. If the horizontal exit provides for movement from one building to the adjacent building but does not require movement in the reverse direction, both doors must swing in the direction of travel to the adjacent building. If the design is based upon both buildings providing complementary movement in either direction, then the doors must swing in opposite directions. Location of a required exit sign directly above a door that swings in the direction of travel is deemed to meet the intent of Clause 3.4.6.10.(5)(b).

A-3.4.6.11.(4) Exit Concealment. Hangings or draperies placed over exit doors may conceal or obscure them.

Exit Doors Concealed with Murals

Some people with cognitive disabilities such as dementia are at risk of wandering away from the residence or healthcare facility in which they are being treated. To reduce this risk, some residences and healthcare facilities install special hardware on egress and exit doors that can only be operated by designated persons. This solution keeps residents/patients from wandering, but the doors can still trigger anxiety in residents/patients who may nevertheless try to leave the space through them, without success.

Recent studies have shown that applying murals (of a landscape, for example) on exit and egress doors in these environments can help reduce anxiety in people with cognitive disabilities who tend to view them as a pleasant natural barrier rather than as a means of escape.

Where this approach is implemented and the doors are not reasonably discernible, an alternative means of egress from the space should be provided. It is expected that the designers and authorities having jurisdiction will use judgement in determining whether or not an alternative means of egress is required. Where this approach is implemented, the murals should be applied with care so that they do not conceal or impair the operation of any fire and life safety systems installed nearby, including, but not limited to, exit signage, emergency lighting, fire alarm devices, sprinklers or door hardware. Egress and exit doors with murals should be reasonably discernible to residential care or healthcare staff who will be required to assist residents/patients in the event that the space must be evacuated, and to visitors who will be expected to evacuate on their own.

A-3.4.6.16.(1) Fastening Device. Turnpieces of a type which must be rotated through an angle of more than 90° before releasing a locking bolt are not considered to be readily openable. The release of a locking bolt should allow the door to open without having to operate other devices on the door.

A-3.4.6.16.(4)(h) Time Delay for Electromagnetic Locks with Proximity Sensors. For the purposes of Clause 3.4.6.16.(4)(h), a door provided with a hardware arrangement complying with Sentence 3.4.6.16.(7) is not considered to have a delay.

A-3.4.6.16.(5) Electromagnetic Lock. Electromagnetic locks are intended for use where there is a need for security additional to that provided by traditional exit hardware. They are not intended for indiscriminate use as alternative locking devices. The design of these devices requires evaluation to ensure that their operation will be fail-safe in allowing exiting in the event of foreseeable emergencies. If more than one locking device is used in a building, it is expected that one switch will release and reset all devices simultaneously.

A-3.4.6.16.(6) Electromagnetic Locks in Care and Treatment Occupancies. The installation of electromagnetic locks in care and treatment occupancies requires special provisions to address the compromised condition of residents and the nature of daily operations. Accordingly, to reduce the incidence of false operation by residents, transparent boxes that set off an audible signal when opened can be installed to cover the manual stations. Also, one optional additional release device (e.g. swipe card device, key pad) can be installed to facilitate the free movement of staff and visitors in the building.

A-3.4.6.16.(8) Electromagnetic Lock for Main Entry Doors. The provisions of Sentence 3.4.6.16.(8) are intended to provide an alternative arrangement for electromagnetic locking devices installed on doors in high-traffic locations, such as the main entry of buildings. This arrangement permits the use of automatic sensing devices that can release the electromagnetic locking device as an occupant approaches, and then relock that door after a period of time, provided that a backup means to request exit is provided in the immediate vicinity should the primary means of release be non-functional. In order to minimize user

confusion, the design of the means to release the electromagnetic lock has been standardized in order to facilitate its recognition throughout the City.

In an emergency, it is possible that persons may be approaching the doors quickly in order to egress, and the sensors may be unable to recognize oncoming traffic before occupants reach the doors. As a result, the electromagnetic locking device is required to design to be disengaged and remain disengage on an alarm signal from the building fire alarm system.

A-3.4.6.17.(1) Special Security for Doors. The need for security in banks and in mercantile occupancies requires the ability to use positive locking devices on doors that may not readily be opened from inside the building. In a fully sprinklered building, the risk to persons inside the building is substantially reduced. The provisions of Sentences 3.4.6.17.(2) to (9) assume that the area is illuminated and that a means of communication is available to any occupant during times that the doors are locked.

A-3.5.2.1.(1) Elevator Design. The reference to the Safety Standards Act and pursuant regulations in this Sentence implies conformance with all requirements of the pursuant regulations for elevator cars, hoistways, pits and machine rooms, including restrictions on other services in these areas and detailed design criteria.

A-3.5.4.1.(1) Elevator Car Dimensions. In some circumstances it is necessary to maintain a patient on a stretcher in the prone position during transit to a hospital or to treatment facilities. Inclining the stretcher to load it into an elevator could be fatal or at the very least detrimental to the patient's health. Many ambulance services use a mobile patient stretcher whose size is 2 010 mm long and 610 mm wide. As well as space for the stretcher in the elevator, there should be sufficient additional space for at least two attendants who may also be providing treatment during transit.

Limited-use/limited-application (LULA) elevators are limited in size, capacity, speed and rise and are not expected to meet the minimum elevator car dimensions stated in Sentence (1).

A-3.6.2.5.(1) Storage of Combustible Refuse and Recycling. Storage of refuse consisting of combustible materials including waste paper, cardboard and plastic, and noncombustible materials such as glass and metallic containers can be accumulated in these rooms for the purpose of recycling. The storage of hazardous materials destined for recycling may need to satisfy other requirements than those stated in Sentence 3.6.2.5.(1).

A-3.6.2.7.(5) Explosion Relief. Examples of good engineering practice for this application can be found in NFPA 68, “Standard on Explosion Protection by Deflagration Venting,” NFPA 69, “Standard on Explosion Prevention Systems,” and the NFPA “Fire Protection Handbook.”

A-3.6.3.1.(1) Vertical Service Spaces. Sentence 3.6.3.1.(1) does not prohibit the internal subdivision of a vertical service space to allow different building services to be installed in physically separated spaces unless other requirements apply (see, for example, Sentences 3.2.7.10.(2) and (3)). Fire separation requirements apply to the perimeter of the group of service spaces. Article 3.6.3.3. has special requirements for linen chutes and refuse chutes.

A-3.6.3.5. Grease Duct Enclosures. NFPA 96, “Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations,” presents two options for enclosing grease ducts for commercial cooking equipment: the first option is to use continuous fire-rated building component assemblies to enclose the ducts and the second one consists of installing proprietary, fire-rated, field-applied or factory-built grease duct assemblies in accordance with the manufacturer's instructions. These types of enclosure assemblies are evaluated for their resistance to fire and their ability to protect adjacent combustibles through reduced clearances. Although NFPA 96 references other standards that deal with grease duct assemblies, Sentence 3.6.3.5.(2) requires that CAN/ULC-S144, “Standard Method of Fire Resistance Test – Grease Duct Assemblies,” be used to determine the fire-resistance rating of factory-built and field-applied grease duct assemblies.

A-3.6.4.2.(2) Ceiling Membrane Rating. In construction assemblies that utilize membrane ceiling protection and have been assigned a fire-resistance rating on the basis of a fire test, the membrane is only one of the elements that contribute to the performance of the assembly and does not in itself provide the protection implied by the rating. For the fire-resistance rating of membrane materials used in this form of construction, reference should be made to the results of fire tests which have been conducted to specifically evaluate the performance of this element.

A-3.6.5.6.(2) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is 75 mm or less.

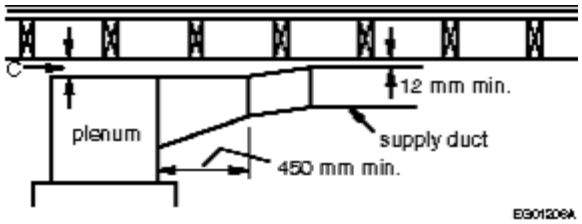

Figure A-3.6.5.6.(2)

Clearance for warm-air supply ducts

A-3.6.5.6.(3) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is more than 75 mm but not more than 150 mm.

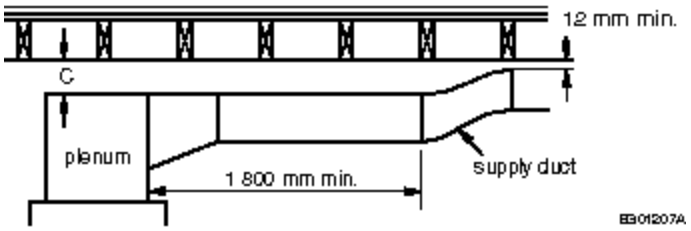

Figure A-3.6.5.6.(3)

Clearance for warm-air supply ducts

A-3.6.5.6.(4) Clearance for Warm-Air Supply Ducts. Applicable to forced-air furnaces where permissible clearance C above plenum is more than 150 mm.

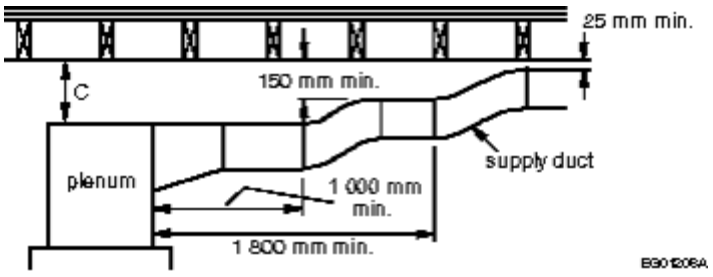

Figure A-3.6.5.6.(4)

Clearance for warm-air supply ducts

A-3.7.2.1.(2) Washroom Units in Industrial Occupancies. Substations and parking garages are examples of industrial occupancies where staff presence may be permanent or may be intermittent. In the case of parking garages, the presence of occupants other than staff is transitory.

A-3.7.2.1.(5) The intent of Sentence 3.7.2.1.(5) is to allow the number of water closets in a new premise to be calculated based on the occupant load of the interior space. The occupant load of exterior spaces (such as decks, patios, and similar areas) does not need to be considered when determining the required number of water closets, provided that the premise either has at least two water closets or the number of additional outdoor seats does not exceed ten.

When applied to an existing premise, the intent of Sentence 3.7.2.1.(5) is to permit additional outdoor seating provided the premise either has at least two existing water closets or the number of additional outdoor seats does not exceed ten, without

requiring additional water closets. This provision is intended to encourage the use of patios and decks without triggering costly renovations for additional washrooms, which could pose a barrier for small business or seasonal expansions, when minimum sanitary facilities are already in place.

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A-3.7.2.9. Gender Neutral Washroom Requirements. The gender neutral washroom requirements of the Building Bylaw introduce a new option for owners, operators, and employers to provide washroom facilities that do not impose unreasonable restrictions on persons who wish to use the washroom facility. The requirements of the Building Bylaw represent the minimum level of performance necessary to achieve the goals of personal security and functionality for all persons.

The intent of the gender neutral washroom is that they may replace washrooms that would otherwise be required by the Building By-law. Where gender neutral washrooms are provided, these are to be assigned proportionally as male or female, for the purposes of determining the building washroom capacity under Section 3.7 of the Building By-law. It is not intended that the gender neutral washrooms be assigned solely as contributing to the male or female washroom capacity exclusively, nor were these to be considered supplemental to the minimum washroom requirements of the building.

Signage for gender neutral washrooms are to reflect the intended use not only by persons outside the gender binary, but also by people with disabilities, the elderly, and anyone else who may require the assistance from someone of another gender. As such, signage denoting this use is recommended to be neutral in tone and nature. Likewise, the iconography associated with these signs is also suggested to be indicative of the facility usage and function, and not of the individual who may use the facility.

The provision of regulations for gender neutral washrooms does not mean the elimination of gender-type washrooms. Typed washrooms, such as men's or women's multi-stall washrooms, and universal single-user washrooms may remain. It is up to each person to self-determine which washroom is most appropriate for them based on their gender identity. Further clarifying text may be added to washroom signage to signal that all persons are welcome.

Example signage from Public Service and Procurement Canada's Guide for Supporting Trans Employees is included below.

Figure 3.7.2.9.-A
Example Gender-Inclusive Signage.

A-3.7.2.9.(1) Gender Neutral Washrooms in Large Suites. The provisions of Sentence 3.7.2.9.(1) establish a minimum number of gender neutral washrooms for larger suites or buildings without suites where the occupant loads exceed 200 persons. This requirement can be satisfied by a universal washroom required by Article 3.8.2.8., provided that the suite or floor area includes access to the universal washroom.

A-3.7.2.9.(2)(c) Duress Alarms. The duress alarm referenced by Clause 3.7.2.9.(2)(c) is a safety device designed to assist individuals in emergencies or dangerous situations. These alarms typically consist of a button or pull cord that, when activated, sends an alert to a designated location, such as a constantly attended location or locally if no such location exists. The primary purpose of these alarms is to provide a quick way to summon assistance, to improve the safety and well-being of users.

A-3.8. Accessible Design Principles. This Section contains minimum requirements for the design of buildings that accommodate people with diverse abilities, across their lifespan, including, but not limited to, people who use wheelchairs or other assistive mobility devices (e.g., walking aids, canes, crutches, braces, prosthetics), people with personal care providers, people with hearing or vision loss, and people with service animals, so they can access and use buildings.

Building Access Handbook

An illustrated guide and commentary has been produced to assist users of Section 3.8. and other access requirements of the Building By-law. This handbook contains the entire text of Section 3.8. and other access requirements, and is supplemented by commentary and illustrations on specific requirements.

Examples of basic accessibility requirements of the By-law are as follows:

- a clear floor space of at least 800 mm by 1 350 mm,
- a 1 000 mm clear width allowing a 90° turn,
- a 2 100 mm diameter clear floor space allowing a 180° turn in one motion, and
- a 1 700 mm diameter clear floor space allowing a 180° turn in multiple motions.

A-3.8.2.1. Accessibility. Industrial buildings often pose a greater risk to their occupants due to the presence of significant quantities of dangerous materials or the use of hazardous processes. For example, plants which are classified as Group F, Division 2 or 3, may store and use toxic or highly flammable substances in significant quantities, or house processes which involve very high temperatures and which have a high degree of automation. In some facilities, particularly in primary industries such as forestry and metallurgy, the construction normally used and the operations carried out within the space can make compliance with the requirements of Section 3.8. impracticable. It is therefore intended that these requirements be applied with discretion in buildings of Group F, Division 2 or 3 major occupancy. However, where industrial buildings contain subsidiary occupancies, such as offices or showrooms, it is reasonable to require that accessibility be provided in these spaces.

A-3.8.2.2. Entrances. An accessible route should exist from the sidewalk or roadway and parking area to an accessible building entrance. This route should be located so that people do not have to pass through dedicated smoking areas or behind parked cars. Accessible routes should coordinate with the routes to other buildings and to public transportation stops.

Article 3.8.2.2. applies to all entrances, including public and employee entrances, that provide access to an accessible storey. Doors that open onto exterior facilities that are only accessible from inside the building (e.g., hotel pools) are not considered entrances in the context of Article 3.8.2.2.

If an intercom system is provided, the system shall comply with the requirements for controls and should be useable by persons who communicate using visual language such as a video system.

A-3.8.2.3. Access to Rooms and Facilities. If access is required into suites or rooms in Subsection 3.8.2., it is intended that access be provided, with some exceptions identified in Sentence 3.8.2.3.(2), throughout each room or suite including access to all facilities and areas. Some examples of where access is required are as follows:

- within each suite (subject to Clauses 3.8.2.3.(2)(k) and (l)),
- within rooms or areas that serve the public or are designated for use by visitors, including interview rooms, holding rooms, changing rooms, areas in assembly occupancies with fixed seats so as to provide viewing of any entertainment areas, display areas and merchandising departments,
- within each type of membership facility,
- within rooms or areas for student use in assembly occupancies,

- within general work areas, including office areas and areas with lockers,
- within general use or general service areas, including shared laundry areas in residential occupancies, recreational areas, cafeterias, lounge rooms, lunch rooms and infirmaries,
- within sleeping rooms in hospitals and nursing homes with treatment,
- (if installed), into at least one passenger elevator or elevating device conforming to Articles 3.5.2.1. and 3.8.3.7.,
- into washrooms described in Sentences 3.8.2.8.(1) to (4),
- to any facility required by this Section to be designed to accommodate persons with physical disabilities,
- onto every balcony provided in conformance with Clause 3.3.1.7.(1)(c), and
- to service counters used by the general public (examples include ticket counters, refreshment stands, drinking fountains, cafeteria counters, checkout counters and bank service counters), and
- to equipment designed to serve the public including self-serve kiosks, automated banking machines and night deposit boxes,

Where one or more hairdressing sinks are provided in barber shops, hairdressing shops and beauty parlors, at least one shall be useable by persons using in wheelchairs. Where fitting rooms are provided in a store, an accessible fitting room is required. An enclosure with not less than a 1700 diameter clear floor area is suggested.

The permission to waive an accessible path of travel for wheelchair access to certain specified areas of a building is not intended to waive accessibility requirements for persons whose physical disabilities do not require special provision for access to raised or sunken levels. Persons with vision impairments or who are deaf or hard of hearing that do not require the use of a wheelchair can be expected to move throughout a building.

Seating booths and banquettes in restaurants and bars are considered furniture, which is beyond the scope of the By-law. However, various types of seating should be considered to ensure the availability of accessible options. Policies for seating such as those based on reservations or sequence of when patrons arrive is beyond the scope of the By-law.

The concept of wheelchair accessibility does not extend to building service facilities, nor to all floor levels within a storey, e.g., mezzanines not served by an elevator. Mezzanines that are accessible by an elevator are therefore not excluded.

A-3.8.2.3.(2)(g) Access to Facilities on a Floor Level other than the Entrance Level. Subclauses 3.8.2.3.(2)(g)(ii) to (iv) are intended to exempt certain storeys other than the entrance level—including basements and mezzanines that are less than 600 m^2 in floor area or 100 m^2 or less in floor area in assembly occupancies, that are self-contained and that contain the same facilities as the entrance level— from the requirement to have an accessible path of travel. Examples of buildings and spaces to which this exemption may apply are small office buildings with additional workspaces on the second storey and small restaurants with a second storey that contains only additional seating. However, if a restaurant's only washrooms are in the basement, they must have an accessible path of travel as they are an integral part of the principal function of the first storey. Similarly, staff lunchrooms and washrooms are also integral to the principal function of a restaurant; as such, if they are located in a floor area such as a second storey, basement or mezzanine that contains the only facilities, they must have an accessible path of travel for potential employees with disabilities.

Mezzanines that are not considered as stories for the purpose of determining building height are considered as stories for the purpose of applying Clause 3.8.2.3.(2)(g).

A-3.8.2.3.(4) Waiting Areas with Fixed Seats. Many types of buildings have waiting areas, such as airports, hospitals, and government office buildings. Waiting areas should have a sufficient number of spaces designated for persons using wheelchairs so they can use the waiting area without blocking any means of egress.

The number of people using wheelchairs is typically much higher in treatment occupancies than in other types of occupancies. Designers should consider adding more designated wheelchair spaces in waiting areas than the numbers indicated in Table 3.8.2.3. in occupancies where a higher number of persons using wheelchairs is expected due to the types of services provided.

A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4) Distribution of Adaptable Seats, Designated Wheelchair Spaces, and Mobility Aid Storage Spaces in Assembly Occupancies.

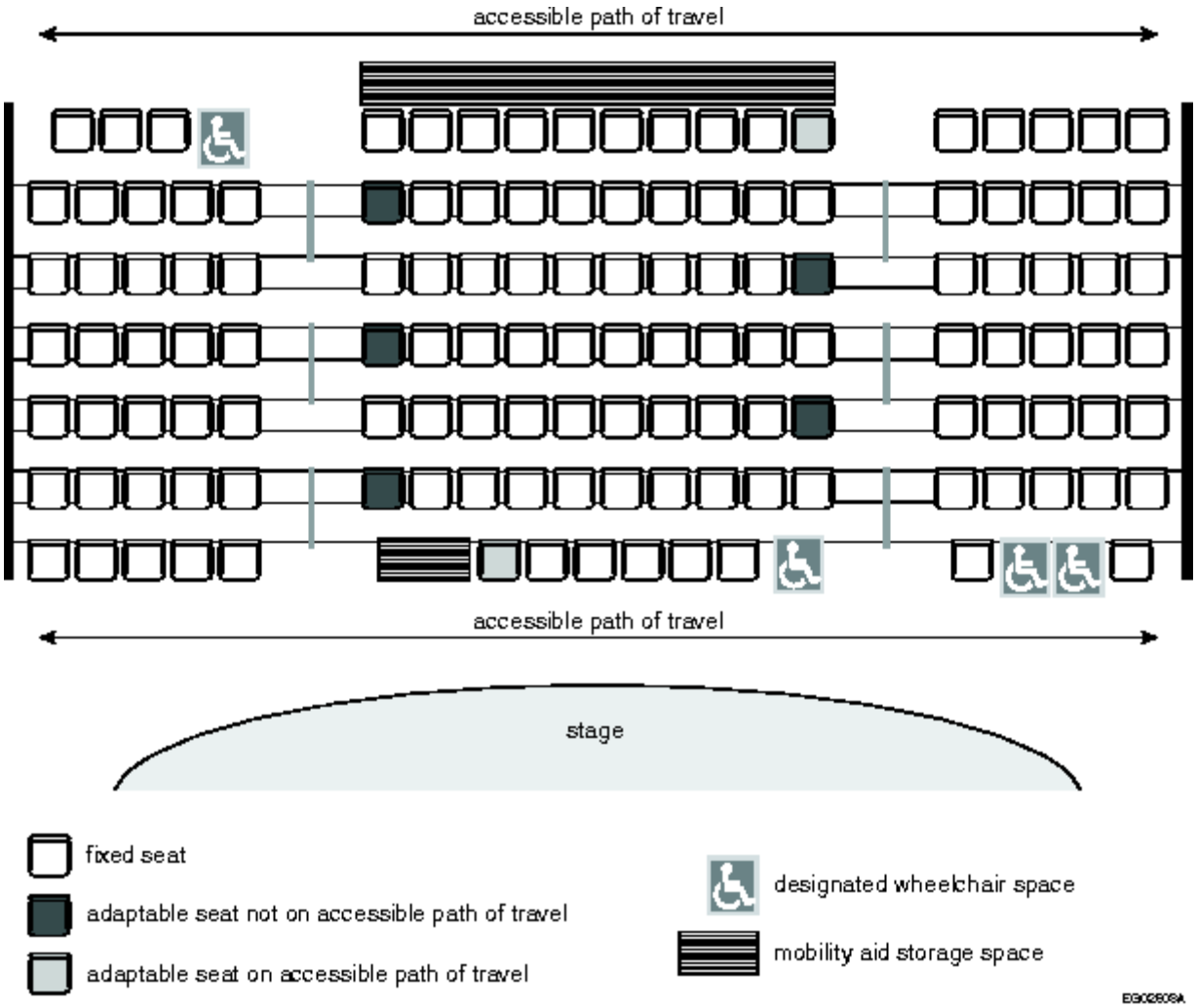


Figure A-3.8.2.3.(5) and (6) and 3.8.3.22.(1) and (4)

Example of distribution of adaptable seats, designated wheelchair spaces, and mobility aid storage spaces in an auditorium

A-3.8.2.4.(1) Accessible Path of Travel to Storeys Served by Escalators and Moving Walks. In some buildings, escalators and inclined moving walks are installed to provide transportation from one floor level to another floor level so as to increase the capacity to move large numbers of persons. Some buildings located on a sloping site are accessible from street level on more than one storey and an escalator or inclined moving walk is provided for internal movement from floor to floor. In both these situations, people must be provided with an equally convenient means of moving between the same floor levels within the building. This may be accomplished by providing elevators, platform-equipped passenger-elevating devices, or ramps, for example.

A-3.8.2.5. Parking Areas. In Vancouver, the design, adequacy, and number of accessible parking spaces for persons with physical disabilities determined in accordance with the Parking By-law (see Sentence 3.8.3.4.(2) for additional details). Further to the Parking By-law requirements, where feasible designers should consider maintaining consistency with provincial guidelines. The CSA B651, "Accessible design for the built environment," standard as well as the following provides guidance to determine appropriate provisions. If parking spaces are provided, parking spaces for use by persons with physical disabilities should be provided in proportion considerate of anticipated use. Where parking spaces are provided, parking spaces for use by persons with physical disabilities should be provided for each accessible viewing position and for each accessible sleeping room or bed space. Parking spaces for use by persons with physical disabilities should

(1) be not less than 2 600 mm wide, provided on one side with an access aisle not less than 2 000 mm wide, provided a perpendicular and adjacent rear access aisle not less than 2 000 mm wide, and have a clear height contiguous with the routes of the vehicular approach and exit of not less than 2 750 mm,

(2) have a firm, slip-resistant and level surface,

(3) be located close to an entrance required to conform to Article 3.8.2.2.,

(4) be clearly marked as being for the use of persons with physical disabilities, and

(5) be identified by a sign located not less than 1 500 mm above ground level, with the International Symbol of Access

Shared access aisle

Asphalt, concrete and firm, compacted gravel are acceptable parking surfaces. Curb ramps should be not less than 1500 mm wide. Parallel parking spaces should be not less than 7 000 mm long. If more than one parking space is provided for persons with physical disabilities, a single access aisle can serve two adjacent parking spaces. Parking to accommodate vans and other vehicles equipped with platform lifts or side ramps should be provided greater dedicated space. The design of the path of travel should accommodate loading to and from lifts and ramps including the necessary vehicle clearances.

A-3.8.2.5.(1) and (2) Exterior Accessible Paths of Travel. The intent of Sentences 3.8.2.5.(1) and (2) is to ensure that exterior accessible paths of travel are readily available, direct and accessible so that persons of all abilities can move to and from a building with minimal effort.

A-3.8.2.6.(1) Application to Security Access Systems. Sentence 3.8.2.6.(1) is not intended to reduce the functionality of security devices that limit access to secure areas and are addressed by other Sections of this By-law.

A-3.8.2.6.(2) Electrical Outlets. Electrical outlets intended for occupant use shall be located so that their height above the finished floor is not a barrier to use. Outlets that are dedicated for specific equipment or functions and not intended to be readily available to occupants need not conform to the location requirements.

A-3.8.2.7.(1)(b) Power Door Operators for Interior Doors. It is not intended that all doors located in an accessible path of travel be equipped with a power door operator, but rather those that are located within public areas of the building, such as public corridors or corridors used by the public. Doors of suites served by a public area do not need to be equipped with a power door operator.

A-3.8.2.7.(3) Accessible Entrances with Multiple Doorways. In selecting which doorway to equip with a power door operator as required by Sentence 3.8.2.7.(3), consideration should be given to the location of accessible paths of travel, to the ease of access, and to minimizing congestion.

A-3.8.2.8.(1) to (4) Accessible and Universal Washrooms. A universal washroom is an accessible space providing privacy for one person and their care attendant(s), regardless of their gender. It is intended that a universal washroom be available in close proximity to each bank of washrooms in a floor area. In the case where only one water closet is provided, a universal washroom would satisfy the requirement of Sentence 3.8.2.8.(1).

A-3.8.2.8.(13) Universal Dressing and Shower Rooms. A universal dressing and shower room is an accessible space that contains a shower and a space for dressing for one person and their care attendant(s) and provides privacy, regardless of gender.

It is intended that a universal dressing and shower room be available within close proximity to each bank of showers in a floor area. In cases where only one shower is provided, a universal dressing and shower room would satisfy the requirement.

A-3.8.2.8.(15) Accessible Change Spaces. The intent of Sentence 3.8.2.8.(15) is to ensure that in large major occupancies, such as large shopping malls, public pools and libraries, occupants who may need assistance with personal hygiene will have access to an accessible change space that can be found in a consistent location.

Universal washrooms containing an accessible change space should be located so that they are available to the public when the large major occupancy is occupied. A suitable location could be in the lobby of a building housing the large major occupancy that remains open during that major occupancy's business hours, for example.

A-3.8.2.9.(2) Assistive Listening Systems and Adaptive Technologies. The intent of Sentence 3.8.2.9.(2) is to require that at least one counter with an assistive listening system or adaptive technology be provided at each group of service counters providing the same exchange of information, goods or services. For example, in a stadium with ticket counters at multiple

building entrances, at least one ticket counter at each entrance should be equipped with an assistive listening system or adaptive technology.

A-3.8.2.10.(4) Directional Signage. This By-law requires that directional signs be provided in a number of situations. Although they are only required to provide visual information, tactile directional signs should also be provided where practicable.

In some buildings, it may be necessary to supplement signs that provide visual and tactile information with visual displays, such as information displays and electronic interactive displays (e.g., wayfinding, exhibits and self-serve points-of-sale). Visual displays are common in motion picture theatres, law courts, exhibition halls, passenger stations/depots, museums, conference facilities, shops, stores and markets.

Wherever practicable, visual displays should be designed so that they are accessible to all people. In order to be accessible to people with low vision, visually displayed information should also be audibly communicated, either electronically or orally. Where touch screens are installed, an alternative means of accessing the information should be provided, for example by providing tactile buttons on an interactive display or by ensuring an attendant is always available to assist customers or visitors. Visual displays should also be accessible to people who use mobility devices. The degree of operability should accommodate people using a wide range of mobility devices (e.g., wheelchairs, scooters, walkers, canes) and people with a wide range of arm and hand mobility. Approach side, mounting height above the finished floor, amount of knee space, types of controls and the ability to reach them are particularly important considerations.

A-3.8.2.11.(1) Counters with Work Surfaces. It is not intended that all counters be accessible, but that sufficient accessible counter space be available. Examples of counters that should be accessible include check-in counters and those in financial institutions and reception areas as well as any counter at which processing and signing of documents takes place. The provision is not intended to apply to work surfaces in industrial occupancies.

A-3.8.3.1.(1) Accessible Design Standards. By-law users who opt to apply the provisions of CSA B651, "Accessible design for the built environment," listed in Table 3.8.3.1. must do so without exception: they cannot randomly select and apply a mix of provisions from this By-law and that standard.

A-3.8.3.2.(2) Reduction in Clear Width of an Accessible Path of Travel. Figure A-3.8.3.2.(2) presents schematic examples of accessible paths of travel with a section whose clear width is reduced as permitted by Sentence 3.8.3.2.(2).

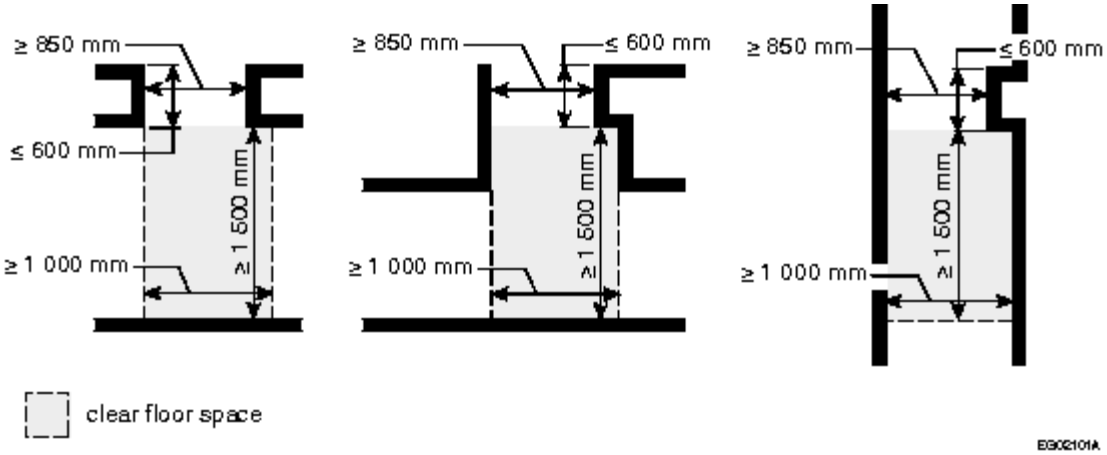


Figure A-3.8.3.2.(2)

Accessible paths of travel with a reduced clear-width section

A-3.8.3.2.(3) Surfaces in an Accessible Path of Travel. Floor finishes, including walk-off matts and carpet, should be selected, installed and securely fixed to provide a firm and stable surface so that people, including those who use mobility aids, can easily travel over them without tripping or expending undue energy. Other than very high-density, short-pile carpeting, most carpeting does not meet these criteria.

Furthermore, where the path of travel is exposed to intense light conditions, such as daylight or directional lighting, a low-glare or matte floor surface should be selected, as glare from floor surfaces can influence all users' perception, particularly those with vision loss. For the same reasons, heavily patterned flooring should also be avoided.

A-3.8.3.2.(6) Wheelchair-Turning Space. Sentence 3.8.3.2.(6) presents three options for the design of clear floor spaces at the end of long narrow sections of accessible paths of travel to allow persons using a wheelchair to turn around instead of having to back up.

Figure A-3.8.3.2.(6) illustrates one possible configuration of a T-shaped wheelchair-turning space.

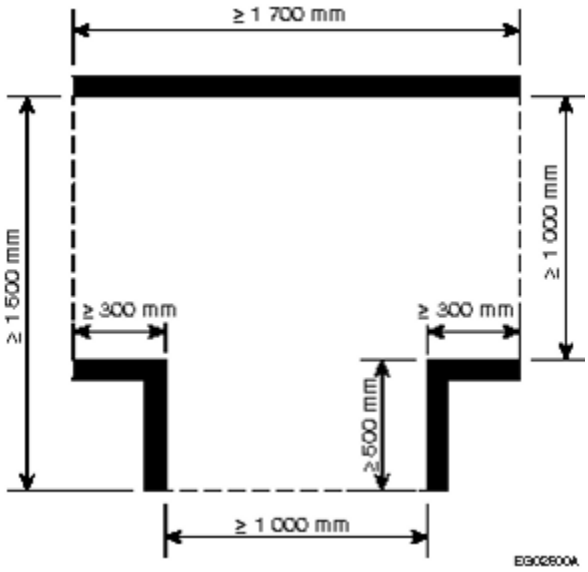


Figure A-3.8.3.2.(6)

T-shaped wheelchair-turning space

A-3.8.3.2.(8)(a) Mechanical Lifts. The provisions for mechanical lifts are not intended for general use to provide accessibility in an exterior location due to its susceptibility to weather or lack of maintenance. It is therefore intended that these be installed only where topography or other similar existing site constraints necessitate the use of a platform lift as the only feasible alternative. While the site constraint must reflect exterior conditions, the lift can be installed in the interior of a building. For example, a new building constructed between and connected to two existing buildings may have insufficient space to coordinate floor levels and also to provide ramped entry from the public way. In this example, an exterior or interior platform lift could be used to provide an accessible entrance or to coordinate one or more interior floor levels.

A-3.8.3.4.(1) Passenger-Loading Zones. The provision of the VBBL regarding Passenger-Loading Zones are applicable to dedicated spaces for the loading and unloading of passengers from vehicles which may require additional clearances due the use of lifts, or a larger than usual door swing to facilitate accessibility.

Sentence 3.8.3.4.(1) is intended to be applied to space for the standing of a vehicle for the purpose of discharging or taking on passengers – exterior on-site with direct grade level access such as a porte-cochere or covered loading area, or interior within the building floor area, where a bus, accessible passenger directed vehicle, or similar commercial passenger vehicle may be expected to be present. As such, this aligns with the requirements of the Parking By-law, where Passenger Class B or larger loading spaces are required by Section 7, or as otherwise required by the Director of Planning, in consultation with the City Engineer.

Note that the design of vehicular access, ingress and egress routes to and from these loading areas, are required to comply with the appropriate provision of the Parking By-law.

A-3.8.3.5.(1)(b) Ramp Slopes. Ramps with a slope of more than 1 in 16 can be very difficult for persons with certain physical disabilities with upper body mobility to manage. Even though they pose less of a problem for persons using motorized wheelchairs, these ramps can be unsafe to descend, especially in cold climates. Although Article 3.8.3.5. permits slopes on

ramps as great as 1 in 12 for distances of up to 9 m, slopes of 1 in 20 are safer and less strenuous. When limited space is available, as may be the case during renovations, ramps with a slope of up to 1 in 12 should be restricted to lengths not exceeding 3 m whenever possible. A strip contrasting in colour and texture should be used at the top and bottom of ramps to warn persons with low or no vision.

The phrase “uniform slope along its length” is intended to mean that the slope remains constant along the length of individual ramp segments.

A-3.8.3.5.(1)(c) Landing Design at Doorways Leading to Ramps.

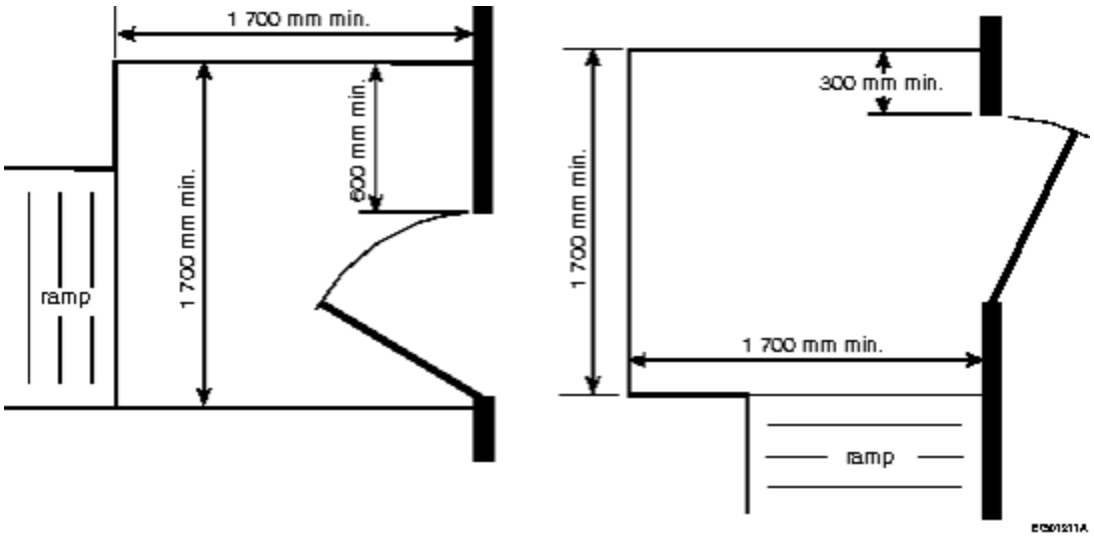


Figure A-3.8.3.5.(1)(c)

Landing design at doorways leading to ramps

A-3.8.3.5.(4)(a) Surface of Ramps. Sentence 3.8.3.2.(3) requires that all walking surfaces in an accessible path of travel be stable and firm to limit the effort required by persons using wheelchairs or other mobility aids. Therefore, Sentence 3.8.3.5.(4) requires that hard or resilient flooring be used on the surfaces of steeper ramps. Furthermore, carpet and like materials should not be installed on any ramp.

A-3.8.3.6.(2) Doorway Width. Standard wheelchair width specifications indicate a range of sizes from 584 mm overall to 685 mm overall. Every doorway that is located in an accessible path of travel must have a clear width of not less than 850 mm when the door is in the open position and therefore it is important that this dimension be measured correctly. Figure A-3.8.3.6.(2) shows a door opened to 90°. It is clear that the door, and to a lesser extent the stop, impinges on the space within the door frame. The clear width of not less than 850 mm is measured from the face of the door in the open position of 90° to the doorway to the outside edge of the stop on the door frame. It is not sufficient just to measure the inside width of the door frame. The hardware selected on sliding doors, such as D-shaped handles, may result in a clear width being substantially less than the inside dimension of the door frame. The clear width for sliding doors is measured from the edge of the open door to the outside edge of the stop on the door frame. Other factors should be taken into account, including the location of door stops other than on the door frame, and the installation of door closers and exit devices, even if they do not span the width of the entire door. The intrusion of a door handle or an exit device into the space is of lesser importance because its height above the floor does not typically obstruct passage using a wheelchair. It is recognized that there are many types of door frames and door mounts, but the overall objective is to maintain a clear width of not less than 850 mm.

Figure 3.8.3.6.(2) depicts a somewhat restrictive scenario, as many doors can open wider than 90° to ensure the minimum clear width of 850 mm that is required. Swing of a door beyond 90° may be of less benefit as extended reach to close the door may be required once the doorway is passed through.

In a doorway with multiple swinging leaves, the active leaf must be capable of providing the required clear width in the open position. The clear width is then measured from the face of the active leaf, in the open position of 90° to the doorway, to the outside edge of the adjacent leaf when the adjacent leaf is in the closed position.

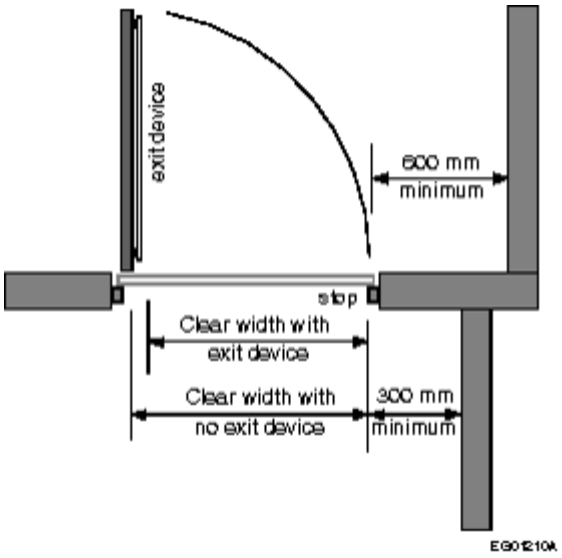


Figure A-3.8.3.6.(2)

Clear doorway width

A-3.8.3.6.(3) Washrooms in Residential Occupancies. This requirement ensures that the doorway to the washroom in a hotel or motel suite is at least large enough to accommodate someone using a wheelchair. The By-law does not require these washrooms to be accessible, in order to avoid a set of prescriptive requirements which could limit design flexibility. It is relatively simple to make washrooms accessible through careful planning and positioning of fixtures and this can be achieved in an area not much larger than that of conventional washrooms.

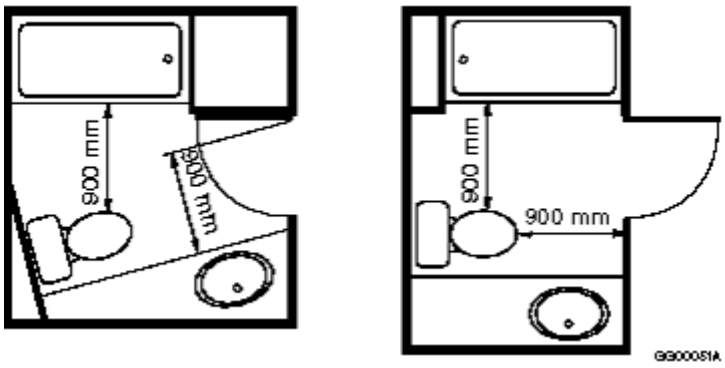


Figure A-3.8.3.6.(3)

Residential washrooms

A-3.8.3.6.(4) Lever Handles. Lever handles are usable by most people and will meet the intent of this requirement. Lever handles with an end return towards the door are less prone to catch the clothing of someone passing through the doorway. Large D-shaped handles should be used on sliding doors.

A-3.8.3.6.(6) and (7) Doors with Power Operators. Doors equipped with a power operator actuated by a pressure plate identified with the International Symbol of Access or, where security is required, by a key, card or radio transmitter, and that can otherwise be opened manually, meet the intent of the requirement. The location of these actuating devices should ensure that a wheelchair will not interfere with the operation of the door once it is actuated. Swinging doors equipped with power operators which are actuated automatically and open into passing pedestrian traffic should be provided with a guard or other device designed to prevent pedestrians from stepping in the swing area of the door. These guards or devices should be detectable by

blind persons. For example, inverted U-shaped guards should have an additional rail at a height not more than 680 mm so that it is detectable by the long cane. These doors should also have a device (mat or other sensor) on the swing side to prevent the door from opening if someone is standing in the swing area.

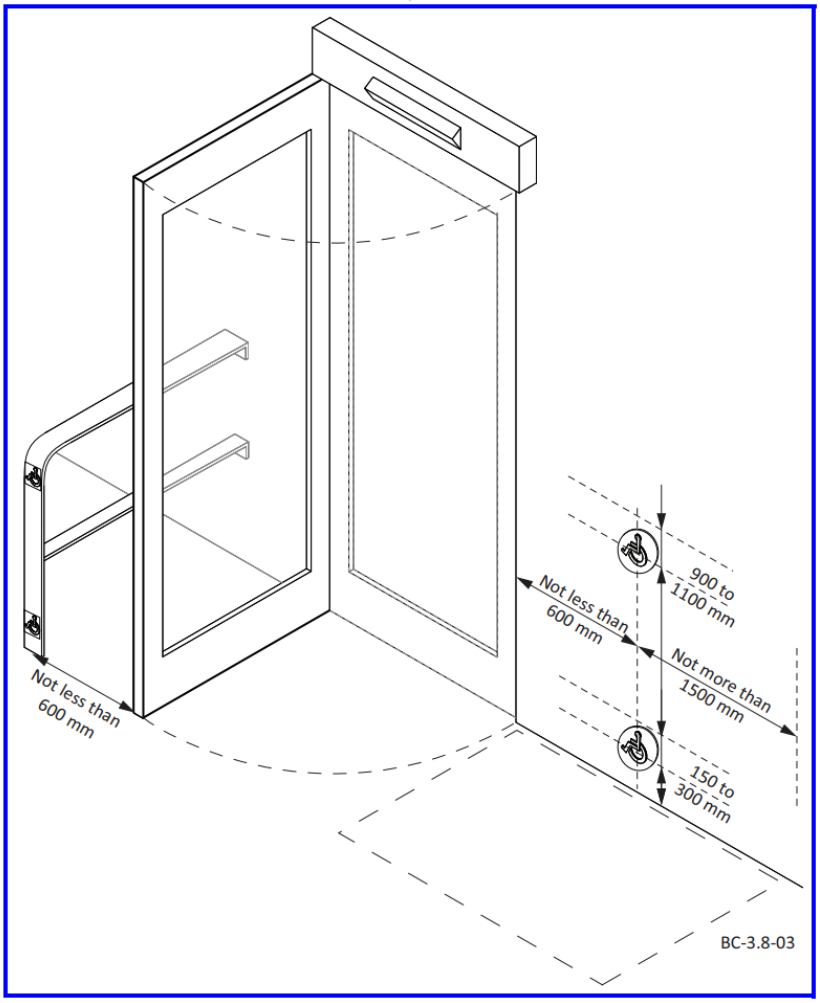


Figure A-3.8.3.6.(6) and (7)

Power operated doors

A-3.8.3.6.(9) Air Pressure Differences. Differences in air pressure on opposite sides of a door may be due to the operation of mechanical systems such as those associated with smoke control. So-called “stack action” in buildings in winter can also cause differential pressures due to the buoyancy of warm air. Stack action is usually most noticeable between stairwells and the remainder of the building, and at the entrances to buildings; the taller the building, the greater the effect. Doors with automatic closers have to operate with sufficient opening force to allow the return action to overcome the differential pressure.

A-3.8.3.6.(10) Delayed Action on Door Closers. In some circumstances, closers with a delay feature which keeps the door open for several seconds before it begins to close might be desirable. However, closers with this feature have limited back-check, a feature of a normal door closer where resistance to opening increases as the door reaches the full arc of swing. Doors equipped with a delayed action closer are therefore more susceptible to damage should the door be opened with too much force or should someone try to force it closed, thinking the closer has failed to operate. Delayed action closers are not recommended for such occupancies as schools.

A-3.8.3.6.(11) Clearance at Doorways. Sufficient clearance must be provided on the latch side of doors for a user to operate the door-opening mechanism and open the door without interference from the wheelchair. This is particularly important for a door swinging towards the approach side. See Figure A-3.8.3.6.(11).

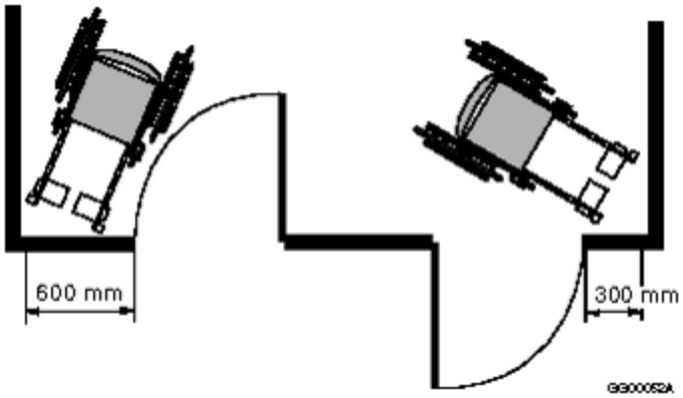


Figure A-3.8.3.6.(11)

Doorway clearance

A-3.8.3.6.(14) to (16) Minimum Clear Floor Space at Doors in an Accessible Path of Travel. Figure A-3.8.3.6.(14) to (16) presents schematic examples of the minimum clear floor space required at doors in an accessible path of travel. Power door operators serving doorways with a reduced width of the clear floor space should be operational at all times when the space is intended to be occupied.

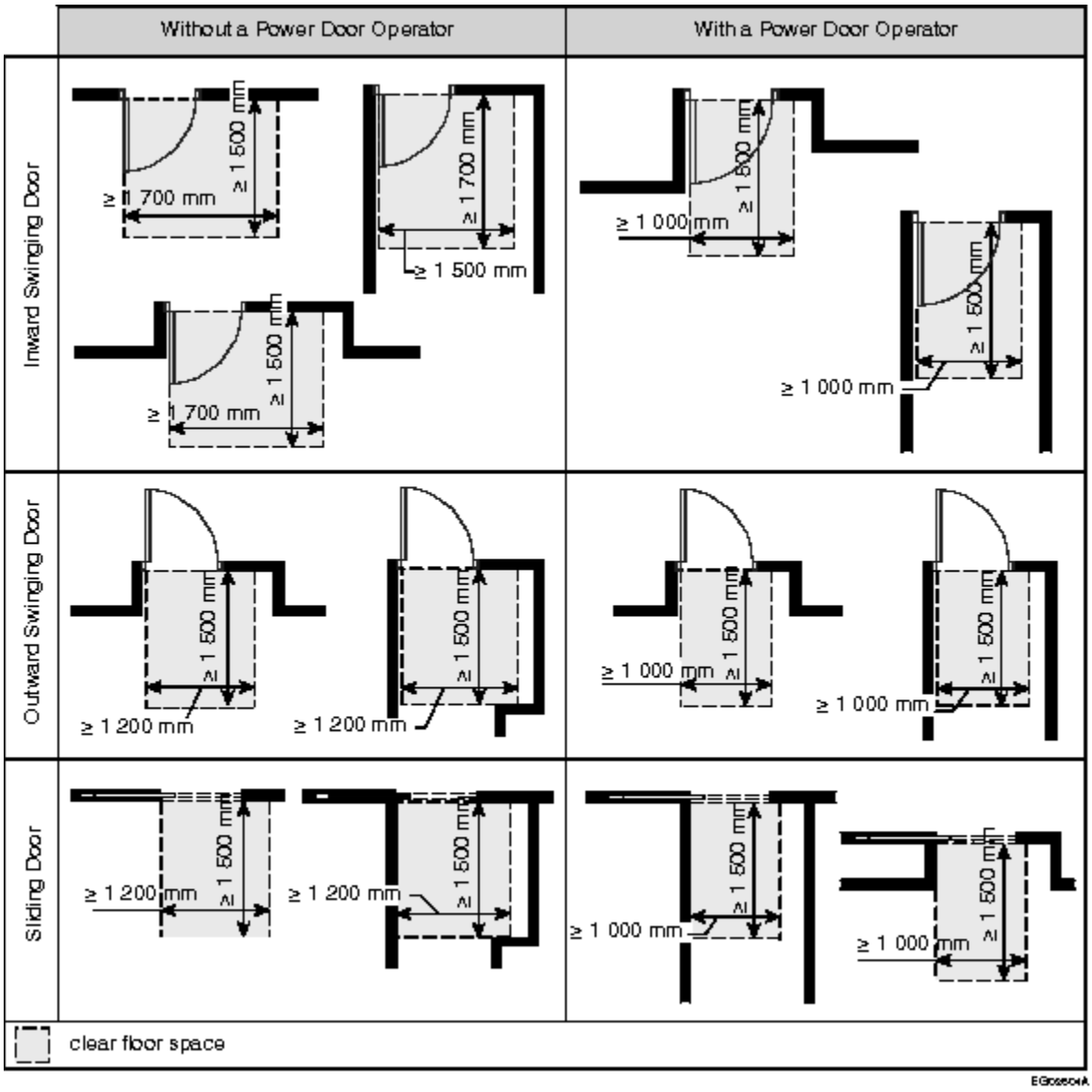


Figure A-3.8.3.6.(14) to (16)

Minimum clear floor space required at doors in an accessible path of travel

A-3.8.3.6.(17) Public Area. In the context of Sentence 3.8.3.6.(17), “public area” is intended to refer to a suite, room or area that is generally open to building occupants, such as a cafeteria, lounge room, washroom or office, but is not intended to include a space such as a janitor's room, service space or service room.

A-3.8.3.8.(1)(c) Controls with Feedback Signals. Security access systems are a typical example of systems that have controls that provide feedback signals, such as illumination and an audible cue, which should be accessible to all users.

A-3.8.3.9.(1) and (2) Visual and Tactile Information Signs.

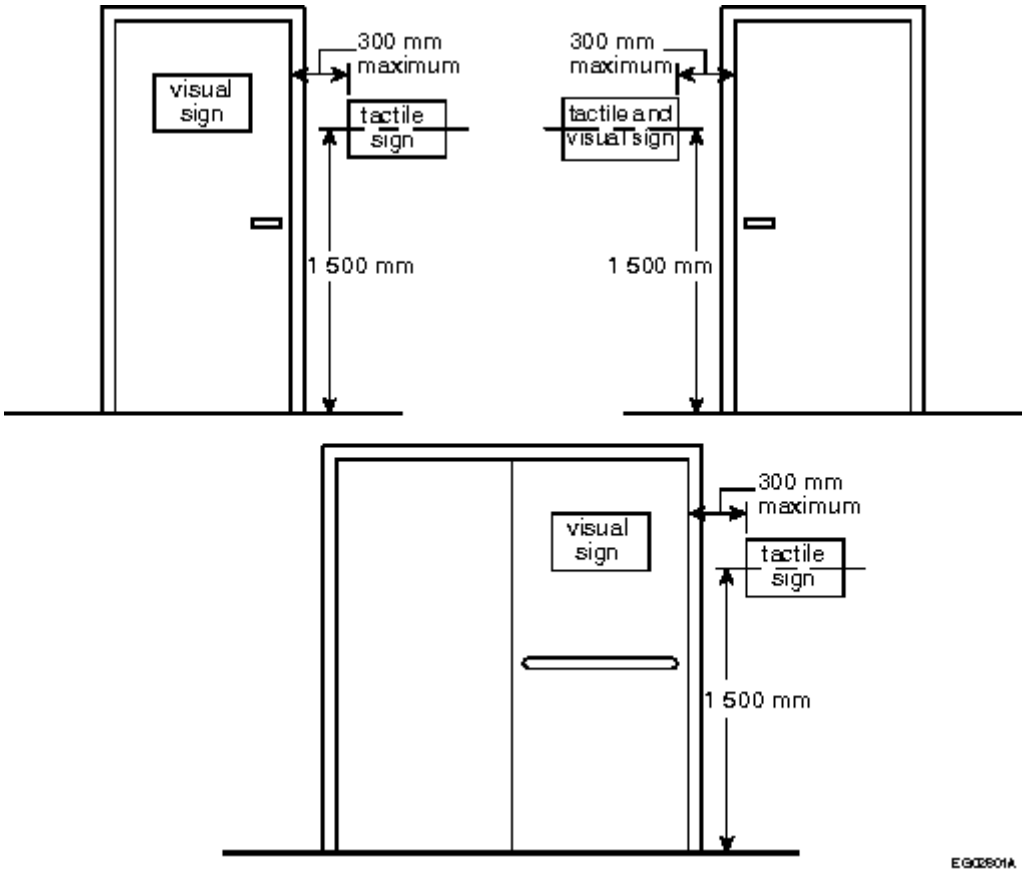


Figure A-3.8.3.9.(1) and (2)

Positioning of visual and tactile information signs on and near doors

A-3.8.3.9.(3) Accessibility Signs. The International Symbol of Access shown in Figure A-3.8.3.9.(3)-A indicates to persons with physical disabilities that they will have reasonable freedom of movement within a building so signed. The symbol is usually white on a blue background; where these colours do not stand out, the sign can be set on a white background. An arrow can be added to indicate direction or the location of an accessible space or facility.

Figure A-3.8.3.9.(3)-A

Signs indicating accessible facilities

The International Symbol of Access for Hearing Loss shown in Figure A-3.8.3.9.(3)-B, which indicates accessibility for persons who are deaf or hard of hearing, should be used to indicate the availability of variable volume controls on telephones, assistive listening systems, and text telephones (TT). These latter devices may also be referred to as teletypewriters (TTY) or telecommunications devices for the deaf (TDD).

Figure A-3.8.3.9.(3)-B

Signs for assistive listening facilities

When characters are used on signs to indicate accessible features, Arabic numerals and sans-serif letters with a stroke width to height ratio from 1 in 6 to 1 in 10 and a character width to height ratio from 3 in 5 to 1 in 1 should be used. Characters identifying doors and openings that lead from public areas and through which the public is permitted to pass should consist of Arabic numerals or sans-serif letters or both, be not less than 25 mm high and raised between 0.7 mm and 3 mm with a stroke to height ratio for ease of reading by touch. This identification should be located at the side of the doors or openings, centred 1 500 mm above the finished floor and within 150 mm of the jamb.

A-3.8.3.11.(2)(b) and (d) Water-Bottle Filling Stations.

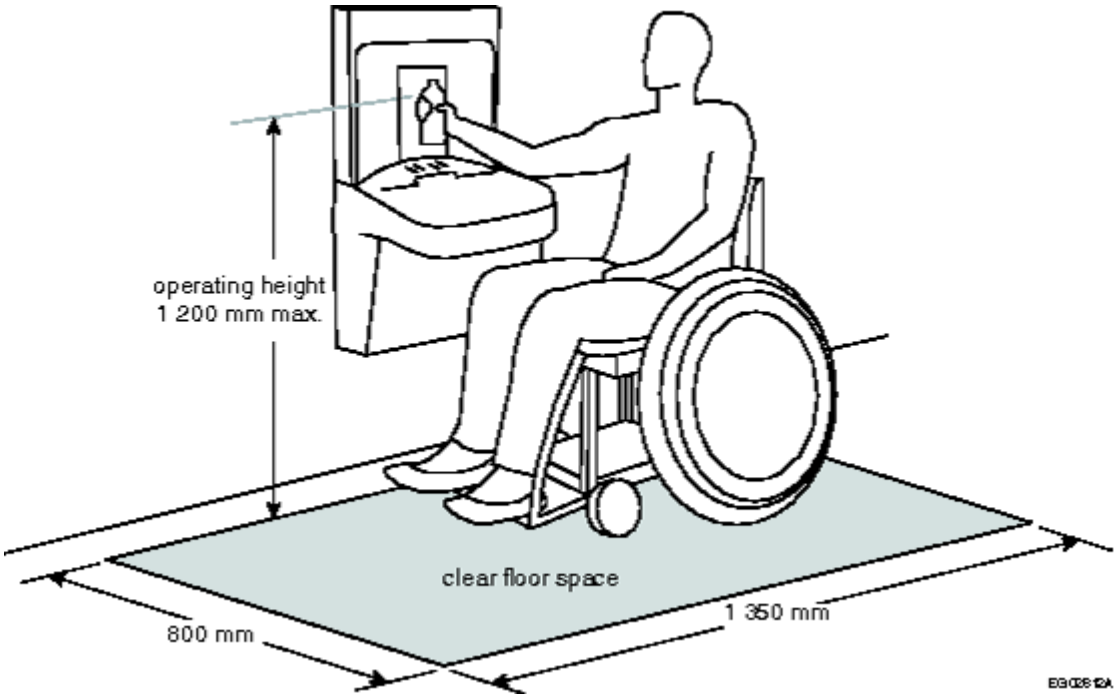


Figure A-3.8.3.11.(2)(b) and (d)

Clear floor space and operating height requirements for water-bottle filling stations

A-3.8.3.12.(1)(b) Lateral Transfer Space on Alternate Sides of Water Closet. The lateral transfer space required by Clause 3.8.3.12.(1)(b) should be provided on the right side in one accessible stall or universal washroom and on the left side in another so that users can choose the facility with a transfer space on the side they prefer to use.

A-3.8.3.12.(1)(d)(v) Water-closet Stalls. Doors to water-closet stalls for persons with physical disabilities should swing outward, preferably against a side wall.

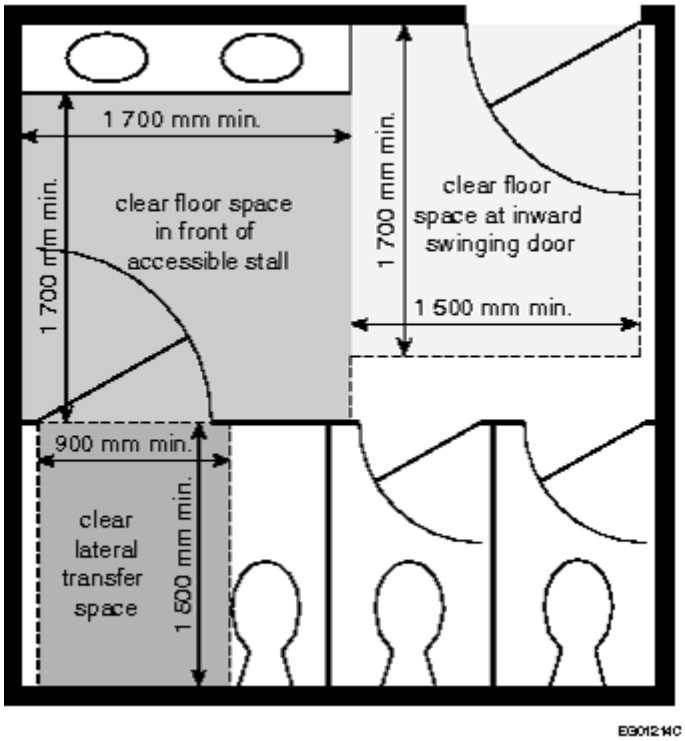


Figure A-3.8.3.12.(1)(d)(v)

Water-closet stalls

A-3.8.3.12.(1)(d)(vi) Door Pulls. The door pull should consist of a D-shaped handle mounted horizontally. The centre lines are the lines drawn through the long axis and the short axis of the handle. The midpoint of the handle must be located horizontally at 200 to 300 mm from the hinged side of the door and vertically at 900 to 1 100 mm above the finished floor surface.

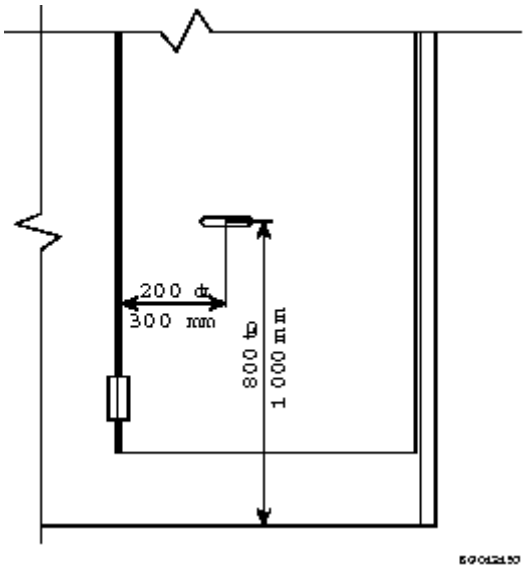


Figure A-3.8.3.12.(1)(d)(vi)-A

Door pull location

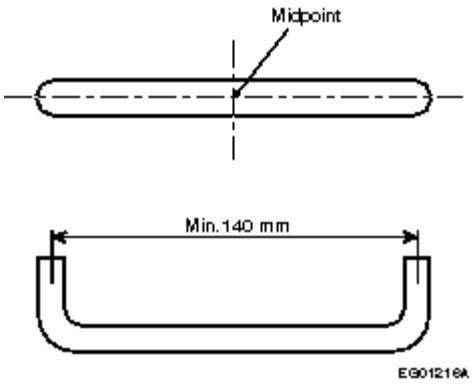


Figure A-3.8.3.12.(1)(d)(vi)-B

Door pull details

A-3.8.3.12.(1)(f)(ii) Additional Grab Bars. It is the designer's prerogative to exceed the minimum requirements found in this By-law and specify the installation of additional grab bars in other locations. These additional grab bars may be of different configurations and can be installed in other orientations.

A-3.8.3.13. Clear Floor Space in Universal Washrooms. Unobstructed areas in front of the lavatory, in front of the water closet and on one side of the water closet are necessary for maneuverability of a wheelchair. Wall-mounted fixtures may project into the required floor space, provided that such projections do not restrict the maneuvering space required for persons using wheelchairs. Although outward swinging doors are preferable for accessibility, inward swinging doors are also permitted. Figures A-3.8.3.13.-A and A-3.8.3.13.-B show design options that meet the intent of Article 3.8.3.13.

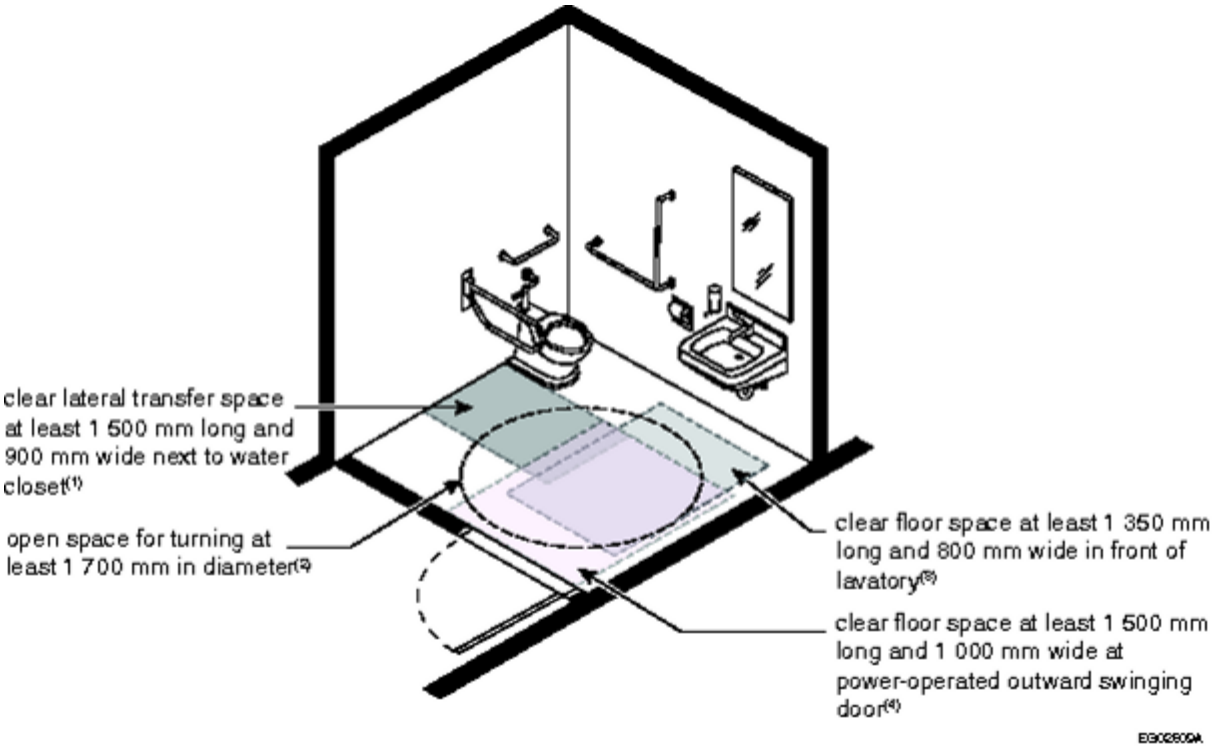


Figure A-3.8.3.13.-A

Universal washroom with outward swinging door

Notes to Figure A-3.8.3.13.-A:

(1) See Article 3.8.3.12.
(2) See Article 3.8.3.13.
(3) See Article 3.8.3.16.
(4) See Article 3.8.3.6.

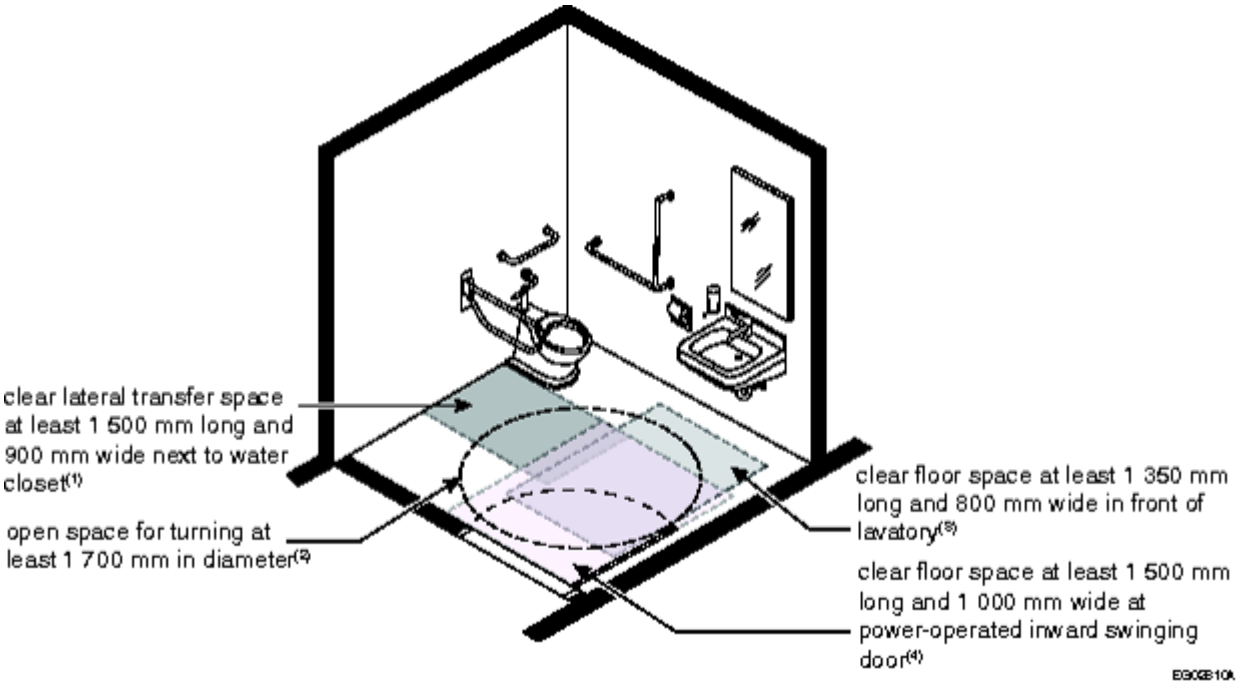


Figure A-3.8.3.13.-B

Universal washroom with inward swinging door

Notes to Figure A-3.8.3.13.-B:

(1) See Article 3.8.3.12.
(2) See Article 3.8.3.13.
(3) See Article 3.8.3.16.
(4) See Article 3.8.3.6.

A-3.8.3.14.(1) Water Closets. Wall- or floor-mounted water closets with recessed bases are preferable because they provide the least amount of obstruction.

A-3.8.3.16.(1)(e) Clearances Beneath a Lavatory.

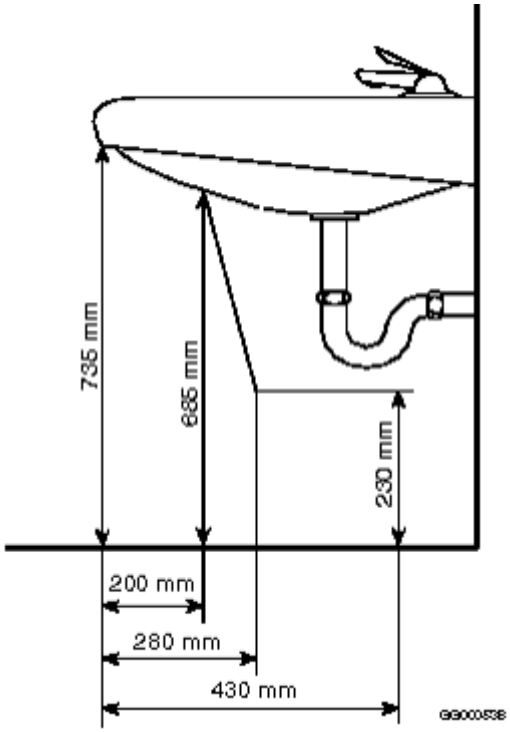


Figure A-3.8.3.16.(1)(e)

Clearances beneath a lavatory

A-3.8.3.16.(1)(f) Pipe Protection. The pipes referred to in Clause 3.8.3.16.(1)(f) include both supply and waste pipes. The hazard can be prevented by insulating the pipes, by locating the pipes in enclosures, or avoided by limiting the temperature of the hot water to a maximum of 45°C.

A-3.8.3.16.(1)(g) Soap Dispenser Location. The location of accessories, such as soap dispensers and faucets, serving accessible lavatories should be established while taking into consideration that their controls must be usable by and within the direct reach of a person in a seated position directly in front of the accessible lavatory.

A-3.8.3.17.(1)(b) Clear Space at Entrances to Showers. The clear space at the entrance to a shower may be encroached upon by fixtures such as a wall hung sink which does not interfere with the leg rests of the wheelchair. However, this sink could restrict movement for persons who need to make a lateral transfer if it were installed at the seat end of the shower.

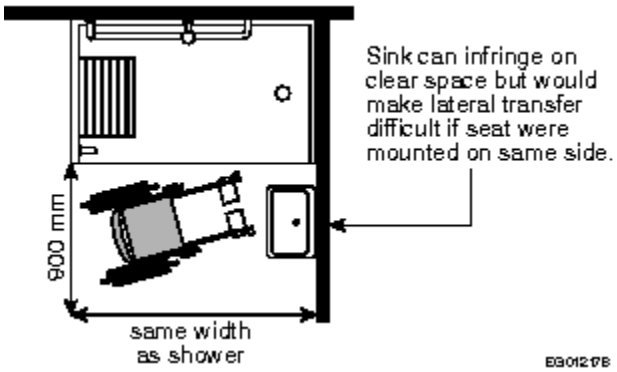


Figure A-3.8.3.17.(1)(b)

Shower design

A-3.8.3.17.(1)(f) Grab Bars. One L-shaped grab bar is required to be installed on the wall next to the seat. A grab bar behind the seat would prevent the user from leaning back against the wall, while one located on the wall opposite the seat cannot be reached from the seated position. The seat itself may be used in conjunction with the bar for transfer. If design flexibility is required, fold away grab bars can be used as an alternative.

A-3.8.3.17.(2)(f) Grab Bar at Bench. Where a bench in a universal dressing and shower room is located adjacent to a wall, it is recommended that a grab bar be installed to assist users in transferring to the bench.

A-3.8.3.19. Assistive Listening Systems. Examples of assistive listening systems include FM, infrared and induction loop systems. However, the technology in this field is advancing rapidly; as such, other types of assistive listening systems could be considered in the design of a space. In choosing the most appropriate system, a number of factors must be taken into account including cost, installation and maintenance requirements, suitability for the intended user or audience, ease of operation, and the need for privacy. Information on designers and suppliers of such systems can be obtained from the Canadian Hearing Society. The intent of Article 3.8.3.19. is to provide clear communication where information, goods or services are provided to the public.

Wireless sound transmission systems, including FM, infrared and magnetic induction loop systems, improve sound reception for persons who are hard of hearing by providing amplification that can be adjusted by each user while blocking out unwanted background noise. Some of these systems transmit a signal that is picked up by a special receiver (FM, infrared) available for use by a person who is hard of hearing, whether or not a hearing aid is used. None of the systems interfere with the listening enjoyment of others.

The transmitter can be connected into an existing public address (P.A.) system amplifier or used independently with microphones. The induction loop system (see Figure A-3.8.3.19.-C) requires users with a hearing aid or cochlear implant to be in the area circumscribed by the loop; though installation of the loop is relatively simple, the installer should be knowledgeable about these systems if proper functioning is to be achieved. FM and infrared systems can be designed to broadcast signals that cover the entire room and thus do not restrict seating to any one area. Figures A-3.8.3.19.-A and A-3.8.3.19.-B show the general configuration of FM and infrared systems. Although portable systems (FM systems, in particular) are available, these are best suited to small audiences. Generally, the systems installed in church halls, auditoria, theatres and similar places of assembly are not easily portable, as they are installed in a fixed location by a sound technician and form an integral part of the P.A. system of the room or building.

Hard-wired systems (where a connection is provided at a particular seat in an auditorium, for example) might meet this requirement when adequate provisions are made to accommodate persons with hearing aids.

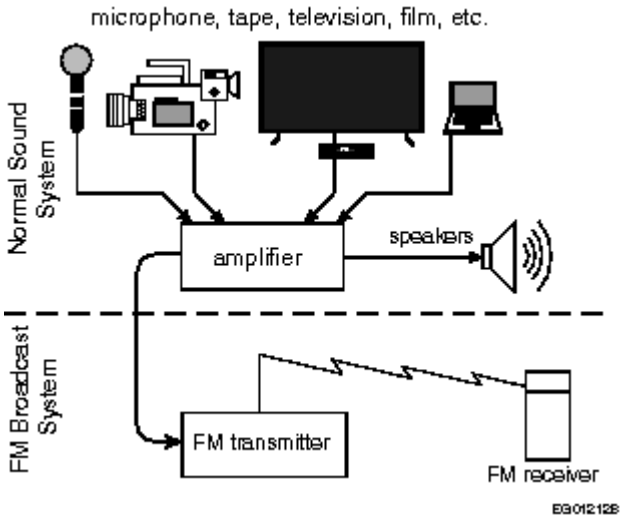


Figure A-3.8.3.19.-A

FM sound transmission system

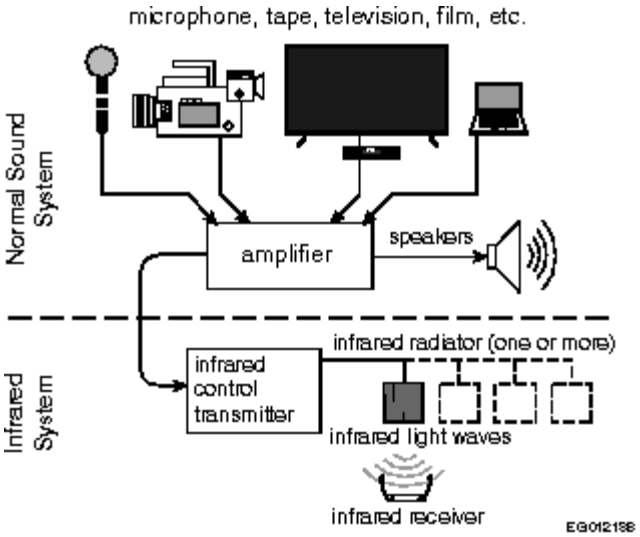


Figure A-3.8.3.19.-B

Infrared sound transmission system

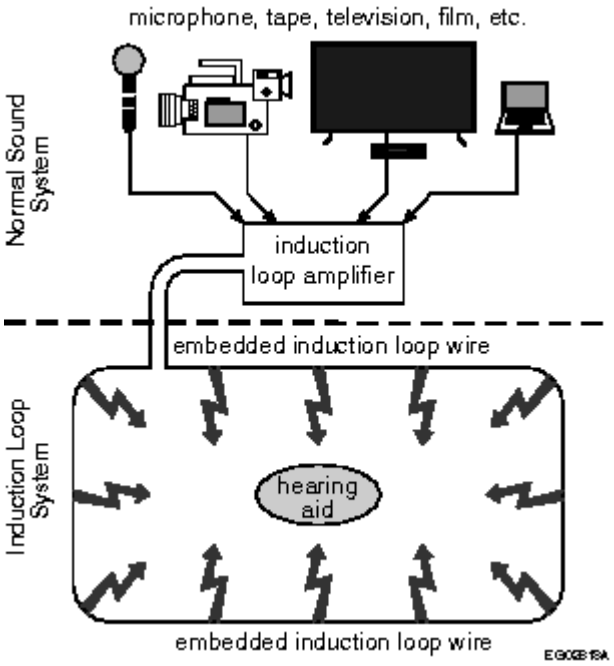


Figure A-3.8.3.19.-C

Induction loop sound transmission system

A-3.8.3.20.(1)(c) Knee Space at Service Counters. Where forward-facing interaction with a person is required, the knee space requirement of Clause 3.8.3.20.(1)(c) applies to both sides of the service counter to ensure accessibility for both service providers and those receiving services.

A-3.8.3.21.(2) Telephone Shelves or Counters. Built-in shelves or counters for public telephones must be designed to accommodate persons using text telephones (TT). These devices may also be referred to as teletypewriters (TTY) or telecommunication devices for the deaf (TDD). These devices require a level surface at least 305 mm deep by 250 mm wide with no obstruction above that space within 250 mm. If a wall-hung telephone or other obstruction extends to less than 250 mm from the shelf or counter, an equivalent clear space must be provided on either side of each telephone. At least one telephone should be equipped with a volume control on a receiver that generates a magnetic field compatible with the T-switch of a hearing aid. The lower portion of the shelf or counter is intended for persons using a wheelchair; therefore all parts of the operating mechanism of the telephone above this portion should be within reach of a person using a wheelchair.

A-3.8.3.22.(4) Storage Spaces for Mobility Aids. The intent of Sentence 3.8.3.22.(4) is that a sufficient number of storage spaces for mobility aids other than wheelchairs and scooters (e.g., walkers) be located such that they can be accessed without leaving the seating area. These storage spaces should preferably be visible from the adaptable seats. The storage spaces may be located adjacent to an aisle but must not reduce the required egress width of the aisle or obstruct egress from the rows of seats.

A-3.8.5.3.(1) Entrance Doors to Dwelling Units. The Chief Building Official will accept the addition of one or two peepholes in a listed door in order to meet the requirements of Clause (1)(a) and to meet the required fire protection rating.

A-3.8.5.4.(1). Adaptable Dwelling Unit Doorways. Where sliding doors are used to provide access, it is necessary to consider the door hardware when determining clear width. Accessible hardware described in Sentence 3.8.3.6.(4) may result in a sliding door standing out from the jamb when in the open position. If not provided with the door during initial construction, accessible hardware when installed must not reduce the clear width of opening to less than required for access.

A-3.8.5.5. Adaptable Dwelling Unit Bathrooms. Figure A-3.8.5.5. illustrates an acceptable layout of an adaptable dwelling unit bathroom.

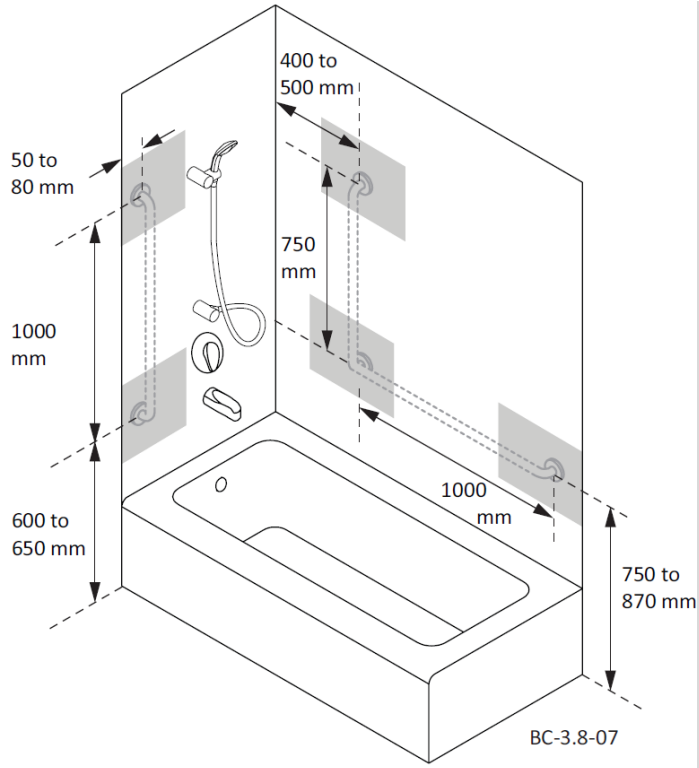


Figure A-3.8.5.5.

Adaptable Dwelling Unit Bathrooms

Despite the requirements of Article 3.8.5.5., the Chief Building Official may accept a lesser standard.

A-3.8.5.5.(1) Location of Adaptable Dwelling Unit Bathrooms. One of the fundamental objectives of the Adaptable Dwelling Unit provisions is to allow for the future installation of a three piece bathroom on the principal floor of each unit with features facilitating use for a persons with a range of abilities. Consequently, the requirements of Article 3.8.5.5.(1) are intended to require that sufficient space is allocated at the outset so that the principal floor of the dwelling unit can accommodate a future three piece bathroom and space for the effective use of its fixtures. This allows for the flexible use of the living space most readily providing access to the exterior for persons with varying degrees of mobility.

In the event that the specific design constraints of the ground floor does not allow for the effective inclusion of a bathroom, the Chief Building Official may permit the allocation of space for the piece washroom on another floor. Similarly, a minimum 40 m^2 floor area has been established to account for the decreasing efficiency in space use and impact on livability in smaller units.

CBO's Interim Position on the design of spaces for the future accommodation of low barrier showers (Updated April 15, 2025):

1. That the triggering requirement for the adaptable bathroom would be based upon an assessment of the size of the livable floor space of a suite on a floor-by-floor basis, meaning that:
   a. at least one adaptable bathroom in a suite is required where any livable floor space exceeds 40 m^2,
   b. the determination of livable floor space is based upon that portion of the floor area of a given storey of the building which is intended for daily use containing kitchen, living, or dining facilities,
   c. that the adaptable washroom should be provided on the principal living space with ground level access, on a floor area that is 40 m^2 or more in order to perform its intended function, and
   d. the current extent of the adaptable bathroom requirements for 3.8.5.5. require either a 3 piece bathroom set, or a sink and toilet plus suitable provision for future installation of a low barrier shower.
2. The underlying general intent of the adaptable bathroom provisions of 3.8.5.5. are to require a dedicated bathroom space ready for future adaptation to accommodate an occupant whose may have physical needs have changes such that they differ from what the present arrangement can accommodate at a minimal cost to the owner.

3. Where an owner opts to forego a 3 piece bathroom, a proposal for a two piece adaptable washroom generally complying with Article 3.8.5.5. shall include the following:
    a. a washbasin and toilet;
    b. the pre allocation of a dedicated space for the installation of a low barrier shower which:
        i. is a dedicated separate space that is not currently a part of the 2 piece bathroom, (such as a 3'X3' / 3'X 4' / 3'X5' / 5'x2.5' bathtub size);
        ii. may include storage space or similar non-essential space;
        iii. may not include the current washer and dryer location, service rooms or spaces,
        iv. shall have suitable structural support to accommodate the future installation of the low barrier shower and surrounds; and
        v. where the floor is concrete or has a concrete topping, it shall be constructed to accommodate for the future installation of the shower that does not require extensive demolition or cutting of the concrete.
    c. a minimum clear floor space of 750mm X 1200mm for maneuvering shall be provided in front of the washbasin, toilet, and the dedicated bathtub / shower space.
        i. The clear floor space is to be designed to allow sufficient maneuvering room for the occupant to readily transition to and from the future low barrier shower from dedicated separate space without unusual effort; and
        ii. The minimum clear floor space may not overlap the sink, toilet, or the dedicated space for the lower barrier shower.
    d. The washroom fixtures shall not overlap nor shall they overlap the dedicated space.
    e. Preplumbing shall be required to support the future installation of a low barrier shower:
        i. with domestic cold and hot water;
        ii. with a drain intended for the future installation of a low barrier shower; and
        iii. without requiring extensive or costly modification to a facilitate the future installation of the low barrier shower.; and
    f. The design drawings shall indicate:
        i. the location and extents of the dedicated space for the low barrier shower and indicate the location of all pre-plumbing roughed-in at the dedicated separate space on the initial permit application drawings,
        ii. walls intended to be demolished or renovated to make way for a future low barrier shower shall not contain equipment, service panels, wiring, piping, or other services that cannot be readily relocated.

A-3.8.5.5.(2) Grab Bar Installation. This provision is intended to provide adequate backing for the installation of grab bars by the occupant of the adaptable dwelling unit in the future. For example, plywood or solid lumber behind the wall finish and encompassing the location of future grab bars located as described in Clause 3.8.3.11.(1)(e) and Clause 3.8.3.16.(1)(f) or 3.8.3.17.(1)(f) would provide suitable backing for the grab bar fasteners.

A-3.8.5.5.(3)(a) Offset controls. Offset controls should not be provided for new construction. It should not be required for a person in a wheelchair to transfer to an adjacent fixture in order to reach the controls (see CSA-B651 for examples of good design practice). The intent of offset controls is to facilitate access to fixture controls for persons in a wheelchair, having limited mobility, or requiring a mobility aid. The offset typically includes a change in position of the controls from the traditional halfway mark at the centreline of the bathtub or shower to towards the exterior edge adjacent to the clear floor area. Even where controls are offset, these are often still not easily reachable over adjoining fixtures. Therefore, these should only be considered only in the conversion of existing bathrooms, where controls available from the open side cannot be readily achieved due to significant limitations of the existing construction.

A-3.9.2.1.(1) Building Area of Self-service Storage Buildings. Sentence 3.9.2.1.(1) permits a group of self-service storage buildings to be treated as a single building for determining the construction requirements and number of streets that the group faces under Subsection 3.2.2. This can often result in more stringent construction criteria for the individual buildings than would be required if their construction requirements were determined based on each building's individual area.

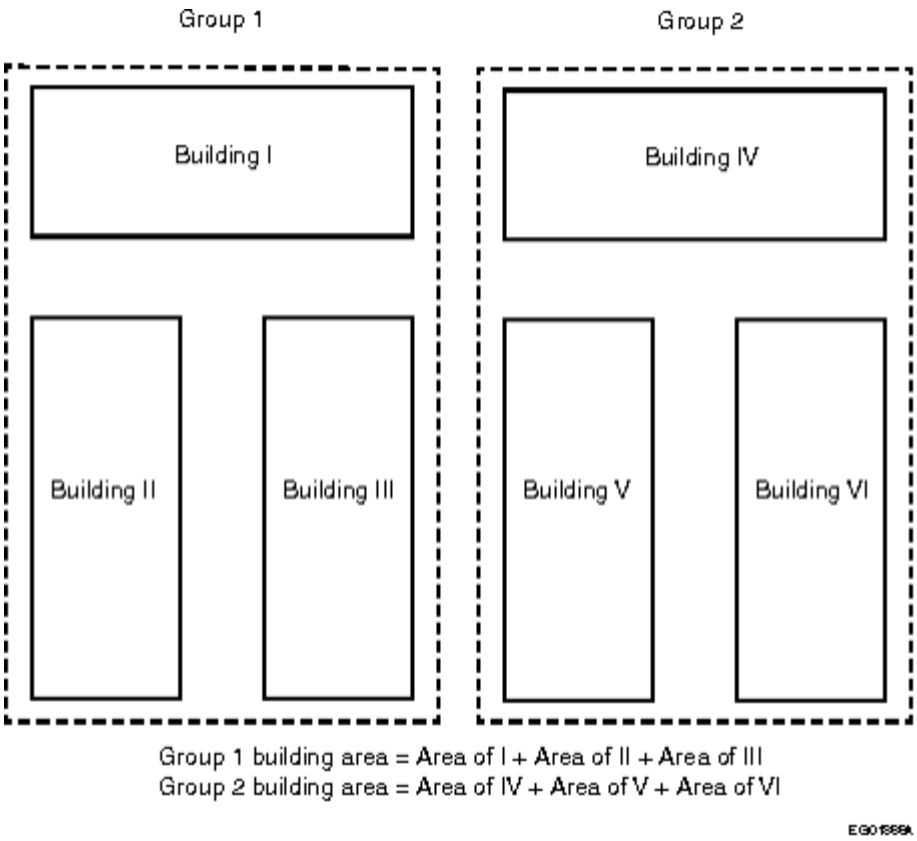


Figure A-3.9.2.1.(1)

Building area of self-service storage buildings

A-3.9.2.2. Spatial Separation Between Self-service Storage Buildings. Where a group of self-service storage buildings is treated as a single building as permitted in Sentence 3.9.2.1.(1), buildings within the same group are exempted from the spatial separation requirements in Subsection 3.2.3. as long as a minimum distance of 6 m is provided between each of them. If the owner wants less distance between the buildings, the requirements of Subsection 3.2.3. must be applied.

In addition, where there are multiple groups of buildings on a single property, the minimum distance required to separate one group from another group is the greater of 9 m and the limiting distance calculated in Subsection 3.2.3.

Except as provided in Article 3.9.2.2., Subsection 3.2.3. applies to each building within a group.

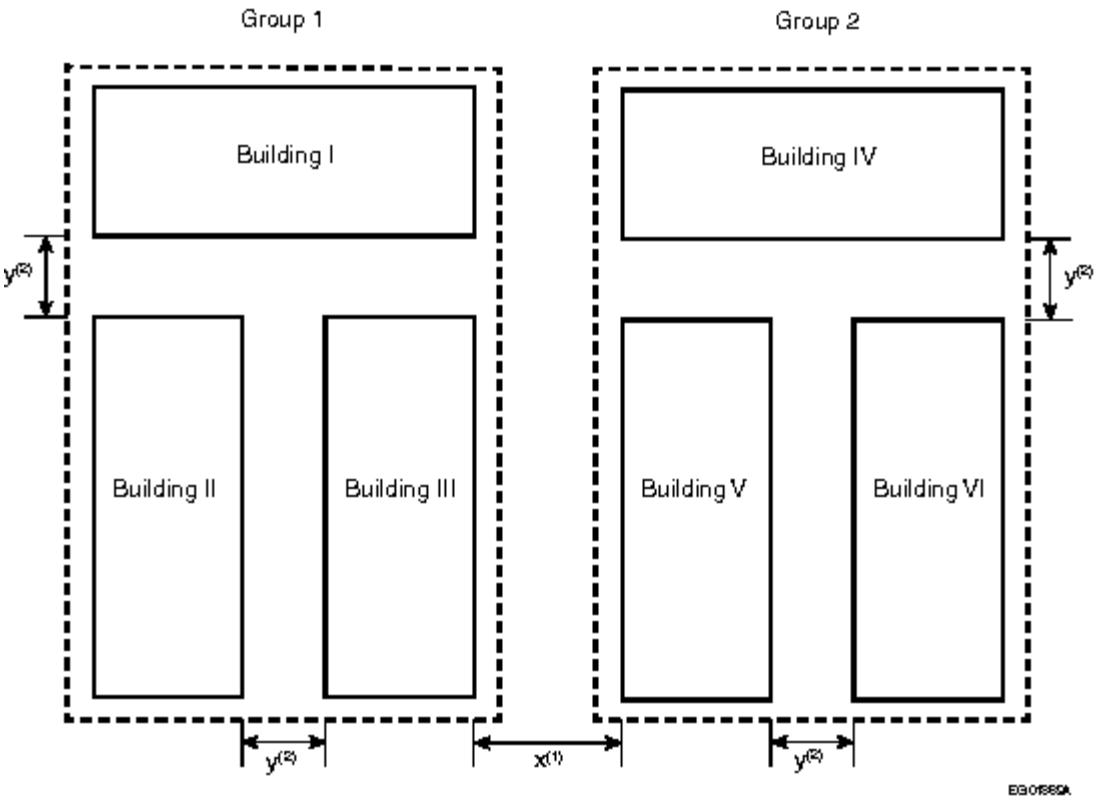


Figure A-3.9.2.2.

Spatial separation between self-service storage buildings
Notes to Figure A-3.9.2.2.:
(1) x = 9 m, or the distance calculated in Subsection 3.2.3., whichever is greater.
(2) y ≥ 6 m, or Subsection 3.2.3. applies.

A-3.9.3.1.(1) Storage of Flammable and Combustible Liquids. Refer to Subsection 4.2.12. of Division B of the NFC for requirements regarding the storage of flammable and combustible liquids in individual self-service storage units.

A-3.9.3.2.(1) Sanitary Facilities. Properties with self-service storage buildings on them may have multiple buildings or one large building. Due to the low occupant load of these types of buildings, only one building on the property is required to have a pair of washrooms.

Part 4
Structural Design

Section 4.1. Structural Loads and Procedures

4.1.1. General

4.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

4.1.1.2. Definitions

1) Words that appear in italics in this Part are defined in Article 1.4.1.2. of Division A.

4.1.1.3. Design Requirements

1) *Buildings* and their structural members and connections, including formwork and falsework, shall be designed to have sufficient structural capacity and structural integrity to safely and effectively resist all loads, effects of loads and influences that may reasonably be expected, having regard to the expected service life of *buildings*, and shall in any case satisfy the requirements of this Section. (See Note A-4.1.1.3.(1).)

2) *Buildings* and their structural members shall be designed for serviceability, in accordance with Articles 4.1.3.4., 4.1.3.5. and 4.1.3.6. (See Note A-4.1.1.3.(2).)

3) All permanent and temporary structural members, including the formwork and falsework of a *building*, shall be protected against loads exceeding the specified loads during the construction period except when, as verified by analysis or test, temporary overloading of a structural member would result in no impairment of that member or any other member.

4) Falsework, scaffolding, and formwork shall be designed in conformance with

a) CSA S269.1, “Falsework and formwork,”

b) CSA S269.2, “Access scaffolding for construction purposes,” or

c) CAN/CSA-S269.3-M, “Concrete Formwork.”

5) Precautions shall be taken during all phases of *construction* to ensure that the *building* is not damaged or distorted due to loads applied during *construction*.

4.1.1.4. Structural Drawings and Related Documents

1) Structural drawings and related documents shall conform to the appropriate requirements of Section 2.2. of Division C. (See Subsection 2.2.4. of Division C.)

4.1.1.5. Design Basis

1) Except as provided in Sentence (2), *buildings* and their structural members shall be designed in conformance with the procedures and practices provided in this Part.

2) Provided the design is carried out by a person especially qualified in the specific methods applied and provided the design demonstrates a level of safety and performance in accordance with the requirements of Part 4, *buildings* and their structural components falling within the scope of Part 4 that are not amenable to analysis using a generally established theory may be designed by

a) evaluation of a full-scale structure or a prototype by a loading test, or

b) studies of model analogues.

(See Note A-4.1.1.5.(2).)

4.1.2. Specified Loads and Effects

4.1.2.1. Loads and Effects

(See Note A-4.1.2.1.)

1) Except as provided in Article 4.1.2.2., the following categories of loads, specified loads and effects shall be taken into consideration in the design of a *building* and its structural members and connections:

D *dead load* – a permanent load due to the weight of *building* components, as specified in Subsection 4.1.4.,

E earthquake load and effects – a rare load due to an earthquake, as specified in Subsection 4.1.8.,

H a permanent load due to lateral earth pressure, including *groundwater*,

L *live load* – a variable load due to intended use and *occupancy* (including loads due to cranes and the pressure of liquids in containers), as specified in Subsection 4.1.5.,

LXC *live load* exclusive of crane loads,

C *live load* due to cranes including self weight,

Cd self weight of all cranes positioned for maximum effects,

C7 crane bumper impact load,

P permanent effects caused by pre-stress,

S variable load due to snow, including ice and associated rain, as specified in Article 4.1.6.2., or due to rain, as specified in Article 4.1.6.4.,

T effects due to contraction, expansion, or deflection caused by temperature changes, shrinkage, moisture changes, creep, ground settlement, or a combination thereof (see Note A-4.1.2.1.(1)), and

W wind load – a variable load due to wind, as specified in Subsection 4.1.7.,

where

a) load means the imposed deformations (i.e. deflections, displacements or motions that induce deformations and forces in the structure), forces and pressures applied to the *building* structure,

b) permanent load is a load that changes very little once it has been applied to the structure, except during repair,

c) variable load is a load that frequently changes in magnitude, direction or location, and

d) rare load is a load that occurs infrequently and for a short time only.

2) Minimum specified values of the loads described in Sentence (1), as set forth in Subsections 4.1.4. to 4.1.8., shall be increased to account for dynamic effects where applicable.

3) For the purpose of determining specified loads S, W or E in Subsections 4.1.6., 4.1.7. and 4.1.8., *buildings* shall be assigned an Importance Category based on intended use and *occupancy*, in accordance with Table 4.1.2.1. (See Note A-4.1.2.1.(3).)

Table 4.1.2.1.
Importance Categories for Buildings(1)
Forming Part of Sentence 4.1.2.1.(3)

Type of Building	Importance Category
A Low Importance Category *building* is a *building* that represents a low direct or indirect hazard to human life in the event of structural failure.	Low
A Normal Importance Category *building* is a *building* that does not meet the criteria for a Low Importance Category *building*, High Importance Category *building* or *post-disaster building*.	Normal
A High Importance Category *building* is a building that provides a greater degree of safety to human life than a Normal Importance Category *building*. Community centres and elementary, middle and secondary schools are High Importance Category *buildings*.	High
A *post-disaster building*.	Post-disaster

Notes to Table 4.1.2.1.:
(1) See Note A-Table 4.1.2.1.

4.1.2.2. Loads Not Listed

1) Where a *building* or structural member can be expected to be subjected to loads, forces or other effects not listed in Article 4.1.2.1., such effects shall be taken into account in the design based on the most appropriate information available. (See Note A-4.1.2.2.(1).)

4.1.3. Limit States Design

(See Note A-4.1.3.)

4.1.3.1. Definitions

1) In this Subsection, the term

a) limit states means those conditions of a *building* structure that result in the *building* ceasing to fulfill the function for which it was designed (those limit states concerning safety are called ultimate limit states (ULS) and include exceeding the load-carrying capacity, overturning, sliding and fracture; those limit states that restrict the intended use and *occupancy* of the *building* are called serviceability limit states (SLS) and include deflection, vibration, permanent deformation and local structural damage such as cracking; and those limit states that represent failure under repeated loading are called fatigue limit states),

b) specified loads (C, D, E, H, L, P, S, T and W) means those loads defined in Article 4.1.2.1.,

c) principal load means the specified variable load or rare load that dominates in a given load combination,

d) companion load means a specified variable load that accompanies the principal load in a given load combination,

e) service load means a specified load used for the evaluation of a serviceability limit state,

f) principal-load factor means a factor applied to the principal load in a load combination to account for the variability of the load and load pattern and the analysis of its effects,

g) companion-load factor means a factor that, when applied to a companion load in the load combination, gives the probable magnitude of a companion load acting simultaneously with the factored principal load,

h) importance factor, I, means a factor applied in Subsections 4.1.6., 4.1.7. and 4.1.8. to obtain the specified load and take into account the consequences of failure as related to the limit state and the use and *occupancy* of the *building*,

i) factored load means the product of a specified load and its principal-load factor or companion-load factor,

j) effects refers to forces, moments, deformations or vibrations that occur in the structure,

k) nominal resistance, R, of a member, connection or structure, is based on the geometry and on the specified properties of the structural materials,

l) resistance factor, φ, means a factor applied to a specified material property or to the resistance of a member, connection or structure, and that, for the limit state under consideration, takes into account the variability of dimensions and material properties, workmanship, type of failure and uncertainty in the prediction of resistance, and

m) factored resistance, φR, means the product of nominal resistance and the applicable resistance factor.

4.1.3.2. Strength and Stability

1) A *building* and its structural components shall be designed to have sufficient strength and stability so that the factored resistance, φR, is greater than or equal to the effect of factored loads, which shall be determined in accordance with Sentence (2).

2) Except as provided in Sentence (3), the effect of factored loads for a *building* or structural component shall be determined in accordance with the requirements of this Article and the following load combination cases, the applicable combination being that which results in the most critical effect:

a) for load cases without crane loads, the load combinations listed in Table 4.1.3.2.-A, and

b) for load cases with crane loads, the load combinations listed in Table 4.1.3.2.-B.

(See Note A-4.1.3.2.(2).)

3) Other load combinations that must also be considered are the principal loads acting with the companion loads taken as zero.

4) Where the effects due to lateral earth pressure, H, restraint effects from pre-stress, P, and imposed deformation, T, affect the structural safety, they shall be taken into account in the calculations, with load factors of 1.5, 1.0 and 1.25 assigned to H, P and T respectively. (See Note A-4.1.3.2.(4).)

5) Except as provided in Sentence 4.1.8.16.(2), the counteracting factored *dead load*—0.9D in load combination cases 2, 3 and 4 and 1.0D in load combination case 5 in Table 4.1.3.2.-A, and 0.9D in load combination cases 1 to 5 and 1.0D in load combination case 6 in Table 4.1.3.2.-B—shall be used when the dead load acts to resist overturning, uplift, sliding, failure due to stress reversal, and to determine anchorage requirements and the factored resistance of members. (See Note A-4.1.3.2.(5).)

6) The principal-load factor 1.5 for *live loads* L in Table 4.1.3.2.-A and L_{XC} in Table 4.1.3.2.-B may be reduced to 1.25 for liquids in tanks.

7) The companion-load factor for *live loads* L in Table 4.1.3.2.-A and L_{XC} in Table 4.1.3.2.-B shall be increased by 0.5 for storage areas, and equipment areas and service rooms referred to in Table 4.1.5.3.

Table 4.1.3.2.-A
Load Combinations Without Crane Loads for Ultimate Limit States
Forming Part of Sentences 4.1.3.2.(2) and (5) to (10), and 4.2.4.1.(3)

Case	Load Combination[1]	
	Principal Loads	Companion Loads
1	1.4D[2]	—
2	(1.25D[3] or 0.9D[4]) + 1.5L[5]	1.0S[6] or 0.4W
3	(1.25D[3] or 0.9D[4]) + 1.5S	1.0L[6][7] or 0.4W
4	(1.25D[3] or 0.9D[4]) + 1.4W	0.5L[7] or 0.5S
5	1.0D[4] + 1.0E[8]	0.5L[6][7] + 0.25S[6]

Notes to Table 4.1.3.2.-A:
[1] See Sentences 4.1.3.2.(2) to (4).

[2] See Sentence 4.1.3.2.(9).
[3] See Sentence 4.1.3.2.(8).
[4] See Sentence 4.1.3.2.(5).
[5] See Sentence 4.1.3.2.(6).
[6] See Article 4.1.5.5.
[7] See Sentence 4.1.3.2.(7).
[8] See Sentence 4.1.3.2.(10).

Table 4.1.3.2.-B

Load Combinations With Crane Loads for Ultimate Limit States

Forming Part of Sentences 4.1.3.2.(2), (5) to (8), and (10)

Case	Load Combination[1]	
	Principal Loads	**Companion Loads**
1	(1.25D[2] or 0.9D[3]) + (1.5C + 1.0LXC)	1.0S[4] or 0.4W
2	(1.25D[2] or 0.9D[3]) + (1.5LXC[5] + 1.0C)	1.0S(4) or 0.4W
3	(1.25D[2] or 0.9D[3]) + 1.5S	1.0C + 1.0LXC[4][6]
4	(1.25D[2] or 0.9D[3]) + 1.4W	1.0C[7] + 0.5LXC[4][6]
5	(1.25D[2] or 0.9D[3]) + C7	—
6	1.0D[3] + 1.0E[8]	1.0Cd + 0.5LXC[4][6] + 0.25S[4]

Notes to Table 4.1.3.2.-B:
(1) See Sentences 4.1.3.2.(2) to (4).
(2) See Sentence 4.1.3.2.(8).
(3) See Sentence 4.1.3.2.(5).
(4) See Article 4.1.5.5.
(5) See Sentence 4.1.3.2.(6).
(6) See Sentence 4.1.3.2.(7).
(7) Side thrust due to cranes need not be combined with full wind load.
(8) See Sentence 4.1.3.2.(10).

8) Except as provided in Sentence (9), the load factor 1.25 for *dead load*, D, for *soil*, superimposed earth, plants and trees given in Tables 4.1.3.2.-A and 4.1.3.2.-B shall be increased to 1.5, except that when the *soil* depth exceeds 1.2 m, the factor may be reduced to $1 + 0.6/h_s$ but not less than 1.25, where h_s is the depth of *soil*, in m, supported by the structure.

9) A principal-load factor of 1.5 shall be applied to the weight of saturated *soil* used in load combination case 1 of Table 4.1.3.2.-A.

10) Earthquake load, E, in load combination cases 5 of Table 4.1.3.2.-A and 6 of Table 4.1.3.2.-B includes horizontal earth pressure due to earthquake determined in accordance with Sentence 4.1.8.16.(7).

11) Provision shall be made to ensure adequate stability of the structure as a whole and adequate lateral, torsional and local stability of all structural parts.

12) Sway effects produced by vertical loads acting on the structure in its displaced configuration shall be taken into account in the design of *buildings* and their structural members.

4.1.3.3. Fatigue

1) A *building* and its structural components, including connections, shall be checked for fatigue failure under the effect of cyclical loads, as required in the standards listed in Section 4.3. (See Note A-4.1.3.3.(1).)

2) Where vibration effects, such as resonance and fatigue resulting from machinery and equipment, are likely to be significant, a dynamic analysis shall be carried out. (See Note A-4.1.3.3.(2).)

4.1.3.4. Serviceability

1) A *building* and its structural components shall be checked for serviceability limit states as defined in Clause 4.1.3.1.(1)(a) under the effect of service loads for serviceability criteria specified or recommended in Articles 4.1.3.5. and 4.1.3.6. and in the standards listed in Section 4.3. (See Note A-4.1.3.4.(1).)

2) The effect of service loads on the serviceability limit states shall be determined in accordance with this Article and the load combinations listed in Table 4.1.3.4., the applicable combination being that which results in the most critical effect.

3) Other load combinations that must also be considered are the principal loads acting with the companion loads taken as zero.

4) Deflections calculated for load types P, T and H, if present, with load factors of 1.0 shall be included with the calculated deflections due to principal loads.

5) The determination of the deflection shall consider the following:

a) for materials that result in increased deformations over time under sustained loads, the deflection calculation shall consider the portion of *live load*, L, that is sustained over time, Ls, and the portion that is transitory, Lt, and

b) the calculated deflection due to *dead load*, D, and sustained *live load*, Ls, shall be increased by a creep factor as specified in the standards listed in Section 4.3. to obtain the additional long-term deflection.

6) The determination of the long-term settlement of *foundations* shall consider the following:

a) for foundation soil types that result in increased settlement over time under sustained loads, the additional long-term settlements shall be determined for the portion of *live load*, L, that is sustained over time, Ls, and the portion that is transitory, Lt, and

b) the additional long-term settlements due to *dead load*, D, and sustained *live loads*, Ls, shall be calculated from the *foundation soil* properties provided by a qualified professional geotechnical engineer.

Table 4.1.3.4.
Loads and Load Combinations for Serviceability
Forming Part of Sentence 4.1.3.4.(2)

Limit State	Structural Parameter	Load Case	Load Combinations	
			Principal Loads	Companion Loads
Deflection for materials not subject to creep	Deflection of the structure or of components of the structure[1]	1	1.0D + 1.0L	0.3W or 0.35S
		2	1.0D + 1.0W	0.35L[2] or 0.35S
		3	1.0D + 1.0S	0.3W or 0.35L[2]
Deflection for materials subject to creep	Total deflection of the structure or of components of the structure[3]	1	1.0D + 1.0Ls[4] + 1.0Lt[5]	0.3W or 0.35S
		2	1.0D + 1.0W	0.35L(2) or 0.35S
		3	1.0D + 1.0S	0.3W or 0.35L[2]
Vibration serviceability	Acceleration	[6]		

Notes to Table 4.1.3.4.:
[1] The calculated deflection due to dead load, D, is permitted to be excluded where specified in the standards listed in Section 4.3.
[2] The companion load factor of 0.35 for *live load*, L, shall be increased to 0.5 for storage areas, equipment areas and service rooms.
[3] The calculated immediate deflection due to dead load, D, is permitted to be excluded where specified in the standards listed in Section 4.3.
[4] Ls = sustained portion of the *live load*, L.
[5] Lt = transitory portion of the *live load*, L.
[6] See Note A-Table 4.1.3.4.

4.1.3.5. Deflection

1) In proportioning structural members to limit serviceability problems resulting from deflections, consideration shall be given to

a) the intended use of the *building* or member,

b) limiting damage to non-structural members made of materials whose physical properties are known at the time of design,

c) limiting damage to the structure itself, and

d) creep, shrinkage, temperature changes and pre-stress.

(See Note A-4.1.3.5.(1).)

2) The lateral deflection of *buildings* due to service wind and gravity loads shall be checked to ensure that structural elements and non-structural elements whose nature is known at the time the structural design is carried out will not be damaged.

3) Except as provided in Sentence (4), the total drift per *storey* under service wind and gravity loads shall not exceed 1/500 of the *storey* height unless other drift limits are specified in the design standards referenced in Section 4.3. (See Note A-4.1.3.5.(3).)

4) The deflection limits required in Sentence (3) do not apply to industrial *buildings* or sheds if experience has proven that greater movement will have no significant adverse effects on the strength and function of the *building*.

5) The *building* structure shall be designed for lateral deflection due to E, in accordance with Article 4.1.8.13.

4.1.3.6. Vibration

1) Floor systems susceptible to vibration shall be designed so that vibrations will have no significant adverse effects on the intended *occupancy* of the *building*. (See Note A-4.1.3.6.(1).)

2) Where floor vibrations caused by resonance with operating machinery or equipment are anticipated, dynamic analysis of the floor system shall be carried out. (See Note A-4.1.3.6.(2).)

3) Where the fundamental vibration frequency of a structural system supporting an *assembly occupancy* used for rhythmic activities, such as dancing, concerts, jumping exercises or gymnastics, is less than 6 Hz, the effects of resonance shall be investigated by means of a dynamic analysis. (See Note A-4.1.3.6.(3).)

4) A *building* susceptible to lateral vibration under wind load shall be designed in accordance with Article 4.1.7.1. so that the vibrations will have no significant adverse effects on the intended use and *occupancy* of the *building*. (See Note A-4.1.3.6.(4).)

4.1.4. Dead Loads

4.1.4.1. Dead Loads

1) The specified *dead load* for a structural member consists of

a) the weight of the member itself,

b) the weight of all materials of *construction* incorporated into the *building* to be supported permanently by the member,

c) the weight of *partitions*,

d) the weight of permanent equipment, and

e) the vertical load due to *soil*, superimposed earth, plants and trees.

2) In areas of a *building* for which *partitions* are shown on the drawings, the weight of *partitions* referred to in Clause (1)(c) shall be taken as the actual weight of such *partitions*. (See Note A-4.1.4.1.(2).)

3) In areas of a *building* for which *partitions* are not shown on the drawings, the weight of *partitions* referred to in Clause (1)(c) shall be a *partition* weight allowance determined from the anticipated weight and position of the *partitions*, but shall not be less than 1 kPa over the area of floor being considered. (See Note A-4.1.4.1.(3).)

4) The weights of *partitions* and *partition* weight allowances used in the design shall be shown on the drawings as provided in Clause 2.2.4.3.(1)(d) of Division C.

5) Where the *partition* weight allowance referred to in Sentence (3) is counteractive to other loads, it shall not be included in the design calculations.

6) Except for structures where the *dead load* of *soil* is part of the load-resisting system, where the *dead load* due to *soil*, superimposed earth, plants and trees is counteractive to other loads, it shall not be included in the design calculations. (See Note A-4.1.4.1.(6).)

4.1.5. Live Loads Due to Use and Occupancy

4.1.5.1. Loads Due to Use of Floors and Roofs

1) Except as provided in Sentence (2), the specified *live load* on an area of floor or roof depends on the intended use and *occupancy*, and shall not be less than either the uniformly distributed load patterns listed in Article 4.1.5.3., the loads due to the intended use and *occupancy*, or the concentrated loads listed in Article 4.1.5.9., whichever produces the most critical effect. (See Note A-4.1.5.1.(1).)

2) For *buildings* in the Low Importance Category as described in Table 4.1.2.1., a factor of 0.8 may be applied to the *live load*.

4.1.5.2. Uses Not Stipulated

1) Except as provided in Sentence (2), where the use of an area of floor or roof is not provided for in Article 4.1.5.3., the specified *live loads* due to the use and *occupancy* of the area shall be determined from an analysis of the loads resulting from the weight of

a) the probable assembly of persons,

b) the probable accumulation of equipment and furnishings, and

c) the probable storage of materials.

2) For *buildings* in the Low Importance Category as described in Table 4.1.2.1., a factor of 0.8 may be applied to the *live load*.

4.1.5.3. Full and Partial Loading

1) The uniformly distributed *live load* shall be not less than the value listed in Table 4.1.5.3., which may be reduced as provided in Article 4.1.5.8., applied uniformly over the entire area or on any portions of the area, whichever produces the most critical effects in the members concerned.

Table 4.1.5.3.
Specified Uniformly Distributed Live Loads on an Area of Floor or Roof
Forming Part of Sentence 4.1.5.3.(1)

Use of Area of Floor or Roof	Minimum Specified Load, kPa
Assembly Areas	4.8
a) Except for the areas listed under b), c), d) and e), assembly areas with or without fixed seats including	
Arenas[1] (areas without fixed seats that have backs)	
Auditoria	
Churches (areas without fixed seats that have backs)	

Dance floors	
Dining areas(2)	
Foyers and entrance halls	
Grandstands(1) (areas without fixed seats that have backs), reviewing stands and bleachers	
Gymnasia	
Lecture halls(1) (areas without fixed seats that have backs)	
Promenades	
Rinks	
Stadia(1) (areas without fixed seats that have backs)	
Theatres (areas without fixed seats that have backs)	
Other areas with similar uses	
b) Classrooms and courtrooms with or without fixed seats(1)	2.4
c) Portions of assembly areas with fixed seats that have backs for the following uses:	2.9
Arenas(1)	
Grandstands(1)	
Stadia(1)	
d) Portions of assembly areas with fixed seats that have backs for the following uses:	2.4
Churches	
Lecture halls(1)	
Theatres	
e) Vomitories, *exits*, lobbies and corridors(1)	4.8
Attics(1)	
Accessible by a stairway in *residential occupancies* only	1.4
Having limited *accessibility* so that there is no storage of equipment or material	0.5
Balconies	
Exterior	4.8
Interior and *mezzanines* that could be used by an assembly of people as a viewing area(1)	4.8
Interior and *mezzanines* other than above	(3)
Corridors, lobbies and aisles(1)	
Other than those listed below	4.8
Not more than 1 200 mm in width, and all upper floor corridors of residential areas only of apartments, hotels and motels (that cannot be used by an assembly of people as a viewing area)	(3)
Equipment areas and *service rooms* including	3.6(4)

Generator rooms	
Mechanical equipment exclusive of elevators	
Machine rooms	
Pump rooms	
Transformer vaults	
Ventilating or air-conditioning equipment	
Exits and fire escapes	4.8
Factories	6.0(4)
Footbridges	4.8
Garages for	
Vehicles not exceeding 4 000 kg gross weight	2.4
Vehicles exceeding 4 000 kg but not exceeding 9 000 kg gross weight	6.0
Vehicles exceeding 9 000 kg gross weight(1)	12.0
Kitchens (other than residential)	4.8
Libraries	
Stack rooms	7.2
Reading and study rooms	2.9
Office areas(1) (not including record storage and computer rooms) located in	
Basements, and floors, including *mezzanines*, with direct access to the exterior at ground level	4.8
Other floors	2.4
Operating rooms and laboratories	3.6
Patients' bedrooms	1.9
Recreation areas that cannot be used for assembly purposes including	3.6
Billiard rooms	
Bowling alleys	
Pool rooms	
Residential areas (within the scope of Article 1.3.3.2. of Division A)	
Sleeping and living quarters in apartments, hotels, motels, boarding schools and colleges	1.9
Residential areas (within the scope of Article 1.3.3.3. of Division A)	1.9
Bedrooms	
Other areas	
Stairs within *dwelling units*	
Retail and wholesale areas	4.8

Roofs[1]	1.0[5]
Sidewalks and driveways over areaways and *basements*[1]	12.0[5]
Storage areas	4.8[4]
Toilet areas	2.4
Underground slabs with earth cover	[5]
Warehouses	4.8[4]

Notes to Table 4.1.5.3.:
[1] See Note A-Table 4.1.5.3.
[2] See Article 4.1.5.6.
[3] See Article 4.1.5.4.
[4] See Sentence 4.1.5.1.(1).
[5] See Article 4.1.5.5.

4.1.5.4. Loads for Occupancy Served

1) The following shall be designed to carry not less than the specified load required for the *occupancy* they serve, provided they cannot be used by an assembly of people as a viewing area:

a) corridors, lobbies and aisles not more than 1 200 mm wide,

b) all corridors above the *first storey* of residential areas of apartments, hotels and motels, and

c) interior balconies and *mezzanines*.

4.1.5.5. Loads on Exterior Areas

(See Note A-4.1.5.5.)

1) Exterior areas accessible to vehicular traffic shall be designed for their intended use, including the weight of firefighting equipment, but not for less than the snow and rain loads prescribed in Subsection 4.1.6.

2) Except as provided in Sentences (3) and (4), roofs shall be designed for either the uniform *live loads* specified in Table 4.1.5.3., the concentrated *live loads* listed in Table 4.1.5.9., or the snow and rain loads prescribed in Subsection 4.1.6., whichever produces the most critical effect.

3) Exterior areas accessible to pedestrian traffic, but not vehicular traffic, shall be designed for their intended use, but not for less than the greater of

a) the *live load* prescribed for assembly areas in Table 4.1.5.3., or

b) the snow and rain loads prescribed in Subsection 4.1.6.

4) Roof parking decks and exterior areas accessible to vehicular traffic shall be designed

a) for the appropriate load combination listed in Sentence 4.1.3.2.(2) with a *live load*, L, consisting of either a uniformly distributed *live load* as specified in Table 4.1.5.3. or a concentrated *live load* as listed in Table 4.1.5.9., whichever produces the most critical effect, and a companion snow load, S, as prescribed in Subsection 4.1.6., but with the companion-load factor reduced to 0.2, and

b) such that the load combination in Clause (a) is not less than the snow and rain loads prescribed in Subsection 4.1.6. with the *live load* taken as zero.

5) Roof parking decks that are used for the long-term storage of vehicles shall be designed for the appropriate load combination listed in Sentence 4.1.3.2.(2) with a *live load*, L, consisting of either a uniformly distributed *live load* as specified in Table 4.1.5.3. or a concentrated *live load* as listed in Table 4.1.5.9., whichever produces the most critical effect, and a snow load, S, as prescribed in Subsection 4.1.6.

4.1.5.6. Loads for Dining Areas

1) The minimum specified live load listed in Table 4.1.5.3. for dining areas may be reduced to 2.4 kPa for areas in *buildings* that are being converted to dining areas, provided that the floor area does not exceed 100 m^2 and the dining area will not be used for other assembly purposes, including dancing.

4.1.5.7. More Than One Occupancy

1) Where an area of floor or roof is intended for 2 or more *occupancies* at different times, the value to be used from Table 4.1.5.3. shall be the greatest value for any of the *occupancies* concerned.

4.1.5.8. Variation with Tributary Area

(See Note A-4.1.5.8.)

1) One- and two-way floor slabs shall have no reduction for tributary area applied to *live load*.

2) An area used for *assembly occupancies* designed for a *live load* of less than 4.8 kPa and roofs designed for the minimum loading specified in Table 4.1.5.3. shall have no reduction for tributary area.

3) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 80 m^2 and either used for *assembly occupancies* designed for a *live load* of 4.8 kPa or more, or used for storage, manufacturing, retail stores, garages or as a footbridge, the specified *live load* due to use and *occupancy* is the load specified in Article 4.1.5.3. multiplied by

$$0.5 + \sqrt{20/A}$$

where A is the tributary area in square metres for this type of use and *occupancy*.

4) Where a structural member supports a tributary area of a floor or a roof, or a combination thereof, that is greater than 20 m^2 and used for any use or *occupancy* other than those indicated in Sentences (2) and (3), the specified live load due to use and *occupancy* is the load specified in Article 4.1.5.3. multiplied by

$$0.3 + \sqrt{9.8/B}$$

where B is the tributary area in square metres for this type of use and *occupancy*.

5) Where the specified *live load* for a floor is reduced in accordance with Sentence (3) or (4), the structural drawings shall indicate that a *live load* reduction factor for tributary area has been applied and which structural elements are impacted by this factor.

4.1.5.9. Concentrated Loads

1) The specified *live load* due to possible concentrations of load resulting from the use of an area of floor or roof shall not be less than that listed in Table 4.1.5.9. applied over the loaded area noted and located so as to cause maximum effects, except that for occupancies not listed in Table 4.1.5.9., the concentrations of load shall be determined in accordance with Article 4.1.5.2.

Table 4.1.5.9.

Specified Concentrated Live Loads on an Area of Floor or Roof

Forming Part of Sentence 4.1.5.9.(1)

Area of Floor or Roof	Minimum Specified Concentrated Load, kN	Loaded Area, mm × mm
Roof surfaces	1.3	200 × 200
Floors of classrooms	4.5	750 × 750
Floors of offices, manufacturing *buildings*, hospital wards and *stages*	9.0	750 × 750
Floors and areas used by vehicles not exceeding 4 000 kg gross weight	18	120 × 120

Floors and areas used by vehicles exceeding 4 000 kg but not exceeding 9 000 kg gross weight	36	120 × 120
Floors and areas used by vehicles exceeding 9 000 kg gross weight	54(1)	250 × 600(1)
Driveways and sidewalks over areaways and *basements*	54(1)	250 × 600(1)

Notes to Table 4.1.5.9.:
(1) See Note A-Table 4.1.5.9.

4.1.5.10. Sway Forces in Assembly Occupancies

1) The floor assembly and other structural elements that support fixed seats in any *building* used for *assembly occupancies* accommodating large numbers of people at one time, such as grandstands, stadia and *theatre* balconies, shall be designed to resist a horizontal force equal to not less than 0.3 kN for each metre length of seats acting parallel to each row of seats, and not less than 0.15 kN for each metre length of seats acting at right angles to each row of seats, based on the assumption that these forces are acting independently of each other.

4.1.5.11. Crane-Supporting Structures and Impact of Machinery and Equipment

(See Note A-4.1.5.11.)

1) The minimum specified load due to equipment, machinery or other objects that may produce impact shall be the sum of the weight of the equipment or machinery and its maximum lifting capacity, multiplied by an appropriate factor listed in Table 4.1.5.11.

2) Crane-supporting structures shall be designed for the appropriate load combinations listed in Article 4.1.3.2.

3) Crane runway structures shall be designed to resist a horizontal force applied normal to the top of the rails equal to not less than 20% of the sum of the weights of the lifted load and the crane trolley (excluding other parts of the crane).

4) The force described in Sentence (3) shall be equally distributed on each side of the runway and shall be assumed to act in either direction.

5) Crane runway structures shall be designed to resist a horizontal force applied parallel to the top of the rails equal to not less than 10% of the maximum wheel loads of the crane.

Table 4.1.5.11.
Factors for the Calculation of Impact Loads
Forming Part of Sentence 4.1.5.11.(1)

Cause of Impact	Factor
Operation of cab or radio-operated cranes	1.25
Operation of pendant or hand-operated cranes	1.10
Operation of elevators	(1)
Supports for light machinery, shaft or motor-driven	1.20
Supports for reciprocating machinery (e.g., compressors)	1.50
Supports for power-driven units (e.g., piston engines)	1.50

Notes to Table 4.1.5.11.:
(1) See the Safety Standards Act and pursuant regulations.

4.1.5.12. Bleachers

1) Bleacher seats shall be designed for a uniformly distributed *live load* of 1.75 kN for each linear metre or for a concentrated load of 2.2 kN distributed over a length of 0.75 m, whichever produces the most critical effect on the supporting members.

2) Bleachers shall be checked by the erector after erection to ensure that all structural members, including bracing specified in the design, have been installed.

3) Telescopic bleachers shall be provided with locking devices to ensure stability while in use.

4.1.5.13. Helicopter Landing Areas

1) Helicopter landing areas on roofs shall be constructed in conformance with the requirements for heliports contained in TC SOR/96-433, "Canadian Aviation Regulations – Part III."

4.1.5.14. Loads on Guards and Handrails

(See Note A-4.1.5.14. and 4.1.5.15.(1).)

1) The minimum horizontal specified *live load* applied outward at the minimum required height of every required *guard* shall be

a) 3.0 kN/m for open viewing stands without fixed seats and for means of egress in grandstands, stadia, bleachers and arenas,

b) 1.0 kN applied at any point, so as to produce the most critical effect, for access ways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable, and

c) 0.75 kN/m or 1.0 kN applied at any point so as to produce the most critical effect, whichever governs, for locations other than those described in Clauses (a) and (b).

2) The minimum horizontal specified *live load* applied inward at the minimum required height of every required *guard* shall be half that specified in Sentence (1).

3) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a horizontal specified *live load* of 0.5 kN applied outward over an area of 100 mm by 100 mm located at any point on the element or elements so as to produce the most critical effect.

4) The size of the opening between any two adjacent vertical elements within a *guard* shall not exceed the limits required by Part 3 when each of these elements is subjected to a horizontal specified *live load* of 0.1 kN applied in opposite directions in the in-plane direction of the *guard* so as to produce the most critical effect.

5) The specified *live loads* required in Sentence (3) need not be considered to act simultaneously with the loads provided for in Sentences (1), (2), (6) and (7).

6) The minimum specified *live load* applied vertically at the top of every required *guard* shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal specified *live load* provided for in Sentences (1), (3) and (7).

7) Handrails and their supports shall be designed and constructed to withstand the following minimum specified *live loads*, which need not be considered to act simultaneously:

a) 0.9 kN applied at any point and in any direction for all handrails, and

b) 0.7 kN/m applied in any direction for handrails not located within *dwelling units*.

4.1.5.15. Loads on Vehicle Guardrails

1) Vehicle guardrails shall be designed for a concentrated load of 22 kN applied horizontally outward at any point 500 mm above the floor surface so as to produce the most critical effect. (See Note A-4.1.5.14. and 4.1.5.15.(1).)

2) The loads required in Sentence (1) need not be considered to act simultaneously with the loads provided for in Article 4.1.5.14.

4.1.5.16. Loads on Walls Acting As Guards

1) Where the floor elevation on one side of a wall, including a wall around a shaft, is more than 600 mm higher than the elevation of the floor or ground on the other side, the wall shall be designed to resist the appropriate outward lateral design loads prescribed elsewhere in Subsection 4.1.5. or 0.5 kPa acting outward, whichever produces the more critical effect.

4.1.5.17. Firewalls

(See Note A-4.1.5.17.)

1) *Firewalls* shall be designed to resist the maximum effect due to

a) the appropriate lateral design loads prescribed elsewhere in this Section, or

b) a factored lateral load of 0.5 kPa under fire conditions, as described in Sentence (2).

2) Under fire conditions, where the fire-resistance rating of the structure is less than that of the *firewall*,

a) lateral support shall be assumed to be provided by the structure on one side only, or

b) another structural support system capable of resisting the loads imposed by a fire on either side of the *firewall* shall be provided.

4.1.5.18. Loads for Building Maintenance

1) *Buildings* shall be designed to support the loads and forces required to support *building* maintenance equipment.

4.1.6. Loads Due to Snow and Rain

4.1.6.1. Specified Load Due to Rain or to Snow and Associated Rain

1) The specified load on a roof or any other building surface subject to snow and associated rain shall be the snow load specified in Article 4.1.6.2., or the rain load specified in Article 4.1.6.4., whichever produces the more critical effect. (See Note A-4.1.6.1.(1).)

4.1.6.2. Specified Snow Load

(See Note A-4.1.6.2.)

1) The specified load, S, due to snow and associated rain accumulation on a roof or any other building surface subject to snow accumulation shall be calculated using the formula

$$S = I_s[S_s(C_b C_w C_s C_a) + S_r]$$

where

I_s = importance factor for snow load, as provided in Table 4.1.6.2.-A,

S_s = 1-in-50-year ground snow load, in kPa, determined in accordance with Subsection 1.1.3.,

C_b = basic roof snow load factor in Sentence (2),

C_w = wind exposure factor in Sentences (3) and (4),

C_s = slope factor in Sentences (5) to (7),

C_a = accumulation factor in Sentence (8), and

S_r = 1-in-50-year associated rain load, in kPa, determined in accordance with Subsection 1.1.3., but not greater than $S_s(C_bC_wC_sC_a)$.

Table 4.1.6.2.-A
Importance Factor for Snow Load, IS
Forming Part of Sentence 4.1.6.2.(1)

Importance Category	Importance Factor, Is	
	ULS	SLS
Low	0.8	0.9
Normal	1	0.9
High	1.15	0.9
Post-disaster	1.25	0.9

2) The basic roof snow load factor, C_b, shall

a) be determined as follows:

i)

$$C_b = 0.8 \text{ for } l_c \leq \left(\frac{70}{C_w^2}\right), \text{ and}$$

ii)

$$C_b = \frac{1}{C_w}\left[1 - (1 - 0.8\,C_w)\exp\left(-\frac{l_c C_w^2 - 70}{100}\right)\right] \text{ for } l_c > \left(\frac{70}{C_w^2}\right)$$

where

l_c = characteristic length of the upper or lower roof, defined as $2w - w^2/l$, in m,

w = smaller plan dimension of the roof, in m, and

l = larger plan dimension of the roof, in m,

b) conform to Table 4.1.6.2.-B, using linear interpolation for intermediate values of $l_c C_w^2$, or

c) be taken as equal to 1 for any roof structure with a mean height of less than $1 + S_s/\gamma$, in m, above grade, where γ is the specific weight of snow determined in accordance with Article 4.1.6.13.

(See Note A-4.1.6.2.(2).)

3) Except as provided for in Sentence (4), the wind exposure factor, C_w, shall be 1.0.

4) For *buildings* in the Low and Normal Importance Categories as set out in Table 4.1.2.1., the wind exposure factor, C_w, given in Sentence (3) may be reduced to 0.75 for rural areas only, or to 0.5 for exposed areas north of the treeline, where

a) the building is exposed on all sides to wind over open terrain as defined in Clause 4.1.7.3.(5)(a), and is expected to remain so during its life,

b) the area of roof under consideration is exposed to the wind on all sides with no significant obstructions on the roof, such as parapet walls, within a distance of at least 10 times the difference between the height of the obstruction and $C_bC_wS_s/\gamma$, in m, where γ is the specific weight of snow on roofs as specified in Article 4.1.6.13., and

c) the loading does not involve the accumulation of snow due to drifting from adjacent surfaces.

5) Except as provided for in Sentences (6) and (7), the slope factor, C_s, shall be

a) 1.0 where the roof slope, α, is equal to or less than 30°,

b) (70° − α)/40° where α is greater than 30° but not greater than 70°, and

c) 0 where α exceeds 70°.

Table 4.1.6.2.-B
Basic Roof Snow Load Factor for $l_c > (70/C_w^2)$
Forming Part of Sentence 4.1.6.2.(2)

Value of $l_c C_w^2$	Value of Cw		
	1.0	**0.75**	**0.5**
	Value of Cb		
70	0.80	0.80	0.80
80	0.82	0.85	0.91
100	0.85	0.94	1.11
120	0.88	1.01	1.27
140	0.90	1.07	1.40
160	0.92	1.12	1.51
180	0.93	1.16	1.60
200	0.95	1.19	1.67
220	0.96	1.21	1.73
240	0.96	1.24	1.78
260	0.97	1.25	1.82
280	0.98	1.27	1.85
300	0.98	1.28	1.88
320	0.98	1.29	1.90
340	0.99	1.30	1.92
360	0.99	1.30	1.93
380	0.99	1.31	1.95
400	0.99	1.31	1.96
420	0.99	1.32	1.96
440	1.00	1.32	1.97
460	1.00	1.32	1.98
480	1.00	1.32	1.98
500	1.00	1.33	1.98
520	1.00	1.33	1.99
540	1.00	1.33	1.99
560	1.00	1.33	1.99
580	1.00	1.33	1.99
600	1.00	1.33	1.99

620	1.00	1.33	2.00

6) The slope factor, C_s, for unobstructed slippery roofs where snow and ice can slide completely off the roof shall be

a) 1.0 where the roof slope, α, is equal to or less than 15°,

b) (60° − α)/45° where α is greater than 15° but not greater than 60°, and

c) 0 where α exceeds 60°.

7) Unless otherwise stated in this Subsection, the slope factor, C_s, shall be 1.0 when used in conjunction with accumulation factors for increased snow loads.

8) The accumulation factor, C_a, shall be 1.0, which corresponds to the uniform snow load case, except that where appropriate for the shape of the roof, it shall be assigned other values that account for

a) increased non-uniform snow loads due to snow drifting onto a roof that is at a level lower than other parts of the same building or at a level lower than another building within 5 m of it horizontally, as prescribed in Articles 4.1.6.5., 4.1.6.6. and 4.1.6.8.,

b) increased non-uniform snow loads on areas adjacent to roof projections, such as penthouses, large *chimneys* and equipment, as prescribed in Articles 4.1.6.7. and 4.1.6.8.,

c) non-uniform snow loads on gable, arch or curved roofs and domes, as prescribed in Articles 4.1.6.9. and 4.1.6.10.,

d) increased snow or ice loads due to snow sliding as prescribed in Article 4.1.6.11.,

e) increased snow loads in roof valleys, as prescribed in Article 4.1.6.12., and

f) increased snow or ice loads due to meltwater draining from adjacent building elements and roof projections.

9) For shapes not addressed in Sentence (8), C_a corresponding to the non-uniform snow load case shall be established based on applicable field observations, special analyses including local climatic effects, appropriate model tests, or a combination of these methods.

4.1.6.3. Full and Partial Loading

1) A roof or other building surface and its structural members subject to loads due to snow accumulation shall be designed for the specified load given in Sentence 4.1.6.2.(1), distributed over the entire loaded area.

2) In addition to the distribution mentioned in Sentence (1), flat roofs and shed roofs, gable roofs of 15° slope or less, and arch or curved roofs shall be designed for the specified uniform snow load indicated in Sentence 4.1.6.2.(1), which shall be calculated using the accumulation factor C_a = 1.0, distributed on any one portion of the loaded area and half of this load on the remainder of the loaded area, in such a way as to produce the most critical effects on the member concerned. (See Note A-4.1.6.3.(2).)

4.1.6.4. Specified Rain Load

1) Except as provided in Sentence (4), the specified load, S, due to the accumulation of rainwater on a surface whose position, shape and deflection under load make such an accumulation possible, is that resulting from the one-day rainfall determined in conformance with Subsection 1.1.3. and applied over the horizontal projection of the surface and all tributary surfaces. (See Note A-4.1.6.4.(1).)

2) The provisions of Sentence (1) apply whether or not the surface is provided with a means of drainage, such as rainwater leaders.

3) Except as provided in Sentence 4.1.6.2.(1), loads due to rain need not be considered to act simultaneously with loads due to snow. (See Note A-4.1.6.4.(3).)

4) Where scuppers are provided as secondary drainage systems and where the position, shape and deflection of the loaded surface make an accumulation of rainwater possible, the loads due to rain shall be the

lesser of either the one-day rainfall determined in conformance with Subsection 1.1.3. or a depth of rainwater equal to 30 mm above the bottom of the scuppers, applied over the horizontal projection of the surface and tributary areas.

4.1.6.5. Multi-level Roofs

1) The drifting load of snow on a roof adjacent to a higher roof shall be taken as trapezoidal, as shown in Figure 4.1.6.5.-A, and the accumulation factor, C_a, shall be determined as follows:

$$C_a = C_{a0} - (C_{a0} - 1)(x/x_d) \text{ for } 0 \leq x \leq x_d,$$

or

$$C_a = 1.0 \text{ for } x > x_d$$

where

C_{a0} = peak value of C_a at x = 0 determined in accordance with Sentences (3) to (5) and as shown in Figure 4.1.6.5.-B,

X = distance from roof step as shown in Figure 4.1.6.5.-A, and

x_d = length of drift determined in accordance with Sentence (2) and as shown in Figure 4.1.6.5.-A.

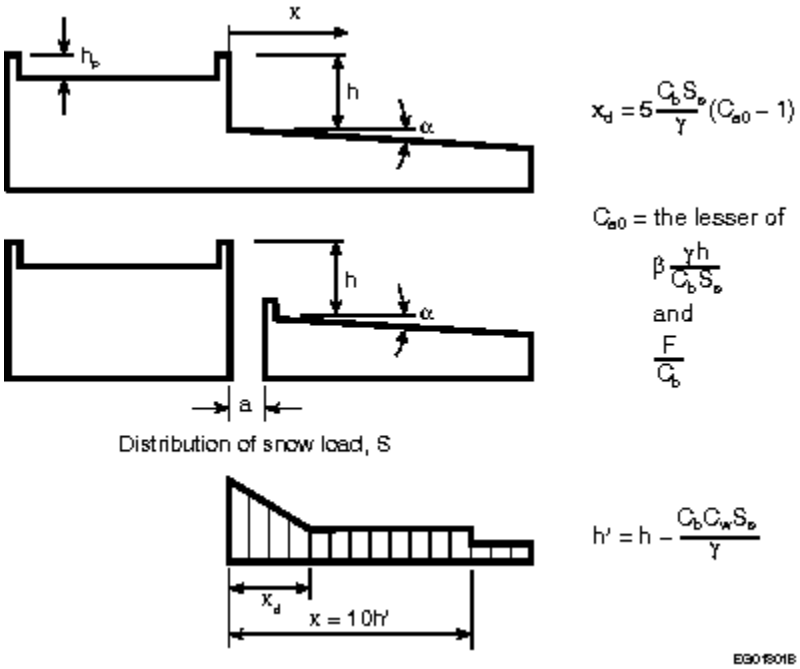
2) The length of the drift, x_d, shall be calculated as follows:

$$x_d = 5\frac{C_b S_s}{\gamma}(C_{a0} - 1)$$

where

γ = specific weight of snow as specified in Article 4.1.6.13.

Figure 4.1.6.5.-A
Snow load factors for lower level roofs
Forming Part of Sentences 4.1.6.5.(1) and (3), Table 4.1.6.5.-A and Sentence 4.1.6.6.(1)



Notes to Figure 4.1.6.5.-A:

(1) If a > 5 m or h ≤ 0.8Ss/γ, drifting from the higher roof need not be considered.
(2) If h ≥ 5 m, the value of Ca0 for Case I is permitted to be determined in accordance with Sentence 4.1.6.5.(4).

Table 4.1.6.5.-A
Wind Exposure, Slope and Accumulation Factors in Figure 4.1.6.5.-A

Distance from Roof Step, x	Factors		
	Cw	Cs(1)	Ca
0	1.0	f(α)	Ca0
0 < x ≤ xd	1.0	f(α)	Ca0 − (Ca0 − 1)(x/xd)
xd < x ≤ 10h'	1.0	f(α)	1.0
x> 10h'	1.0 for unexposed roof areas	f(α)	1.0
	0.75 for exposed roof areas		
	0.5 for exposed roof areas north of tree line		

Notes to Table 4.1.6.5.-A:
(1) For lower roofs with parapets, Cs = 1.0; otherwise, Cs varies as a function of slope, α, as defined in Sentences 4.1.6.2.(5) and (6).

3) Except as provided in Sentence (4), the value of C_{a0} for each of Cases I, II and III shall be the lesser of

$$C_{a0} = \beta \frac{\gamma h}{C_b S_s}$$

and

$$C_{a0} = \frac{F}{C_b}$$

where

β = 1.0 for Case I, and 0.67 for Cases II and III,

h = difference in elevation between the lower roof surface and the top of the parapet on the upper roof as shown in Figure 4.1.6.5.-A, and

$$F = 0.35\beta\sqrt{\frac{\gamma(l_{cs} - 5h_p')}{S_s}} + C_b, \text{ but } F \leq 5 \text{ for } C_{ws} = 1.0$$

where

C_{ws} = value of C_w applicable to the source of drifting,

L_{cs} = characteristic length of the source area for drifting, defined as $l_{cs} = 2w_s - \frac{w_s^2}{l_s}$, where w_s and l_s are respectively the shorter and longer dimensions of the relevant source areas for snow drifting shown in Figure 4.1.6.5.-B for Cases I, II and III, and

$$h_p' = h_p - \left(\frac{0.8S_s}{\gamma}\right), \text{ but } 0 \leq h_p' \leq \left(\frac{l_{cs}}{5}\right)$$

where

h_p = height of the roof perimeter parapet of the source area, to be taken as zero unless all the roof edges of the source area have parapets.

4) Where h ≥ 5 m, the value of C_{a0} for Case I is permitted to be taken as

$$C_{a0} = \left(\frac{25 - h}{20}\right)\left(\frac{F}{C_b} - 1\right) + 1 \text{ for } 5\text{ m} \leq h \leq 25\text{ m, and}$$

$$C_{a0} = 1 \text{ for } h > 25\text{ m}$$

5) The value of C_{a0} shall be the highest of Cases I, II and III, considering the different roof source areas for drifting snow, as specified in Sentences (3) and (4) and Figure 4.1.6.5.-B.

Figure 4.1.6.5.-B
Snow load cases I, II and III for lower level roofs
Forming Part of Sentences 4.1.6.5.(1), (3) and (5), and Table 4.1.6.5.-B

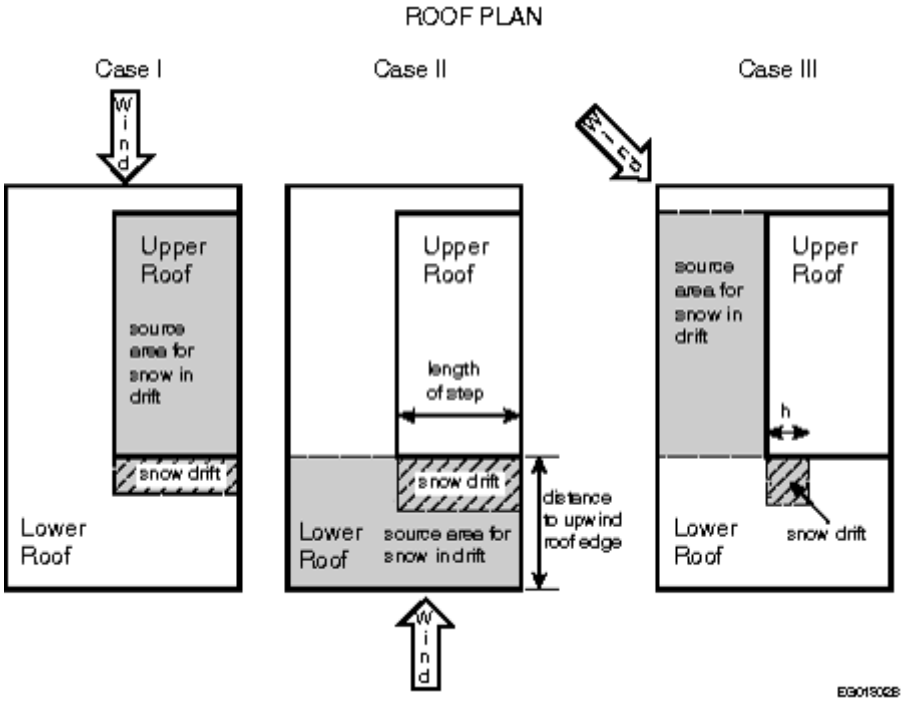


Table 4.1.6.5.-B
Parameters for Snow Load Cases in Figure 4.1.6.5.-B

Parameter	Case I	Case II	Case III
β	1.0	0.67	0.67
hp	parapet height of upper-roof source area	parapet height of lower-roof source area	parapet height of lower-roof source area
$l_{cs} = 2w_s - \frac{w_s^2}{l_s}$	with ws and ls being the shorter and longer dimensions of the upper roof	with ws and ls being the shorter and longer dimensions of the source area on the lower roof for upwind-facing step	with ws and ls being the shorter and longer dimensions of the source area on the lower roof for downwind-facing step

4.1.6.6. Horizontal Gap between a Roof and a Higher Roof

1) Where the roof of one building is separated by a distance, a, from an adjacent building with a higher roof as shown in Figure 4.1.6.5.-A, the influence of the adjacent building on the value of the accumulation factor, C_a, for the lower roof shall be determined as follows:

a) if $a > 5$ m, the influence of the adjacent building on C_a for the lower roof can be ignored, and

b) if $a \leq 5$ m, C_a for the lower roof shall be calculated in accordance with Article 4.1.6.5. for values of $x \geq a$.

4.1.6.7. Areas Adjacent to Roof Projections

1) Except as provided in Sentences (2) and (3), the accumulation factor, C_a, for areas adjacent to roof-mounted vertical projections shall be calculated in accordance with Sentence 4.1.6.5.(1) using the following values for the peak accumulation factor, C_{a0}, and the drift length, x_d:

a) C_{a0} shall be taken as the lesser of

$$0.67\frac{\gamma h}{C_b S_s} \text{ and } \frac{\gamma l_0}{7.5 C_b S_s} + 1, \text{and}$$

b) x_d shall be taken as the lesser of 3.35h and (2/3)l_0,

where

h = height of the projection, and

l_0 = longest horizontal dimension of the projection.

(See Note A-4.1.6.7.(1).)

2) C_a is permitted to be calculated in accordance with Article 4.1.6.5. for larger projections. (See Note A-4.1.6.7.(2).)

3) Where the longest horizontal dimension of the roof projection, l_0, is less than 3 m, the drift surcharge adjacent to the projection need not be considered.

4.1.6.8. Snow Drift at Corners

1) The drift loads on the lower level roof against the two faces of an outside corner of an upper level roof or roof obstruction shall be extended radially around the corner as shown in Figure 4.1.6.8.-A and may be taken as the least severe of the drift loads lying against the two faces of the corner.

2) The drift loads on the lower level roof against the two faces of an inside corner of an upper level roof or a parapet shall be calculated for each face and the higher of the two loads shall be applied where the drifts overlap as shown in Figure 4.1.6.8.-B

Figure 4.1.6.8.-A
Snow load at outside corner
Forming Part of Sentence 4.1.6.8.(1)

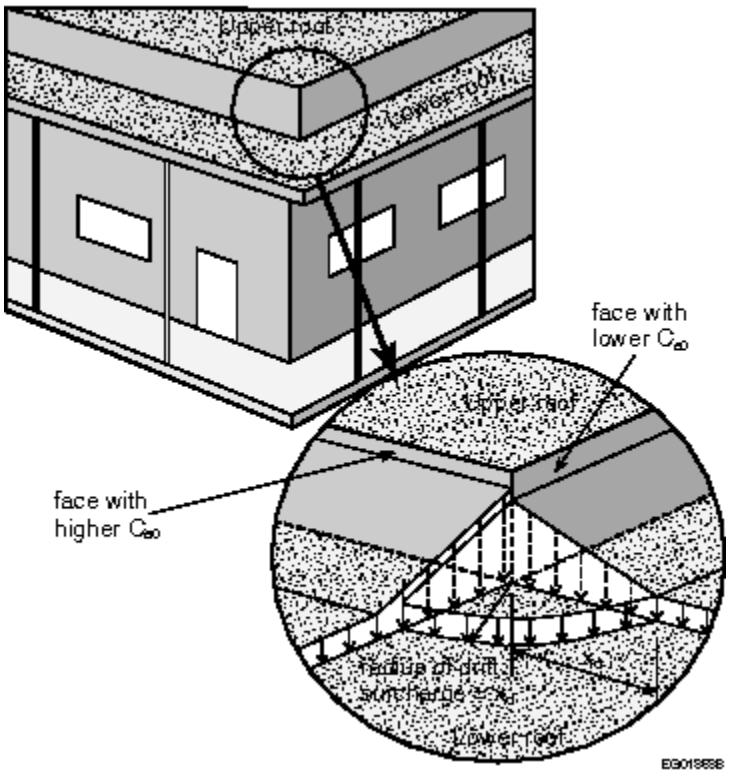
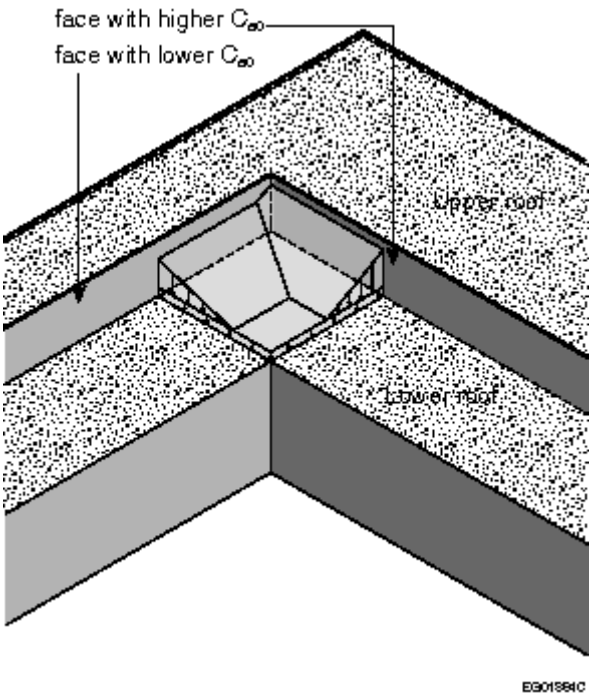


Figure 4.1.6.8.-B
Snow load at inside corner
Forming Part of Sentence 4.1.6.8.(2)



4.1.6.9. Gable Roofs

(See Note A-4.1.6.9.)

1) For all gable roofs, the full and partial load cases defined in Article 4.1.6.3. shall be considered.

2) For gable roofs with a slope $\alpha > 15°$, the unbalanced load case shall also be considered by setting the values of the accumulation factor, C_a, as follows:

a) on the upwind side of the roof peak, C_a shall be taken as 0, and

b) on the downwind side of the roof peak, C_a shall be taken as

i) $0.25 + \alpha/20$, where $15° \leq \alpha \leq 20°$, and

ii) 1.25, where $20° < \alpha \leq 90°$.

3) For all gable roofs, the slope factor, C_s, shall be as prescribed in Sentences 4.1.6.2.(5) and (6).

4) For all gable roofs, the wind exposure factor, C_w, shall be

a) as prescribed in Sentences 4.1.6.2.(3) and (4) for the full and partial load cases, and

b) 1.0 for the unbalanced load case referred to in Sentence (2).

4.1.6.10. Arch Roofs, Curved Roofs and Domes

1) For all arch roofs, curved roofs and domes, the full and partial load cases defined in Article 4.1.6.3. shall be considered.

2) For arch roofs, curved roofs and domes with a rise-to-span ratio $h/b > 0.05$ (see Figure 4.1.6.10.-A), the load cases provided in Sentences (3) to (7) shall also be considered.

3) For arch roofs with a slope at the edge $\alpha_e \leq 30°$ (see Figure 4.1.6.10.-A and Table 4.1.6.10.), C_a shall be

a) taken as 0 on the upwind side of the peak, and

b) on the downwind side of the peak, taken as

$$C_a = \frac{xh}{0.03 C_b b^2} \text{ for } 0.05 < \frac{h}{b} \leq 0.12 \text{ and}$$

$$C_a = \frac{4x}{C_b b} \text{ for } \frac{h}{b} > 0.12$$

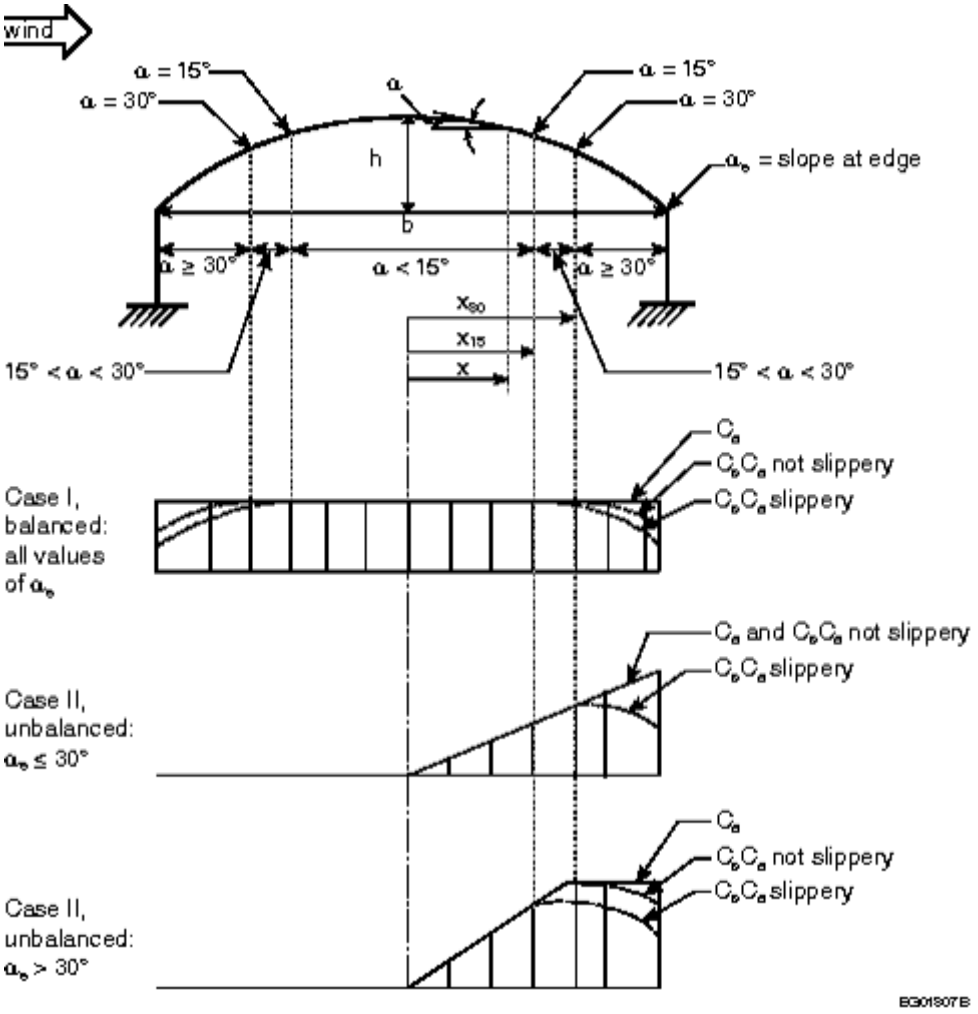
where

x = horizontal distance from the roof peak,

h = height of arch, and

b = width of arch.

Figure 4.1.6.10.-A
Accumulation factors for arch roofs and curved roofs
Forming Part of Sentences 4.1.6.10.(2) to (4)



Note to Figure 4.1.6.10.-A:
(1) Refer to Table 4.1.6.10. for applicable values of Cw and Sentences 4.1.6.2.(5) and (6) for applicable values of Cs.

4) For arch roofs with a slope at the edge $\alpha_e > 30°$ (see Figure 4.1.6.10.-A and Table 4.1.6.10.), C_a shall be

a) taken as 0 on the upwind side of the peak, and

b) on the downwind side of the peak,

i) for the part of the roof between the peak and point where the slope α = 30°, taken as

$$C_a = \frac{xh}{0.06 C_b x_{30} b} \text{ for } 0.05 < \frac{h}{b} \leq 0.12, \text{ and}$$

$$C_a = \frac{2x}{C_b x_{30}} \text{ for } \frac{h}{b} > 0.12$$

where

x, h, b = as specified in Sentence (2), and

x_{30} = value of x where the slope α = 30°, and

ii) for the part of the roof where the slope α > 30°, taken as

$$C_a = \frac{h}{0.06 C_b b} \text{ for } 0.05 < \frac{h}{b} \leq 0.12, \text{ and}$$

$$C_a = \frac{2}{C_b} \text{ for } \frac{h}{b} > 0.12$$

5) Except as provided in Sentence (6), C_a for curved roofs shall be determined in accordance with the requirements for arch roofs stated in Sentences (3) and (4).

Table 4.1.6.10.
Load Cases for Arch Roofs, Curved Roofs and Domes
Forming Part of Sentences 4.1.6.10.(3), (4) and (9)

Load Case	Range of Application	Factors			
		All Arch or Curved Roofs and Domes	Arch and Curved Roofs		Domes
		C_w	C_a Upwind Side	C_a Downwind Side	C_a Downwind Side
Case I	All values of h/b	As stated in 4.1.6.2.(3) and (4)	1.0	1.0	1.0
Case II	Slope at edge ≤ 30° h/b > 0.05 all values of x	1.0	0.0	$C_a = \frac{xh}{0.03 C_b b^2}$ for $\frac{h}{b} \leq 0.12$ $C_a = \frac{4x}{C_b b}$ for $\frac{h}{b} > 0.12$	$C_a(x,y) = C_a(x,0)\left(1 - \frac{y}{r}\right)$
	Slope at edge > 30° h/b > 0.05 0 < x < x30	1.0	0.0	$C_a = \frac{xh}{0.06 C_b x_{30} b}$ for $\frac{h}{b} \leq 0.12$ $C_a = \frac{2x}{C_b x_{30}}$ for $\frac{h}{b} > 0.12$	
	Slope at edge > 30° h/b > 0.05 x ≥ x30	1.0	0.0	$C_a = \frac{h}{0.06 C_b b}$ for $\frac{h}{b} \leq 0.12$ $C_a = \frac{2}{C_b}$ for $\frac{h}{b} > 0.12$	

6) Where the slope, α, of a curved roof at its peak is greater than 10°, C_a shall be determined in accordance with the requirements for gable roofs stated in Article 4.1.6.9. using a slope equal to the mean slope of the curved roof.

7) For domes of circular plan form (see Figure 4.1.6.10.-B), C_a shall

a) along the central axis parallel to the wind, vary in the same way as for an arch roof with the same rise-to-span ratio, h/b, and

b) off this axis, vary according to

$$C_a(x,y) = C_a(x,0)\left(1 - \frac{y}{r}\right)$$

where

$C_a(x,y)$ = value of C_a at location (x,y),

$C_a(x,0)$ = value of C_a on the central axis parallel to the wind,

x = distance along the central axis parallel to the wind,

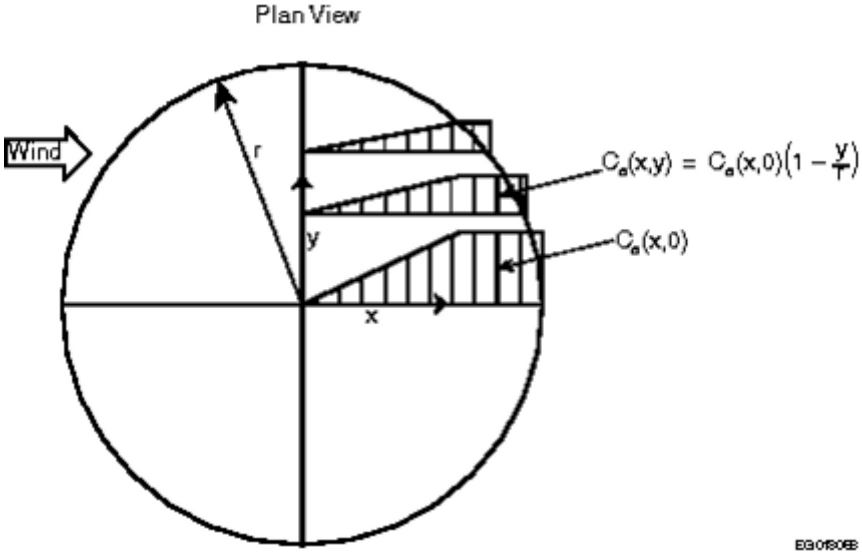
y = horizontal coordinate normal to the x direction, and

r = radius of dome.

8) For all arch roofs, curved roofs and domes, the slope factor, C_s, shall be as prescribed in Sentences 4.1.6.2.(5) and (6).

9) For all arch roofs, curved roofs and domes, the wind exposure factor, C_w, shall be as prescribed in Table 4.1.6.10.

Figure 4.1.6.10.-B
Unbalanced snow accumulation factor on a circular dome
Forming Part of Sentence 4.1.6.10.(7)



Notes to Figure 4.1.6.10.-B:
(1) Refer to Table 4.1.6.10. for applicable values of Cw and Sentences 4.1.6.2.(5) and (6) for applicable values of Cs.
(2) Refer to Sentences 4.1.6.10.(3) and (4) for the calculation of Ca(x,0).

4.1.6.11. Snow Loads Due to Sliding

1) Except as provided in Sentence (2), where an upper roof, or part thereof, slopes downwards with a slope α > 0 towards a lower roof, the snow load, S, on the lower roof, determined in accordance with

Articles 4.1.6.2. and 4.1.6.5., shall be augmented in accordance with Sentence (3) to account for the additional load resulting from sliding snow.

2) Sentence (1) need not apply where

a) snow from the upper roof is prevented from sliding by a parapet or other effective means, or

b) the upper roof is not considered slippery and has a slope of less than 20°.

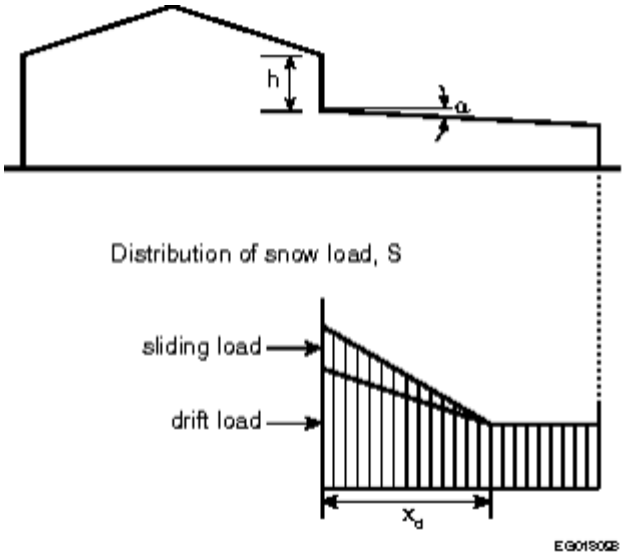
3) The total weight of additional snow resulting from sliding shall be taken as half the total weight of snow resulting from the uniform load case prescribed in Article 4.1.6.2. with

a) the accumulation factor C_a = 1.0 for the relevant part of the upper roof,

b) the slope factor, C_s, based on the slope of the lower roof, as prescribed in Sentences 4.1.6.2.(5) and (6), and

c) the sliding snow distributed on the lower roof such that it is a maximum for x = 0 and decreases linearly to 0 at x = x_d, as shown in Figure 4.1.6.11., where x and x_d are as defined in Article 4.1.6.5.

Figure 4.1.6.11.
Snow distribution on lower roof with sloped upper roof
Forming Part of Sentence 4.1.6.11.(3)



4.1.6.12. Valleys in Curved or Sloped Roofs

1) For valleys in curved or sloped roofs with a slope α > 10°, in addition to the full and partial load cases defined in Article 4.1.6.3., the non-uniform load cases II and III presented in Sentences (2) and (3) shall be considered to account for sliding, creeping and movement of meltwater.

2) For case II (see Figure 4.1.6.12.), the accumulation factor, C_a, shall be calculated as follows:

$$C_a = \frac{1}{C_b} \text{ for } 0 < x \leq b/4, \text{ and}$$

$$C_a = \frac{0.5}{C_b} \text{ for } b/4 < x \leq b/2$$

where

x = horizontal distance from the bottom of the valley, and

b = twice the horizontal distance between the bottom of the valley and the peak of the roof surface in question.

3) For case III (see Figure 4.1.6.12.), C_a shall be calculated as follows:

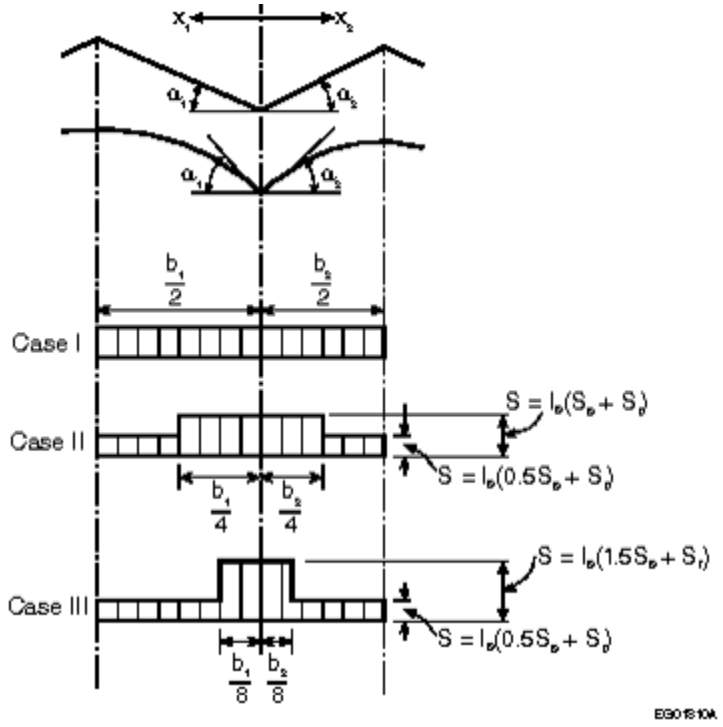
$$C_a = \frac{1.5}{C_b} \text{ for } 0 < x \leq b/8, \text{ and}$$

$$C_a = \frac{0.5}{C_b} \text{ for } b/8 < x \leq b/2$$

where

x, b = as specified in Sentence (2).

Figure 4.1.6.12.
Snow loads in valleys of sloped or curved roofs
Forming Part of Sentences 4.1.6.12.(2) and (3)



Notes to Figure 4.1.6.12.:
(1) Cw = 1, as per Sentence 4.1.6.2.(3).
(2) Cs = 1, as per Sentence 4.1.6.2.(7).

4.1.6.13. Specific Weight of Snow

1) For the purposes of calculating snow loads in drifts, the specific weight of snow, γ, shall be taken as 4.0 kN/m³ or $0.43S_S + 2.2$ kN/m³, whichever is lesser.

4.1.6.14. Snow Removal

1) Snow removal by mechanical, thermal, manual or other means shall not be used as a rationale to reduce design snow loads.

4.1.6.15. Ice Loading of Structures

1) For lattice structures connected to the building, and other building components or appurtenances involving small width elements subject to significant ice accretion, the weight of ice accretion and the effective

area presented to wind shall be as prescribed in CAN/CSA-S37, “Antennas, towers, and antenna-supporting structures.”

4.1.6.16. Roofs with Solar Panels

(See Note A-4.1.6.16.)

1) Where solar panels are installed on a roof, the snow loads, S, shall be determined in accordance with Sentences (2) to (6) or with the requirements for roofs without solar panels, whichever produces the most critical effect.

2) For the purposes of this Article, solar panels shall be classified as

a) Parallel Flush, where the panels are installed parallel to the roof surface with their upper surface less than or equal to $C_bC_wS_s/\gamma$ above the roof surface,

b) Parallel Raised, where the panels are installed parallel to the roof surface with their upper surface greater than $C_bC_wS_s/\gamma$ above the roof surface, or

c) Tilted, where the panels are installed at an angle to the roof surface with their highest edge greater than $C_bC_wS_s/\gamma$ above the roof surface.

3) For sloped roofs with solar panels, the snow loads, S, shall be determined in accordance with the requirements for roofs without solar panels, except that the slope factor, C_s, shall be

a) taken as 1.0 for roof areas extending upslope from the downslope edge of a panel or array of panels at an angle of 45° from each side edge of the panel or array, and

b) as specified in Sentences 4.1.6.2.(5) to (7) for all other roof areas.

(See Note A-4.1.6.16.(3).)

4) For sloped roofs with Parallel Flush solar panels, the snow loads, S, shall be determined in accordance with the requirements for roofs without solar panels, except that

a) C_s shall be determined in accordance with Sentence (3),

b) where the gap width, w_g, between the panels along the roof slope is greater than or equal to the panel width, w_p, along the roof slope, the accumulation factor, C_a, shall be taken as

   i) 0.0 for the panels,

   ii) 2.0 for roof areas within a distance of w_p downslope from a downslope panel edge, and

   iii) 1.0 for all other roof areas

(see Note A-4.1.6.16.(4)(b)), and

c) where the gap width, w_g, between the panels along the roof slope is less than the panel width, w_p, along the roof slope, C_a shall be taken as

   i) 0.0 for panel areas within a distance of w_g downslope from an upslope panel edge,

   ii) 1.0 for other panel areas,

   iii) 2.0 for roof areas in gaps between the panels, and

   iv) 1.0 for all other roof areas

(see Note A-4.1.6.16.(4)(c)).

5) For roofs with Parallel Raised solar panels, the snow loads, S, shall be determined in accordance with the requirements for roofs without solar panels, except that

a) where the roof is flat, C_a shall be taken as

   i) 1.0 for the panels,

ii) 1.0 for roof areas not under the panels,

iii) 1.0 for roof areas under the panels within a distance of min($2h_g$,$2w_g$) from a panel edge, where h_g is the gap height between the lower surface of the panels and the roof surface, and w_g is the gap width between the panels, and

iv) 0.0 for other roof areas under the panels

(see Note A-4.1.6.16.(5)(a)), and

b) where the roof is sloped, the snow loads, S, derived from Clause (a) shall be used, except that

i) C_s shall be determined in accordance with Sentence (3),

ii) S shall be taken as 0.0 on the panels, and

iii) S for all roof areas shall be taken as the sum of S on the panels, as derived from Subclause (a)(i) and shifted by a distance of w_p downslope onto the roof, where w_p is the panel width along the roof slope, and S on the roof areas, as derived from Subclauses (a)(ii) to (a)(iv)

(see Note A-4.1.6.16.(5)(b)).

6) For flat roofs with Tilted solar panels, the snow loads, S, shall be determined in accordance with the requirements for roofs without solar panels, except that

a) C_a shall be taken as 0.0 for the panels,

b) C_a shall be taken as 1.0 for roof areas beyond a distance of $5(h - C_bC_wS_s/\gamma)$ from the lowest edge of the panels, where h is the height of the highest edge of the panels above the roof surface,

c) except as provided in Clauses (d) and (e), for roof areas within a distance of $5(h - C_bC_wS_s/\gamma)$ from the lowest edge of the panels, C_a shall be taken as

i) 1.25 for $(h_g - C_bC_wS_s/\gamma) \leq 0.3$ m, where h_g is the gap height between the lowest edge of the panels and the roof surface,

ii) $1.294 - 0.1471(h_g - C_bC_wS_s/\gamma)$ for $0.3 < (h_g - C_bC_wS_s/\gamma) \leq 2.0$ m, and

iii) 1.0 for $(h_g - C_bC_wS_s/\gamma) > 2.0$ m

(see Note A-4.1.6.16.(6)(c)),

d) except as provided in Clause (e), C_a shall be taken as 2.0 for roof areas within a distance of w_{ph} beyond the lowest edge of the panels, where w_{ph} is the horizontal projection of the panel width, w_p, along the sloped panel edges, and

e) where the panels, panel supports or back plates obstruct snow from sliding under the panels, the load of the increased volume of snow in the gaps between the panels shall be considered to be uniformly distributed.

(See Note A-4.1.6.16.(6).)

4.1.7. Wind Load

4.1.7.1. Specified Wind Load

1) The specified wind loads for a building and its components shall be determined using the Static, Dynamic or Wind Tunnel Procedure as stated in Sentences (2) to (5).

2) For the design of *buildings* that are not dynamically sensitive, as defined in Sentence 4.1.7.2.(1), one of the following procedures shall be used to determine the specified wind loads:

a) the Static Procedure described in Article 4.1.7.3.,

b) the Dynamic Procedure described in Article 4.1.7.8., or

c) the Wind Tunnel Procedure described in Article 4.1.7.14.

3) For the design of *buildings* that are dynamically sensitive, as defined in Sentence 4.1.7.2.(2), one of the following procedures shall be used to determine the specified wind loads:

a) the Dynamic Procedure described in Article 4.1.7.8., or

b) the Wind Tunnel Procedure described in Article 4.1.7.14.

4) For the design of *buildings* that may be subject to wake buffeting or channelling effects from nearby *buildings*, or that are very dynamically sensitive, as defined in Sentence 4.1.7.2.(3), the Wind Tunnel Procedure described in Article 4.1.7.14., shall be used to determine the specified wind loads.

5) For the design of cladding and secondary structural members, one of the following procedures shall be used to determine the specified wind loads:

a) the Static Procedure described in Article 4.1.7.3., or

b) the Wind Tunnel Procedure described in Article 4.1.7.14.

6) Computational fluid dynamics shall not be used to determine the specified wind loads for a building and its components. (See Note A-4.1.7.1.(6).)

4.1.7.2. Classification of Buildings

(See Note A-4.1.7.2.(2))

1) Except as provided in Sentences (2) and (3), a building is permitted to be classified as not dynamically sensitive.

2) A building shall be classified as dynamically sensitive if

a) its lowest natural frequency is less than 1 Hz and greater than 0.25 Hz,

b) its height is greater than 60 m, or

c) its height is greater than 4 times its minimum effective width, where the effective width, w, of a building shall be taken as

$$w = \frac{\sum h_i w_i}{\sum h_i}$$

where the summations are over the height of the building for a given wind direction, h_i is the height above grade to level i, and w_i is the width normal to the wind direction at height h_i; the minimum effective width is the lowest value of the effective width considering all wind directions.

3) A building shall be classified as very dynamically sensitive if

a) its lowest natural frequency is less than or equal to 0.25 Hz, or

b) it contains a human *occupancy*, and its height is more than 6 times its minimum effective width as defined in Clause (2)(c).

4.1.7.3. Static Procedure

1) The specified external pressure or suction due to wind on part or all of a surface of a building shall be calculated as follows:

$$p = I_w q C_e C_t C_g C_p$$

where

p = specified external pressure acting statically and in a direction normal to the surface, considered positive when the pressure acts towards the surface and negative when it acts away from the surface,

Iw = importance factor for wind load, as provided in Table 4.1.7.3.,

Q = reference velocity pressure, as provided in Sentence (4),

C_e = exposure factor, as provided in Sentences (5) and (7),

C_t = topographic factor, as provided in Article 4.1.7.4.,

C_g = gust effect factor, as provided in Sentence (8), and

C_p = external pressure coefficient, as provided in Articles 4.1.7.5. and 4.1.7.6.

Table 4.1.7.3.
Importance Factor for Wind Load, IW
Forming Part of Sentences 4.1.7.3.(1) and 4.1.7.8.(4)

Importance Category	Importance Factor, IW	
	ULS	SLS
Low	0.8	0.75
Normal	1	0.75
High	1.15	0.75
Post-disaster	1.25	0.75

2) The net wind load for the building as a whole shall be the algebraic difference of the loads on the windward and leeward surfaces, and in some cases, may be calculated as the sum of the products of the external pressures or suctions and the areas of the surfaces over which they are averaged as provided in Sentence (1).

3) The net specified pressure due to wind on part or all of a surface of a building shall be the algebraic difference, such as to produce the most critical effect, of the external pressure or suction calculated in accordance with Sentence (1) and the specified internal pressure or suction due to wind calculated as follows:

$$p_i = I_W q C_{ei} C_t C_{gi} C_{pi}$$

where

p_i = specified internal pressure acting statically and in a direction normal to the surface, either as a pressure directed towards the surface or as a suction directed away from the surface,

I_W, q, C_t = as defined in Sentence (1),

C_{ei} = exposure factor for internal pressure, as provided in Sentence (7),

C_{gi} = internal gust effect factor, as provided in Sentence (10), and

C_{pi} = internal pressure coefficient, as provided in Article 4.1.7.7.

4) The reference velocity pressure, q, shall be the appropriate value determined in conformance with Subsection 1.1.3., based on a probability of being exceeded in any one year of 1 in 50.

5) The exposure factor, C_e, shall be based on the reference height, h, determined in accordance with Sentence (6), for the surface or part of the surface under consideration and shall be

a) $(h/10)^{0.2}$ but not less than 0.9 for open terrain, where open terrain is level terrain with only scattered *buildings*, trees or other obstructions, open water or shorelines thereof,

b) $0.7(h/12)^{0.3}$ but not less than 0.7 for rough terrain, where rough terrain is suburban, urban or wooded terrain extending upwind from the building uninterrupted for at least 1 km or 20 times the height of the building, whichever is greater, or

c) an intermediate value between the two exposures defined in Clauses (a) and (b) in cases where the site is less than 1 km or 20 times the height of the building from a change in terrain conditions, whichever is greater, provided an appropriate interpolation method is used (see Note A-4.1.7.3.(5)(c)).

6) The reference height, h, shall be determined as follows:

a) for *buildings* whose height is less than or equal to 20 m and less than the smaller plan dimension, h shall be the mid-height of the roof above grade, but not less than 6 m,

b) for other *buildings*, h shall be

i) the actual height above grade of the point on the windward wall for which external pressures are being calculated,

ii) the mid-height of the roof for pressures on surfaces parallel to the wind direction, and

iii) the mid-height of the building for pressures on the leeward wall, and

c) for any structural element exposed to wind, h shall be the mid-height of the element above the ground.

7) The exposure factor for internal pressures, C_{ei}, shall be determined as follows:

a) for *buildings* whose height is greater than 20 m and that have a dominant opening, C_{ei} shall be equal to the exposure factor for external pressures, C_e, calculated at the mid-height of the dominant opening, and

b) for other *buildings*, C_{ei} shall be the same as the exposure factor for external pressures, C_e, calculated for a reference height, h, equal to the mid-height of the building or 6 m, whichever is greater.

8) Except as provided in Sentences (9) and 4.1.7.6.(1), the gust effect factor, C_g, shall be one of the following values:

a) 2.0 for the building as a whole and main structural members, or

b) 2.5 for external pressures and suctions on secondary structural members, including cladding.

9) For cases where C_g and C_p are combined into a single product, C_gC_p, the values of C_g and C_p need not be independently specified. (See Article 4.1.7.6.)

10) The internal gust effect factor, C_{gi}, shall be 2.0, except it is permitted to be calculated using the following equation for large structures enclosing a single large unpartitioned volume that does not have numerous overhead doors or openings:

$$C_{gi} = 1 + \frac{1}{\sqrt{1 + \frac{V_0}{6\,950A}}}$$

where

V_0 = internal volume, in m^3, and

A = total area of all exterior openings of the volume, in m^2.

(See Note A-4.1.7.3.(10).)

4.1.7.4. Topographic Factor

1) Except as provided in Sentence (2), the topographic factor, C_t, shall be taken as 1.0.

2) For *buildings* on hills or escarpments with a slope, $H_h/(2L_h)$, greater than 0.1 (see Figure 4.1.7.4.), the topographic factor, C_t, shall be calculated as follows:

$$C_t = \left(1 + \frac{\Delta S}{C_s}\right)(1 + \Delta S)$$

where

$$\Delta S = \Delta S_{max}\left(1 - \frac{|x|}{kL_h}\right)\exp(-\alpha z/L_h)$$

where

ΔS_{max} = applicable value from Table 4.1.7.4.,

x = horizontal distance from the peak of the hill or escarpment,

L_h = horizontal distance upwind from the peak to the point where the ground surface lies at half the height of the hill or escarpment, or $2H_h$ (where H_h = height of hill or escarpment), whichever is greater,

z = height above ground, and

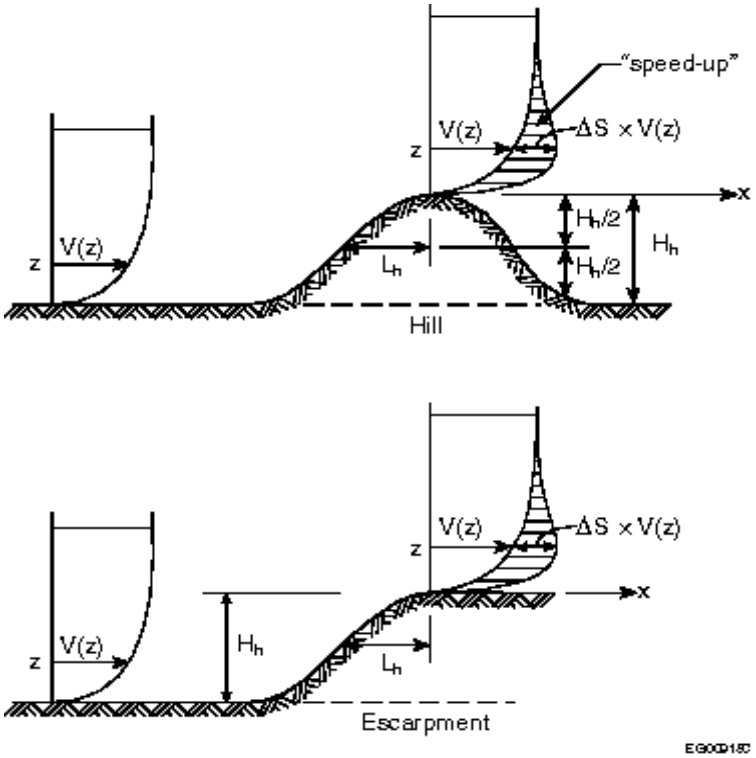
k and α = applicable constants from Table 4.1.7.4. based on shape of hill or escarpment.

Table 4.1.7.4.
Parameters for Maximum Speed-up Over Hills and Escarpments
Forming Part of Sentence 4.1.7.4.(2)

Shape of Hill or Escarpment	ΔSmax(1)	α	k	
			x < 0	x ≥ 0
2-dimensional hill	2.2Hh/Lh	3	1.5	1.5
2-dimensional escarpment	1.3Hh/Lh	2.5	1.5	4
3-dimensional axi-symmetrical hill	1.6Hh/Lh	4	1.5	1.5

Notes to Table 4.1.7.4.:
(1)For Hh/Lh > 0.5, assume Hh/Lh = 0.5 and substitute 2Hh for Lh in the equation for ΔS.

Figure 4.1.7.4.
Speed-up of mean velocity on a hill or escarpment
Forming Part of Sentence 4.1.7.4.(2)



Note to Figure 4.1.7.4.:
(1) V(z) = wind speed

4.1.7.5. External Pressure Coefficients

1) Applicable values of external pressure coefficients, C_p, are provided in

a) Sentences (2) to (9), and

b) Article 4.1.7.6. for certain shapes of low *buildings*.

2) For the design of the main structural system, the value of C_p shall be established as follows, where H is the height of the building and D is the width of the building parallel to the wind direction:

a) on the windward face,

C_p = 0.6 for H/D < 0.25

= 0.27(H/D + 2) for 0.25 ≤ H/D < 1.0, and

= 0.8 for H/D ≥ 1.0,

b) on the leeward face,

C_p = –0.3 for H/D < 0.25,

= –0.27(H/D + 0.88) for 0.25 ≤ H/D < 1.0, and

= –0.5 for H/D ≥ 1.0, and

c) on the walls parallel to the wind, C_p = –0.7.

(See Note A-4.1.7.5.(2) and (3).)

3) For the design of roofs, the value of C_p shall be established as follows, where x is the distance from the upwind edge of the roof:

a) for H/D ≥ 1.0, C_p = –1.0, and

b) for H/D < 1.0,

C_p = –1.0 for x ≤ H, and

= –0.5 for x > H.

(See Note A-4.1.7.5.(2) and (3).)

4) For the design of the cladding and of secondary structural elements supporting the cladding, the value of C_p shall be established as follows, where W and D are the widths of the building:

a) on walls, C_p shall be taken as ±0.9, except that within a distance equal to the larger of 0.1D and 0.1W from a building corner, the negative value of C_p shall be taken as –1.2,

b) on walls where vertical ribs deeper than 1 m are placed on the facade, C_p shall be taken as ±0.9, except that, within a distance equal to the larger of 0.2D and 0.2W from a building corner, the negative value of C_p shall be taken as –1.4, and

c) on roofs, C_p shall be taken as –1.0, except that

i) within a distance equal to the larger of 0.1D and 0.1W from a roof edge, C_p shall be taken as –1.5,

ii) in a zone that is within a distance equal to the larger of 0.2W and 0.2D from a roof corner, C_p shall be taken as –2.3 but is permitted to be taken as –2.0 for roofs with perimeter parapets that are higher than 1 m, and

iii) on lower levels of flat stepped roofs, positive pressure coefficients established for the walls of the steps apply for a distance b (see Figure 4.1.7.6.-D for the definition of b).

(See Note A-4.1.7.5.(4).)

5) Except as provided in Sentence (6), for the design of balcony *guards*, the internal pressure coefficient, C_{pi}, shall be taken as zero and the value of C_p shall be taken as ±0.9, except that, within a distance equal to the larger of 0.1W and 0.1D from a building corner, C_p shall be taken as ±1.2.

6) Where the top of the balcony *guard* is 2.0 m or less below the roof surface, the values of C_p shall be taken as equal to those determined for parapets in Sentences (7) and (8).

7) To determine the contribution from parapets to the wind loads on the main structural system, the values of C_p shall be taken as

a) on the outer faces, equal to those on the walls below,

b) on the inner face of the windward parapet, equal to that on the upwind edge of a roof surface at the level of the top of the parapet, and

c) on the inner faces of the other parapets, zero.

8) For the structural design of parapets themselves, the values of C_p shall be taken as equal to those specified in Sentence (7), except that the value of C_p on the inner face of the leeward parapet shall be taken as equal to that on the outer face of the windward parapet.

9) For the design of cladding on parapets, the values of C_p shall be taken as

a) on the outer vertical surfaces, equal to those on the cladding on the walls below, and

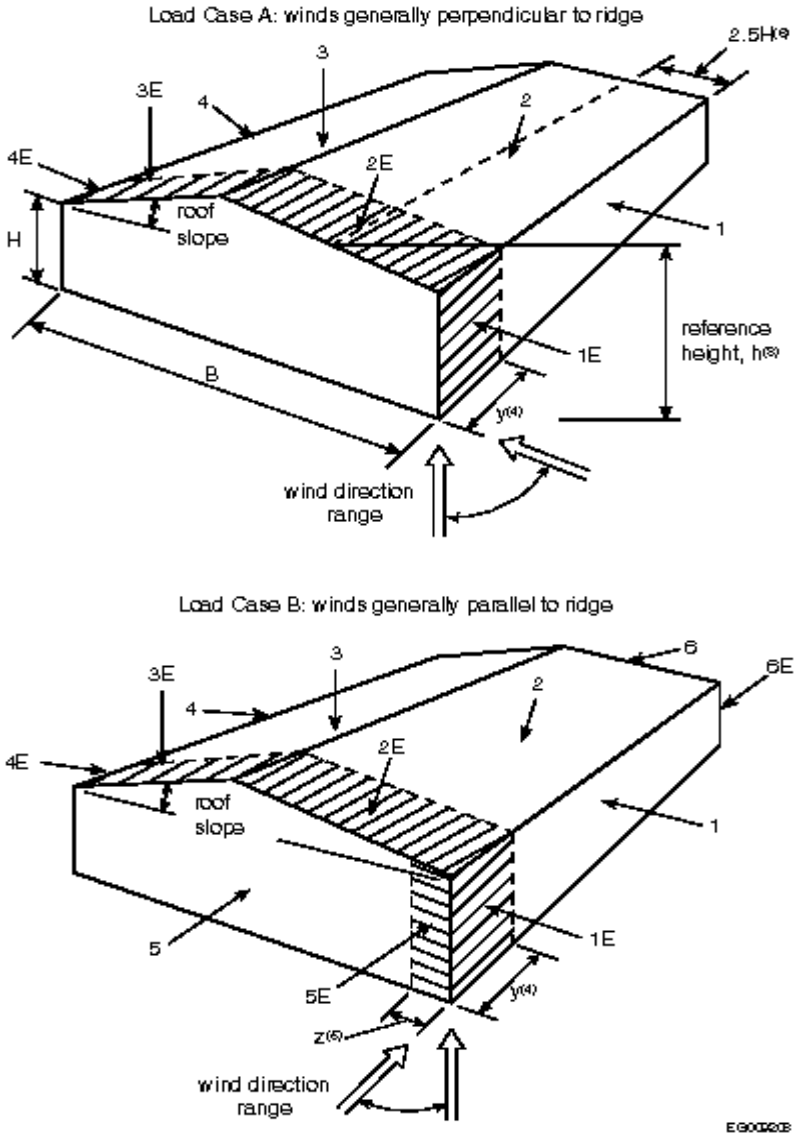
b) on the inner and top surfaces, equal to those on the cladding of a roof surface at the level of the top of the parapet.

4.1.7.6. External Pressure Coefficients for Low Buildings

1) For the design of *buildings* with a height, H, that is both less than or equal to 20 m and less than the smaller plan dimension, the values of the product of the pressure coefficient and gust factor, C_gC_p, provided in Sentences (2) to (9) are permitted to be used.

2) For the design of the main structural system of the building, which is affected by wind pressures on more than one surface as shown in Figure 4.1.7.6.-A, the values of C_gC_p are provided in Table 4.1.7.6.

Figure 4.1.7.6.-A
Primary structural actions arising from wind load acting simultaneously on all surfaces of low buildings (H ≤ 20 m)
Forming Part of Sentence 4.1.7.6.(2) and Table 4.1.7.6.



Notes to Figure 4.1.7.6.-A:
(1) The building must be designed for all wind directions. Each corner must be considered in turn as the windward corner shown in the sketches. For all roof slopes, Load Case A and Load Case B are required as two separate loading conditions to generate the wind actions, including torsion, to be resisted by the structural system.
(2) For the design of *foundations*, exclusive of anchorages to the frame, only 70% of the effective load is to be considered.
(3) The reference height, h, for pressures is the mid-height of the roof or 6 m, whichever is greater. The eave height, H, may be substituted for the mid-height of the roof if the roof slope is less than 7°.
(4) End-zone width y should be the greater of 6 m or 2z, where z is the width of the gable-wall end zone defined for Load Case B below. Alternatively, for *buildings* with frames, the end-zone width y may be the distance between the end and the first interior frame.
(5) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(6) For B/H > 5 in Load Case A, the negative coefficients listed for surfaces 2 and 2E in Table 4.1.7.6. should only be applied on an area whose width is 2.5H measured from the windward eave. The pressures on the remainder of the windward roof should be reduced to the pressures for the leeward roof.

Table 4.1.7.6.
External Peak Values of CgCp in Figure 4.1.7.6.-A
Forming Part of Sentence 4.1.7.6.(2)

Load Case	Roof Slope	External Peak Values of C_gC_p[1][2]											
		Building Surfaces											
		1	1E	2	2E	3	3E	4	4E	5	5E	6	6E
A	0° to 5°	0.75	1.15	−1.3	−2.0	−0.7	−1.0	−0.55	−0.8	–	–	–	–
	20°	1.0	1.5	−1.3	−2.0	−0.9	−1.3	−0.8	−1.2	–	–	–	–
	30° to 45°	1.05	1.3	0.4	0.5	−0.8	−1.0	−0.7	−0.9	–	–	–	–
	90°	1.05	1.3	1.05	1.3	−0.7	−0.9	−0.7	−0.9	–	–	–	–
B	0° to 90°	−0.85	−0.9	−1.3	−2.0	−0.7	−1.0	−0.85	−0.9	0.75	1.15	−0.55	−0.8

Notes to Table 4.1.7.6.:
(1) For values of roof slope not shown, the coefficient CgCp can be interpolated linearly.
(2) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface.

3) For the design of individual walls and wall cladding, the values of C_gC_p are provided in Figure 4.1.7.6.-B.

4) For the design of roofs with a slope less than or equal to 7°, the values of C_gC_p are provided in Figure 4.1.7.6.-C.

5) For the design of flat roofs with steps in elevation, the values of C_gC_p are provided in Figure 4.1.7.6.-D.

6) For the design of gabled or hipped, single-ridge roofs with a slope greater than 7°, the values of C_gC_p are provided in Figure 4.1.7.6.-E.

7) For the design of gabled, multi-ridge roofs, the values of C_gC_p are provided in

a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 10°, and

b) Figure 4.1.7.6.-F for roofs with a slope greater than 10°.

8) For monosloped roofs, the values of C_gC_p are provided in

a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 3°, and

b) Figure 4.1.7.6.-G for roofs with a slope greater than 3° and less than or equal to 30°.

9) For sawtooth roofs, the values of C_gC_p are provided in

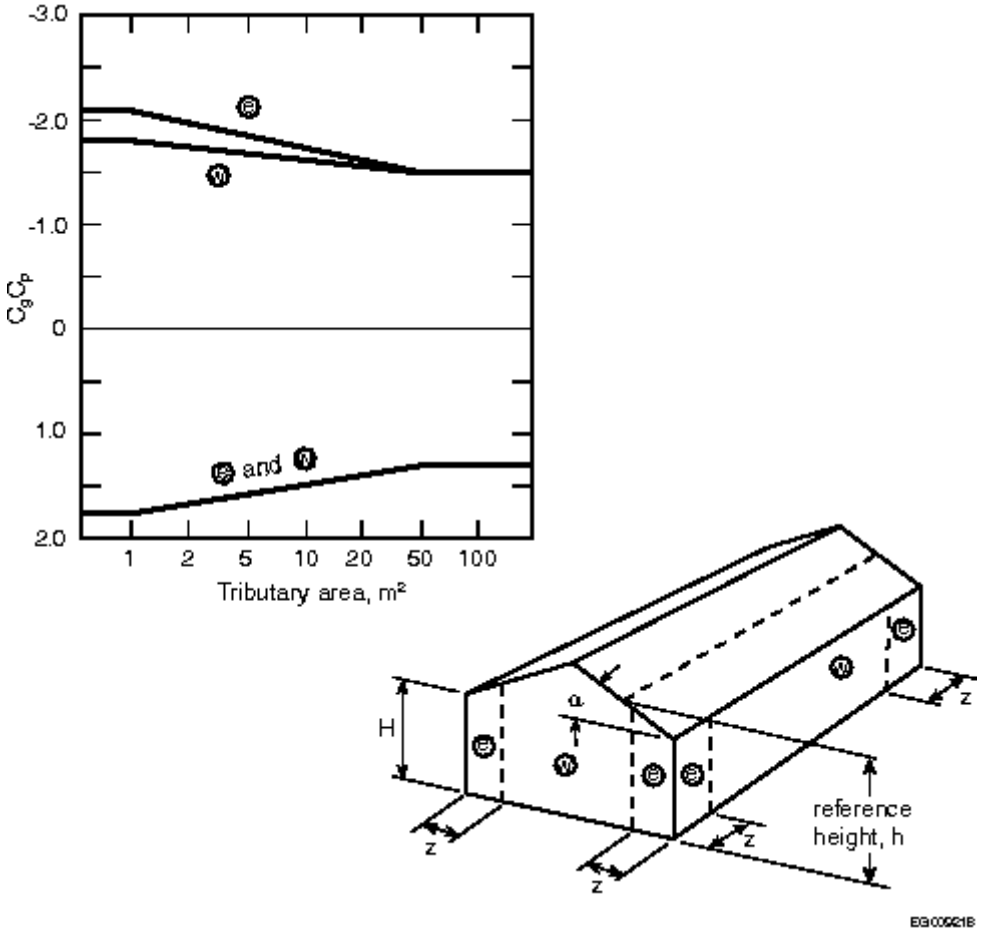
a) Figure 4.1.7.6.-C for roofs with a slope less than or equal to 10°, and

b) Figure 4.1.7.6.-H for roofs with a slope greater than 10°.

10) The wind loads on balcony *guard*s on low *buildings* shall be as specified in Sentences 4.1.7.5.(5) and (6).

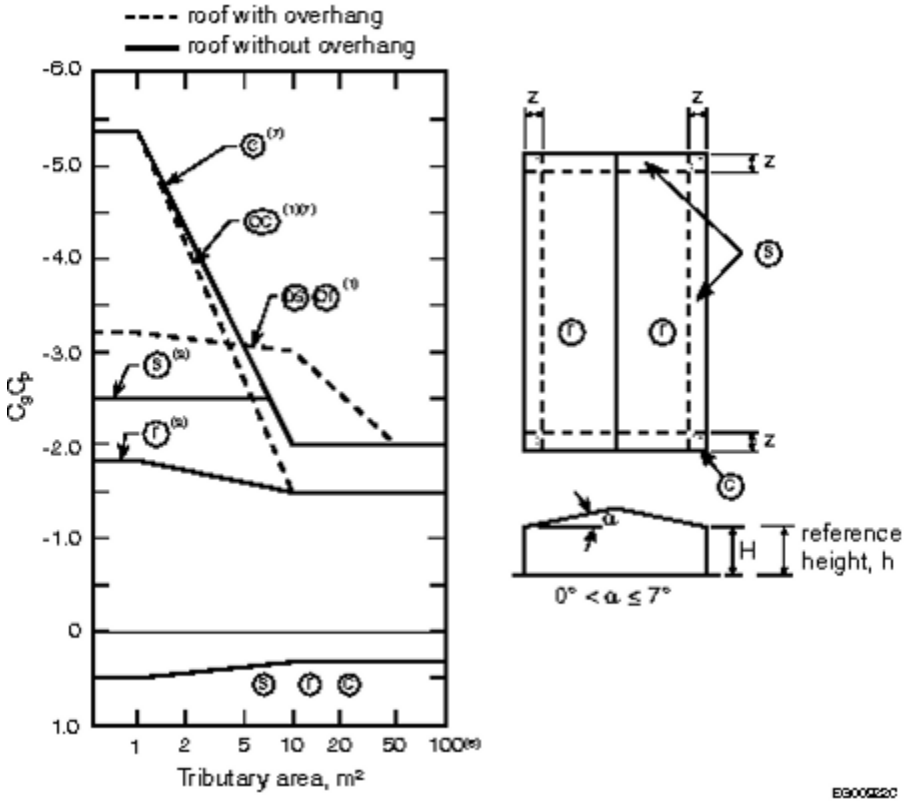
11) The wind loads on parapets on low *buildings* shall be as specified in Sentences 4.1.7.5.(7) to (9).

Figure 4.1.7.6.-B
External peak values of CgCp on individual walls for the design of cladding and secondary structural members
Forming Part of Sentence 4.1.7.6.(3)



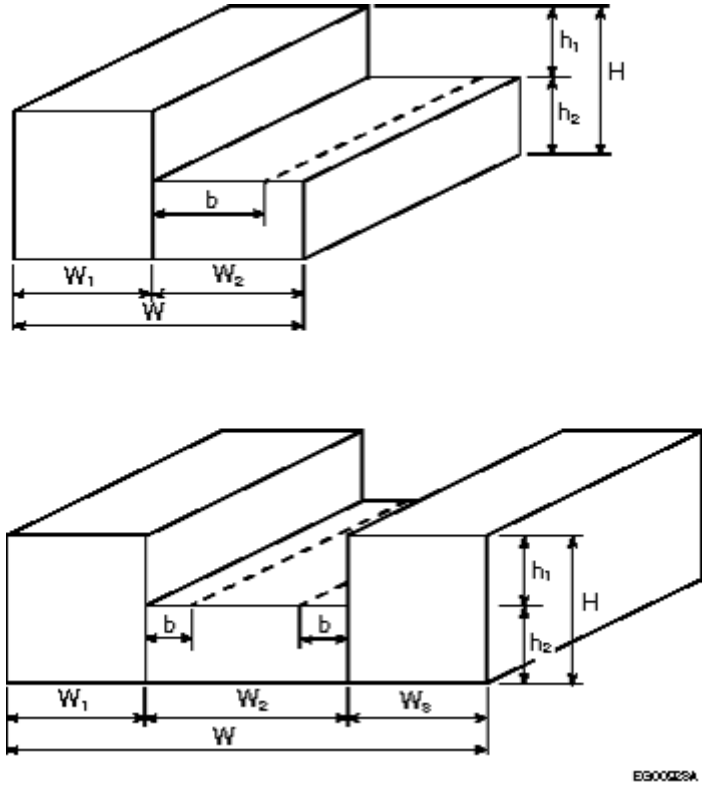
Notes to Figure 4.1.7.6.-B:
(1) These coefficients apply for any roof slope, α.
(2) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(3) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(4) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(5) Pressure coefficients generally apply for facades with architectural features; however, where vertical ribs deeper than 1 m are placed on a facade, a local CgCp of –2.8 applies to zone e.

Figure 4.1.7.6.-C
External peak values of CgCp on roofs with a slope of 7° or less for the design of structural components and cladding
Forming Part of Sentences 4.1.7.6.(4), (7), (8) and (9)



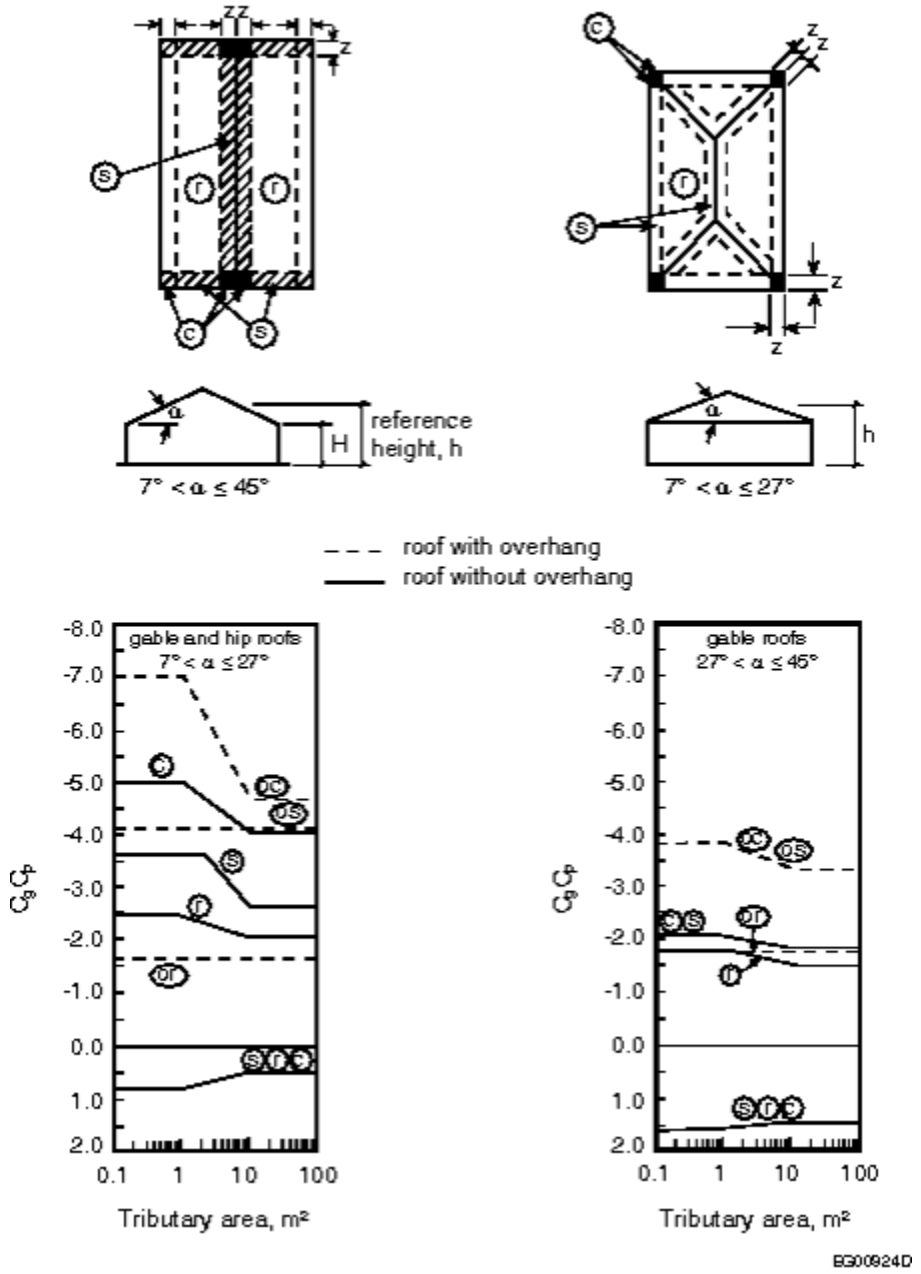
Notes to Figure 4.1.7.6.-C:
(1) Coefficients for overhung roofs have the prefix "o" and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces. In the case of overhangs, the walls are inboard of the roof outline.
(2) s and r apply to both roofs and upper surfaces of canopies.
(3) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(4) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(5) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(6) For calculating the uplift forces on tributary areas larger than 100 m^2 on unobstructed nearly-flat roofs with low parapets, and where the centre of the tributary area is at least twice the height of the building from the nearest edge, the value of CgCp may be reduced from –1.5 to –1.1 at x/H = 2 and further reduced linearly to –0.6 at x/H = 5, where x is the distance to the nearest edge and H is the height of the building.
(7) For roofs having a perimeter parapet with a height of 1 m or greater, the corner coefficients CgCp for tributary areas less than 1 m^2 can be reduced from –5.4 to –4.4.

Figure 4.1.7.6.-D
External peak values of CgCp for the design of the structural components and cladding of buildings with stepped roofs
Forming Part of Sentence 4.1.7.6.(5)



Notes to Figure 4.1.7.6.-D:
(1) The zone designations, pressure-gust coefficients and notes provided in Figure 4.1.7.6.-C apply on both the upper and lower levels of flat stepped roofs, except that on the lower levels, positive pressure-gust coefficients equal to those in Figure 4.1.7.6.-B for walls apply for a distance, b, where b is equal to 1.5h1 but not greater than 30 m. For all walls in Figure 4.1.7.6.-D, zone designations and pressure coefficients provided for walls in Figure 4.1.7.6.-B apply.
(2) Note (1) above applies only when the following conditions are met: h1 ≥ 0.3H, h1 ≥ 3 m, and W1, W2 or W3 is greater than 0.25W but not greater than 0.75W.

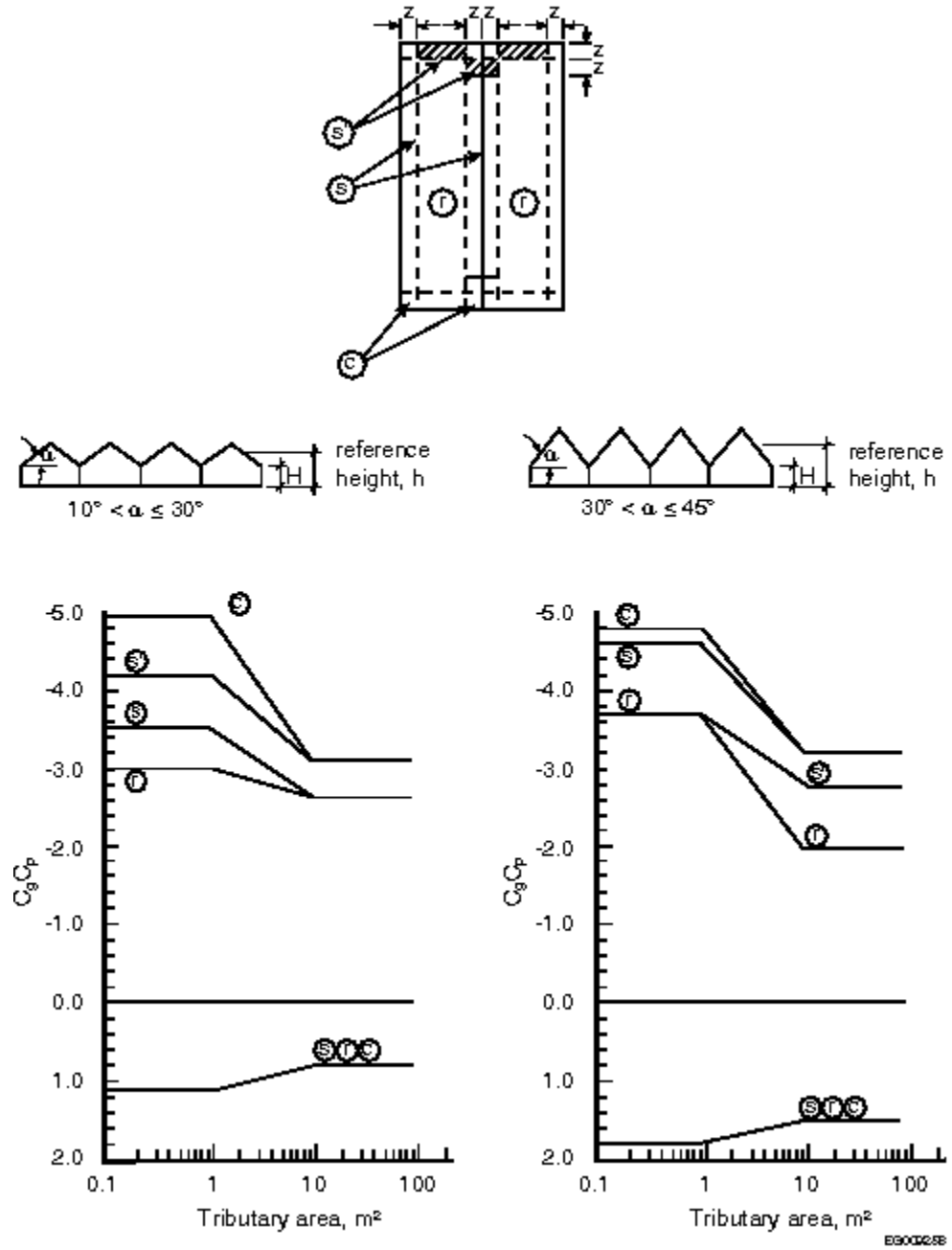
Figure 4.1.7.6.-E
External peak values of CgCp on single-span gabled and hipped roofs with a slope greater than 7° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(6)



Notes to Figure 4.1.7.6.-E:
(1) Coefficients for overhung roofs have the prefix "o" and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces.
(2) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(3) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(4) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.

(5) For hipped roofs with 7° < α ≤ 27°, edge/ridge strips and pressure-gust coefficients for ridges of gabled roofs apply along each hip.

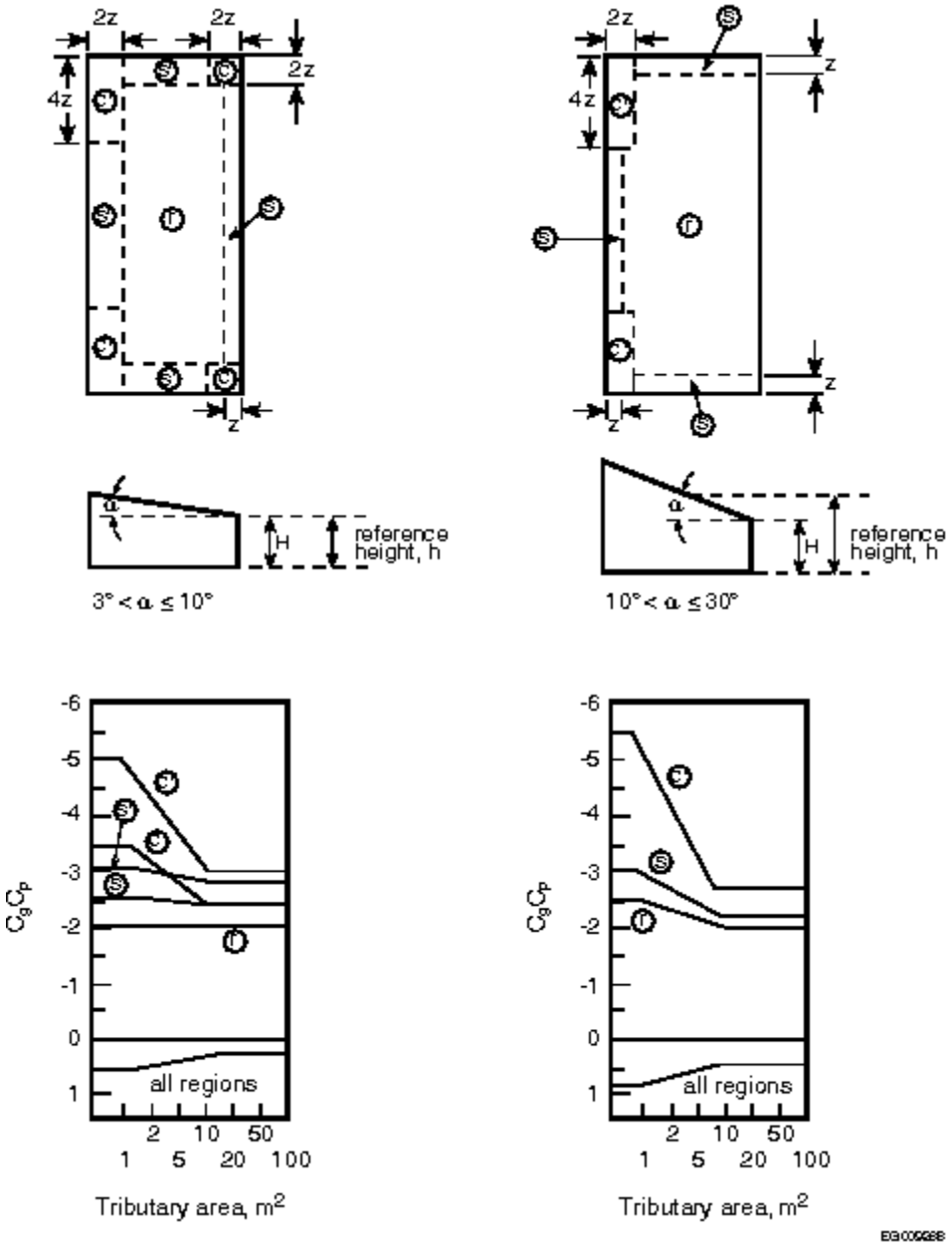
Figure 4.1.7.6.-F
External peak values of CgCp on multi-span gabled (folded) roofs with a slope greater than 10° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(7)



Notes to Figure 4.1.7.6.-F:
(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.

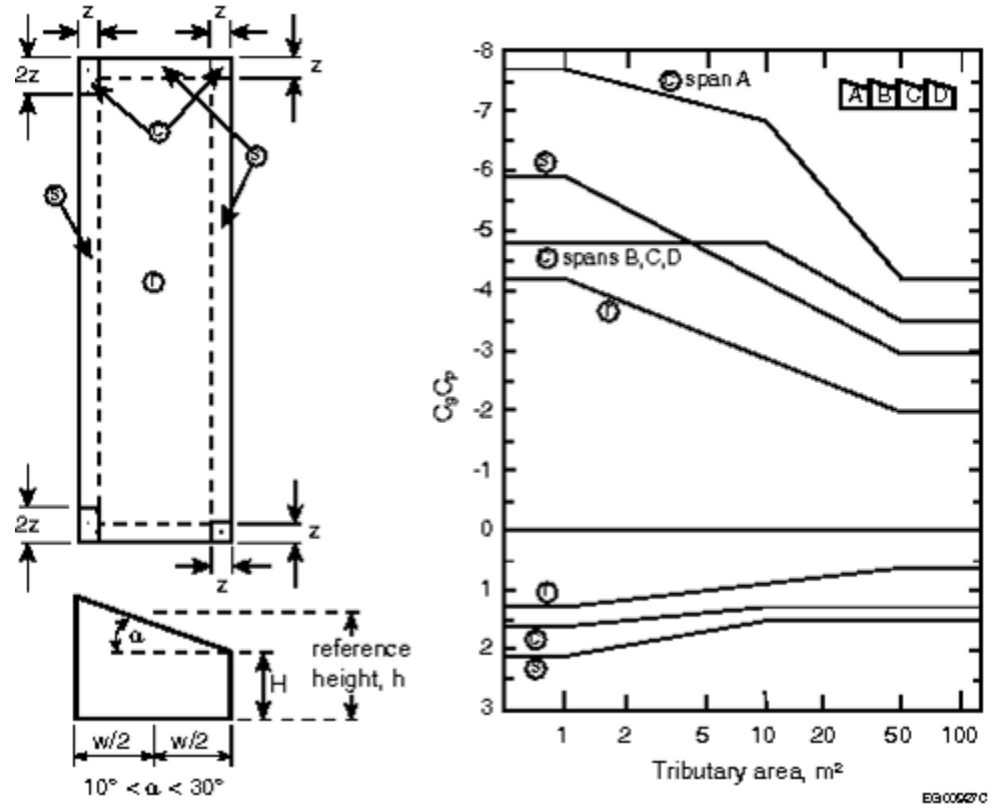
(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(4) For α ≤ 10°, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where α > than 7°, use α = 7°.

Figure 4.1.7.6.-G
External peak values of CgCp on monoslope roofs for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(8)



Notes to Figure 4.1.7.6.-G:
(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(4) For α ≤ 3°, the coefficients given in Figure 4.1.7.6.-C apply.

Figure 4.1.7.6.-H
External peak values of CgCp on sawtooth roofs with a slope greater than 10° for the design of structural components and cladding
Forming Part of Sentence 4.1.7.6.(9)



Notes to Figure 4.1.7.6.-H:
(1) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H, but not less than 4% of the least horizontal dimension or 1 m.
(2) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
(3) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
(4) Negative coefficients on the corner zones of Span A differ from those on Spans B, C and D.
(5) For α ≤ 10°, the coefficients given in Figure 4.1.7.6.-C apply, but for cases where α > than 7°, use α = 7°.

4.1.7.7. Internal Pressure Coefficient

1) The internal pressure coefficient, C_{pi}, for *buildings* shall be as prescribed in Table 4.1.7.7.

Table 4.1.7.7.
Internal Pressure Coefficients
Forming Part of Sentence 4.1.7.7.(1)

Building Openings	Values for Cpi
Uniformly distributed small openings amounting to less than 0.1% of the total surface area of the building	–0.15 to 0.0

Non-uniformly distributed openings of which none is significant or significant openings that are wind-resistant and closed during storms	–0.45 to +0.30
Large openings likely to remain open during storms	–0.70 to +0.70

2) The internal pressure coefficient, C_{pi}, for cladding on parapets shall be –0.70 to +0.70. (See Note A-4.1.7.7.(2).)

4.1.7.8. Dynamic Procedure

1) For the application of the Dynamic Procedure, the provisions of Article 4.1.7.3. shall be followed, except that the exposure factor, C_e, shall be as prescribed in Sentences (2) and (3), and the gust effect factor, C_g, shall be as prescribed in Sentence (4), when determining the wind loads on the main structural system.

2) For *buildings* in open terrain, as defined in Clause 4.1.7.3.(5)(a), the value of C_e for the design of the main structural system shall be calculated as follows:

$$C_e = \left(\frac{h}{10}\right)^{0.28}, \text{ but } 1.0 \le C_e \le 2.5$$

(See Note A-4.1.7.8.(2) and (3).)

3) For *buildings* in rough terrain, as defined in Clause 4.1.7.3.(5)(b), the value of C_e for the design of the main structural system shall be calculated as follows:

$$C_e = 0.5\left(\frac{h}{12.7}\right)^{0.50}, \text{ but } 0.5 \le C_e \le 2.5$$

(See Note A-4.1.7.8.(2) and (3).)

4) For the design of the main structural system, C_g shall be calculated as follows:

$$C_g = 1 + g_p \frac{\sigma}{\mu}$$

where

g_p = peak factor calculated as $\sqrt{2\ln(\nu T)} + \frac{0.577}{\sqrt{2\ln(\nu T)}}$, and

$$\sigma/\mu = \sqrt{\frac{K}{C_{eH}}\left(B + \frac{sF}{\beta}\right)},$$

where

v = average fluctuation rate calculated as $f_{nD}\sqrt{\frac{sF}{sF+\beta B}}$,

T = 3 600 s,

K = 0.08 for open terrain and 0.10 for rough terrain,

C_{eH} = exposure factor evaluated at reference height h = H,

B = background turbulence factor, a function of w/H determined from Figure 4.1.7.8.,

s = size reduction factor calculated as $\frac{\pi}{3}\left[\frac{1}{1+\frac{8f_{nD}H}{3V_H}}\right]\left[\frac{1}{1+\frac{10f_{nD}W}{V_H}}\right]$,

F = gust energy ratio calculated as $\frac{x_0^2}{(1+x_0^2)^{4/3}}$, where $x_0 = (1\,220 f_{nD}/V_H)$, and

β = damping ratio, which shall be determined by a rational method, or may be taken to be 0.01 for steel structures, 0.02 for concrete structures, and 0.015 for composite structures,

where

f_{nD} = natural frequency of vibration of the building in the along-wind direction, in Hz,

H= height of the building,

w = effective width of windward face of the building calculated as $\frac{\sum h_i w_i}{\sum h_i}$, where w_i = width normal to wind direction at height h_i, and

V_H = mean wind speed at the top of the structure, in m/s, calculated as $\bar{V}\sqrt{C_{eH}}$,

Where

$\bar{V}$ = reference wind speed at a height of 10 m, in m/s, calculated as $\sqrt{\frac{2I_w q}{\rho}}$,

where

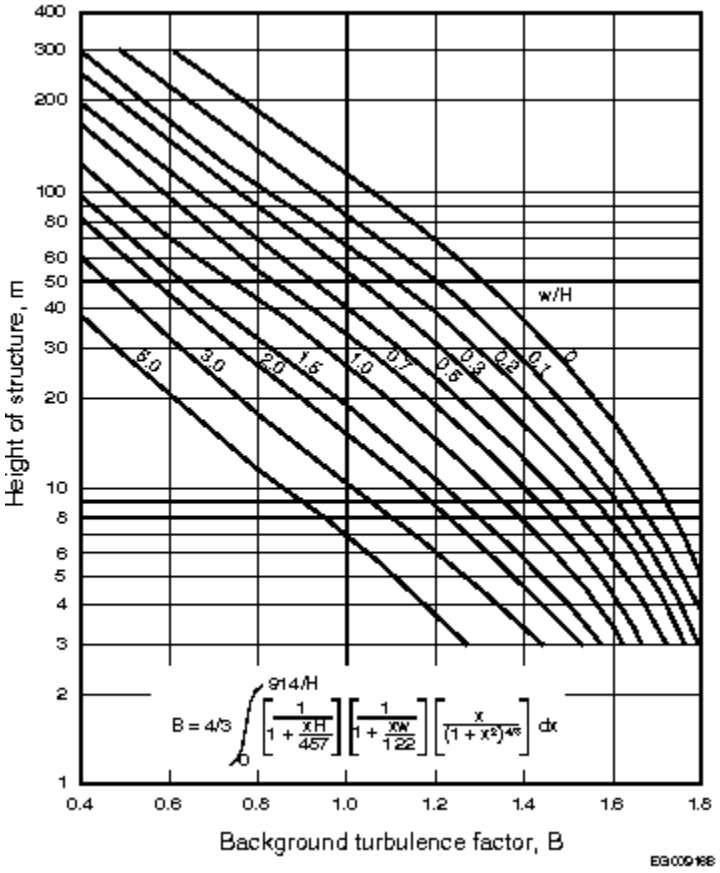
I_W = importance factor for wind load, as provided in Table 4.1.7.3.,

q = reference velocity pressure, in Pa, and

ρ = air density = 1.2929 kg/m³.

(See Note A-4.1.7.8.(4).)

Figure 4.1.7.8.
Background turbulence factor, B
Forming Part of Sentence 4.1.7.8.(4)



4.1.7.9. Full and Partial Wind Loading

1) Except where the wind loads are derived from the combined C_gC_p values determined in accordance with Article 4.1.7.6., *buildings* and structural members shall be capable of withstanding the effects of the following loads:

a) the full wind loads acting along each of the 2 principal horizontal axes considered separately,

b) 75% of the wind loads described in Clause (a) but offset from the central geometric axis of the building by 15% of its width normal to the direction of the force to produce the worst load effect,

c) 75% of the wind loads described in Clause (a) but with both axes considered simultaneously, and

d) 56% of the wind loads described in Clause (a) but with both axes considered simultaneously and offset from the central geometric axis of the building by 15% of its width normal to the direction of the force.

(See Note A-4.1.7.9.(1).)

4.1.7.10. Interior Walls and Partitions

1) In the design of interior walls and partitions, due consideration shall be given to differences in air pressure on opposite sides of the wall or partition which may result from

a) pressure differences between the windward and leeward sides of a building,

b) stack effects due to a difference in air temperature between the exterior and interior of the building, and

c) air pressurization by the mechanical services of the building.

4.1.7.11. Exterior Ornamentations, Equipment and Appendages

(See Note A-4.1.7.11.)

1) The effects of wind loads on exterior ornamentations, equipment and appendages, including the increase in exposed area as a result of ice buildup as prescribed in CAN/CSA-S37, "Antennas, towers, and antenna-supporting structures," shall be considered in the structural design of the connections and the building.

2) Where there are a number of similar components, the net increase in force is permitted to be based on the total area for all similar components as opposed to the summation of forces of individual elements.

4.1.7.12. Attached Canopies on Low Buildings with a Height H ≤ 20 m

(See Note A-4.1.7.12.)

1) For the purposes of this Article, "attached canopy" shall mean a horizontal canopy with a maximum slope of 2% that is attached to a building wall at any height, h_c, above ground level.

2) The specified external wind pressure, p, and the specified net external wind pressure, p_{net}, for attached canopies on exterior walls of low *buildings* with a height H ≤ 20 m shall be determined as follows:

$$p = I_w q C_e C_t C_g C_p, \text{ and}$$

$$p_{net} = I_w q C_e C_t (C_g C_p)_{net}$$

where

p = specified external wind pressure acting statically and in a direction normal to the upper or lower surface of the canopy, considered positive when acting towards the surface and negative when acting away from the surface,

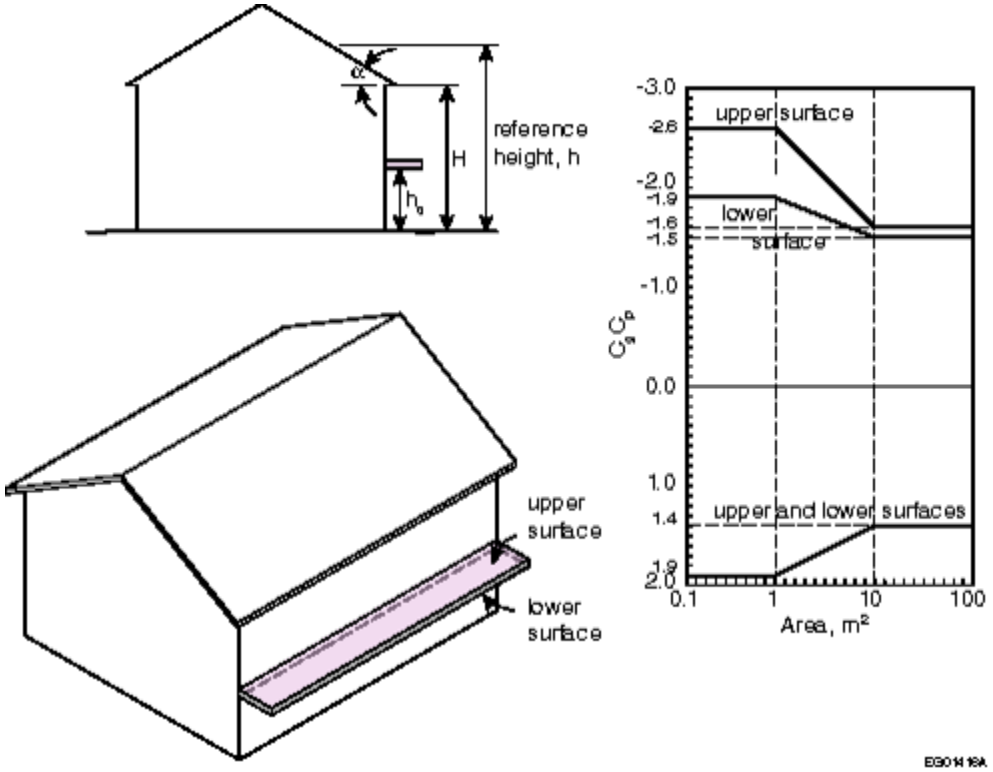
p_{net} = specified net external wind pressure acting statically on the canopy, considered positive when acting in a downward direction and negative when acting in an upward direction,

I_w, q, C_e, C_t = as defined in Sentence 4.1.7.3.(1),

C_gC_p = gust pressure coefficient on the upper or lower surface of the canopy, as given in Figure 4.1.7.12.-A, and

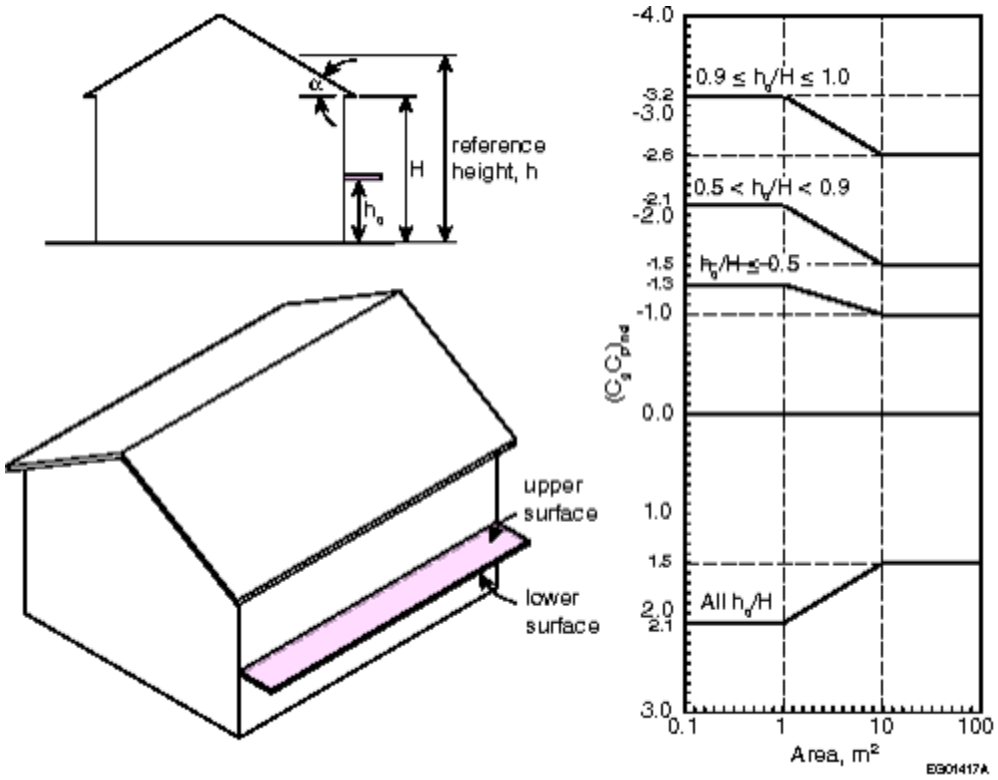
$(C_gC_p)_{ne}$ = net gust pressure coefficient on the canopy, considering simultaneous contributions from the upper and lower surfaces of the canopy, as given in Figure 4.1.7.12.-B.

Figure 4.1.7.12.-A
Gust pressure coefficients on the upper and lower surfaces of attached canopies with no gap between the canopy and the building
Forming Part of Sentence 4.1.7.12.(2)



Notes to Figure 4.1.7.12.-A:
(1) The coefficients apply for any roof slope, α.
(2) The reference height, h, is the mid-height of the roof or 6 m, whichever is greater.
(3) Positive CgCp values denote forces acting towards the upper or lower surface of the canopy, whereas negative CgCp values denote forces acting away from the surface. Each structural element must be designed to resist both the positive and negative forces.

Figure 4.1.7.12.-B
Net gust pressure coefficients on attached canopies, considering simultaneous contributions from the upper and lower surfaces of the canopy
Forming Part of Sentence 4.1.7.12.(2)



Notes to Figure 4.1.7.12.-B:
(1) The coefficients apply for any roof slope, α.
(2) The reference height, h, is the mid-height of the roof or 6 m, whichever is greater.
(3) Positive (CgCp)net values denote net forces acting in a downward direction on the canopy, whereas negative (CgCp)net values denote net forces acting in an upward direction on the canopy. The canopy must be designed to resist both the positive and negative net forces.

4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height

(See Note A-4.1.7.13.)

1) Where solar panels are installed on a roof, the roof wind loads shall account for the wind loads on the solar panels, as determined in accordance with Sentences (2) to (7), or shall be determined in the same way as for the roof without solar panels, whichever approach results in the most critical effect.

2) For an array of solar panels where the panels are installed close and parallel to the roof surface with their upper surface not more than 250 mm above the roof surface and with gaps around the panels of not less than 6 mm, the net positive or negative pressure difference between the upper and lower surfaces of a panel or the array shall be calculated as follows:

$$p = I_W q C_e C_t C_g C_p E \gamma_a$$

where

I_W, q, C_e, C_t, C_g, C_p = as defined in Sentence 4.1.7.3.(1), determined in the same manner as for the roof cladding,

E = edge factor, as provided in Sentence (4), and

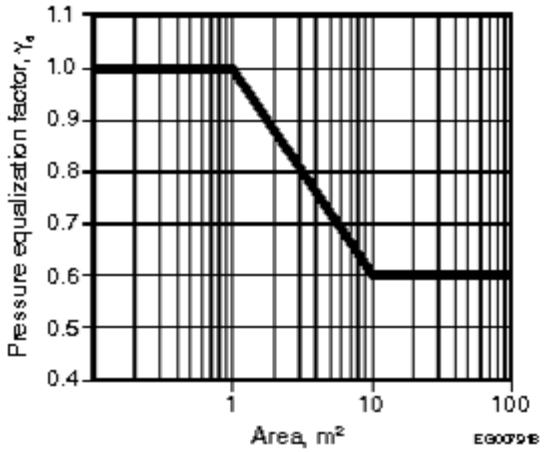
γ_a = pressure equalization factor, as provided in Sentence (3).

3) The pressure equalization factor, γ_a, in Sentence (2) shall be

a) for a panel or an array where the panel chord length, L_p, is greater than 2 m or for a panel or an array that is within a distance of $2h_2$ from the roof edge or ridge, where h_2 is the height of the panel's highest point above the roof surface, taken as 1.0, and

b) for other panels or arrays, determined from Figure 4.1.7.13.-A based on the area of the panel or array over which the wind load is being calculated.

Figure 4.1.7.13.-A
Pressure equalization factor, γ_a, for solar panels or arrays mounted on roofs of *buildings* of any height
Forming Part of Clause 4.1.7.13.(3)(b)



4) The edge factor, E, in Sentence (2) shall be taken as

a) 1.5 within a distance of $1.5L_p$ from an exposed edge of the array of solar panels, as defined in Sentence (5), and

b) 1.0 elsewhere.

5) For the purposes of Clause (4)(a), an exposed edge of the array of solar panels shall be considered to occur

a) where the distance to the next row of panels or the distance across a gap in the same row of panels exceeds $4h_2$ or 1.2 m, whichever is greater, or

b) where the distance to the roof edge exceeds $4h_2$ or 1.2 m, whichever is greater, and exceeds 0.5h, where h is the reference height of the roof.

6) For an array of solar panels mounted on a roof with a slope, α, less than or equal to 7°, where the panels are tilted relative to the roof surface, have a chord length, L_p, not greater than 2 m, and are installed such that the height of their lowest point above the roof surface, h_1, is not greater than 0.6 m, the height of their highest point above the roof surface, h_2, is not greater than 1.2 m, and their tilt angle relative to the roof surface, ω, is not greater than 35°, or where the panels are installed parallel to the roof surface with their upper surface greater than 250 mm above the roof surface and with gaps not less than 6 mm between the panels, the net positive or negative pressure difference between the upper and the lower surfaces of a panel or the array shall be calculated as follows:

$$p_{net} = I_w q C_e C_t (C_g C_p)_{net}$$

where

I_W, q, C_e, C_t = as defined in Sentence 4.1.7.3.(1), determined in the same manner as for the roof cladding, and

$(C_gC_p)_{net}$ = net gust pressure coefficient, as provided in Sentence (7).

7) The net gust pressure coefficient, $(C_gC_p)_{net}$, in Sentence (6) shall be calculated as follows:

$$(C_g C_p)_{net} = \pm \gamma_p \gamma_c E (C_g C_p)_n$$

where

γ_p = parapet factor, determined as the lesser of 1.2 and $(0.9 + h_{pt}/h)$,

γ_c = chord factor, determined as the greater of $(0.6 + 0.2L_p)$ and 0.8,

E = as defined in Sentence (2), and

$(C_gC_p)_n$ = normalized gust pressure coefficient, determined from Figure 4.1.7.13.-B based on ω and A_N,

where

h_{pt} = height of the parapet above the roof surface, in m,

h = reference height of the roof, in m,

L_p = panel chord length, in m,

ω = panel tilt angle relative to the roof surface, and

A_N = normalized panel or array area, calculated as $A_N = \frac{1000A}{\max(L_b^2, 25)}$

where

A = panel or array area over which the wind load is being calculated, in m^2, and

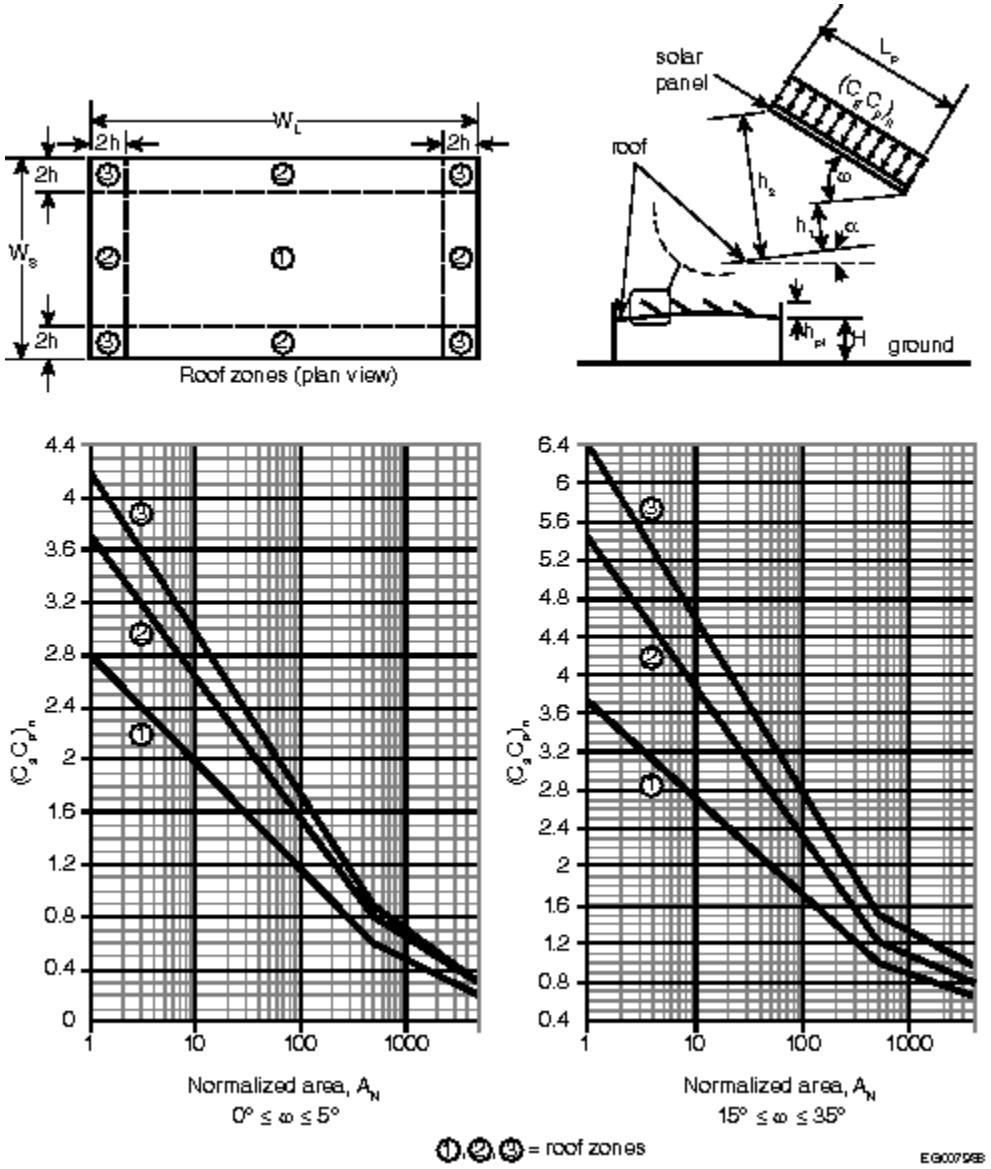
L_b = normalized building length, in m, determined as the lesser of $\left(0.4\sqrt{hW_L}\right)$, h and W_S,

where

W_L = longest horizontal dimension of the building, in m, and

W_S = smallest horizontal dimension of the building, in m.

Figure 4.1.7.13.-B
Normalized gust pressure coefficient, (CgCp)n, for solar panels or arrays mounted on low-sloped roofs of buildings of any height
Forming Part of Sentence 4.1.7.13.(7)



Notes to Figure 4.1.7.13.-B:
(1) H = height of the building.
(2) h = reference height of the roof.
(3) (CgCp)n values are for both positive and negative values.
(4) For panels with 5° < ω <15°, linear interpolation is permitted.

4.1.7.14. Wind Tunnel Procedure

1) Except as provided in Sentences (2) and (3), wind tunnel tests on scale models to determine wind loads on *buildings* shall be conducted in accordance with ASCE/SEI 49, "Wind Tunnel Testing for *Buildings* and Other Structures."

2) Where an adjacent building provides substantial sheltering effect, the wind loads for the main structural system shall be no lower than 80% of the loads determined from tests referred to in Sentence (1) with the effect of the sheltering building removed as applied to

a) the base shear force for *buildings* with a ratio of height to minimum effective width, as defined in Sentence 4.1.7.2.(2), less than or equal to 1.0, or

b) the base moment for *buildings* with a ratio of height to minimum effective width greater than 1.0.

3) For the design of cladding and secondary structural members, the exterior wind loads determined from the wind tunnel tests shall be no less onerous than those determined by analysis in accordance with Article 4.1.7.3. using the following assumptions:

a) $C_g = 2.5$ and $C_p = \pm 0.72$, where the building's height is greater than 20 m or greater than its minimum effective width, and

b) C_gC_p = 80% of the values for zones w and r provided in Article 4.1.7.6., where the building's height is less than or equal to 20 m and no greater than its minimum effective width.

4.1.8. Earthquake Load and Effects

4.1.8.1. Analysis

1) Except as permitted in Sentence (2), the deflections and specified loading due to earthquake motions shall be determined according to the requirements of Articles 4.1.8.2. to 4.1.8.23.

2) Where $I_EF_sS_a(0.2,X_{450})$ and $I_EF_sS_a(2.0,X_{450})$ are less than 0.16 and 0.03 respectively, the deflections and specified loading due to earthquake motions are permitted to be determined in accordance with Sentences (3) to (15), where

a) I_E is the earthquake importance factor and has a value of 0.8, 1.0, 1.3 and 1.5 for *buildings* in the Low, Normal, High and Post-disaster Importance Categories respectively,

b) F_s is the site coefficient based on the average $\bar{N}_{60}$ or $\bar{s}_u$, as defined in Article 4.1.8.2., for the top 30 m of soil below the footings, pile caps, or mat *foundations* and has a value of

   i) 1.0 for rock sites or when $\bar{N}_{60} > 50$ or $\bar{s}_u > 100$ kPa,

   ii) 1.6 when $15 \le \bar{N}_{60} \le 50$ or 50 kPa $\le \bar{s}_u \le$ 100 kPa, and

   iii) 2.8 for all other cases, and

c) $S_a(T,X_{450})$ is the 5%-damped spectral acceleration value at period T for site designation X_{450}, as defined in Article 4.1.8.2., determined in accordance with Subsection 1.1.3. and corresponding to a 2% probability of exceedance in 50 years.

3) The structure shall have a clearly defined

a) seismic force resisting system (SFRS) to resist the earthquake loads and their effects, and

b) load path (or paths) that will transfer the inertial forces generated in an earthquake to the supporting ground.

4) An unreinforced masonry SFRS shall not be permitted where

a) I_E is greater than 1.0, or

b) the height above grade is greater than or equal to 30 m.

5) The height above grade of an SFRS designed in accordance with CSA S136, “North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada),” shall be less than 15 m.

6) Earthquake forces shall be assumed to act horizontally and independently about any two orthogonal axes.

7) The specified lateral earthquake force, V_s, at the base of the structure in the direction under consideration shall be calculated as follows:

$$V_s = F_sS_a(T_s,X_{450})I_EW/R_s$$

where

$S_a(T_s,X_{450})$ = value of $S_a(T_s,X_{450})$ determined by linear interpolation between the values of $S_a(0.2,X_{450})$, $S_a(0.5,X_{450})$ and $S_a(1.0,X_{450})$,

= $S_a(0.2,X_{450})$ for $T_s \leq 0.2$ s, and

= $S_a(1.0,X_{450})$ for $T_s \geq 1.0$ s,

W = sum of W_i over the height of the building, where W_i is defined in Article 4.1.8.2., and

R_s = 1.5, except R_s = 1.0 for structures where the *storey* strength is less than that in the *storey* above and for an unreinforced masonry SFRS,

where

T_s = fundamental lateral period of vibration of the building, as defined in Article 4.1.8.2.,

= $0.085(h_n)^{3/4}$ for steel moment frames,

= $0.075(h_n)^{3/4}$ for concrete moment frames,

= 0.1N for other moment frames,

= $0.025h_n$ for braced frames, and

= $0.05(h_n)^{3/4}$ for shear walls and other structures,

where

h_n = height, in m, above the base to level n, as defined in Article 4.1.8.2., and

N = total number of *storeys* above exterior grade to level n, as defined in Article 4.1.8.2.,

except that, in cases where R_s = 1.5, V_s need not be greater than $F_s S_a(0.5,X_{450})I_E W/R_s$.

8) The specified lateral earthquake force, V_s, shall be distributed over the height of the building in accordance with the following formula:

$$F_x = V_s W_x h_x / \left(\sum_{i=1}^{n} W_i h_i \right)$$

where

F_x = force applied through the centre of mass at level x,

W_x, W_i = portion of W that is located at or is assigned to level x or i respectively, and

h_x, h_i = height, in m, above the base to level x or i respectively, as defined in Article 4.1.8.2.

9) Accidental torsional effects applied concurrently with F_x shall be considered by applying torsional moments about the vertical axis at each level for each of the following cases considered separately:

a) $+0.1D_{nx}F_x$, and

b) $-0.1D_{nx}F_x$.

10) Deflections obtained from a linear analysis shall include the effects of torsion and be multiplied by R_s/I_E to get realistic values of expected deflections.

11) The deflections referred to in Sentence (10) shall be used to calculate the largest interstorey deflection, which shall not exceed

a) $0.01h_s$ for *post-disaster buildings*,

b) $0.02h_s$ for High Importance Category *buildings*, and

c) $0.025h_s$ for all other *buildings*,

where h_s is the interstorey height as defined in Article 4.1.8.2.

12) When earthquake forces are calculated using R_s = 1.5, the following elements in the SFRS shall have their design forces due to earthquake effects increased by 33%:

a) diaphragms and their chords, connections, struts and collectors,

b) tie downs in wood or drywall shear walls,

c) connections and anchor bolts in steel- and wood-braced frames,

d) connections in precast concrete, and

e) connections in steel moment frames.

13) Except as provided in Sentence (14), where cantilever parapet walls, other cantilever walls, exterior ornamentation and appendages, towers, *chimneys* or penthouses are connected to or form part of a building, they shall be designed, along with their connections, for a lateral force, V_{sp}, distributed according to the distribution of mass of the element and acting in the lateral direction that results in the most critical loading for design using the following equation:

$$V_{sp} = 0.9 S_a(0.2, X_{450}) F_s I_E W_p$$

where

W_p = weight of a portion of a structure as defined in Article 4.1.8.2.

14) The value of V_{sp} shall be doubled for unreinforced masonry elements.

15) Structures designed in accordance with this Article need not comply with the seismic requirements stated in the applicable design standard referenced in Section 4.3.

4.1.8.2. Notation

1) In this Subsection

A_r = element or component force amplification factor to account for type of attachment, as defined in Sentence 4.1.8.18.(1),

A_x = height factor at level x to account for variation of response of an element or component with elevation within the building, as defined in Sentence 4.1.8.18.(1),

B_x = ratio at level x used to determine torsional sensitivity, as defined in Sentence 4.1.8.11.(10),

B = maximum value of B_x, as defined in Sentence 4.1.8.11.(10),

C_p = seismic coefficient for an element or component, as defined in Sentence 4.1.8.18.(1),

D_{nx} = plan dimension of the building at level x perpendicular to the direction of seismic loading being considered,

e_x = distance measured perpendicular to the direction of earthquake loading between centre of mass and centre of rigidity at the level being considered (see Note A-4.1.8.2.(1)),

F_a = acceleration-based site coefficient for application in standards referenced in Subsection 4.1.8., as defined in Sentence 4.1.8.4.(7),

F_s = site coefficient as defined in Sentence 4.1.8.1.(2) for application in Article 4.1.8.1.,

F_t = portion of V to be concentrated at the top of the structure, as defined in Sentence 4.1.8.11.(7),

F_v = velocity-based site coefficient for application in standards referenced in Subsection 4.1.8., as defined in Sentence 4.1.8.4.(7),

F_x = lateral force applied to level x, as defined in Sentence 4.1.8.11.(7),

h_i, h_n, h_x = height, in m, above the base (i = 0) to level i, n, or x respectively, where the base of the structure is the level at which horizontal earthquake motions are considered to be imparted to the structure,

h_s = interstorey height ($h_i - h_{i-1}$),

I_E = earthquake importance factor of the structure, as described in Sentence 4.1.8.5.(1),

J = numerical reduction coefficient for base overturning moment, as defined in Sentence 4.1.8.11.(6),

J_x = numerical reduction coefficient for overturning moment at level x, as defined in Sentence 4.1.8.11.(8),

Level I = any level in the building, i = 1 for first level above the base,

Level n = level that is uppermost in the main portion of the structure,

Level x = level that is under design consideration,

M_v = factor to account for higher mode effects on base shear, as defined in Sentence 4.1.8.11.(6),

M_x = overturning moment at level x, as defined in Sentence 4.1.8.11.(8),

N = total number of *storeys* above exterior grade to level n,

$\bar{N}_{60}$ = average standard penetration resistance, in blows per 0.3 m, in the top 30 m of soil, corrected to a rod energy efficiency of 60% of the theoretical maximum,

PGA(X) = peak ground acceleration, expressed as a ratio to gravitational acceleration, for site designation X, as defined in Sentence 4.1.8.4.(1),

PGV(X) = peak ground velocity, in m/s, for site designation X, as defined in Sentence 4.1.8.4.(1),

PI = plasticity index for soil,

R_d = ductility-related force modification factor reflecting the capability of a structure to dissipate energy through reversed cyclic inelastic behaviour, as defined in Article 4.1.8.9.,

R_o = overstrength-related force modification factor accounting for the dependable portion of reserve strength in a structure designed according to these provisions, as defined in Article 4.1.8.9.,

R_p = element or component response modification factor, as defined in Sentence 4.1.8.18.(1),

R_s = combined overstrength and ductility-related modification factor, as defined in Sentence 4.1.8.1.(7), for application in Article 4.1.8.1.,

$S_a(T,X)$ = 5%-damped spectral acceleration, expressed as a ratio to gravitational acceleration, at period T for site designation X, as defined in Sentence 4.1.8.4.(1),

SC = Seismic Category assigned to a building based on its Importance Category and the design spectral acceleration values at periods of 0.2 s and 1.0 s, as defined in Article 4.1.8.5.,

S_p = horizontal force factor for part or portion of a building and its anchorage, as given in Sentence 4.1.8.18.(1),

S(T) = design spectral acceleration, expressed as a ratio to gravitational acceleration, at period T, as defined in Sentence 4.1.8.4.(6),

$\bar{s}_u$ = average undrained shear strength, in kPa, in the top 30 m of soil,

T = period, in s,

T_a = fundamental lateral period of vibration of the building or structure, in s, in the direction under consideration, as defined in Sentence 4.1.8.11.(3),

T_s = fundamental lateral period of vibration of the building or structure, in s, in the direction under consideration, as defined in Sentence 4.1.8.1.(7),

T_x = floor torque at level x, as defined in Sentence 4.1.8.11.(11),

V = specified lateral earthquake force at the base of the structure, as determined in Article 4.1.8.11.,

V_d = specified lateral earthquake force at the base of the structure, as determined in Article 4.1.8.12.,

V_e = lateral earthquake elastic force at the base of the structure, as determined in Article 4.1.8.12.,

V_{ed} = adjusted lateral earthquake elastic force at the base of the structure, as determined in Article 4.1.8.12.,

V_p = specified lateral earthquake force on an element or component, as determined in Article 4.1.8.18.,

V_s = specified lateral earthquake force at the base of the structure, as determined in Sentence 4.1.8.1.(7), for application in Article 4.1.8.1.,

V_{s30} = average shear wave velocity, in m/s, in the top 30 m of soil or rock,

W = specified *dead load*, as defined in Article 4.1.4.1., except that the minimum partition weight as defined in Sentence 4.1.4.1.(3) need not exceed 0.5 kPa, plus 25% of the specified snow load as defined in Subsection 4.1.6., plus 60% of the storage load for areas used for storage, except that storage garages need not be considered storage areas, and the full contents of any tanks (see Note A-4.1.8.2.(1)),

W_i, W_x = portion of W that is located at or is assigned to level i or x respectively,

W_p = weight of a part or portion of a structure, e.g., cladding, partitions and appendages,

X = site designation, either X_V or X_S,

X_S = site designation in terms of Site Class, where S is the Site Class determined in accordance with Sentence 4.1.8.4.(3),

X_V = site designation in terms of V_{s30}, where V is the V_{s30} value calculated from in situ measurements of shear wave velocity,

X_{450} = site designation X_V with V_{s30} = 450 m/s,

δ_{ave} = average displacement of the structure at level x, as defined in Sentence 4.1.8.11.(10), and

δ_{max} = maximum displacement of the structure at level x, as defined in Sentence 4.1.8.11.(10).

4.1.8.3. General Requirements

1) The building shall be designed to meet the requirements of this Subsection and of the design standards referenced in Section 4.3.

2) Structures shall be designed with a clearly defined load path, or paths, that will transfer the inertial forces generated in an earthquake to the supporting ground.

3) The structure shall have a clearly defined SFRS, as defined in Article 4.1.8.2.

4) The SFRS shall be designed to resist 100% of the earthquake loads and their effects. (See Note A-4.1.8.3.(4).)

5) All structural framing elements not considered to be part of the SFRS must be investigated and shown to behave elastically or to have sufficient non-linear capacity to support their gravity loads while undergoing earthquake-induced deformations calculated from the deflections determined in Article 4.1.8.13.

6) Stiff elements that are not considered part of the SFRS, such as concrete, masonry, brick or precast walls or panels, shall be

a) separated from all structural elements of the building such that no interaction takes place as the building undergoes deflections due to earthquake effects as calculated in this Subsection, or

b) made part of the SFRS and satisfy the requirements of this Subsection.

(See Note A-4.1.8.3.(6).)

7) Stiffness imparted to the structure from elements not part of the SFRS, other than those described in Sentence (6), shall not be used to resist earthquake deflections but shall be accounted for

a) in calculating the period of the structure for determining forces if the added stiffness decreases the fundamental lateral period by more than 15%,

b) in determining the irregularity of the structure, except the additional stiffness shall not be used to make an irregular SFRS regular or to reduce the effects of torsion (see Note A-4.1.8.3.(7)(b) and (c)), and

c) in designing the SFRS if inclusion of the elements not part of the SFRS in the analysis has an adverse effect on the SFRS (see Note A-4.1.8.3.(7)(b) and (c)).

8) Structural modeling shall be representative of the magnitude and spatial distribution of the mass of the building and of the stiffness of all elements of the SFRS, including stiff elements that are not separated in accordance with Sentence 4.1.8.3.(6), and shall account for

a) the effect of cracked sections in reinforced concrete and reinforced masonry elements,

b) the effect of the finite size of members and joints,

c) sway effects arising from the interaction of gravity loads with the displaced configuration of the structure, and

d) other effects that influence the lateral stiffness of the building.

(See Note A-4.1.8.3.(8).)

4.1.8.4. Site Properties

1) For site designation X, as determined in accordance with Sentence (2) or (3), the peak ground acceleration, PGA(X), the peak ground velocity, PGV(X), and the 5%-damped spectral acceleration values, $S_a(T,X)$, at periods T of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s shall

a) except as provided in Sentence (4), be determined in accordance with Subsection 1.1.3., and

b) except as provided in Article 4.1.8.23., correspond to a 2% probability of exceedance in 50 years.

2) Except as provided in Sentence (3), the site designation referred to in Sentence (1) shall be determined using the average shear wave velocity, V_{s30}, calculated from in situ measurements of shear wave velocity, as follows:

a) for the ground profiles described in Table 4.1.8.4.-A, the site designation shall be determined in accordance with the Table, and

b) for all other ground profiles, the site designation shall be X_V, where V is the value of V_{s30}.

(See Note A-4.1.8.4.(2) and (3).)

Table 4.1.8.4.-A
Exceptions for Site Designation Using Vs30 Calculated from In Situ Measurements
Forming Part of Sentence 4.1.8.4.(2)

Ground Profile Characteristics		**Site Designation**
Average Shear Wave Velocity in Top 30 m, Vs30, Calculated from In Situ Measurements, in m/s	**Additional Characteristics**	

Vs30 > 760	Ground profile contains more than 3 m of softer materials between rock and the underside of footing or mat *foundations*	X760
Vs30 > 140	Ground profile contains more than 3 m of soil with all the following characteristics: • plasticity index, PI > 20, • moisture content, w ≥ 40%, and • undrained shear strength, su < 25 kPa	XE
Vs30 > 140	Ground profile contains • liquefiable soil, quick and highly sensitive clay, collapsible weakly cemented soil, or other soil susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic soil (with PI > 75), or • more than 30 m of soft to medium-stiff clay	XF
Vs30 ≤ 140	n/a	XF

3) Where V_{s30} calculated from in situ measurements is not available, the site designation referred to in Sentence (1) shall be X_S, where S is the Site Class determined using the energy-corrected average standard penetration resistance, $\bar{N}_{60}$, or the average undrained shear strength, $\bar{s}_u$, in accordance with Table 4.1.8.4.-B, $\bar{N}_{60}$ and $\bar{s}_u$being calculated based on rational analysis. (See Notes A-4.1.8.4.(3) and A-4.1.8.4.(2) and (3).)

Table 4.1.8.4.-B
Site Classes, S, for Site Designation XS
Forming Part of Sentence 4.1.8.4.(3)

Site Class, S	Ground Profile	Ground Profile Characteristics		
		Average Shear Wave Velocity in Top 30 m, Vs30, in m/s(1)	**Average Standard Penetration Resistance in Top 30 m, $\bar{N}$60, in Blows per 0.3 m**	**Average Undrained Shear Strength in Top 30 m, $\bar{s}_u$, in kPa**
A	Hard rock(2)	Vs30 > 1 500	n/a	n/a
B	Rock(2)	760 < Vs30 ≤ 1 500	n/a	n/a
C	Very dense soil and soft rock	360 < Vs30 ≤ 760	$\bar{N}$60 > 50	$\bar{s}_u$> 100
D	Stiff soil	180 < Vs30 ≤ 360	15 < $\bar{N}$60 ≤ 50	50 < $\bar{s}_u$≤ 100
E	Soft soil	140 < Vs30 ≤ 180	10 < $\bar{N}$60 ≤ 15	40 < $\bar{s}_u$≤ 50
		Any ground profile other than Site Class F that contains more than 3 m of soil with all the following characteristics: • plasticity index, PI > 20, • moisture content, w ≥ 40%, and • undrained shear strength, su < 25 kPa		
F	Other soils(3)	Vs30 ≤ 140	$\bar{N}$60 ≤ 10	$\bar{s}_u$≤ 40
		Any ground profile that contains • liquefiable soil, quick and highly sensitive clay, collapsible weakly cemented soil, or other soil susceptible to failure or collapse under seismic loading, • more than 3 m of peat and/or highly organic clay, • more than 8 m of highly plastic soil (with PI > 75), or • more than 30 m of soft to medium-stiff clay		

Notes to Table 4.1.8.4.-B:

(1) See Note A-4.1.8.4.(2) and (3).
(2) Site designations XA and XB, corresponding to Site Classes A and B, are not to be used in cases where the ground profile contains more than 3 m of softer materials between rock and the underside of footing or mat *foundations*. The appropriate site designation for such cases is X760.
(3) Site-specific geotechnical evaluation is required.

4) Site-specific geotechnical evaluation is required to determine the values of PGA(X_F), PGV(X_F) and $S_a(T,X_F)$ for site designation X_F.

5) Where structures on liquefiable soils have a fundamental lateral period, T_a, of 0.5 s or less, the site designation X and the corresponding values of $S_a(T,X)$ and PGA(X) are permitted to be determined in accordance with Sentence (1) by assuming that the soils are not liquefiable.

6) The design spectral acceleration, S(T), shall be determined in accordance with Table 4.1.8.4.-C, using log–log or linear interpolation for intermediate values of T. (See Note A-4.1.8.4.(6).)

Table 4.1.8.4.-C
Design Spectral Acceleration
Forming Part of Sentence 4.1.8.4.(6)

Period, T, in s	Design Spectral Acceleration, S(T)
≤ 0.2	Sa(0.2,X) or Sa(0.5,X), whichever is greater
0.5	Sa(0.5,X)
1.0	Sa(1.0,X)
2.0	Sa(2.0,X)
5.0	Sa(5.0,X)
10.0	Sa(10.0,X)

7) Where required for the application of a standard referenced in this Subsection, the acceleration-based site coefficient, F_a, for site designation X shall be taken as $S(0.2)/S_a(0.2,X_{450})$ and the velocity-based site coefficient, F_v, for site designation X shall be taken as $S(1.0)/S_a(1.0,X_{450})$.

4.1.8.5. Importance Factor and Seismic Category

1) The earthquake importance factor, I_E, shall be determined according to Table 4.1.8.5.-A

Table 4.1.8.5.-A
Importance Factor for Earthquake Loads and Effects, IE
Forming Part of Sentence 4.1.8.5.(1)

Importance Category	Importance Factor, IE	
	ULS	SLS(1)
Low	0.8	(2)
Normal	1.0	
High	1.3	
Post-disaster	1.5	

Notes to Table 4.1.8.5.-A:
(1) See Article 4.1.8.13.

(2) See Note A-Table 4.1.8.5.-A.

2) *Buildings* shall be assigned a Seismic Category in accordance with Table 4.1.8.5.-B.

Table 4.1.8.5.-B
Seismic Categories for Buildings
Forming Part of Sentence 4.1.8.5.(2)

Seismic Category[1]	IE**S**(0.2)	IE**S**(1.0)
SC1	IES(0.2) < 0.2	IES(1.0) < 0.1
SC2	0.2 ≤ IES(0.2) < 0.35	0.1 ≤ IES(1.0) < 0.2
SC3	0.35 ≤ IES(0.2) ≤ 0.75	0.2 ≤ IES(1.0) ≤ 0.3
SC4	IES(0.2) > 0.75	IES(1.0) > 0.3

Notes to Table 4.1.8.5.-B:
[1] The Seismic Category of a building shall be taken as the more severe of the categories determined on the basis of IES(0.2) and IES(1.0), irrespective of the fundamental lateral period of the building, Ta.

4.1.8.6. Structural Configuration

1) Structures having any of the features listed in Table 4.1.8.6. shall be designated irregular.

2) Structures not classified as irregular according to Sentence (1) may be considered regular.

3) Except as required by Article 4.1.8.10., where the Seismic Category is SC3 or SC4, structures designated as irregular must satisfy the provisions referenced in Table 4.1.8.6.

Table 4.1.8.6.
Structural Irregularities(1)(2)
Forming Part of Sentences 4.1.8.6.(1) and (3), Clause 4.1.8.7.(1)(c) and Article 4.1.8.10.

Type	Irregularity Type and Definition	Notes
1	**Vertical Stiffness Irregularity** For concrete and masonry shear walls, vertical stiffness irregularity shall be considered to exist where the lateral stiffness of the SFRS in any *storey* is less than 70% of the stiffness in an adjacent *storey*, or less than 80% of the average stiffness in the three *storeys* above or below. For all other types of SFRS, vertical stiffness irregularity shall be considered to exist where the interstorey deflection under lateral earthquake forces divided by the interstorey height, hs, of any *storey* is greater than 130% of that of an adjacent *storey*.	(3)(4)(5)
2	**Weight (mass) Irregularity** Weight irregularity shall be considered to exist where the weight, Wi, of any *storey* is more than 150% of the weight of an adjacent *storey*. A roof that is lighter than the floor below need not be considered.	(3)
3	**Vertical Geometric Irregularity** Vertical geometric irregularity shall be considered to exist where the horizontal dimension of the SFRS in any *storey* is more than 130% of that in an adjacent *storey*.	(3)(4)[6]
4	**In-Plane Discontinuity in Vertical Lateral-Force-Resisting Element** Except for braced frames and moment-resisting frames, an in-plane discontinuity shall be considered to exist where there is an offset of a lateral-force-resisting element of the SFRS or a reduction in lateral stiffness of the resisting element in the *storey* below.	(3)(4)(6)
5	**Out-of-Plane Offsets** Discontinuities in a lateral force path, such as out-of-plane offsets of the vertical elements of the SFRS.	(3)(4)(6)
6	**Discontinuity in Capacity – Weak Storey** A weak *storey* is one in which the *storey* shear strength is less than that in the *storey*	(3)(4)

	above. The *storey* shear strength is the total strength of all seismic-resisting elements of the SFRS sharing the *storey* shear for the direction under consideration.	
7	**Torsional Sensitivity (to be considered when diaphragms are not flexible)** Torsional sensitivity shall be considered to exist when the ratio B calculated according to Sentence 4.1.8.11.(10) exceeds 1.7.	(3)(4)[7]
8	**Non-orthogonal Systems** A non-orthogonal system irregularity shall be considered to exist when the SFRS is not oriented along a set of orthogonal axes.	(3)[8]
9	**Gravity-Induced Lateral Demand Irregularity** Gravity-induced lateral demand irregularity on the SFRS shall be considered to exist where the ratio α calculated in accordance with Sentence 4.1.8.10.(7) exceeds 0.1 for an SFRS with self-centering characteristics and 0.03 for other systems.	(3)(4)(8)
10	**Sloped Column Irregularity** Sloped column irregularity shall be considered to exist where a vertical member that is inclined more than 2° from the vertical supports a portion of the weight of the building in axial compression.	(4)

Notes to Table 4.1.8.6.:
[1] One-*storey* penthouses with a weight of less than 10% of the level below need not be considered in the application of this Table.
[2] See Note A-Table 4.1.8.6.
[3] See Article 4.1.8.7.
[4] See Article 4.1.8.10.
[5] Increased stiffness in *storeys* below grade need not be considered in the determination of vertical stiffness irregularity.
[6] See Article 4.1.8.15.
[7] See Sentences 4.1.8.11.(10) and (11), and 4.1.8.12.(4).
[8] See Article 4.1.8.8.

4.1.8.7. Methods of Analysis

1) Analysis for earthquake actions shall be carried out in accordance with the Dynamic Analysis Procedure described in Article 4.1.8.12. (see Note A-4.1.8.7.(1)), except that the Equivalent Static Force Procedure described in Article 4.1.8.11. may be used for structures that meet any of the following criteria:

a) where the Seismic Category is SC1 or SC2,

b) regular structures that are less than 60 m in height and have a fundamental lateral period, T_a, less than 2 s in each of two orthogonal directions as defined in Article 4.1.8.8., or

c) structures with a structural irregularity of Type 2, 3, 4, 5, 6 or 8 as defined in Table 4.1.8.6. that are less than 20 m in height and have a fundamental lateral period, T_a, less than 0.5 s in each of two orthogonal directions as defined in Article 4.1.8.8.

4.1.8.8. Direction of Loading

1) Earthquake forces shall be assumed to act in any horizontal direction, except that the following shall be considered to provide adequate design force levels in the structure:

a) where components of the SFRS are oriented along a set of orthogonal axes, independent analyses about each of the principal axes of the structure shall be performed,

b) where the components of the SFRS are not oriented along a set of orthogonal axes and the Seismic Category is SC1 or SC2, independent analyses about any two orthogonal axes is permitted, or

c) where the components of the SFRS are not oriented along a set of orthogonal axes and the Seismic Category is SC3 or SC4, analysis of the structure independently in any two orthogonal directions for 100% of the specified earthquake loads applied in one direction plus 30% of the specified earthquake loads in the perpendicular direction, with the combination requiring the greater element strength being used in the design.

4.1.8.9. SFRS Force Modification Factors and General Restrictions

1) Except as provided in Articles 4.1.8.20. and 4.1.8.22., the values of R_d and R_o and the corresponding system restrictions shall conform to Table 4.1.8.9. and the requirements of this Subsection.

2) When a particular value of R_d is required by this Article, the corresponding R_o shall be used.

3) For combinations of different types of SFRS acting in the same direction in the same *storey*, R_dR_o shall be taken as the lowest value of R_dR_o corresponding to these systems.

4) For vertical variations of R_dR_o, excluding rooftop structures not exceeding two *storeys* in height whose weight is less than the greater of 10% of W and 30% of W_i of the level below, the value of R_dR_o used in the design of any *storey* shall be less than or equal to the lowest value of R_dR_o used in the given direction for the *storeys* above, and the requirements of Sentence 4.1.8.15.(6) must be satisfied. (See Note A-4.1.8.9.(4).)

5) If it can be demonstrated through testing, research and analysis that the seismic performance of a structural system is at least equivalent to one of the types of SFRS defined in Table 4.1.8.9., then such a structural system will qualify for values of R_d and R_o corresponding to the equivalent type in that Table. (See Note A-4.1.8.9.(5).)

Table 4.1.8.9.
SFRS Ductility-Related Force Modification Factors, Rd, Overstrength-Related Force Modification Factors, Ro, and General Restrictions(1)
Forming Part of Sentences 4.1.8.9.(1) and (5), 4.1.8.10.(5) and (6), 4.1.8.11.(12), 4.1.8.15.(9) and 4.1.8.20.(8)

Type of SFRS	Rd	Ro	Restrictions[2]			
			Seismic Category			
			SC1	SC2	SC3	SC4
Steel Structures Designed and Detailed According to CSA S16[3][4]						
Ductile moment-resisting frames	5.0	1.5	NL	NL	NL	NL
Moderately ductile moment-resisting frames	3.5	1.5	NL	NL	NL	NL
Limited ductility moment-resisting frames	2.0	1.3	NL	NL	60	30
Moderately ductile truss moment-resisting frames	3.5	1.6	NL	NL	50	30
Moderately ductile concentrically braced frames						
Tension-compression braces	3.0	1.3	NL	NL	40	40
Tension only braces	3.0	1.3	NL	NL	20	20
Limited ductility concentrically braced frames						
Tension-compression braces	2.0	1.3	NL	NL	60	60
Tension only braces	2.0	1.3	NL	NL	40	40
Ductile buckling-restrained braced frames	4.0	1.2	NL	NL	40	40
Ductile eccentrically braced frames	4.0	1.5	NL	NL	NL	NL
Ductile plate walls	5.0	1.6	NL	NL	NL	NL
Moderately ductile plate walls	3.5	1.3	NL	NL	40	40
Limited ductility plate walls	2.0	1.3	NL	NL	60	60
Conventional construction of moment-resisting frames, braced frames or plate walls						

Assembly occupancies	1.5	1.3	NL	NL	15	15
Other occupancies	1.5	1.3	NL	NL	60	40
Other steel SFRSs not defined above	1.0	1.0	15	15	NP	NP
Concrete Structures Designed and Detailed According to CSA A23.3						
Ductile moment-resisting frames	4.0	1.7	NL	NL	NL	NL
Moderately ductile moment-resisting frames	2.5	1.4	NL	NL	60	40
Ductile coupled walls	4.0	1.7	NL	NL	NL	NL
Moderately ductile coupled walls	2.5	1.4	NL	NL	NL	60
Ductile partially coupled walls	3.5	1.7	NL	NL	NL	NL
Moderately ductile partially coupled walls	2.0	1.4	NL	NL	NL	60
Ductile shear walls	3.5	1.6	NL	NL	NL	NL
Moderately ductile shear walls	2.0	1.4	NL	NL	NL	60
Conventional construction						
Moment-resisting frames	1.5	1.3	NL	NL	20	10[(5)(6)]
Shear walls	1.5	1.3	NL	NL	40	30
Two-way slabs without beams	1.3	1.3	20	15	NP	NP
Tilt-up construction						
Moderately ductile walls and frames	2.0	1.3	30	25	25	25
Limited ductility walls and frames	1.5	1.3	30	25	20	20[(7)]
Conventional walls and frames	1.3	1.3	25	20	NP	NP
Other concrete SFRSs not listed above	1.0	1.0	15	15	NP	NP
Timber Structures Designed and Detailed According to CSA O86						
Shear walls						
Nailed shear walls: wood-based panel	3.0	1.7	NL	NL	30	20
Shear walls: wood-based and gypsum panels in combination	2.0	1.7	NL	NL	20	20
Moderately ductile cross-laminated timber shear walls: platform-type construction	2.0	1.5	30	30	30	20
Limited ductility cross-laminated timber shear walls: platform-type construction	1.0	1.3	30	30	30	20
Braced or moment-resisting frames with ductile connections						
Moderately ductile	2.0	1.5	NL	NL	20	20
Limited ductility	1.5	1.5	NL	NL	15	15
Other wood- or gypsum-based SFRSs not listed above	1.0	1.0	15	15	NP	NP

Masonry Structures Designed and Detailed According to CSA S304						
Ductile shear walls	3.0	1.5	NL	NL	60	40
Moderately ductile shear walls	2.0	1.5	NL	NL	60	40
Conventional construction						
Shear walls	1.5	1.5	NL	60	30	15
Moment-resisting frames	1.5	1.5	NL	30	NP	NP
Unreinforced masonry	1.0	1.0	30	15	NP	NP
Other masonry SFRSs not listed above	1.0	1.0	15	NP	NP	NP
Cold-Formed Steel Structures Designed and Detailed According to CSA S136						
Shear walls						
Screw-connected shear walls – wood-based panels	2.5	1.7	20	20	20	20
Screw-connected shear walls – wood-based and gypsum panels in combination	1.5	1.7	20	20	20	20
Diagonal strap concentrically braced walls						
Limited ductility	1.9	1.3	20	20	20	20
Conventional construction	1.2	1.3	15	15	NP	NP
Other cold-formed SFRSs not defined above	1.0	1.0	15	15	NP	NP

Notes to Table 4.1.8.9.:
(1) See Article 4.1.8.10.
(2) NP = system is not permitted.
NL = system is permitted and not limited in height as an SFRS.
Numbers in this Table are maximum height limits above grade, in m.
Height may be limited in other Parts of the Code.
The most stringent requirement governs.
(3) Higher design force levels are prescribed in CSA S16 for some heights of *buildings*.
(4) See Note A-Table 4.1.8.9.
(5) Frames are limited to a maximum of 2 *storeys*.
(6) The maximum height limit is permitted to be increased to 15 m where IES(1.0) ≤ 0.3.
(7) Frames are limited to a maximum of 3 *storeys*.

4.1.8.10. Additional System Restrictions

1) Except as required by Clause (2)(b), structures with a Type 6 irregularity, Discontinuity in Capacity - Weak Storey, as described in Table 4.1.8.6., are not permitted unless the Seismic Category is SC1 and the forces used for design of the SFRS are multiplied by R_dR_o.

2) *Post-disaster buildings* shall

a) not have Type 1, 3, 4, 5, 7, 9 or 10 irregularities as described in Table 4.1.8.6., where the Seismic Category is SC3 or SC4,

b) not have a Type 6 irregularity as described in Table 4.1.8.6.,

c) have an SFRS with an R_d of 2.0 or greater,

d) where they are constructed with concrete or masonry shear walls, have no *storey* with a lateral stiffness that is less than that of the *storey* above it, and

e) where they are constructed with other types of SFRS, have no *storey* for which the interstorey deflection under lateral earthquake forces divided by the interstorey height, h_s, is greater than that of the *storey* above it.

3) High Importance Category *buildings* shall

a) not have Type 1, 3, 4, 5, 7, 9 or 10 irregularities as described in Table 4.1.8.6., where the Seismic Category is SC4,

b) not have a Type 6 irregularity as described in Table 4.1.8.6.,

c) have an SFRS with an R_d of at least

i) 2.0 where the Seismic Category is SC4, and

ii) 1.5 otherwise,

d) where they are constructed with concrete or masonry shear walls, have no *storey* with a lateral stiffness that is less than that of the *storey* above it, and

e) where they are constructed with other types of SFRS, have no *storey* for which the interstorey deflection under lateral earthquake forces divided by the interstorey height, h_s, is greater than that of the *storey* above it.

4) Where the fundamental lateral period, T_a, is greater than or equal to 1.0 s and $I_E S(1.0)$ is greater than 0.25, shear walls that are other than wood-based and form part of the SFRS shall be continuous from their top to the *foundation* and shall not have Type 4 or 5 irregularities as described in Table 4.1.8.6.

5) For *buildings* in Seismic Category SC3 or SC4 that are constructed with more than 4 *storeys* of continuous wood construction, timber SFRSs consisting of shear walls with wood-based panels or of braced or moment-resisting frames as defined in Table 4.1.8.9. within the continuous wood construction shall not have Type 4 or 5 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(5) and (6).)

6) For *buildings* in Seismic Category SC3 or SC4 that are constructed with more than 4 *storeys* of continuous wood construction, timber SFRSs consisting of moderately ductile or limited ductility cross-laminated timber shear walls, platform-type construction, as defined in Table 4.1.8.9. within the continuous wood construction shall not have Type 4, 5, 6, 8, 9 or 10 irregularities as described in Table 4.1.8.6. (See Note A-4.1.8.10.(5) and (6).)

7) The ratio α for a Type 9 irregularity as described in Table 4.1.8.6. shall be determined independently for each orthogonal direction using the following equation:

$$\alpha = Q_G / Q_y$$

where

Q_G = gravity-induced lateral demand on the SFRS at the critical level of the yielding system, and

Q_y = the resistance of the yielding mechanism required to resist the earthquake loads, which need not be taken as less than R_o multiplied by the specified lateral earthquake force as determined in Article 4.1.8.11. or 4.1.8.12., as appropriate.

(See Note A-4.1.8.10.(7).)

8) For *buildings* with a Type 9 irregularity as described in Table 4.1.8.6. and where $I_E S(0.2)$ is equal to or greater than 0.5, deflections determined in accordance with Article 4.1.8.13. shall be multiplied by 1.2.

9) For *buildings* where the value of α, as determined in accordance with Sentence (7), exceeds twice the appropriate limit specified in Table 4.1.8.6. for a Type 9 irregularity and where $I_E S(0.2)$ is equal to or greater than 0.5, a Non-linear Dynamic Analysis of the structure shall be carried out in accordance with Article 4.1.8.12. and the following criteria:

a) the analysis shall account for the effects of the vertical response of the building mass,

b) the analysis shall account for the effects of the vertical response of building components that undergo a vertical displacement when displaced laterally,

c) the analysis shall use vertical ground motion time histories that are compatible with horizontal ground motion time histories scaled to the target response spectrum and that are applied concurrently with the horizontal ground motion time histories,

d) the largest interstorey deflection at any level of the building as determined from the analysis shall not be greater than 60% of the appropriate limit stated in Sentence 4.1.8.13.(3), and

e) the results of an analysis using the ground motion time histories in Clause (c) multiplied by 1.5 shall satisfy the non-linear acceptance criteria.

(See Note A-4.1.8.10.(9).)

10) The design of *buildings* in Seismic Category SC3 or SC4 with a Type 10 irregularity as described in Table 4.1.8.6. shall satisfy the following requirements:

a) the structure shall be designed to resist the additional earthquake forces due to the vertical accelerations of the mass supported by inclined vertical members (see Note A-4.1.8.10.(10)(a)), and

b) the effects of the horizontal and vertical movements of inclined vertical members, while undergoing earthquake-induced deformations, on the floor systems they support shall be considered in the design of the building and accounted for in the application of Sentence 4.1.8.3.(5).

4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1.8.7.

1) The static loading due to earthquake motion shall be determined according to the procedures given in this Article.

2) Except as provided in Sentence (12), the specified lateral earthquake force, V, shall be calculated using the following formula:

$$V = S(T_a)M_vI_EW/(R_dR_o)$$

except

a) for walls, coupled walls and wall-frame systems, V shall not be less than

$$S(4.0)M_vI_EW/(R_dR_o)$$

b) for moment-resisting frames, braced frames, and other systems, V shall not be less than

$$S(2.0)M_vI_EW/(R_dR_o), \text{and}$$

c) for *buildings* located on a site designated as other than X_F and having an SFRS with an R_d equal to or greater than 1.5, V need not be greater than the larger of

$$(2/3)S(0.2)I_EW/(R_dR_o) \text{ and}$$
$$S(0.5)I_EW/(R_dR_o)$$

3) Except as provided in Sentence (4), the fundamental lateral period, T_a, in the direction under consideration in Sentence (2), shall be determined as:

a) for moment-resisting frames that resist 100% of the lateral earthquake forces and where the frame is not enclosed by or adjoined by more rigid elements that would tend to prevent the frame from resisting lateral forces:

i) $0.085(h_n)^{3/4}$ for steel moment frames,

ii) $0.075(h_n)^{3/4}$ for concrete moment frames, or

iii) 0.1N for other moment frames,

b) $0.025h_n$ for braced frames,

c) $0.05(h_n)^{3/4}$ for shear wall and other structures, or

d) other established methods of mechanics using a structural model that complies with the requirements of Sentence 4.1.8.3.(8), except that

i) for moment-resisting frames, T_a shall not be taken as greater than 1.5 times that determined in Clause (a),

ii) for braced frames, T_a shall not be taken as greater than 2.0 times that determined in Clause (b),

iii) for shear wall structures, T_a shall not be taken as greater than 2.0 times that determined in Clause (c),

iv) for other structures, T_a shall not be taken as greater than that determined in Clause (c), and

v) for the purpose of calculating the deflections, the period without the upper limit specified in Subclauses (d)(i) to (d)(iv) may be used, except that, for walls, coupled walls and wall-frame systems, T_a shall not exceed 4.0 s, and for moment-resisting frames, braced frames, and other systems, T_a shall not exceed 2.0 s.

(See Note A-4.1.8.11.(3).)

4) For single-*storey buildings* with steel deck or wood roof diaphragms, the fundamental lateral period, T_a, in the direction under consideration is permitted to be taken as

a) $0.05(h_n)^{3/4} + 0.004L$ for shear walls,

b) $0.035h_n + 0.004L$ for steel moment frames and steel braced frames, or

c) the value obtained from methods of mechanics using a structural model that complies with the requirements of Sentence 4.1.8.3.(8), except that T_a shall not be greater than 1.5 times the value determined in Clause (a) or (b), as applicable,

where L is the shortest length of the diaphragm, in m, between adjacent vertical elements of the SFRS in the direction perpendicular to the direction under consideration.

5) The weight, W, of the building shall be calculated using the following formula:

$$W = \sum_{i=1}^{n} W_i$$

6) The higher mode factor, M_v, and its associated base overturning moment reduction factor, J, shall conform to Table 4.1.8.11.

7) The specified lateral earthquake force, V, shall be distributed such that

a) a portion, F_t, is concentrated at the top of the building, where F_t is equal to $0.07T_aV$ but need not exceed 0.25V and may be considered as zero where the fundamental lateral period, T_a, does not exceed 0.7 s, and

b) the remainder, $V - F_t$, is distributed along the height of the building, including the top level, in accordance with the following formula:

$$F_x = (V - F_t)W_x h_x / \left(\sum_{i=1}^{n} W_i h_i\right)$$

Table 4.1.8.11.
Higher Mode Factor, Mv, and Base Overturning Moment Reduction Factor, J(1)(2)(3)(4)
Forming Part of Sentence 4.1.8.11.(6)

S(0.2)/S(5.0)	Mv for Ta ≤ 0.5	Mv for Ta = 1.0	Mv for Ta = 2.0	Mv for Ta ≥ 5.0	J for Ta ≤ 0.5	J for Ta = 1.0	J for Ta = 2.0	J for Ta ≥ 5.0
Moment-Resisting Frames								
5	1	1	1	(5)	1	1	0.95	(5)

20	1	1	1	(5)	1	0.97	0.88	(5)
40	1	1	1	(5)	1	0.90	0.79	(5)
70	1	1	1	(5)	0.98	0.88	0.70	(5)
Coupled Walls[6]								
5	1	1	1	1[7]	1	1	0.95	0.80[8]
20	1	1	1	1.09(7)	1	0.97	0.88	0.66(8)
40	1	1	1	1.33(7)	1	0.90	0.79	0.52(8)
70	1	1	1	1.90(7)	0.98	0.88	0.70	0.40(8)
Braced Frames								
5	1	1	1	(5)	1	0.98	0.93	(5)
20	1	1	1	(5)	1	0.91	0.80	(5)
40	1	1	1	(5)	0.91	0.82	0.72	(5)
70	1	1	1.19	(5)	0.91	0.77	0.61	(5)
Walls, Wall-Frame Systems								
5	1	1	1	1.30(7)	1	1	0.85	0.59(8)
20	1	1	1.18	2.50(7)	1	0.80	0.60	0.35(8)
40	1	1.25	1.85	4.10(7)	0.80	0.59	0.42	0.23(8)
70	1	1.25	2.30	6.40(7)	0.80	0.56	0.30	0.18(8)
Other Systems								
5	1	1	1	(5)	1	1	0.85	(5)
20	1	1	1.18	(5)	1	0.80	0.60	(5)
40	1	1.25	1.85	(5)	0.80	0.59	0.44	(5)
70	1	1.37	2.30	(5)	0.80	0.56	0.30	(5)

Notes to Table 4.1.8.11.:

[1] For intermediate values of the spectral ratio S(0.2)/S(5.0), Mv and J shall be obtained by linear interpolation. For spectral ratios less than 5, Mv and J shall be obtained by linear interpolation with their values at a spectral ratio of 0 taken as equal to 1. For spectral ratios greater than 70, Mv and J shall be taken as equal to their values at a spectral ratio of 70.

[2] For intermediate values of the fundamental lateral period, Ta, in cases where S(Ta) is obtained by log–log interpolation, Mv shall be obtained by linear interpolation using the values of Mv obtained in accordance with Note (1). In cases where S(Ta) is obtained by linear interpolation, the product S(Ta)Mv shall be obtained by linear interpolation using the values of Mv obtained in accordance with Note (1).

[3] For intermediate values of the fundamental lateral period, Ta, J shall be obtained by linear interpolation using the values of J obtained in accordance with Note (1).

[4] For a combination of different SFRSs not given in Table 4.1.8.11. that are in the same direction under consideration, use the highest Mv factor of all the SFRSs and the corresponding value of J.

[5] For fundamental lateral periods, Ta , greater than 2.0 s, use the 2.0 s values obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(b).

[6] A "coupled" wall is a wall system with coupling beams, where at least 66% of the base overturning moment resisted by the wall system is carried by the axial tension and compression forces resulting from shear in the coupling beams.

[7] For fundamental lateral periods, Ta, greater than 4.0 s, use the 4.0 s values of S(Ta)Mv obtained by interpolation between 2.0 s and 5.0 s using the value of Mv obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(a).

[8] For fundamental lateral periods, Ta, greater than 4.0 s, use the 4.0 s values of J obtained by interpolation between 2.0 s and 5.0 s using the value of J obtained in accordance with Note (1). See Clause 4.1.8.11.(2)(a).

8) The structure shall be designed to resist overturning effects caused by the earthquake forces determined in Sentence (7) and the overturning moment at level x, M_x, shall be determined using the following equation:

$$M_x = J_x \sum_{i=x}^{n} F_i(h_i - h_x)$$

where

J_x = 1.0 for $h_x \geq 0.6h_n$, and

J_x = $J + (1 - J)(h_x/0.6h_n)$ for $h_x < 0.6h_n$,

where

J = base overturning moment reduction factor conforming to Table 4.1.8.11.

9) Torsional effects that are concurrent with the effects of the forces determined in Sentence (7) and are caused by the simultaneous actions of the following torsional moments shall be considered in the design of the structure according to Sentence (11):

a) torsional moments introduced by eccentricity between the centres of mass and resistance and their dynamic amplification, and

b) torsional moments due to accidental eccentricities.

10) Torsional sensitivity shall be determined by calculating the ratio B_x for each level x according to the following equation for each orthogonal direction determined independently:

$$B_x = \delta_{max} / \delta_{ave}$$

where

B = maximum of all values of B_x in both orthogonal directions, except that the B_x for one-*storey* penthouses with a weight less than 10% of the level below need not be considered,

δ_{max} = maximum *storey* displacement at the extreme points of the structure at level x in the direction of the earthquake induced by the forces determined in Sentence (7) acting at distances $\pm 0.10D_{nx}$ from the centres of mass at each floor, and

δ_{ave} = average of the displacements at the extreme points of the structure at level x produced by the forces determined in Sentence (7).

11) Torsional effects shall be accounted for as follows:

a) for a building with B ≤ 1.7 or in Seismic Category SC1 or SC2, by applying torsional moments about a vertical axis at each level throughout the building, derived for each of the following load cases considered separately:

i) $T_x = F_x(e_x + 0.10D_{nx})$, and

ii) $T_x = F_x(e_x - 0.10D_{nx})$

where F_x is determined in accordance with Sentence (7) and where each element of the building is designed for the most severe effect of the above load cases, or

b) for a building with B > 1.7 in Seismic Category SC3 or SC4, by a Dynamic Analysis Procedure as specified in Article 4.1.8.12.

12) Where the fundamental lateral period, T_a, is determined in accordance with Clause (3)(d) and the building is constructed with more than 4 *storeys* of continuous wood construction and has a timber SFRS consisting of shear walls with wood-based panels or of braced or moment-resisting frames as defined in Table 4.1.8.9., the specified lateral earthquake force, V, as determined in Sentence (2) shall be multiplied by 1.2 but need not exceed the value determined by using Clause (2)(c). (See Note A-4.1.8.10.(5) and (6).)

4.1.8.12. Dynamic Analysis Procedure

1) Except as provided in Articles 4.1.8.19. and 4.1.8.21., the Dynamic Analysis Procedure shall be in accordance with one of the following methods:

a) Linear Dynamic Analysis by either the Modal Response Spectrum Method or the Numerical Integration Linear Time History Method using a structural model that complies with the requirements of Sentence 4.1.8.3.(8) (see Note A-4.1.8.12.(1)(a)), or

b) Non-linear Dynamic Analysis, in which case a special study shall be performed (see Note A-4.1.8.12.(1)(b)).

2) The spectral acceleration values used in the Modal Response Spectrum Method shall be the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(6).

3) The ground motion time histories used in the Numerical Integration Linear Time History Method shall be compatible with a response spectrum constructed from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(6). (See Note A-4.1.8.12.(3).)

4) The effects of accidental torsional moments acting concurrently with the lateral earthquake forces that cause them shall be accounted for by the following methods:

a) the static effects of torsional moments due to $(\pm 0.10 D_{nx})F_x$ at each level x, where F_x is either determined from the elastic dynamic analysis or determined from Sentence 4.1.8.11.(7) multiplied by $R_d R_o / I_E$, shall be combined with the effects determined by dynamic analysis (see Note A-4.1.8.12.(4)(a)), or

b) if B, as defined in Sentence 4.1.8.11.(10), is less than 1.7, it is permitted to use a three-dimensional dynamic analysis with the centres of mass shifted by a distance of $-0.05D_{nx}$ and $+0.05D_{nx}$.

5) Except as provided in Sentence (6), the adjusted elastic base shear, V_{ed}, shall be equal to the elastic base shear, V_e, obtained from a Linear Dynamic Analysis.

6) For *buildings* located on a site designated as other than X_F that have an SFRS with R_d equal to or greater than 1.5, the elastic base shear, V_e, obtained from a Linear Dynamic Analysis may be multiplied by the larger of the following factors to obtain V_{ed}:

$$(2/3)S(0.2)/S(T_a) \leq 1.0 \text{ and}$$

$$S(0.5)/S(T_a) \leq 1.0$$

7) V_{ed} shall be multiplied by the earthquake importance factor, I_E, as determined in Article 4.1.8.5., and shall be divided by $R_d R_o$, as determined in Article 4.1.8.9., to obtain the specified lateral earthquake force, V_d.

8) Except as required by Sentence (9) or (12), if V_d, as determined in Sentence (7), is less than 80% of V, as determined in Article 4.1.8.11., V_d shall be taken as 0.8V.

9) For irregular structures requiring dynamic analysis in accordance with Article 4.1.8.7., V_d shall be taken as the larger of V_d, as determined in Sentence (7), and 100% of V, as determined in Article 4.1.8.11.

10) Except as required by Sentence (11), the values of elastic *storey* shears, *storey* forces, member forces, and deflections obtained from the Linear Dynamic Analysis, including the effect of accidental torsion determined in Sentence (4), shall be multiplied by V_d/V_e to determine their design values.

11) For the purpose of calculating deflections, it is permitted to use a value of V based on the value of T_a determined in Clause 4.1.8.11.(3)(d) to obtain V_d in Sentences (8) and (9).

1**2)** For *buildings* constructed with more than 4 *storeys* of continuous wood construction, having a timber SFRS consisting of shear walls with wood-based panels or braced or moment-resisting frames as defined in Table 4.1.8.9., and whose fundamental lateral period, T_a, is determined in accordance with Clause 4.1.8.11.(3)(d), V_d shall be taken as the larger of V_d, as determined in Sentence (7), and 100% of V, as determined in Article 4.1.8.11. (See Note A-4.1.8.10.(5) and (6).)

4.1.8.13. Deflections and Drift Limits

1) Except as provided in Sentences (5) and (6), lateral deflections of a structure shall be calculated in accordance with the loads and requirements defined in this Subsection.

2) Lateral deflections obtained from a linear elastic analysis using the methods given in Articles 4.1.8.11. and 4.1.8.12. and incorporating the effects of torsion, including accidental torsional moments, shall be multiplied by R_dR_o/I_E and increased as required in Sentences 4.1.8.10.(8) and 4.1.8.16.(1) to give realistic values of anticipated deflections.

3) Based on the lateral deflections calculated in Sentences (2), (5) and (6), the largest interstorey deflection at any level shall be limited to $0.01h_s$ for *post-disaster buildings*, $0.02h_s$ for High Importance Category *buildings*, and $0.025h_s$ for all other *buildings*.

4) The deflections calculated in Sentence (2) shall be used to account for sway effects as required by Sentence 4.1.3.2.(12). (See Note A-4.1.8.13.(4).)

5) The lateral deflections of a seismically isolated structure shall be calculated in accordance with Article 4.1.8.20.

6) The lateral deflections of a structure with supplemental energy dissipation shall be calculated in accordance with Article 4.1.8.22.

4.1.8.14. Structural Separation

1) Adjacent structures shall be

a) separated by a distance equal to at least the square root of the sum of the squares of their individual deflections calculated in Sentence 4.1.8.13.(2), or

b) connected to each other.

2) The method of connection required in Sentence (1) shall take into account the mass, stiffness, strength, ductility and anticipated motion of the connected *buildings* and the character of the connection.

3) Rigidly connected *buildings* shall be assumed to have the lowest R_dR_o value of the *buildings* connected.

4) *Buildings* with non-rigid or energy-dissipating connections require special studies.

4.1.8.15. Design Provisions

1) Except as provided in Sentences (2) and (3), diaphragms, collectors, chords, struts and connections shall be designed so as not to yield, and the design shall account for the shape of the diaphragm, including openings, and for the forces generated in the diaphragm due to the following cases, whichever one governs:

a) forces determined in Article 4.1.8.11. or 4.1.8.12. applied to the diaphragm are increased to reflect the lateral load capacity of the SFRS, plus forces in the diaphragm due to the transfer of forces between elements of the SFRS associated with the lateral load capacity of such elements and accounting for discontinuities and changes in stiffness in these elements, or

b) a minimum force corresponding to the specified lateral earthquake force, V, divided by N for the diaphragm at level x.

(See Note A-4.1.8.15.(1).)

2) Steel deck roof diaphragms in *buildings* of less than 4 *storeys* or wood diaphragms that are designed and detailed according to the applicable referenced design standards to exhibit ductile behaviour shall meet the requirements of Sentence (1), except that they may yield and the forces shall be

a) for wood diaphragms acting in combination with vertical wood shear walls, equal to the specified lateral earthquake force, V,

b) for wood diaphragms acting in combination with other SFRSs, not less than the force corresponding to $R_dR_o = 2.0$, and

c) for steel deck roof diaphragms, not less than the force corresponding to $R_dR_o = 2.0$.

3) Where diaphragms are designed in accordance with Sentence (2), the struts shall be designed in accordance with Clause (1)(a), and the collectors, chords and connections between the diaphragms and the

vertical elements of the SFRS shall be designed for forces corresponding to the capacity of the diaphragms in accordance with the applicable CSA standards. (See Note A-4.1.8.15.(3).)

4) For single-*storey buildings* with steel deck or wood roof diaphragms designed with a value of R_d greater than 1.5 and where the calculated maximum relative deflection, Δ_D, of the diaphragm under lateral loads exceeds 50% of the average *storey* drift, Δ_B, of the adjoining vertical elements of the SFRS, dynamic magnification of the inelastic response due to the in-plane diaphragm deformations shall be accounted for in the design as follows:

a) the vertical elements of the SFRS shall be designed and detailed to any one of the following:

   i) to accommodate the anticipated magnified lateral deformations taken as $R_oR_d(\Delta_B + \Delta_D) - R_o\Delta_D$,

   ii) to resist the forces magnified by $R_d(1 + \Delta_D/\Delta_B)/(R_d + \Delta_D/\Delta_B)$, or

   iii) by a special study, and

b) the roof diaphragm and chords shall be designed for in-plane shears and moments determined while taking into consideration the inelastic higher mode response of the structure.

(See Note A-4.1.8.15.(4).)

5) Where the Seismic Category is SC3 or SC4, the elements supporting any discontinuous wall, column or braced frame shall be designed for the lateral load capacity of the components of the SFRS they support. (See Note A-4.1.8.15.(5).)

6) Where structures have vertical variations of R_dR_o satisfying Sentence 4.1.8.9.(4), the elements of the SFRS below the level where the change in R_dR_o occurs shall be designed for the forces associated with the lateral load capacity of the SFRS above that level. (See Note A-4.1.8.15.(6).)

7) Where earthquake effects can produce forces in a column or wall due to lateral loading along both orthogonal axes, account shall be taken of the effects of potential concurrent yielding of other elements framing into the column or wall from all directions at the level under consideration and as appropriate at other levels. (See Note A-4.1.8.15.(7).)

8) The design forces associated with the lateral capacity of the SFRS need not exceed the forces determined in accordance with Sentence 4.1.8.7.(1) with R_dR_o taken as 1.0, unless otherwise provided by the applicable referenced design standards for elements, in which case the design forces associated with the lateral capacity of the SFRS need not exceed the forces determined in accordance with Sentence 4.1.8.7.(1) with R_dR_o taken as less than or equal to 1.3. (See Note A-4.1.8.15.(8).)

9) *Foundations* need not be designed to resist the lateral load overturning capacity of the SFRS, provided the design and the R_d and R_o for the type of SFRS used conform to Table 4.1.8.9. and that the *foundation* is designed in accordance with Sentence 4.1.8.16.(4).

10) *Foundation* displacements and rotations shall be considered as required by Sentence 4.1.8.16.(1).

4.1.8.16. Foundation Provisions

1) The increased displacements of the structure resulting from *foundation* movement shall be shown to be within acceptable limits for both the SFRS and the structural framing elements not considered to be part of the SFRS. (See Note A-4.1.8.16.(1).)

2) Except as provided in Sentences (3) and (4), *foundations* shall be designed to have factored shear and overturning resistances greater than the lateral load capacity of the SFRS. (See Note A-4.1.8.16.(2).)

3) The shear and overturning resistances of the *foundation* determined using a bearing stress equal to 1.5 times the factored bearing strength of the soil or rock and all other resistances equal to 1.3 times the factored resistances need not exceed the forces determined in Sentence 4.1.8.7.(1) using $R_dR_o = 1.0$, except that the factor of 1.3 shall not apply to the portion of the resistance to uplift or overturning resulting from gravity loads.

4) A *foundation* is permitted to have a factored overturning resistance less than the lateral load overturning capacity of the supported SFRS, provided the following requirements are met:

a) neither the *foundation* nor the supported SFRS are constrained against rotation, and

b) the design overturning moment of the *foundation* is

i) not less than 75% of the overturning capacity of the supported SFRS, and

ii) not less than that determined in Sentence 4.1.8.7.(1) using R_dR_o = 2.0.

(See Note A-4.1.8.16.(4).)

5) The design of *foundations* shall be such that they are capable of transferring earthquake loads and effects between the building and the ground without exceeding the capacities of the soil and rock.

6) Where the Seismic Category is SC3 or SC4, the following requirements shall be satisfied:

a) piles or pile caps, drilled piers, and caissons shall be interconnected by continuous ties in not less than two directions (see Note A-4.1.8.16.(6)(a)),

b) piles, drilled piers, and caissons shall be embedded a minimum of 100 mm into the pile cap or structure, and

c) piles, drilled piers, and caissons, other than wood piles, shall be connected to the pile cap or structure for a minimum tension force equal to 0.15 times the factored compression load on the pile.

7) Where the Seismic Category is SC3 or SC4, *basement* walls shall be designed to resist earthquake lateral pressures from backfill or natural ground. (See Note A-4.1.8.16.(7).)

8) Where the Seismic Category is SC4, the following requirements shall be satisfied:

a) piles, drilled piers, or caissons shall be designed and detailed to accommodate cyclic inelastic behaviour when the design moment in the element due to earthquake effects is greater than 75% of its moment capacity (see Note A-4.1.8.16.(8)(a)), and

b) spread footings founded on soil designated as X_V, where V_{s30} is less than or equal to 180 m/s, X_E or X_F shall be interconnected by continuous ties in not less than two directions.

9) Each segment of a tie between elements that is required by Clause (6)(a) or (8)(b) shall be designed to carry by tension or compression a horizontal force at least equal to the greatest factored pile cap or column vertical load in the elements it connects, multiplied by a factor of $0.1I_ES(0.2)$, unless it can be demonstrated that equivalent restraints can be provided by other means. (See Note A-4.1.8.16.(9).)

10) The potential for liquefaction of the soil and its consequences, such as significant ground displacement and loss of soil strength and stiffness, shall be evaluated based on the ground motion parameters referenced in Subsection 1.1.3., as modified by Article 4.1.8.4., and shall be taken into account in the design of the structure and its *foundations*. (See Note A-4.1.8.16.(10).)

4.1.8.17. Site Stability

1) The potential for slope instability and its consequences, such as slope displacement, shall be evaluated based on site-specific material properties and ground motion parameters referenced in Subsection 1.1.3., as modified by Article 4.1.8.4., and shall be taken into account in the design of the structure and its *foundations*. (See Note A-4.1.8.17.(1).)

4.1.8.18. Elements of Structures, Non-structural Components and Equipment

(See Note A-4.1.8.18.)

1) Except as provided in Sentences (2), (7) and (16), elements and components of *buildings* described in Table 4.1.8.18. and their connections to the structure shall be designed to accommodate the building deflections calculated in accordance with Article 4.1.8.13. and the element or component deflections calculated in accordance with Sentence (9), and shall be designed for a specified lateral earthquake force, V_p, distributed according to the distribution of mass:

$$V_p = 0.3S(0.2)I_ES_pW_p$$

where

$S(0.2)$ = design spectral acceleration value at a period of 0.2 s, as defined in Sentence 4.1.8.4.(6),

I_E = earthquake importance factor for the building, as defined in Article 4.1.8.5.,

S_p = $C_pA_rA_x/R_p$ (the maximum value of S_p shall be taken as 4.0 and the minimum value of S_p shall be taken as 0.7), where

C_p = element or component factor from Table 4.1.8.18.,

A_r = element or component force amplification factor from Table 4.1.8.18.,

A_x = height factor $(1 + 2h_x/h_n)$,

R_p = element or component response modification factor from Table 4.1.8.18., and

W_p = weight of the component or element.

Table 4.1.8.18.
Elements of Structures and Non-structural Components and Equipment(1)
Forming Part of Sentences 4.1.8.18.(1) to (3), (6), (7) and (16), and Clauses 4.1.8.23.(2)(c) and (3)(c)

Category	**Part or Portion of** Building	**C**p	**A**r	**R**p
Architectural and Structural Components				
1	All exterior and interior walls, and cladding panels, except those in Category 2 or 3	1.00	1.00	2.50
2	Cantilever parapet and other cantilever walls, including cantilever cladding panels, except retaining walls	1.00	2.50	2.50
3	Exterior and interior ornamentations and appendages	1.00	2.50	2.50
4	Floors and roofs acting as diaphragms(2)	–	–	–
5	Towers, *chimneys*, smokestacks and penthouses when connected to or forming part of a building	1.00	2.50	2.50
6	Horizontally cantilevered floors, balconies, beams, etc.	1.00	1.00	2.50
7	Suspended ceilings, light fixtures and other attachments to ceilings with independent vertical support	1.00	1.00	2.50
8	Masonry veneer connections	1.00	1.00	1.50
9	Access floors	1.00	1.00	2.50
10	Masonry or concrete fences more than 1.8 m tall	1.00	1.00	2.50
Mechanical and Electrical Components				
11	Machinery, fixtures, equipment and tanks (including contents)			
	that are rigid and rigidly connected	1.00	1.00	1.25
	that are flexible or flexibly connected	1.00	2.50	2.50
12	Machinery, fixtures, equipment and tanks (including contents) containing toxic or explosive materials, materials having a flash point below 38°C or firefighting fluids			
	that are rigid and rigidly connected	1.50	1.00	1.25
	that are flexible or flexibly connected	1.50	2.50	2.50
13	Flat bottom tanks (including contents) attached directly to a floor at or below grade within a building	0.70	1.00	2.50

14	Flat bottom tanks (including contents) attached directly to a floor at or below grade within a building containing toxic or explosive materials, materials having a flash point below 38°C or firefighting fluids	1.00	1.00	2.50
15	Pipes, ducts (including contents)	1.00	1.00	3.00
16	Pipes, ducts (including contents) containing toxic or explosive materials	1.50	1.00	3.00
17	Electrical cable trays, bus ducts, conduits	1.00	2.50	5.00
Other System Components				
18	Rigid components with ductile material and connections	1.00	1.00	2.50
19	Rigid components with non-ductile material or connections	1.00	1.00	1.00
20	Flexible components with ductile material and connections	1.00	2.50	2.50
21	Flexible components with non-ductile material or connections	1.00	2.50	1.00
22	Elevators and escalators(3)			
	machinery and equipment	as per Category 11		
	elevator rails	1.00	1.00	2.50
23	Floor-mounted steel pallet storage racks(4)	1.00	2.50	2.50
24	Floor-mounted steel pallet storage racks on which are stored toxic or explosive materials or materials having a flash point below 38°C(4)	1.50	2.50	2.50

Notes to Table 4.1.8.18.:

(1) See Note A-Table 4.1.8.18.

(2) See Sentence (8).

(3) See also the Safety Standards Act and pursuant regulations.

(4) See Sentence (13) and Note A-Table 4.1.8.18.

2) For *buildings* in Seismic Category SC1 or SC2, other than *post-disaster buildings*, seismically isolated *buildings*, and *buildings* with supplemental energy dissipation systems, the requirements of Sentence (1) need not apply to Categories 6 through 22 of Table 4.1.8.18.

3) For the purpose of applying Sentence (1) for Categories 11 and 12 of Table 4.1.8.18., elements or components shall be assumed to be flexible or flexibly connected unless it can be shown that the fundamental period of the element or component and its connection is less than or equal to 0.06 s, in which case the element or component is classified as being rigid and rigidly connected.

4) The weight of access floors shall include the *dead load* of the access floor and the weight of permanent equipment, which shall not be taken as less than 25% of the floor *live load*.

5) When the mass of a tank plus its contents or the mass of a flexible or flexibly connected piece of machinery, fixture or equipment is greater than 10% of the mass of the supporting floor, the lateral forces shall be determined by rational analysis.

6) Forces shall be applied in the horizontal direction that results in the most critical loading for design, except for Category 6 of Table 4.1.8.18., where the forces shall be applied up and down vertically.

7) Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence (1), and shall also satisfy these additional requirements:

a) except as provided in Sentence (17), friction due to gravity loads shall not be considered to provide resistance to earthquake forces,

b) R_p for non-ductile connections, such as adhesives or power-actuated fasteners, shall be taken as 1.0,

c) R_p for shallow post-installed mechanical, post-installed adhesive, and cast-in-place anchors in concrete shall be 1.5, where shallow anchors are those with a ratio of embedment length to diameter of less than 8,

d) post-installed mechanical, drop-in and adhesive anchors in concrete shall be pre-qualified for seismic applications by cyclic load testing in accordance with

   i) CSA A23.3, "Design of concrete structures," and

   ii) ACI 355.2, "Qualification of Post-Installed Mechanical Anchors in Concrete (ACI 355.2-19) and Commentary," or ACI 355.4, "Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4-19) and Commentary," as applicable,

e) post-installed mechanical and adhesive anchors in masonry and post-installed mechanical anchors in structural steel shall be pre-qualified for seismic applications by cyclic tension load testing (see Note A-4.1.8.18.(7)(e)),

f) power-actuated fasteners shall not be used for cyclic tension loads,

g) connections for non-structural elements or components of Category 1, 2 or 3 of Table 4.1.8.18. attached to the side of a building and above the first level above grade shall satisfy the following requirements:

   i) for connections where the body of the connection is ductile, the body shall be designed for values of C_p, A_r and R_p given in Table 4.1.8.18., and all of the other parts of the connection, such as anchors, welds, bolts and inserts, shall be capable of developing 2.0 times the nominal yield resistance of the body of the connection, and

   ii) connections where the body of the connection is not ductile shall be designed for values of C_p = 2.0, R_p = 1.0 and A_r given in Table 4.1.8.18., and

h) a ductile connection is one where the body of the connection is capable of dissipating energy through cyclic inelastic behaviour.

8) Floors and roofs acting as diaphragms shall satisfy the requirements for diaphragms stated in Article 4.1.8.15.

9) Lateral deflections of elements or components shall be based on the loads defined in Sentence (1) and lateral deflections obtained from an elastic analysis shall be multiplied by R_p/I_E to give realistic values of the anticipated deflections.

10) The elements or components shall be designed so as not to transfer to the structure any forces unaccounted for in the design, and rigid elements such as walls or panels shall satisfy the requirements of Sentence 4.1.8.3.(6).

11) Seismic restraint for suspended equipment, pipes, ducts, electrical cable trays, etc. shall be designed to meet the force and displacement requirements of this Article and be constructed in a manner that will not subject hanger rods to bending.

12) Isolated suspended equipment and components, such as pendent lights, may be designed as a pendulum system provided that adequate chains or cables capable of supporting 2.0 times the weight of the suspended component are provided and the deflection requirements of Sentence (10) are satisfied.

13) Free-standing steel pallet storage racks are permitted to be designed according to CSA A344.2, "Standard for the design and construction of steel storage racks," and to resist earthquake effects using rational analysis, provided the design achieves the minimum performance level required by Subsection 4.1.8. (See Note A-4.1.8.18.(13) and 4.4.3.1.(1).)

14) Except as provided in Sentence (15), the relative displacement of glass in glazing systems, $D_{fallout}$, shall be equal to the greater of

a) $D_{fallout} \geq 1.25 I_E D_p$, where

   $D_{fallout}$ = relative displacement at which glass fallout occurs, and

D_p = relative earthquake displacement that the component must be designed to accommodate, calculated in accordance with Article 4.1.8.13. and applied over the height of the glass component, or

b) 13 mm.

(See Note A-4.1.8.18.(14) and (15).)

15) Glass need not comply with Sentence (14), provided at least one of the following conditions is met:

a) the Seismic Category is SC1 or SC2,

b) the glass has sufficient clearance from its frame such that $D_{clear} \geq 1.25D_p$ calculated as follows:

$$D_{clear} = 2C_1(1 + h_p C_2/(b_p C_1))$$

where

D_{clear} = relative horizontal displacement measured over the height of the glass panel, which causes initial glass-to-frame contact,

C_1 = average of the clearances on both sides between the vertical glass edges and the frame,

h_p = height of the rectangular glass panel,

C_2 = averages of the top and bottom clearances between the horizontal glass edges and the frame, and

b_p = width of the rectangular glass panel,

c) the glass is fully tempered, monolithic, installed in a non-*post-disaster building*, and no part of the glass is located more than 3 m above a walking surface, or

d) the glass is annealed or heat-strengthened laminated glass in a single thickness with an interlayer no less than 0.76 mm and captured mechanically in a wall system glazing pocket with the perimeter secured to the frame by a wet, glazed, gunable, curing, elastomeric sealant perimeter bead of 13 mm minimum glass contact width.

(See Note A-4.1.8.18.(14) and (15).)

16) For structures with supplemental energy dissipation, elements and components of *buildings* described in Table 4.1.8.18. and their connections to the structure shall be designed for a specified lateral earthquake force, V_p, determined at each floor level as follows:

$$V_p = S_{sed} I_E (C_p A_r / R_p) W_p$$

where

S_{sed} = peak spectral acceleration, $S_a(T,X)$, in the period range of T = 0 s to T = 0.5 s determined from the mean 5%-damped floor spectral acceleration values by averaging the individual 5%-damped floor response spectra at the centroid of the floor area at that floor level determined using Non-linear Dynamic Analysis, and

I_E, C_p, A_r, R_p, W_p= as defined in Sentence (1).

(See Note A-4.1.8.18.(16).)

17) For a ballasted array of interconnected solar panels mounted on a roof, where $I_E S(0.2)$ is less than or equal to 1.0, friction due to gravity loads is permitted to be considered to provide resistance to seismic forces, provided

a) the roof is not normally occupied,

b) the roof is surrounded by a parapet extending from the roof surface to not less than the greater of

i) 150 mm above the centre of mass of the array, and

ii) 400 mm above the roof surface,

c) the height of the centre of mass of the array above the roof surface is less than the lesser of

i) 900 mm, and

ii) one half of the smallest plan dimension of the supporting base of the array,

d) the roof slope at the location of the array is less than or equal to 3°,

e) the factored friction resistance calculated using the kinetic friction coefficient determined in accordance with Sentence (18) and a resistance factor of 0.7 is greater than or equal to the specified lateral earthquake force, V_p, on the array determined in accordance with Sentence (1) using values of $A_r = 1.0$, $A_x = 3.0$, $C_p = 1.0$, and $R_p = 1.25$,

f) the minimum clearance between the array and other arrays or fixed objects is the greater of

i) 225 mm, and

ii) $1\,500(I_E S(0.2) - 0.4)^2$, in mm, and

g) the minimum clearance between the array and the roof parapet is the greater of

i) 450 mm, and

ii) $3\,000(I_E S(0.2) - 0.4)^2$, in mm.

18) For the purpose of Clause (17)(e), the kinetic friction coefficient shall be determined in accordance with ASTM G115, "Standard Guide for Measuring and Reporting Friction Coefficients," through experimental testing that

a) is carried out by an accredited laboratory on a full-scale array or a prototype of the array,

b) models the interface between the supporting base of the array and the roof surface, and

c) accounts for the adverse effects of anticipated climatic conditions on the friction resistance.

(See Note A-4.1.8.18.(18).)

4.1.8.19. Seismic Isolation

1) For the purposes of this Article and Article 4.1.8.20., the following terms shall have the meanings stated herein:

a) "seismic isolation" is an alternative seismic design concept that consists of installing an isolation system with low horizontal stiffness, thereby substantially increasing the fundamental period of the structure;

b) "isolation system" is a collection of structural elements at the level of the isolation interface that includes all individual isolator units, all structural elements that transfer force between elements of the isolation system, all connections to other structural elements, and may also include a wind-restraint system, energy-dissipation devices, and a displacement restraint system;

c) "seismically isolated structure" includes the upper portion of the structure above the isolation system, the isolation system, and the portion of the structure below the isolation system;

d) "isolator unit" is a structural element of the isolation system that permits large lateral deformations under lateral earthquake forces and is characterized by vertical-load-carrying capability combined with increased horizontal flexibility and high vertical stiffness, energy dissipation (hysteretic or viscous), self-centering capability, and lateral restraint (sufficient elastic stiffness) under non-seismic service lateral loads;

e) "isolation interface" is the boundary between the isolated upper portion of the structure above the isolation system and the lower portion of the structure below the isolation system; and

f) "wind-restraint system" is the collection of structural elements of the isolation system that provides restraint of the seismically isolated structure for wind loads and is permitted to be either an integral part of the isolator units or a separate device.

2) Every seismically isolated structure and every portion thereof shall be analyzed and designed in accordance with

a) this Article and Article 4.1.8.20.,

b) other applicable requirements of this Subsection, and

c) appropriate engineering principles and current engineering practice.

(See Note A-4.1.8.19.(2))

3) For the analysis and modeling of the seismically isolated structure, the following criteria shall apply:

a) a three-dimensional Non-linear Dynamic Analysis of the structure shall be performed in accordance with Article 4.1.8.12. (see Note A-4.1.8.19.(3)(a)),

b) unless verified from rational analysis, the inherent equivalent viscous damping—excluding the hysteretic damping provided by the isolation system or supplemental energy dissipation devices—used in the analysis shall not be taken as more than 2.5% of the critical damping at the significant modes of vibration,

c) all individual isolator units shall be modeled with sufficient detail to account for their non-linear force-deformation characteristics, including effects of the relevant loads, and with consideration of variations in material properties over the design life of the structure, and

d) except for elements of the isolation system, other components of the seismically isolated structure shall be modeled using elastic material properties in accordance with Sentence 4.1.8.3.(8).

4) The ground motion time histories used in Sentence (3) shall be

a) appropriately selected and scaled following good engineering practice,

b) compatible with

i) a response spectrum derived from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(6) for site designations X_V, where V_{s30} is greater than 360 m/s, X_A, X_B and X_C, and

ii) a 5%-damped response spectrum based on a site-specific evaluation for site designations X_V, where V_{s30} is less than or equal to 360 m/s, X_D, X_E and X_F, and

c) amplitude-scaled in an appropriate manner over the period range of $0.2T_1$ to $1.5T_1$, where T_1 is the period of the isolated structure determined using the post-yield stiffness of the isolation system in the horizontal direction under consideration, or the period specified in Sentence 4.1.8.20.(1) if the post-yield stiffness of the isolation system is not well defined.

(See Note A-4.1.8.19.(4) and 4.1.8.21.(5).)

4.1.8.20. Seismic Isolation Design Provisions

1) The period of the isolated structure, determined using the post-yield stiffness of the isolation system in the horizontal direction under consideration, shall be greater than three times the period of the structure above the isolation interface calculated as a fixed base.

2) The isolation system shall be configured to produce a restoring force such that the lateral force at the TDD at the centre of mass of the isolated structure above the isolation interface is at least $0.025W_b$ greater than the lateral force at 50% of the TDD at the same location, in each horizontal direction, where W_b is the portion of W above the isolation interface.

3) The values of *storey* shears, *storey* forces, member forces, and deflections used in the design of all structural framing elements and components of the isolation system shall be obtained from analysis conforming to Sentence 4.1.8.19.(3) using one of the following values, whichever produces the most critical effect:

a) mean plus I_E times the standard deviation of results of all Non-linear Dynamic Analyses, or

b) $\sqrt{I_E}$ times the mean of the results of all Non-linear Dynamic Analyses.

4) The force-deformation and damping characteristics of the isolation system used in the analysis and design of seismically isolated structures shall be validated by testing at least two full-size specimens of each predominant type and size of isolator unit of the isolation system, which shall include

a) the individual isolator units,

b) separate supplemental damping devices, if used, and

c) separate sacrificial wind-restraint systems, if used.

5) The force-deformation characteristics and damping value of a representative sample of the isolator units installed in the building shall be validated by tests prior to their installation.

6) A diaphragm or horizontal structural elements shall provide continuity immediately above the isolation interface to transmit forces due to non-uniform ground motions from one part of the structure to another.

7) All structural framing elements shall be designed for the forces described in Sentence (3) with R_dR_o = 1.0, except

a) for structures with I_E < 1.5, all SFRSs shall be detailed in accordance with the requirements for R_d ≥ 1.5 and the applicable referenced design standards, and

b) for structures with I_E = 1.5, all SFRSs shall be detailed in accordance with the requirements for R_d ≥ 2.0 and the applicable referenced design standards.

8) The height restrictions noted in Table 4.1.8.9. need not apply to seismically isolated structures.

9) All isolator units shall be

a) designed for the forces described in Sentence (3), and

b) able to accommodate the TDD determined at the specific location of each isolator unit.

10) The isolation system, including a separate wind-restraint system if used, shall limit lateral displacement due to wind loads across the isolation interface to a value equal to that required for the least *storey* height in accordance with Sentence 4.1.3.5.(3).

4.1.8.21. Supplemental Energy Dissipation

1) For the purposes of this Article and Article 4.1.8.22., the following terms shall have the meanings stated herein:

a) “supplemental energy dissipation device” is a dedicated structural element of the supplemental energy dissipation system that dissipates energy due to relative motion of each of its ends or by alternative means, and includes all pins, bolts, gusset plates, brace extensions and other components required to connect it to the other elements of the structure; a device may be classified as either displacement-dependent or velocity-dependent, or a combination thereof, and may be configured to act in either a linear or non-linear manner; and

b) “supplemental energy dissipation system” is a collection of energy dissipation devices installed in a structure that supplement the energy dissipation of the SFRS.

2) Every structure with a supplemental energy dissipation system and every portion thereof shall be designed and constructed in accordance with

a) this Article and Article 4.1.8.22.,

b) other applicable requirements of this Subsection, and

c) appropriate engineering principles and current engineering practice.

(See Note A-4.1.8.21.(2).)

3) Where supplemental energy dissipation devices are used across the isolation interface of a seismically isolated structure, displacements, velocities, and accelerations shall be determined in accordance with Article 4.1.8.20.

4) For the analysis and modeling of structures with supplemental energy dissipation devices, the following criteria shall apply:

a) a three-dimensional Non-linear Dynamic Analysis of the structure shall be performed in accordance with Article 4.1.8.12. (see Note A-4.1.8.21.(4)(a)),

b) for an SFRS with R_d > 1.0, the non-linear hysteretic behaviour of the SFRS shall be explicitly—with sufficient detail—accounted for in the modeling and analysis of the structure,

c) unless verified from rational analysis, the inherent equivalent viscous damping—excluding the damping provided by the supplemental energy dissipation devices—used in the analysis shall not be taken as more than 2.5% of the critical damping at the significant modes of vibration,

d) all supplemental energy dissipation devices shall be modeled with sufficient detail to account for their non-linear force deformation characteristics, including effects of the relevant loads, and with consideration of variations in their properties over the design life of the structure, and

e) except for the SFRS and elements of the supplemental energy dissipation system, other components of the structure shall be modeled using elastic material properties in accordance with Sentence 4.1.8.3.(8).

5) The ground motion time histories used in Sentence (4) shall be

a) appropriately selected and scaled following good engineering practice,

b) compatible with a 5%-damped response spectrum derived from the design spectral acceleration values, S(T), defined in Sentence 4.1.8.4.(6), and

c) amplitude-scaled in an appropriate manner over the period range of $0.2T_1$ to $1.5T_1$, where T_1 is the fundamental lateral period of the structure with the supplemental energy dissipation system.

(See Note A-4.1.8.19.(4) and 4.1.8.21.(5).)

4.1.8.22. Supplemental Energy Dissipation Design Considerations

1) The values of *storey* shears, *storey* forces, member forces, and deflections for the design of all structural framing elements and all supplemental energy dissipation devices shall be obtained from analysis conforming to Sentence 4.1.8.21.(4) using one of the following values, whichever produces the most critical effect:

a) mean plus I_E times the standard deviation of the results of all Non-linear Dynamic Analyses, or

b) $\sqrt{I_E}$ times the mean of the results of all Non-linear Dynamic Analyses.

2) The largest interstorey deflection at any level of the structure as determined in accordance with Sentence (1) shall conform to the limits stated in Sentence 4.1.8.13.(3).

3) The force-deformation and force-velocity characteristics of the supplemental energy dissipation devices used in the analysis and design of structures with supplemental energy dissipation systems shall be validated by testing at least two full-size specimens of each type of supplementary energy dissipation device.

4) The force-deformation and force-velocity characteristics and damping values of a representative sample of the supplemental energy dissipation devices installed in the building shall be validated by tests prior to their installation.

5) All components of a supplemental energy dissipation device, except that portion of the device that dissipates energy, shall be designed to remain elastic.

6) All structural framing elements shall be designed

a) for an SFRS with R_d = 1.0, using the forces referred to in Sentence (1) with R_dR_o = 1.0, except that the SFRS shall be detailed in accordance with the requirements for $R_d \geq 1.5$ and the applicable referenced design standards, or

b) for an SFRS with R_d > 1.0, using the forces referred to in Sentence (1) with R_dR_o = 1.0, except that the SFRS shall be detailed in accordance with the requirements for the selected R_d and the applicable referenced design standards.

7) Supplemental energy dissipation devices and other components of the supplemental energy dissipation system shall be designed in accordance with Sentence (1) with consideration of the following:

a) low-cycle, large-displacement degradation due to earthquake loads,

b) high-cycle, small-displacement degradation due to wind, thermal, or other cyclic loads,

c) forces or displacements due to gravity loads,

d) adhesion of device parts due to corrosion or abrasion, biodegradation, moisture, or chemical exposure,

e) exposure to environmental conditions, including, but not limited to, temperature, humidity, moisture, radiation (e.g., ultraviolet light), and reactive or corrosive substances (e.g., salt water),

f) devices subject to failure due to low-cycle fatigue must resist wind forces without slip, movement, or inelastic cycling,

g) the range of thermal conditions, device wear, manufacturing tolerances, and other effects that cause device properties to vary during the design life of the device, and

h) connection points of devices must provide sufficient articulation to accommodate simultaneous longitudinal, lateral, and vertical displacements of the supplemental energy dissipation system.

8) Means of access for inspection and removal for replacement of all supplemental energy dissipation devices shall be provided.

4.1.8.23. Additional Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings

1) *Buildings* designed in accordance with Articles 4.1.8.19. to 4.1.8.22. need not comply with this Article.

2) The design of *post-disaster buildings* in Seismic Category SC2, SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 5% probability of exceedance in 50 years and shall satisfy the following requirements:

a) the building shall be shown to behave elastically for a specified lateral earthquake force, V, determined in accordance with Sentence 4.1.8.11.(2) using I_E = 1.0 and R_dR_o = 1.3,

b) the largest interstorey deflection at any level of the building, as determined in accordance with Sentence 4.1.8.13.(2) using I_E = 1.0 and R_dR_o = 1.0, shall not exceed $0.005h_s$, and

c) the connections of elements and components of the building described in Table 4.1.8.18. with R_p > 1.5 shall be shown to behave elastically for a specified lateral earthquake force, V_p, determined in accordance with Sentence 4.1.8.18.(1) using R_p = 1.5.

3) The design of High Importance Category *buildings* in Seismic Category SC3 or SC4 shall be verified using 5%-damped spectral acceleration values based on a 10% probability of exceedance in 50 years and shall satisfy the following requirements:

a) the building shall be shown to behave elastically for a specified lateral earthquake force, V, determined in accordance with Sentence 4.1.8.11.(2) using I_E = 1.0 and R_dR_o = 1.3,

b) the largest interstorey deflection at any level of the building, as determined in accordance with Sentence 4.1.8.13.(2) using I_E = 1.0 and R_dR_o = 1.0, shall not exceed $0.005h_s$, and

c) the connections of elements and components of the building described in Table 4.1.8.18. with R_p > 1.3 shall be shown to behave elastically for a specified lateral earthquake force, V_p, determined in accordance with Sentence 4.1.8.18.(1) using R_p = 1.3.

4) For Normal Importance Category *buildings* in Seismic Category SC4 with a height above grade of more than 30 m, the structural framing elements not considered to be part of the SFRS shall be designed to behave elastically for a specified lateral earthquake force, V, determined in accordance with Sentence 4.1.8.11.(2) using spectral acceleration values based on a 10% probability of exceedance in 50 years and R_dR_o = 1.3.

5) For the purposes of applying Sentences (2) to (4), torsional moments due to accidental eccentricities need not be considered if B, as determined in accordance with Sentence 4.1.8.11.(10), does not exceed 1.7.

6) For the purposes of applying Sentences (2) to (4), elements of the SFRS and structural framing elements not considered to be part of the SFRS, when included in the analysis, shall be modeled in accordance with Sentence 4.1.8.3.(8) using elastic properties.

7) All other requirements of Articles 4.1.8.2. to 4.1.8.18. shall be satisfied in meeting the additional requirements of this Article.

Section 4.2. Foundations

4.2.1. General

4.2.1.1. Application

1) This Section applies to *excavations* and *foundation* systems for *buildings*.

4.2.2. Subsurface Investigations, Drawings and Reviews

4.2.2.1. Subsurface Investigation

1) A subsurface investigation, including groundwater conditions, shall be carried out by or under the direction of a professional engineer having knowledge and experience in planning and executing such investigations to a degree appropriate for the building and its use, the ground and the surrounding site conditions. (See Note A-4.2.2.1.(1).)

4.2.2.2. Drawings

1) Drawings associated with *foundations* and *excavations* shall conform to the appropriate requirements of Section 2.2. of Division C. (See Article 2.2.4.6. of Division C.)

4.2.2.3. Field Review

1) A field review shall be carried out by the designer or by another suitably qualified person to ascertain that the subsurface conditions are consistent with the design and that construction is carried out in accordance with the design and good engineering practice. (See Note A-4.2.2.3.(1).)

2) The review required by Sentence (1) shall be carried out

a) on a continuous basis

   i) during the construction of all deep *foundation* units with all pertinent information recorded for each *foundation* unit,

   ii) during the installation and removal of retaining structures and related backfilling operations, and

   iii) during the placement of engineered *fills* that are to be used to support the *foundation* units, and

b) as required, unless otherwise directed by the *Chief Building Official*,

   i) in the construction of all shallow *foundation* units, and

   ii) in excavating, dewatering and other related works.

4.2.2.4. Altered Subsurface Condition

1) If, during construction, the soil, rock or groundwater is found not to be of the type or in the condition used in design and as indicated on the drawings, the design shall be reassessed by the designer.

2) If, during construction, climatic or any other conditions change the properties of the soil, rock or groundwater, the design shall be reassessed by the designer.

4.2.3. Materials Used in Foundations

4.2.3.1. Wood

1) Wood used in *foundations* or in support of soil or rock shall conform with the appropriate requirements of Subsection 4.3.1.

4.2.3.2. Preservation Treatment of Wood

1) Wood exposed to soil, rock or air above the lowest anticipated groundwater table shall be treated with preservative in conformance with CAN/CSA-O80 Series, "Wood preservation," and the requirements of the appropriate standard as follows:

a) CAN/CSA-O80.1, "Specification of treated wood,"

b) CAN/CSA-O80.2, "Processing and treatment," or

c) CAN/CSA-O80.3, "Preservative formulations."

2) Wood treated as required in Sentence (1) shall be cared for as provided in Clause 4 of CAN/CSA-O80.0, "General requirements for wood preservation."

4.2.3.3. Plain and Reinforced Masonry

1) Plain or reinforced masonry used in *foundations* or in support of soil or rock shall conform with the requirements of Subsection 4.3.2.

4.2.3.4. Prevention of Deterioration of Masonry

1) Where plain or reinforced masonry in *foundations* or in structures supporting soil or rock may be subject to conditions conducive to deterioration, protection shall be provided to prevent such deterioration.

4.2.3.5. Concrete

1) Plain, reinforced or pre-stressed concrete used in *foundations* or in support of soil or rock shall conform with the requirements of Subsection 4.3.3.

4.2.3.6. Protection Against Chemical Attack

1) Where concrete in *foundations* may be subject to chemical attack, it shall be treated in conformance with the requirements in CSA A23.1, "Concrete materials and methods of concrete construction."

4.2.3.7. Steel

1) Steel used in *foundations* or in support of soil or rock shall conform with the appropriate requirements of Subsection 4.3.3. or 4.3.4., unless otherwise specified in this Section.

4.2.3.8. Steel Piles

1) Where steel piles are used in deep *foundations* and act as permanent load-carrying members, the steel shall conform with one of the following standards:

a) ASTM A252, "Standard Specification for Welded and Seamless Steel Pipe Piles,"

b) ASTM A283/A283M, "Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates,"

c) ASTM A1008/A1008M, “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable,”

d) ASTM A1011/A1011M, “Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength,” or

e) CSA G40.21, “Structural quality steel.”

4.2.3.9. High Strength Steel Tendons

1) Where high strength steel is used for tendons in anchor systems used for the permanent support of a *foundation* or in the erection of temporary support of soil or rock adjacent to an *excavation*, it shall conform with the requirements of CSA A23.1, “Concrete materials and methods of concrete construction.”

4.2.3.10. Corrosion of Steel

1) Where conditions are corrosive to steel, adequate protection of exposed steel shall be provided. (See Article 1.2.1.1. of Division A for use of other materials.)

4.2.4. Design Requirements

4.2.4.1. Design Basis

1) The design of *foundations*, *excavations* and soil- and rock-retaining structures shall be based on a subsurface investigation carried out in conformance with the requirements of this Section, and on any of the following, as appropriate:

a) application of generally *accepted* geotechnical and civil engineering principles by a professional engineer especially qualified in this field of work, as provided in this Section and other Sections of Part 4,

b) established local practice, where such practice includes successful experience both with soils and rocks of similar type and condition and with a *foundation* or *excavation* of similar type, construction method, size and depth, or

c) in situ testing of *foundation* units, such as the load testing of piles, anchors or footings, carried out by a person competent in this field of work.

(See Note A-4.2.4.1.(1).)

2) The *foundations* of a building shall be capable of resisting all the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

3) For the purpose of the application of the load combinations given in Table 4.1.3.2.-A, the geotechnical components of loads and the factored geotechnical resistances at ULS shall be determined by a suitably qualified and experienced professional engineer. (See Note A-4.2.4.1.(3).)

4) Geotechnical components of service loads and geotechnical reactions for SLS shall be determined by a suitably qualified and experienced professional engineer.

5) The *foundation* of a building shall be designed to satisfy SLS requirements within the limits that the building is designed to accommodate, including total settlement and differential settlement, heave, lateral movement, tilt or rotation. (See Note A-4.2.4.1.(5).)

6) Communication, interaction and coordination between the designer and the professional engineer responsible for the geotechnical aspects of the project shall take place to a degree commensurate with the complexity and requirements of the project.

4.2.4.2. Subsurface Investigation

1) A subsurface investigation shall be carried out to the depth and extent to which the *building* or *excavation* will significantly change the stress in the soil or rock, or to such a depth and extent as to provide all the necessary information for the design and construction of the *excavation* or the *foundations*.

4.2.4.3. Identification

1) The identification and classification of soil, rock and groundwater and descriptions of their engineering and physical properties shall be in accordance with a widely accepted system.

4.2.4.4. Depth of Foundations

1) Except as permitted in Sentence (2), the *bearing surface* of a *foundation* shall be below the level of potential damage, including damage resulting from *frost action*, and the *foundation* shall be designed to prevent damage resulting from *adfreezing* and frost jacking. (See Note A-4.2.4.4.(1).)

2) The *bearing surface* of a *foundation* need not be below the level of potential damage from frost where the *foundation*

a) is designed against *frost action*, or

b) overlies material not susceptible to *frost action*.

4.2.4.5. Sloping Ground

1) Where a *foundation* is to rest on, in or near sloping ground, this particular condition shall be provided for in the design.

4.2.4.6. Eccentric and Inclined Loads

1) Where there is eccentricity or inclination of loading in *foundation* units, this effect shall be fully investigated and provided for in the design.

4.2.4.7. Dynamic Loading

1) Where dynamic loading conditions apply, the effects shall be assessed by a special investigation of these conditions and provided for in the design.

4.2.4.8. Hydrostatic Uplift

1) Where a *foundation* or any part of a building is subject to hydrostatic uplift, the effects shall be provided for in the design.

4.2.4.9. Groundwater Level Change

1) Where proposed construction will result in a temporary or permanent change in the groundwater level, the effects of this change on adjacent *buildings* shall be fully investigated and provided for in the design.

4.2.4.10. Permafrost

1) Where conditions of permafrost are encountered or proven to exist, the design of the *foundation* shall be based upon analysis of these conditions by a person especially qualified in that field of work.

4.2.4.11. Swelling and Shrinking Soils

1) Where swelling or shrinking soils, in which movements resulting from moisture content changes may be sufficient to cause damage to a structure, are encountered or known to exist, such a condition shall be fully investigated and provided for in the design.

4.2.4.12. Expanding and Deteriorating Rock

1) Where rock that expands or deteriorates when subjected to unfavourable environmental conditions or to stress release is known to exist, this condition shall be fully investigated and provided for in the design.

4.2.4.13. Construction on Fill

1) *Buildings* may be placed on *fill* if it can be shown by subsurface investigation that

a) the *fill* is or can be made capable of safely supporting the building,

b) detrimental movement of the building or of services leading to the building will not occur, and

c) explosive gases can be controlled or do not exist.

4.2.4.14. Structural Design

1) The structural design of the *foundation* of a building, the procedures and construction practices shall conform with the appropriate Sections of this By-law unless otherwise specified in this Section.

4.2.5. Excavations

4.2.5.1. Design of Excavations

1) The design of *excavations* and of supports for the sides of *excavations* shall conform with Subsection 4.2.4. and with this Subsection. (See Note A-4.2.5.1.(1).)

4.2.5.2. Excavation Construction

1) Every *excavation* shall be undertaken in such a manner as to

a) prevent movement that would cause damage to adjacent *buildings* at all phases of construction, and

b) comply with the appropriate requirements of Part 8.

2) Material shall not be placed nor shall equipment be operated or placed in or adjacent to an *excavation* in a manner that may endanger the integrity of the *excavation* or its supports.

4.2.5.3. Supported Excavations

1) The sides of an *excavation* in soil or rock shall be supported by a retaining structure conforming with the requirements of Articles 4.2.5.1. and 4.2.5.2., except as permitted in Article 4.2.5.4.

4.2.5.4. Unsupported Excavations

1) The sides of an *excavation* in soil or rock may be unsupported where a design is prepared in conformance with the requirements of Articles 4.2.5.1. and 4.2.5.2.

4.2.5.5. Control of Water around Excavations

1) Surface water, all groundwater, perched groundwater and in particular artesian groundwater shall be kept under control at all phases of *excavation* and construction.

4.2.5.6. Loss of Ground

1) At all phases of *excavation* and *construction*, loss of ground due to water or any other cause shall be prevented.

4.2.5.7. Protection and Maintenance at Excavations

1) All sides of an *excavation*, supported and unsupported, shall be continuously maintained and protected from possible deterioration by construction activity or by the action of frost, rain and wind.

4.2.5.8. Backfilling

1) Where an *excavation* is backfilled, the backfill shall be placed so as to

a) provide lateral support to the soil adjacent to the *excavation*, and

b) prevent detrimental movements.

2) The material used as backfill or *fill* supporting a footing, *foundation* or a floor on grade shall be of a type that is not subject to detrimental volume change with changes in moisture content and temperature.

4.2.6. Shallow Foundations

4.2.6.1. Design of Shallow Foundations

1) The design of shallow *foundations* shall be in conformance with Subsection 4.2.4. and the requirements of this Subsection. (See Note A-4.2.6.1.(1).)

4.2.6.2. Support of Shallow Foundations

1) Where a shallow *foundation* is to be placed on soil or rock, the soil or rock shall be cleaned of loose and unsound material and shall be adequate to support the design load taking into account temperature, precipitation, construction activities and other factors that may lead to changes in the properties of soil or rock.

4.2.6.3. Incorrect Placement of Shallow Foundations

1) Where a shallow *foundation* unit has not been placed or located as indicated on the drawings,

a) the error shall be corrected, or

b) the design of the *foundation* unit shall be recalculated for the altered conditions by the designer and action taken as required in Article 2.2.4.7. of Division C.

4.2.6.4. Damaged Shallow Foundations

1) If a shallow *foundation* unit is damaged,

a) it shall be repaired, or

b) the design of the *foundation* unit shall be recalculated for the damaged condition by the designer and action taken as required in Article 2.2.4.7. of Division C.

4.2.7. Deep Foundations

4.2.7.1. General

1) A deep *foundation* shall provide support for a building by transferring loads by end-bearing to a competent stratum at considerable depth below the structure, or by mobilizing resistance by adhesion or friction, or both, in the soil or rock in which it is placed. (See Note A-4.2.7.1.(1).)

4.2.7.2. Design of Deep Foundations

1) Deep *foundations* shall be designed in conformance with Subsection 4.2.4. and this Subsection. (See Note A-4.2.7.2.(1).)

2) Where deep *foundation* units are load tested, as required in Clause 4.2.4.1.(1)(c), the determination of the number and type of load test and the interpretation of the results shall be carried out by a professional engineer especially qualified in this field of work. (See Note A-4.2.7.2.(2).)

3) The design of deep *foundations* shall be determined on the basis of geotechnical considerations taking into account

a) the method of installation,

b) the degree of inspection,

c) the spacing of *foundation* units and group effects,

d) other requirements in this Subsection, and

e) the appropriate structural requirements in Section 4.1. and Subsections 4.3.1., 4.3.3. and 4.3.4.

4) The portion of a deep *foundation* unit permanently in contact with soil or rock shall be structurally designed as a laterally supported compression member.

5) The portion of a deep *foundation* unit that is not permanently in contact with soil or rock shall be structurally designed as a laterally unsupported compression member.

6) The structural design of prefabricated deep *foundation* units shall allow for all stresses resulting from driving, handling and testing.

4.2.7.3. Tolerance in Alignment and Location

1) Permissible deviations from the design alignment and the location of the top of deep *foundation* units shall be determined by design analysis and shall be indicated on the drawings.

4.2.7.4. Incorrect Alignment and Location

1) Where a deep *foundation* unit has not been placed within the permissible deviations referred to in Article 4.2.7.3., the condition of the *foundation* shall be assessed by the designer, any necessary changes made and action taken as required in Article 2.2.4.7. of Division C.

4.2.7.5. Installation of Deep Foundations

1) Deep *foundation* units shall be installed in such a manner as not to impair

a) the strength of the deep *foundation* units and the properties of the soil or rock on or in which they are placed beyond the calculated or anticipated limits,

b) the integrity of previously installed deep *foundation* units, or

c) the integrity of neighbouring *buildings*.

4.2.7.6. Damaged Deep Foundation Units

1) Where inspection shows that a deep *foundation* unit is damaged or not consistent with design or good engineering practice,

a) such a unit shall be reassessed by the designer,

b) any necessary changes shall be made, and

c) action shall be taken as required in Article 2.2.4.7. of Division C.

4.2.8. Special Foundations

4.2.8.1. General

1) Where special *foundation* systems are used, such systems shall conform to Subsection 4.2.4., Sentence 4.1.1.5.(2) and Article 1.2.1.1. of Division A.

4.2.8.2. Use of Existing Foundations

1) Existing *foundations* may be used to support new or altered *buildings* provided they comply with all pertinent requirements of this Section.

Section 4.3. Design Requirements for Structural Materials

4.3.1. Wood

4.3.1.1. Design Basis for Wood

1) Except as provided in Sentence (2), *buildings* and their structural members made of wood shall conform to CSA O86, “Engineering design in wood.” (See also the applicable row in Table 1.3.1.2.)

2) *Buildings* or parts of *buildings* of encapsulated mass timber construction and their structural members made of wood shall conform to CSA O86, “Engineering Design in Wood .” (See also the applicable row in Table 1.3.1.2.)

4.3.1.2. Glued-Laminated Members

1) Glued-laminated members shall be fabricated in plants conforming to CSA O177, "Qualification Code for Manufacturers of Structural Glued-Laminated Timber."

4.3.1.3. Termites

1) In areas known to be infested by termites, the requirements in Articles 9.3.2.9., 9.12.1.1. and 9.15.5.1. shall apply.

4.3.2. Plain and Reinforced Masonry

4.3.2.1. Design Basis for Plain and Reinforced Masonry

1) *Buildings* and their structural members made of plain and reinforced masonry shall conform to CSA S304, "Design of masonry structures."

4.3.3. Plain, Reinforced and Pre-stressed Concrete

4.3.3.1. Design Basis for Plain, Reinforced and Pre-stressed Concrete

1) *Buildings* and their structural members made of plain, reinforced and pre-stressed concrete shall conform to CSA A23.3, "Design of concrete structures." (See Note A-4.3.3.1.(1).)

4.3.4. Steel

4.3.4.1. Design Basis for Structural Steel

1) *Buildings* and their structural members made of structural steel shall conform to CSA S16, "Design of steel structures." (See Note A-4.3.4.1.(1).)

4.3.4.2. Design Basis for Cold-Formed Steel

1) *Buildings* and their structural members made of cold-formed steel shall conform to CSA S136, "North American Specification for the Design of Cold-Formed Steel Structural Members (using the Appendix B provisions applicable to Canada)." (See Note A-4.3.4.2.(1).)

4.3.4.3. Steel Building Systems

1) Steel building systems shall be manufactured by companies certified in accordance with the requirements of CSA A660, "Certification of manufacturers of steel building systems."

4.3.5. Aluminum

4.3.5.1. Design Basis for Aluminum

1) *Buildings* and their structural members made of aluminum shall conform to CSA S157/S157.1, "Strength design in aluminum/Commentary on CSA S157-17, Strength design in aluminum," using the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

4.3.6. Glass

4.3.6.1. Design Basis for Glass

1) Glass used in *buildings* shall be designed in conformance with

a) CAN/CGSB-12.20-M, "Structural Design of Glass for *Buildings*," using an adjustment factor on the wind load, W, of not less than 0.75, or

b) ASTM E1300, "Standard Practice for Determining Load Resistance of Glass in *Buildings*," using an adjustment factor on the wind load, W, of not less than 1.0.

(See Note A-4.3.6.1.(1).)

Section 4.4. Design Requirements for Special Structures

4.4.1. Air-, Cable- and Frame-Supported Membrane Structures

4.4.1.1. Design Basis for Air-, Cable- and Frame-Supported Membrane Structures

1) The structural design of air-, cable- and frame-supported membrane structures shall conform to CSA S367, "Air-, cable-, and frame-supported membrane structures," using the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

4.4.2. Parking Structures

4.4.2.1. Design Basis for Storage Garages and Repair Garages

1) Storage garages and repair garages, including associated ramps and pedestrian areas, shall be designed in conformance with the performance requirements of CSA S413, "Parking structures." (See Note A-4.4.2.1.(1).)

4.4.3. Storage Racks

4.4.3.1. Design Basis for Storage Racks

1) Storage racks, including anchorage of racks, shall be designed for loads in accordance with this Part. (See Note A-4.1.8.18.(13) and 4.4.3.1.(1).)

Section 4.5. Objectives and Functional Statements

4.5.1. Objectives and Functional Statements

4.5.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 4.5.1.1. (See Note A-1.1.2.1.(1).)

Table 4.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 4
Forming Part of Sentence 4.5.1.1.(1)

Provision	Functional Statements and Objectives[1]
4.1.1.3. Design Requirements	
(1)	[F20-OS2.1]
(2)	[F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1] Applies to structural members where temporary overloading during construction may result in impairment of that or any other member.
(4)	[F20,F80,F82-OS2.1]
(5)	[F20-OP2.1] [F22-OP2.4]
	[F20-OS2.3,OS2.4]
4.1.1.5. Design Basis	

(2)	[F20-OS2.1] [F22-OS2.4,OS2.5]
	[F20-OP2.1] [F22-OP2.4,OP2.5]
	[F22-OH4]
4.1.2.1. Loads and Effects	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
(3)	[F20-OS2.1]
4.1.2.2. Loads Not Listed	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.3.2. Strength and Stability	
(1)	[F20-OP2.1] [F22-OP2.4]
	[F20-OS2.1]
(2)	[F20-OS2.1] [F22-OS2.4,OS2.5] Applies to the stabilizing resistance of the dead load.
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(3)	[F20-OS2.1] [F22-OS2.4,OS2.5] Applies to the stabilizing resistance of the dead load.
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4,OS2.5]
	[F20-OP2.1] [F22-OP2.4,OP2.5]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	[F20-OS2.1] [F22-OS2.4,OS2.5]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.3.3. Fatigue	
(1)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F22-OH4]
4.1.3.4. Serviceability	
(1)	[F22-OP2.4]
	[F22-OH4]
(2)	[F22-OP2.4]
	[F22-OH4]
(3)	[F22-OP2.4]
	[F22-OH4]
(4)	[F22-OP2.4]
	[F22-OH4]
(5)	(b),(c),(d) [F22-OP2.4]
	[F22-OP2.4]
	[F22-OH4]
(6)	[F21-OS2.5]
	[F21-OP2.4,OP2.5]
	[F22-OH4]
4.1.3.5. Deflection	
(1)	(b),(c),(d) [F22-OP2.4]
	[F22-OP2.4]
	[F22-OH4]
(2)	[F22-OS2.3,OS2.4]
	[F22-OP2.4]
(3)	[F22-OP2.4]
(5)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
4.1.3.6. Vibration	
(1)	[F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]

	[F20-OP2.1,OP2.4] [F22-OP2.4]
	[F22-OH4]
4.1.4.1. Dead Loads	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1] [F22-OS2.4,OS2.5]
4.1.5.1. Loads Due to Use of Floors and Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.2. Uses Not Stipulated	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.3. Full and Partial Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.4. Loads for Occupancy Served	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.5. Loads on Exterior Areas	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.7. More Than One Occupancy	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.8. Variation with Tributary Area	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.5.9. Concentrated Loads	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.5.10. Sway Forces in Assembly Occupancies	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
4.1.5.11. Crane-Supporting Structures and Impact of Machinery and Equipment	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
4.1.5.12. Bleachers	
(1)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.4]
4.1.5.13. Helicopter Landing Areas	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.5.14. Loads on Guards and Handrails	
(1)	[F20-OS2.1]
(2)	[F20-OS2.1]
(3)	[F20-OS2.1,OS2.4]
(4)	[F22-OS2.4]
(6)	[F20-OS2.1]
(7)	[F20-OS2.1]
4.1.5.15. Loads on Vehicle Guardrails	
(1)	[F20-OS2.1]
4.1.5.16. Loads on Walls Acting As Guards	
(1)	[F20-OS2.1]
4.1.5.17. Firewalls	
(1)	[F20-OS1.2]
	[F20-OP1.2]
	[F20-OP3.1]
(2)	[F04-OS1.2]
	[F04-OP1.2]
	[F04-OP3.1]
4.1.5.18. Loads for Building Maintenance	
(1)	[F20-OS2.1]
4.1.6.2. Specified Snow Load	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1] Applies to portion of Code text: “The accumulation factor, Ca, shall be 1.0, …”
	[F20-OP2.1] [F22-OP2.4] Applies to portion of Code text: “The accumulation factor, Ca, shall be 1.0, …”
	(a) to (f) [F20-OS2.1] Applies to roof shapes and configurations that call for a higher accumulation factor.
	(a) to (f) [F20-OP2.1] [F22-OP2.4] Applies to roof shapes and configurations that call for a higher accumulation factor.
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.3. Full and Partial Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.4. Specified Rain Load	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.5. Multi-level Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

4.1.6.6. Horizontal Gap between a Roof and a Higher Roof	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.7. Areas Adjacent to Roof Projections	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.8. Snow Drift at Corners	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.9. Gable Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.10. Arch Roofs, Curved Roofs and Domes	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

4.1.6.11. Snow Loads Due to Sliding	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.12. Valleys in Curved or Sloped Roofs	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.13. Specific Weight of Snow	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.14. Snow Removal	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.15. Ice Loading of Structures	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.6.16. Roofs with Solar Panels	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.1. Specified Wind Load	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.2. Classification of Buildings	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.3. Static Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]

(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.4. Topographic Factor	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.5. External Pressure Coefficients	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
(6)	[F20-OS2.1]
(7)	[F20-OS2.1]

	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.6. External Pressure Coefficients for Low Buildings	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.7. Internal Pressure Coefficient	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
4.1.7.8. Dynamic Procedure	

(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.9. Full and Partial Wind Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.7.10. Interior Walls and Partitions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.11. Exterior Ornamentations, Equipment and Appendages	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.12. Attached Canopies on Low Buildings with a Height H ≤ 20 m	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
(4)	[F20-OS2.1]
(5)	[F20-OS2.1]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.7.14. Wind Tunnel Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
	[F22-OH4]
4.1.8.1. Analysis	
(2)	(a) [F20-OS2.1]
	(a) [F20-OP2.1,OP2.3] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(13)	[F20-OS2.1]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
(14)	[F20-OS2.1]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
4.1.8.3. General Requirements	
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.4. Site Properties	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.5. Importance Factor and Seismic Category	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]

4.1.8.6. Structural Configuration	
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.7. Methods of Analysis	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.8. Direction of Loading	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.9. SFRS Force Modification Factors and General Restrictions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.10. Additional System Restrictions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	(a) [F20-OP2.3] [F22-OP2.4]
	(b) [F20-OP2.3] [F22-OP2.4]
	(c) [F20-OP2.3] [F22-OP2.4]
	(d) [F20-OP2.3] [F22-OP2.4]
(3)	(a) [F20-OP2.3] [F22-OP2.4]
	(b) [F20-OP2.3] [F22-OP2.4]
	(c) [F20-OP2.3] [F22-OP2.4]
	(d) [F20-OP2.3] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

(8)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(9)	[F22-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(10)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
4.1.8.11. Equivalent Static Force Procedure for Structures Satisfying the Conditions of Article 4.1.8.7.	
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(11)	(a) [F20-OP2.1] [F22-OP2.4]
	(a) [F20-OS2.1]
	(b) [F20-OS2.1]
	(b) [F20-OP2.1] [F22-OP2.4]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]

4.1.8.12. Dynamic Analysis Procedure	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	(a) [F20-OS2.1]
	(a) [F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1,OP2.3] [F22-OP2.4]
(8)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(10)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(12)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.13. Deflections and Drift Limits	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(2)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(3)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
4.1.8.14. Structural Separation	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
	[F22-OP4.3]
(2)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]

(3)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]
(4)	[F20-OS2.1,OS2.3,OS2.4]
	[F20-OP2.1,OP2.3,OP2.4]
	[F20-OP4.3]
4.1.8.15. Design Provisions	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1,OP2.3,OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4]
(6)	[F20-OS2.1,OS2.4]
	[F20-OP2.1,OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.16. Foundation Provisions	
(1)	[F22-OS2.3,OS2.4]
	[F22-OP2.3,OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1]
(5)	[F20-OS2.2,OS2.4]
	[F20-OP2.2,OP2.4]
(6)	(a) [F22-OS2.4]
	(a) [F22-OP2.4]
	(b) [F22-OS2.4]
	(b) [F22-OP2.4]
	(c) [F20-OS2.4]
	(c) [F20-OP2.4]
(7)	[F20-OS2.1]

	[F20-OP2.1,OP2.4]
(8)	(a) [F20-OS2.1]
	(a) [F20-OP2.1]
	(b) [F22-OS2.4]
	(b) [F22-OP2.4]
(9)	[F20-OS2.4]
	[F20-OP2.4]
(10)	[F20-OS2.2] [F22-OS2.4]
	[F20-OP2.2] [F22-OP2.4]
4.1.8.17. Site Stability	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.18. Elements of Structures, Non-structural Components and Equipment	
(1)	[F20,F22-OS2.4]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
(4)	[F20,F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(5)	[F20,F22-OS2.1]
	[F20,F22-OP2.1,OP2.4]
(6)	[F20,F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(7)	[F20,F22-OS2.4] Applies to portion of Code text: “Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence (1) …”
	[F20,F22-OP2.3,OP2.4] Applies to portion of Code text: “Connections to the structure of elements and components listed in Table 4.1.8.18. shall be designed to support the component or element for gravity loads, shall conform to the requirements of Sentence (1) …”
	(a) [F20,F22-OS2.4]
	(a) [F20,F22-OP2.3,OP2.4]
	(b),(c) [F20,F22-OS2.4]
	(b),(c) [F20,F22-OP2.3,OP2.4]
	(d),(f) [F20,F22-OS2.4]
	(d),(f) [F20,F22-OP2.3,OP2.4]
	(g) [F20,F22-OS2.4]
	(g) [F20,F22-OP2.3,OP2.4]
(9)	[F22-OS2.3,OS2.4]

	[F22-OP2.3,OP2.4]
(10)	[F22-OS2.1,OS2.3,OS2.4]
	[F22-OP2.1,OP2.3,OP2.4]
(11)	[F20-OS2.1] [F22-OS2.4]
	[F20,F22-OP2.3,OP2.4]
(12)	[F20-OS2.1] [F22-OS2.3]
	[F20-OP2.1] [F22-OP2.3]
(14)	[F22-OS2.4]
(16)	[F20,F22-OS2.4]
	[F20-OP2.3] [F22-OP2.3,OP2.4]
4.1.8.19. Seismic Isolation	
(2)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.20. Seismic Isolation Design Provisions	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(2)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(9)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(10)	[F22-OS2.4]

	[F22-OP2.3,OP2.4]
4.1.8.21. Supplemental Energy Dissipation	
(2)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.22. Supplemental Energy Dissipation Design Considerations	
(1)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(3)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(4)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(5)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(6)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
(7)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
(8)	[F20-OS2.1] [F22-OS2.4]
	[F20-OP2.1] [F22-OP2.4]
4.1.8.23. Additional Performance Requirements for Post-disaster Buildings, High Importance Category Buildings, and a Subset of Normal Importance Category Buildings	
(2)	[F20-OS2.1]
	[F22-OP2.3,OP2.4]
(3)	[F20-OS2.1]
	[F22-OP2.3,OP2.4]
(4)	[F20-OS2.1]
4.2.2.1. Subsurface Investigation	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.2.3. Field Review	

(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.5]
	[F21-OP4.1,OP4.4]
4.2.2.4. Altered Subsurface Condition	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
(2)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.3.2. Preservation Treatment of Wood	
(1)	[F80-OS2.3]
	[F80-OP2.3]
(2)	[F82-OS2.3]
	[F82-OP2.3]
4.2.3.4. Prevention of Deterioration of Masonry	
(1)	[F80-OS2.3]
	[F80-OP2.3]
4.2.3.6. Protection Against Chemical Attack	
(1)	[F80-OS2.3]
	[F80-OP2.3]
4.2.3.8. Steel Piles	
(1)	[F20-OS2.3]
	[F20-OP2.3]
4.2.3.9. High Strength Steel Tendons	
(1)	[F20,F80-OS2.5,OS2.6]
	[F20,F80-OP2.6,OP2.5]
	[F20,F80-OP4.1,OP4.4]
4.2.3.10. Corrosion of Steel	
(1)	[F80-OS2.3]
	[F80-OP2.3]
	[F80-OP4.1]
4.2.4.1. Design Basis	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.5]

	[F21-OP4.1,OP4.4]
(5)	[F21-OS2.5]
	[F21-OP2.4,OP2.5]
4.2.4.2. Subsurface Investigation	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.4.3. Identification	
(1)	[F20-OS2.2,OS2.6] [F21-OS2.6]
	[F20-OP2.2] [F21-OP2.6]
	[F21-OP4.1,OP4.4]
4.2.4.4. Depth of Foundations	
(1)	[F21-OP2.4] Applies to portion of By-law text: "… the *bearing surface* of a foundation shall be below the level of potential damage, including damage resulting from *frost action* …"
	[F21-OP2.4] Applies to portion of By-law text: "… the foundation shall be designed to prevent damage resulting from *adfreezing* and frost jacking."
(2)	[F21-OP2.4]
4.2.4.5. Sloping Ground	
(1)	[F21-OS2.2]
	[F21-OP2.2,OP2.6,OP2.4]
4.2.4.6. Eccentric and Inclined Loads	
(1)	[F20-OS2.1,OS2.2]
	[F20-OP2.1,OP2.2,OP2.4]
4.2.4.7. Dynamic Loading	
(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.6,OP2.4]
	[F20-OH4]
4.2.4.8. Hydrostatic Uplift	
(1)	[F22-OP2.1,OP2.4]
4.2.4.9. Groundwater Level Change	
(1)	[F21-OP4.1]
4.2.4.10. Permafrost	
(1)	[F20-OS2.2] [F21-OS2.5]
	[F20-OP2.2,OP2.4] [F21-OP2.6,OP2.4]
4.2.4.11. Swelling and Shrinking Soils	

(1)	[F21-OP2.6,OP2.4]
4.2.4.12. Expanding and Deteriorating Rock	
(1)	[F21-OP2.6,OP2.4]
4.2.4.13. Construction on Fill	
(1)	(a) [F20-OS2.2] [F21-OS2.5]
	(b) [F20-OP2.2,OP2.4] [F21-OP2.6,OP2.4]
	(c) [F01-OS1.1]
4.2.5.2. Excavation Construction	
(1)	[F21-OP4.1]
(2)	[F20-OS2.6]
	[F20-OP2.3]
	[F20,F21-OP4.1]
4.2.5.3. Supported Excavations	
(1)	[F20-OS2.6]
	[F21-OP4.1]
4.2.5.4. Unsupported Excavations	
(1)	[F20-OS2.6]
	[F21-OP4.1]
4.2.5.5. Control of Water around Excavations	
(1)	[F60-OS2.6]
	[F60-OP4.1,OP4.4]
4.2.5.6. Loss of Ground	
(1)	[F21-OP4.1]
4.2.5.7. Protection and Maintenance at Excavations	
(1)	[F80-OS2.6]
	[F80-OP4.1]
4.2.5.8. Backfilling	
(1)	(a) [F21-OS2.1]
	(a) [F21-OP2.1,OP2.4]
	[F21-OP4.1]
(2)	[F21-OP2.4]
4.2.6.2. Support of Shallow Foundations	
(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.4] [F21-OP2.4]
4.2.6.3. Incorrect Placement of Shallow Foundations	

(1)	[F20-OS2.2]
	[F20-OP2.2,OP2.4] [F21-OP2.4]
4.2.6.4. Damaged Shallow Foundations	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.2. Design of Deep Foundations	
(3)	[F20-OS2.1,OS2.2] [F21-OS2.5]
	[F20-OP2.1,OP2.2] [F21,F22-OP2.4]
(5)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
(6)	[F20-OP2.1,OP2.4]
4.2.7.3. Tolerance in Alignment and Location	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.4. Incorrect Alignment and Location	
(1)	[F20-OS2.1]
	[F20-OP2.1,OP2.4] [F22-OP2.4]
4.2.7.5. Installation of Deep Foundations	
(1)	[F81-OS2.1] [F21-OS2.2,OS2.6]
	(c) [F21-OP4.1]
	(a),(b) [F81-OP2.1,OP2.4] [F21-OP2.2,OP2.4]
4.2.7.6. Damaged Deep Foundation Units	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F22-OP2.4]
4.2.8.2. Use of Existing Foundations	
(1)	[F20-OS2.1,OS2.2]
	[F20-OP2.1,OP2.2] [F22-OP2.4]
4.3.1.1. Design Basis for Wood	
(1)	[F22,F21,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80-OP2.3,OP2.4]
(2)	[F22,F21,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80-OP2.3,OP2.4]

4.3.1.2. Glued-Laminated Members	
(1)	[F20-OS2.1]
	[F20-OP2.1] [F21,F22-OP2.4]
	[F21,F22-OH4]
4.3.2.1. Design Basis for Plain and Reinforced Masonry	
(1)	[F21,F22,F80-OH4]
	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F22,F21-OP2.4] [F80-OP2.3,OP2.4]
4.3.3.1. Design Basis for Plain, Reinforced and Pre-stressed Concrete	
(1)	[F20-OS2.1] [F80,F81-OS2.3]
	[F20-OP2.1] [F21,F22-OP2.4] [F80,F81-OP2.3,OP2.4]
	[F21,F22,F80,F81-OH4]
4.3.4.1. Design Basis for Structural Steel	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]
	[F22,F80-OH4]
4.3.4.2. Design Basis for Cold-Formed Steel	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]
	[F22,F80-OH4]
4.3.5.1. Design Basis for Aluminum	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F20,F22-OP2.4] [F80-OP2.3,OP2.4]
	[F22,F80-OH4]
4.3.6.1. Design Basis for Glass	
(1)	[F20-OS2.1]
	[F20-OP2.1]
4.4.1.1. Design Basis for Air-, Cable- and Frame-Supported Membrane Structures	
(1)	[F20-OS2.1] [F80-OS2.3]
	[F20-OP2.1] [F22-OP2.4] [F80-OP2.3]
	[F22-OH4]
4.4.2.1. Design Basis for Storage Garages and Repair Garages	
(1)	[F21,F61,F80-OS2.3]
	[F21,F61,F80-OP2.3,OP2.4]
	[F21,F61,F80-OH4]

Notes to Table 4.5.1.1.:
(1) See Parts 2 and 3 of Division A.

Notes to Part 4
Structural Design

A-4.1.1.3.(1) Structural Integrity. The requirements of Part 4, including the CSA design standards, generally provide a satisfactory level of structural integrity. Additional considerations may, however, be required for building systems made of components of different materials, whose interconnection is not covered by existing CSA design standards, buildings outside the scope of existing CSA design standards, and buildings exposed to severe accidental loads such as vehicle impact or explosion. Further guidance can be found in the Commentary entitled Structural Integrity in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.1.3.(2) Serviceability. Information on serviceability can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.1.5.(2) Structural Equivalents. Sentence 4.1.1.5.(2) provides for the use of design methods not specified in Part 4, including full-scale testing and model analogues. This provision is usually used to permit the acceptance of new and innovative structures or to permit the acceptance of model tests such as those used to determine structural behaviour, or snow or wind loads. Sentence 4.1.1.5.(2) specifically requires that the level of safety and performance be at least equivalent to that provided by design to Part 4 and requires that loads and designs conform to Section 4.1.

Sentence 4.1.1.5.(2) and the provision for alternative solutions stated in Clause 1.2.1.1.(1)(b) of Division A are not intended to allow structural design using design standards other than those listed in Part 4. The acceptance of structures that have been designed to other design standards would require the designer to prove to the appropriate authority that the structure provides the level of safety and performance required by Clause 1.2.1.1.(1)(b) of Division A. The equivalence of safety and performance can only be established by analyzing the structure for the loads and load factors set out in Section 4.1. and by demonstrating that the structure at least meets the requirements of the design standards listed in Sections 4.3. and 4.4.

A-4.1.2.1. Loads and Effects. Information on the definitions can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.2.1.(1) Temperature Changes. Information on effects due to temperature changes can be found in the Commentary entitled Effects of Deformations in Building Components in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.2.1.(3) Major Occupancies. In a building containing more than one major occupancy and classified in more than one Importance Category, the classification of each independent structural system shall be the same as for any part of the building that is dependent on that structural system and for the highest usage group according to Table 4.1.2.1.

A-Table 4.1.2.1. Importance Categories for Buildings.

Low Importance Category

A minor storage building is an example of a Low Importance Category building.

Low-human-occupancy farm buildings with an occupant load of 1 person or less per 40 m^2 of floor area are also examples of Low Importance Category buildings.

Normal Importance Category

Most buildings will fall into the Normal Importance Category.

The following types of buildings may be classified in the Normal Importance Category: buildings that are equipped with secondary containment of dangerous goods, including, but not limited to, double-walled tanks, dikes of sufficient size to contain a spill, and other means to contain a spill or a blast within the property boundary of the facility and prevent the release of harmful quantities of contaminants to the air, soil, groundwater, surface water or atmosphere, as the case may be.

High Importance Category

The following buildings may contain sufficient quantities of dangerous goods to be classified in the High Importance Category:

- petrochemical facilities,
- fuel storage facilities (other than those required for post-disaster use), and
- manufacturing or storage facilities containing dangerous goods.

Information on community centres can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Post-disaster Importance Category

Before classifying a building as a post-disaster building, Code users should consider the intent of the classification and look beyond the name of the building. For example, a building that is named "ABC Treatment" but is used for emergency care should be considered as a hospital and, as such, classified as a post-disaster building. Conversely, a building named "XYZ Hospital" that is only used for walk-in medical services could be classified as a Normal Importance Category building.

A-4.1.2.2.(1) Loads Not Listed. The intent of Sentence 4.1.2.2.(1) is to draw attention to the fact that there are loads, forces and effects that need to be considered in addition to those specified in the Code. These loads, forces and effects will vary in need, application, and magnitude for each use and location. Some may result from environmental considerations (e.g., ice accretion, wave and ice action, water flow) while others will result from the use and occupancy of the facility (e.g., dangerous goods storage, manufacturing and mining operations). The reasonable determination of the probability, type and magnitude of project-specific loads must be assessed by a knowledgeable project team that includes the building owner/operator and experienced design professionals, and incorporated into the design where deemed necessary to maintain the safety and integrity of the facility.

In recent years, security issues have prompted the consideration of loads and effects due to improvised explosive devices and other methods of sabotage. Consideration of these loads is driven by operational and public safety requirements, and their incorporation in the design is not considered a mandatory provision of the Code.

A-4.1.3. Limit States Design. Information on limit states design can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.2.(2) Load Combinations.

Load Combination Equations

The load combinations in Tables 4.1.3.2.-A and 4.1.3.2.-B apply to most situations for loadbearing building structures. Guidance on special situations such as load combinations for fire resistance and building envelopes is given in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Load Cases and Crane Load Effects

The load combinations in Table 4.1.3.2.-A are to be evaluated for structures with crane load effects for the scenario where the crane loads are zero, and for structures without crane loads. The load combinations in Table 4.1.3.2.-B are to be evaluated for structures with crane loads for the scenario where the crane load effects are other than zero.

Crane Loads

Crane-supporting structures that have cranes in multiple parallel bays should be designed for the maximum vertical crane load with the cranes positioned for the most critical effect in conjunction with a lateral load with each crane in turn positioned for the most critical effect. For load combinations that include crane loads, additional guidance can be found in CISC/ICCA 2018, "Crane-Supporting Steel Structures: Design Guide (Third Edition)."

A-4.1.3.2.(4) Effects of Lateral Earth Pressure, H, Pre-stress, P, and Imposed Deformation, T, in Design Calculations.

Effects of Lateral Earth Pressure, H, in Design Calculations

For common building structures below ground level, such as walls, columns and frames, 1.5H is added to load combinations 2 to 4. For cantilever retaining wall structures, see the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Effects of Pre-stress, P, and Imposed Deformation, T, in Design Calculations

For structures and building envelopes designed in accordance with the requirements specified in the standards listed in Section 4.3., with the exception of Clauses 8 and 18 of CSA A23.3, "Design of concrete structures," P and T need not be included in the load combinations of Table 4.1.3.2.-A. For structures not within the scope of the standards listed in Section 4.3., including building envelopes, P and T must be taken into account in the design calculations. For recommended load combinations including T, see the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.2.(5) Overturning, Uplift or Sliding. Information on overturning, uplift and sliding can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.3.(1) Failure due to Fatigue. Failure due to fatigue of building structures referred to in Section 4.3. and designed for serviceability in accordance with Article 4.1.3.6. is, in general, unlikely except for girders supporting heavily used cranes, on which Article 4.1.5.11. provides guidance.

A-4.1.3.3.(2) Vibration Effects. Guidance on vibration effects can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.4.(1) Loads and Load Combinations for Serviceability. The loads and load combinations for serviceability depend on the serviceability limit states and on the properties of the structural materials. Information on loads and load combinations for the serviceability limit states, other than those controlled by deflection, can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-Table 4.1.3.4. Acceleration due to Vibrations. Information on the determination of acceleration due to vibrations resulting from loads L and W can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.5.(1) Deflections. Serviceability criteria for deflections that cause damage to non-structural building components can be found in the standards listed in Section 4.3. Information on deflections can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)." Information on loads and load combinations for calculating deflection can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.5.(3) Lateral Deflection of Buildings. The limitation of 1/500 drift per storey may be exceeded if it can be established that the drift as calculated will not result in damage to non-structural elements. Information on lateral deflection can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.6.(1) Floor Vibration. Information on floor vibration can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)." Information on loads and load combinations for the calculation of vibration can be found in the Commentary entitled Limit States Design in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.6.(2) Floor Vibrations Caused by Resonance with Operating Machinery or Equipment. Guidance on floor vibration effects caused by operating machinery and equipment can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.6.(3) Dynamic Analyses of Floor Vibrations. Information on a dynamic analysis of floor vibrations from rhythmic activities can be found in the Commentary entitled Deflection and Vibration Criteria for Serviceability and Fatigue Limit States in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.3.6.(4) Lateral Vibration Under Wind Load. Information on lateral vibrations and accelerations under dynamic wind loads can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.4.1.(2) Permanent Partitions Fixed to the Structure. Partitions in residential buildings, including condominiums, apartments and hotels, are typically permanent and fixed to the structure. In such cases, the weight of partitions referred to in Clause 4.1.4.1.(1)(c) is the actual weight of the partitions that are shown on the drawings.

A-4.1.4.1.(3) Partitions Not Shown on the Drawings. The potential locations of partitions in work areas, such as offices, are not typically shown on the drawings. For such areas, a partition weight allowance must be considered based on the anticipated weight and location of partitions, but not less than 1 kPa over the area of floor being considered.

A-4.1.4.1.(6) Counteracting Dead Load Due to Soil. Examples of structures that traditionally employ the dead load of soil to resist loadings are pylon signs, tower structures, retaining walls, and deadmen, which resist wind uplift and overturning in light structures.

A-4.1.5.1.(1) Loads Due to Use of Floors and Roofs. In many areas of buildings, such as equipment areas, service rooms, factories, storage areas, warehouses, museums, and office filing areas, live loads due to their intended use may exceed the minimum specified loads listed in Table 4.1.5.3. In these instances, the probable live load shall be calculated and used as the specified live load for the design of that particular area.

A-Table 4.1.5.3. Considerations for Live Loads.

Arenas, Grandstands and Stadia

The designer should give special consideration to the effects of vibration.

Attics - Limited Accessibility

Attic live loading is not required when the ceiling below the attic consists of removable panels that permit access to the ceiling space without loading the ceiling supporting members. Attic live loading is not required in any area of the attic where the least dimension of the attic space is less than 500 mm.

Corridors, Aisles and Rows of Seats

The spaces between rows of seats are typically designed for the loads of the occupancy they serve. Rows of seats typically discharge into aisles that are designed for the loads used for the rows of seats. Corridors have a minimum width of 1 100 mm and may serve as collectors for aisles; they are therefore part of the exit system and are required to be designed for a minimum live load of 4.8 kPa.

Floor Areas That Could Be Used As Viewing Areas

Some interior balconies, mezzanines, corridors, lobbies and aisles that are not intended to be used by an assembly of people as viewing areas are sometimes used as such; consequently, they are subject to loadings much higher than those for the occupancies they serve. Floor areas that may be subject to such higher loads must, therefore, be designed for a loading of 4.8 kPa.

Lecture Halls and Classrooms

For the purposes of applying the requirements of Table 4.1.5.3., lecture halls with fixed seats are similar to theatres in configuration (the seats may have a writing tablet affixed to one arm). Classrooms are typically furnished with full-sized desks having separate or integrated seats.

Minimum Roof Live Load

Articles 4.1.5.3. and 4.1.5.10. stipulate a minimum uniform roof live load of 1.0 kPa and a minimum concentrated live load of 1.3 kN. These live loads are “use and occupancy loads” intended to provide for maintenance loadings: they are not reduced as a function of area or as a function of the roof slope due to their variability in distribution and location.

Office Areas

The general minimum specified load for office areas, including mezzanines, is 2.4 kPa.

A minimum specified load of 4.8 kPa applies to office areas in basements, which are normally slab-on-grade, and to office areas in floor areas that may be subject to an increase in loading for brief periods, for example, when tenants temporarily use that floor area to store furniture, equipment and files while moving in or out of the building.

Where an office building is situated on a level site, all floors are uniform in elevation, and there are no mezzanines, allocating the correct loads is straightforward. However, where the site is steeply sloped, the situation is more complex—even more so where there are also mezzanines.

The principle is that floor levels and mezzanines with access to the exterior at ground level could be used as staging areas during a move, and so, must be designed for a minimum of 4.8 kPa. Also, there is usually an area adjacent to the exterior exit that can accommodate trucks.

Vehicle Loads

A special study should be undertaken to determine the distributed loads to be used for the design of floors and areas used by vehicles exceeding 9 000 kg gross weight and of driveways and sidewalks over areaways and basements. Where appropriate, the designer should refer to CSA S6, "Canadian Highway Bridge Design Code."

A-4.1.5.5. Loads on Exterior Areas. In Article 4.1.5.5., "accessible" refers to the lack of a physical barrier that prevents or restricts access by vehicles or persons to the site in the context of the specific use.

Information on the design of roof parking decks and exterior areas that are accessible to vehicular traffic can be found in the Commentary entitled Live Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.5.8. Tributary Area. Information on tributary area can be found in the Commentary entitled Live Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-Table 4.1.5.9. Loads Due to Concentrations. Special study is required to determine concentrated loads for the design of floors and areas used by vehicles exceeding 9 000 kg gross weight, and of driveways and sidewalks over areaways and basements. Where appropriate the designer should refer to CSA S6, "Canadian Highway Bridge Design Code."

A-4.1.5.11. Crane-Supporting Structures. Guidance on crane-supporting structures can be found in CSA S16, "Design of steel structures."

A-4.1.5.14. and 4.1.5.15.(1) Design of Guards. In the design of guards, due consideration should be given to the durability of the members and their connections.

A-4.1.5.17. **Loads on Firewalls**. Information on loads on firewalls can be found in the Commentary entitled Structural Integrity of Firewalls in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.1.(1) Specified Load Due to Rain or to Snow and Associated Rain. The location of a new building or obstruction may affect the snow loads on the roof of an adjacent existing building—on the same property or on an adjacent one—that is lower in height. In such cases, designers should consider Sentence 2.2.2.1.(1) of Division C.

Additional guidance can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.2. **Coefficients for Snow Loads on Roofs**. Information on coefficients for snow loads on roofs can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.2.(2) Basic Roof Snow Load Factor. Figure A-4.1.6.2.(2) shows the basic roof snow load factor, C_b, plotted against $l_c C_w^2$.

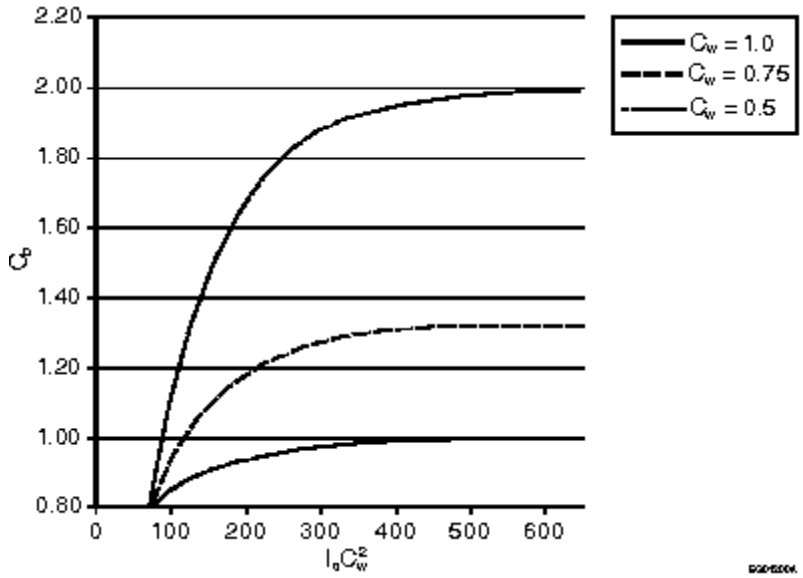


Figure A-4.1.6.2.(2)
Basic roof snow load factor, Cb

A-4.1.6.3.(2) Full and Partial Loading under Snow Loads. Information on full and partial snow loading on roofs can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.4.(1) Rain Loads. Information on rain loads can be found in the Commentary entitled Rain Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.4.(3) Flow Control Drains. The National Plumbing Code (NPC) contains requirements regarding the use of flow control roof drains. The designer must ensure that the building complies with the Vancouver Building By-law Book I and Book II: Plumbing Systems

A-4.1.6.7.(1) Roof Projections. Elevator, air-conditioning and fan housings, small penthouses and wide chimneys are examples of roof projections.

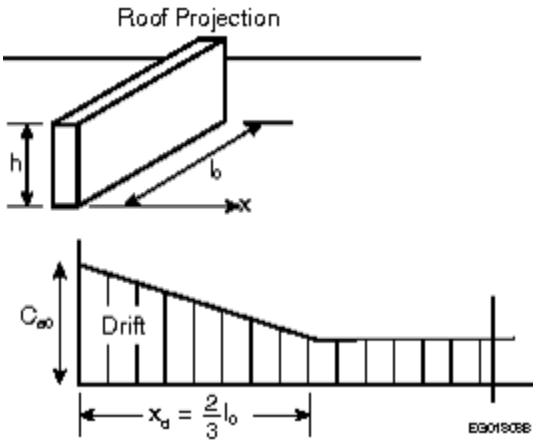


Figure A-4.1.6.7.(1)
Roof projections

A-4.1.6.7.(2) Values of C_a for Small Roof Projections. Calculating C_a in accordance with Article 4.1.6.5. rather than Sentence 4.1.6.7.(1) results in lower values for small projections.

A-4.1.6.9. Snow on Gable Roofs.

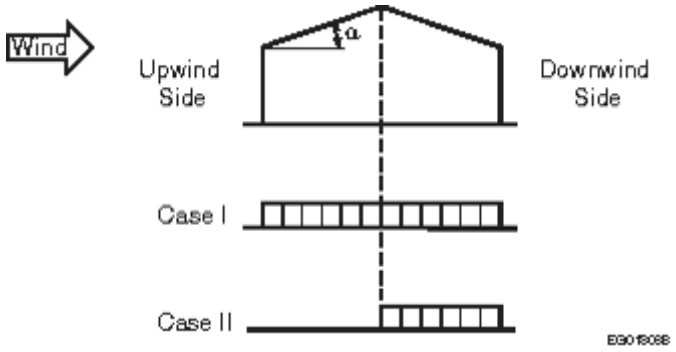


Figure A-4.1.6.9.
Load cases for gable roofs

Table A-4.1.6.9.
Wind Exposure, Slope and Accumulation Factors for Load Cases in Figure A-4.1.6.9.

Load Case	Roof Slope, α	Factors			
		C_w	C_s[1]	C_a	
				Upwind Side	Downwind Side
I	0° ≤ α ≤ 90°	[2]	f(α)	1.0	1.0
II[3]	15° < α ≤ 20°	1.0	f(α)	0.0	0.25 + α/20
	20° < α ≤ 90°				1.25

Notes to Table A-4.1.6.9.:
[1] Cs varies as a function of slope, α, as defined in Sentences 4.1.6.2.(5) and (6).
[2] The value of Cw for load case I is as prescribed in Sentences 4.1.6.2.(3) and (4).
[3] Case II loading does not apply to gable roofs with slopes of 15° or less, to single-sloped (shed) roofs, or to flat roofs.

A-4.1.6.16. Roofs with Solar Panels. Information on the design of roofs with solar panels can be found in the Commentary entitled Snow Loads in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.6.16.(3) Snow Obstructed from Sliding by Solar Panels. Figure A-4.1.6.16.(3) shows the areas on sloped roofs with solar panels where snow is considered to be obstructed from sliding by the solar panels and the slope factor, C_s, must be taken as 1.0.

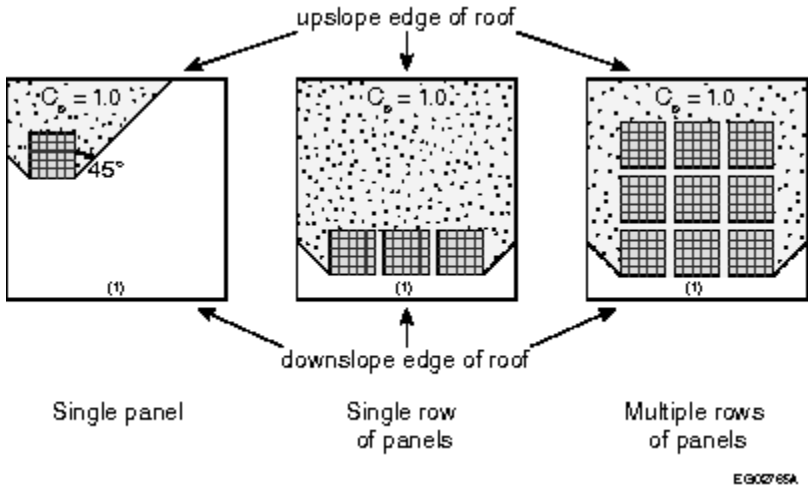


Figure A-4.1.6.16.(3)
Areas on sloped roofs with solar panels where snow is obstructed from sliding by the solar panels
Note to Figure A-4.1.6.16.(3):
(1) Cs = as specified in Sentences 4.1.6.2.(5) to (7)

A-4.1.6.16.(4)(b) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g \geq w_p$. Figure A-4.1.6.16.(4)(b) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g, between the panels is greater than or equal to the panel width, w_p.

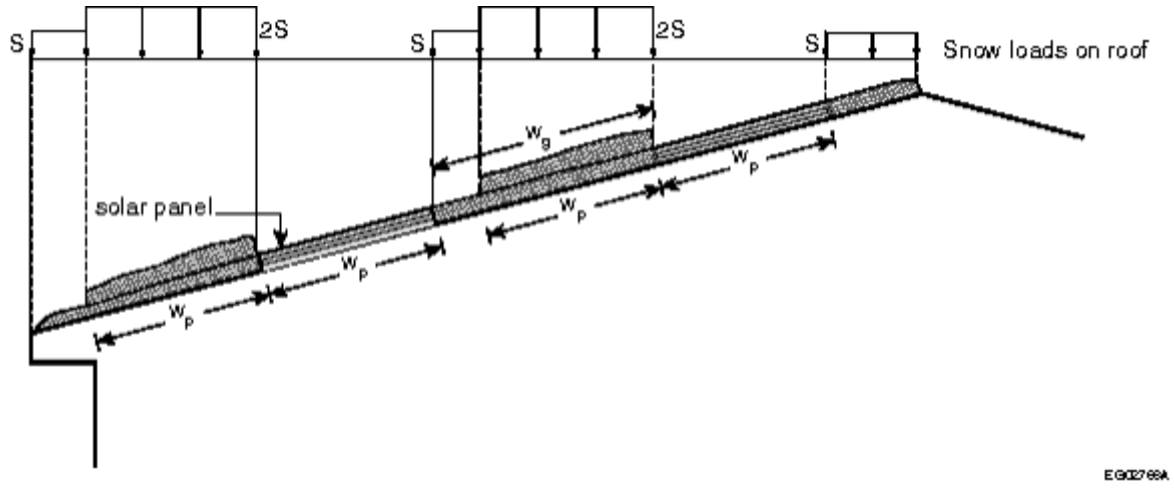


Figure A-4.1.6.16.(4)(b)
Snow loads for a sloped roof with Parallel Flush solar panels where wg ≥ wp

A-4.1.6.16.(4)(c) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g < w_p$. Figure A-4.1.6.16.(4)(c) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g, between the panels is less than the panel width, w_p.

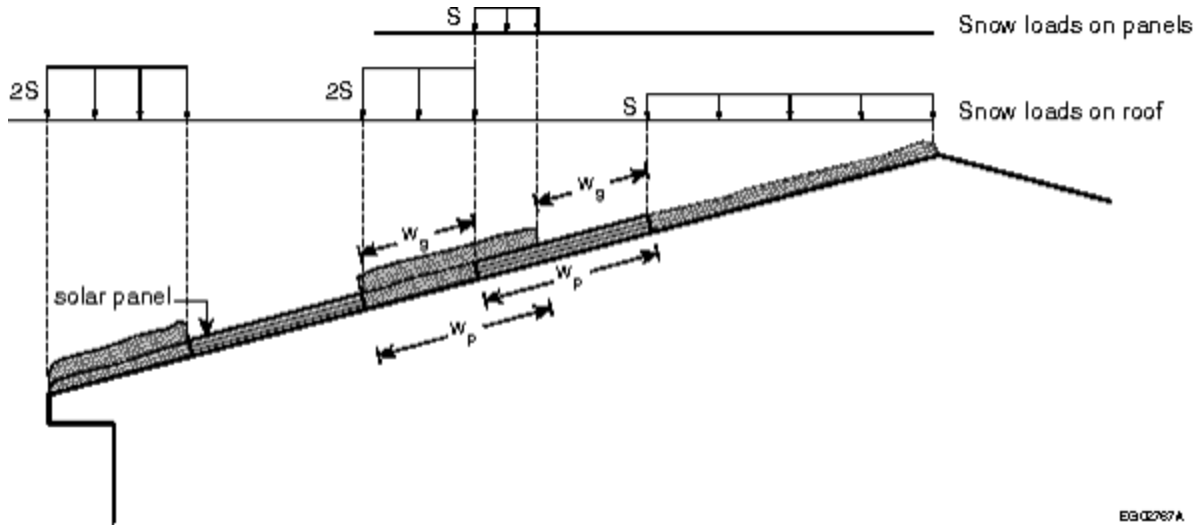


Figure A-4.1.6.16.(4)(c)
Snow loads for a sloped roof with Parallel Flush solar panels where wg < wp

A-4.1.6.16.(5)(a) Snow Loads for a Flat Roof with Parallel Raised Solar Panels. Figure A-4.1.6.16.(5)(a) shows the snow loads for a flat roof with Parallel Raised solar panels.

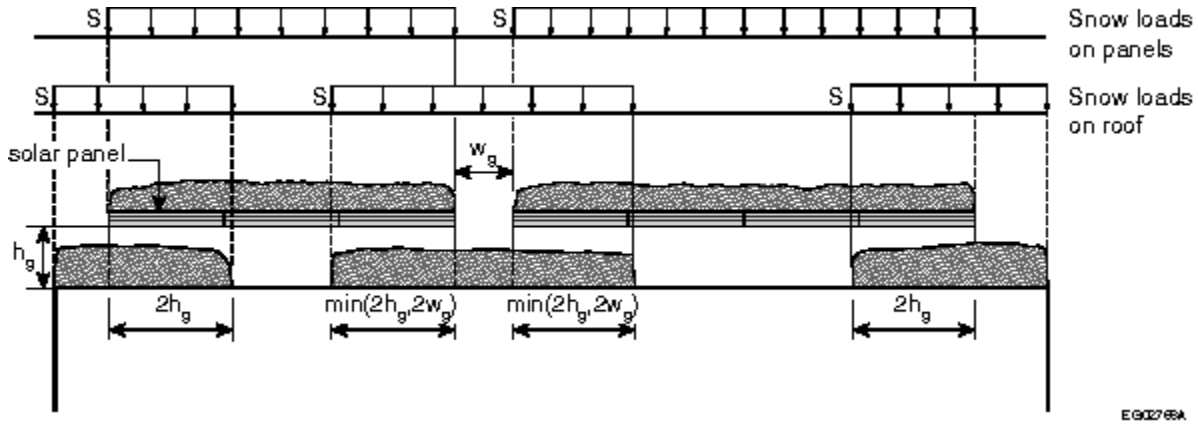


Figure A-4.1.6.16.(5)(a)
Snow loads for a flat roof with Parallel Raised solar panels

A-4.1.6.16.(5)(b) Snow Loads for a Sloped Roof with Parallel Raised Solar Panels. Figure A-4.1.6.16.(5)(b) shows the snow loads for a sloped roof with Parallel Raised solar panels.

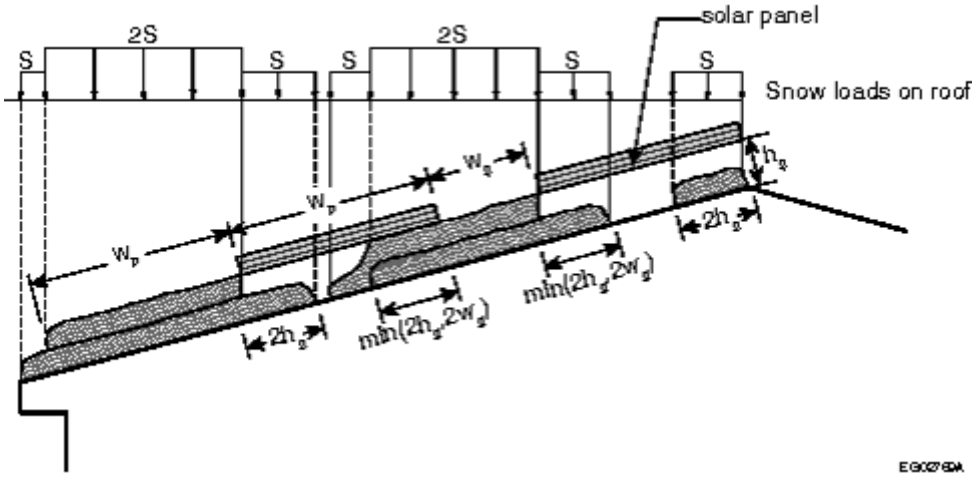


Figure A-4.1.6.16.(5)(b)
Snow loads for a sloped roof with Parallel Raised solar panels

A-4.1.6.16.(6) Snow Loads for a Flat Roof with Tilted Solar Panels. Figure A-4.1.6.16.(6) shows the snow loads for a flat roof with Tilted solar panels.

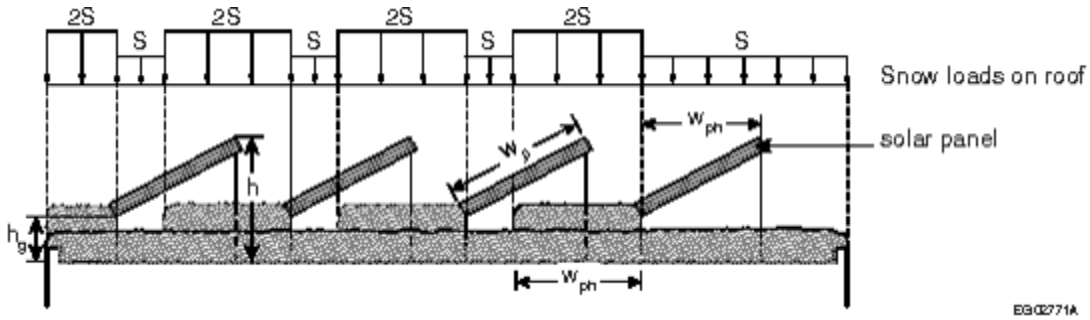


Figure A-4.1.6.16.(6)
Snow loads for a flat roof with Tilted solar panels

A-4.1.6.16.(6)(c) Variation of C_a with $h_g - C_bC_wS_s/\gamma$. Figure A-4.1.6.16.(6)(c) shows the variation of the accumulation factor, C_a, with the height of the lowest edge of the panels above the surface of the uniform snow load, $h_g - C_bC_wS_s/\gamma$, for a flat roof with Tilted solar panels.

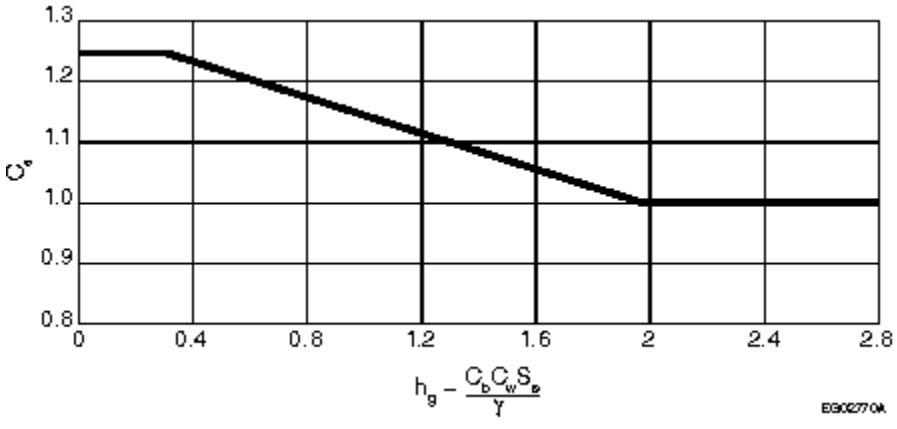


Figure A-4.1.6.16.(6)(c)
Variation of C_a with $h_g - C_bC_wS_s/\gamma$ for a flat roof with Tilted solar panels

A-4.1.7.1.(6) Computational Fluid Dynamics (CFD). It is not currently possible to verify the reliability and accuracy of CFD and no standards address it; as such, this method is not permitted to be used to determine specified wind loads.

A-4.1.7.2.(2) Natural Frequency. Information on calculating the natural frequency of a building can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.7.3.(5)(c) Procedure for Calculating Intermediate C_e. Information on calculating intermediate values of C_e between two exposures can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.7.3.(10) Internal Gust Effect Factor, C_{gi}. The effect of building envelope flexibility can be included in the calculation of C_{gi}. See the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.7.5.(2) and (3) Pressure Coefficients for Main Structural System on Rectangular Buildings.

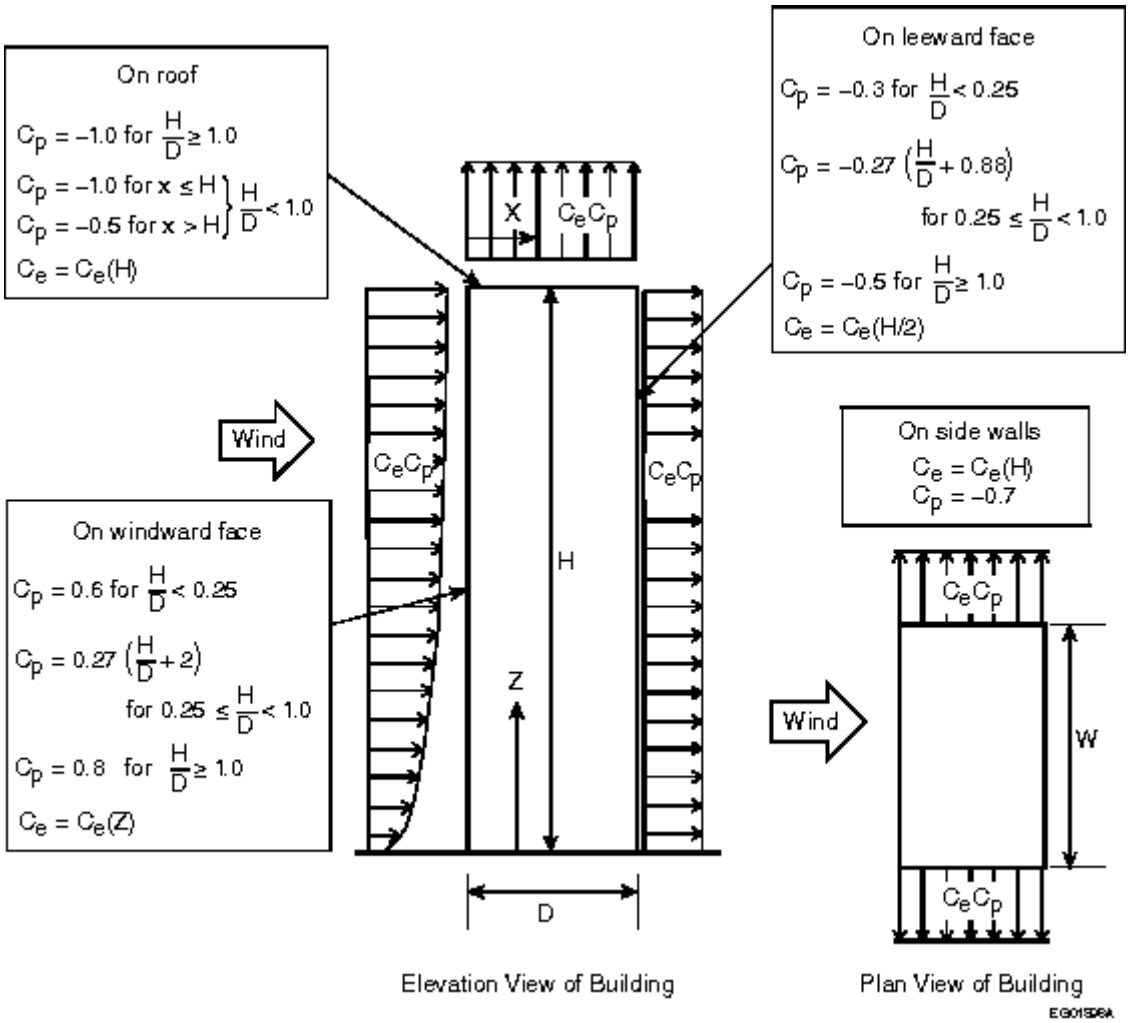


Figure A-4.1.7.5.(2) and (3)
Values of Cp for main structural system on rectangular buildings

A-4.1.7.5.(4) Pressure Coefficients for Roof and Wall Claddings and Secondary Structural Supports of Cladding on Rectangular Buildings.

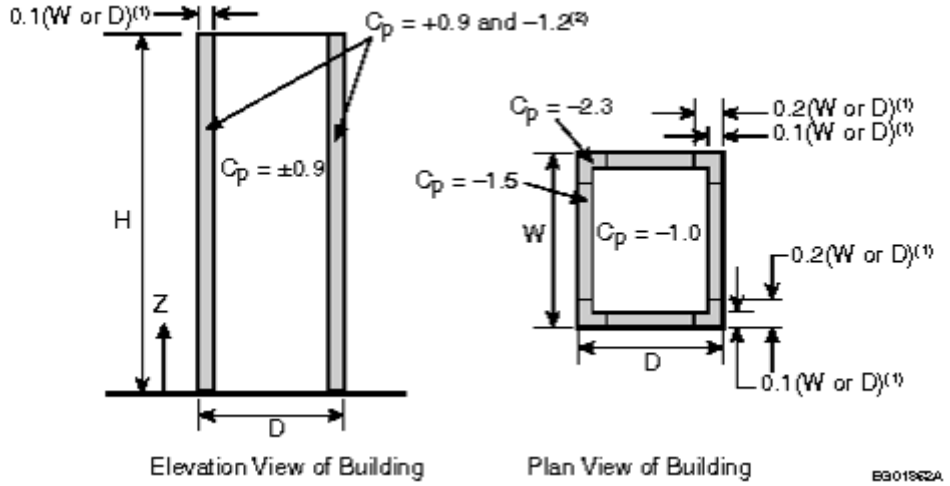


Figure A-4.1.7.5.(4)
Values of Cp for roof and wall claddings and secondary structural supports of cladding on rectangular buildings
Notes to Figure A-4.1.7.5.(4):
(1) The larger of W or D is to be used.
(2) Where vertical ribs deeper than 1 m are present on the walls, the dimensions 0.1D and 0.1W must be changed to 0.2D and 0.2W and the negative value of Cp must be changed from –1.2 to –1.4.

A-4.1.7.7.(2) Cladding on Parapets. Information on the design of cladding on parapets can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.7.8.(2) and (3) Exposure Factor for Dynamic Procedure.

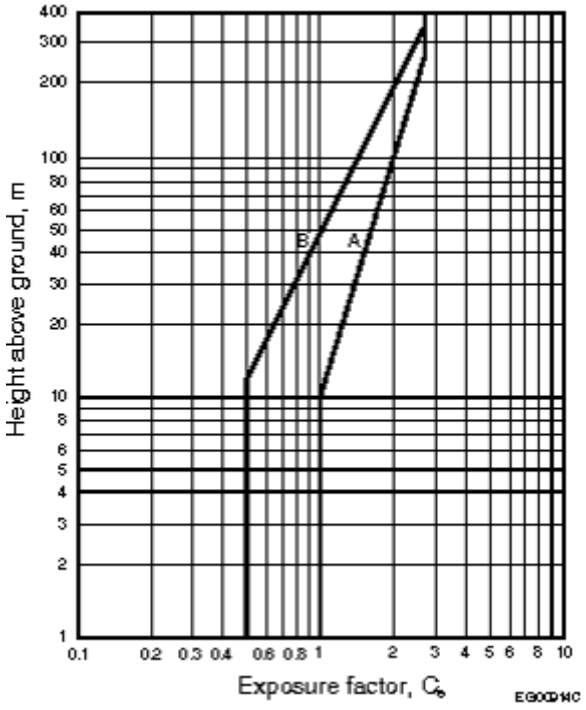


Figure A-4.1.7.8.(2) and (3)
Exposure factor, Ce, for dynamic procedure
Notes to Figure A-4.1.7.8.(2) and (3):

(1) Curve A represents Ce for open terrain, as defined in Clause 4.1.7.3.(5)(a).
(2) Curve B represents Ce for rough terrain, as defined in Clause 4.1.7.3.(5)(b).

A-4.1.7.8.(4) Peak Factor, Size Reduction Factor and Gust Energy Ratio.

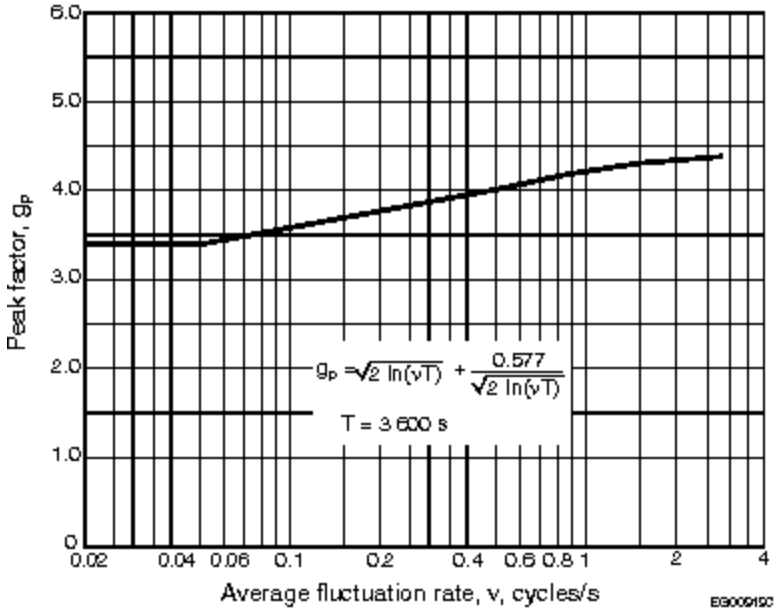


Figure A-4.1.7.8.(4)-A
Peak factor, gp

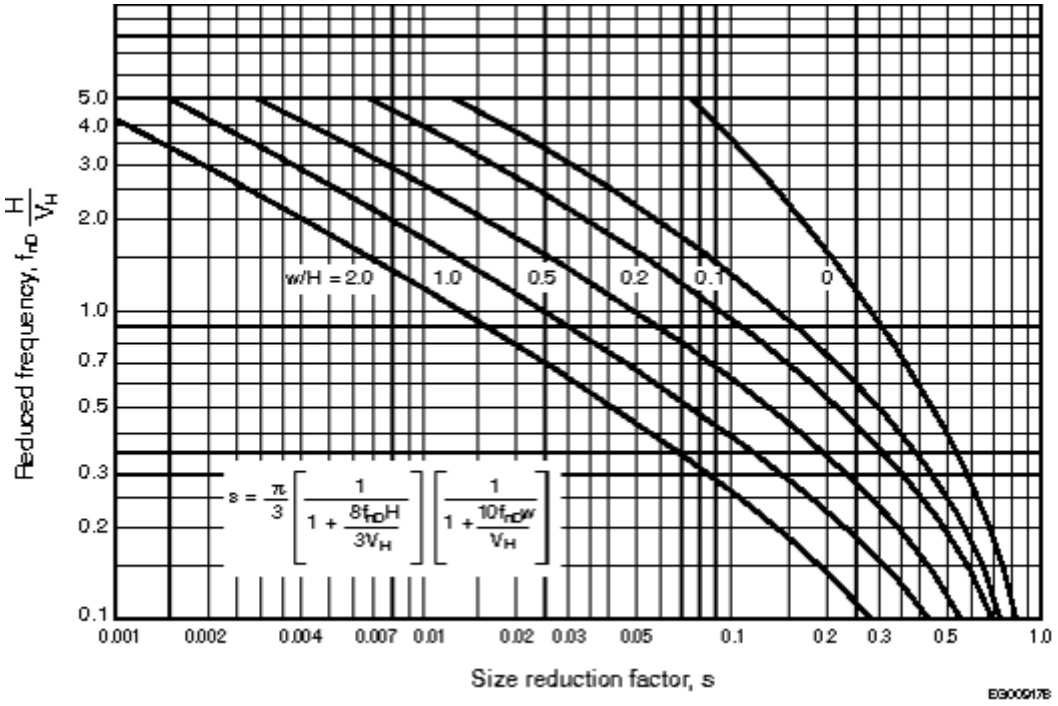


Figure A-4.1.7.8.(4)-B
Size reduction factor, s

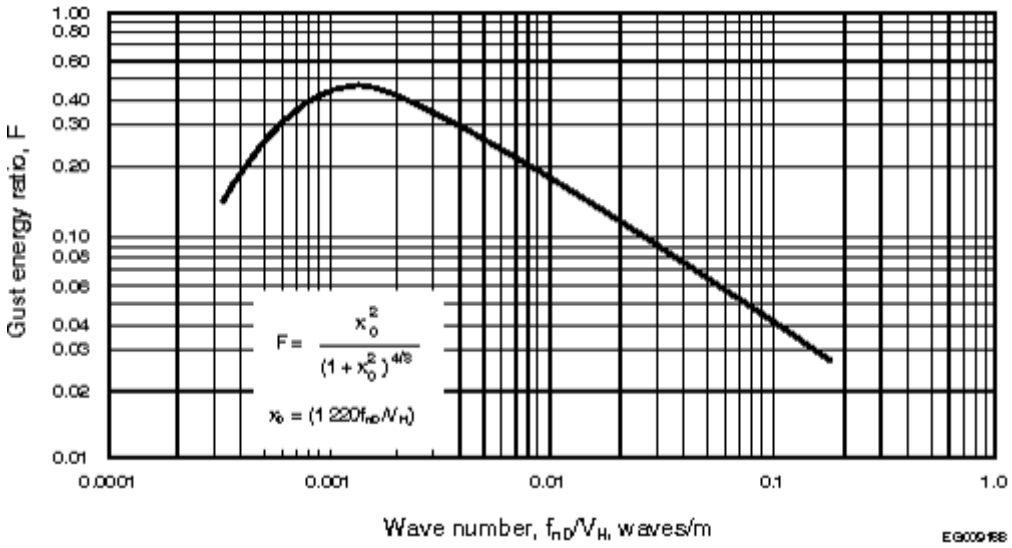


Figure A-4.1.7.8.(4)-C
Gust energy ratio, F

A-4.1.7.9.(1) Full and Partial Wind Loading. Information on full and partial loading under wind loads can be found in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

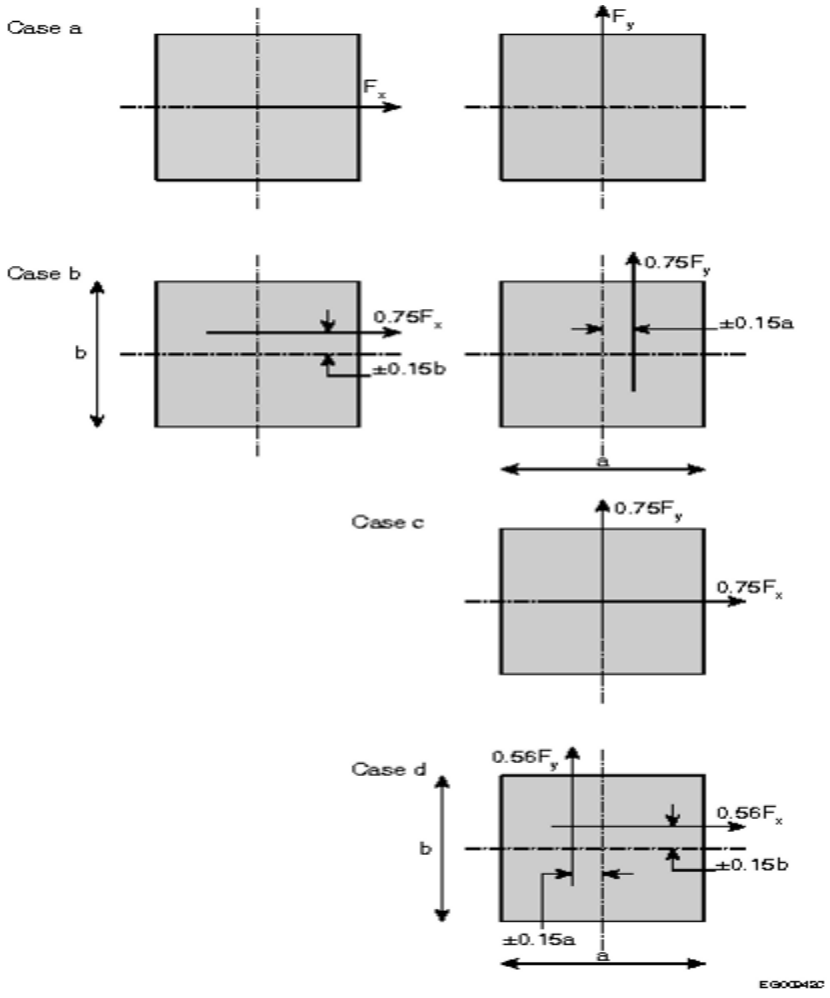


Figure A-4.1.7.9.(1)
Full and partial wind loading

A-4.1.7.11. Exterior Ornamentations, Equipment and Appendages. Appendages may increase the overall forces in the design of the building structure and need to be accounted for.

A-4.1.7.12. Attached Canopies on Low Buildings (H ≤ 20 m). An attached canopy is different from an overhang, which is an extension of the roof surface.

Figure 4.1.7.12.-A, which provides the gust pressure coefficients on the upper and lower surfaces of the canopy, is used to design the cladding for the canopy and the associated fasteners. Figure 4.1.7.12.-B, which provides the net gust pressure coefficients on the canopy, is used to design the structure of the canopy (e.g., joists, posts, building fasteners).

In addition to the external wind pressure addressed in Article 4.1.7.12., the internal pressure addressed in Table 4.1.7.7. should also be considered, where applicable to the canopy.

A-4.1.7.13. Roof-Mounted Solar Panels on Buildings of Any Height. Article 4.1.7.13. provides procedures for calculating the wind loads on roof-mounted arrays of solar panels that satisfy particular geometrical requirements.

The area of the roof that is covered by a solar array does not need to be designed for the simultaneous application of the solar array wind loads and the roof wind loads. However, the cumulative load effect of all solar panels does need to be accounted for in accordance with Article 4.1.7.11. Furthermore, the roof needs to be designed for the case where the solar array has been removed.

Solar arrays that are mechanically fastened to the underlying roof structure can modify the load distribution on the roof. The loads from such arrays must be applied to the structural components of the roof as concentrated loads at the points of attachment.

The calculations in Article 4.1.7.13. assume that the solar panels and their mounting system are rigid. Therefore, there is no allowance for wind-induced vibration of these components. However, if the panels and their mounting system have a natural frequency less than about 10 Hz, it is possible that loads will be magnified as a result of wind-induced vibration. In such cases, it is recommended that expert opinion be sought and that the dynamic effects be investigated in more detail.

Figure A-4.1.7.13. shows an example of a roof-mounted solar array with exposed and unexposed panels. For the purpose of determining the edge factor, E, to be applied in the calculations of Article 4.1.7.13., a panel is defined as exposed if it is located within a distance of 1.5 times the panel chord length, L_p, from an exposed edge of the array. An exposed edge of the array is considered to occur where the horizontal distance, d_1, from the panel edge to the roof edge (ignoring any rooftop equipment) is greater than 0.5h, h being the reference height of the roof, and greater than max($4h_2$,1.2 m), h_2 being the height of the panel's highest point above the roof surface. An exposed edge is also considered to occur where the horizontal distance, d_2, from the panel edge to the nearest edge in the next panel row (or across a gap in the same panel row) is greater than max($4h_2$,1.2 m).

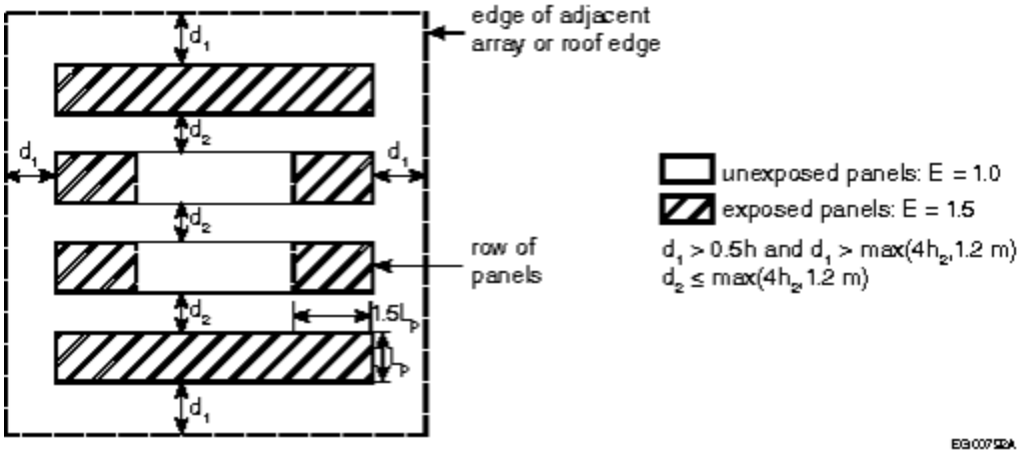


Figure A-4.1.7.13.
Plan view of a roof-mounted solar array with exposed and unexposed panels

A sample calculation of net design wind pressure for roof-mounted solar panels is provided in the Commentary entitled Wind Load and Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

The installation of solar arrays on a roof can significantly affect the distribution of snow loads on the roof. Designers should be aware that the accumulation of snow and ice around solar panels can influence the calculations described in Article 4.1.7.13. For example, accumulated snow may obstruct the ventilation areas between the roof and the underside of the panels, thereby increasing wind loads on the panels. For the design of the anchorage of a solar array to the roof and of the array itself, the pressure equalization factor, γ_a, in Sentence 4.1.7.13.(2) should be taken as 1.0, unless it can be shown that the accumulation of snow and ice will not obstruct the gaps between the panels in the array.

A-4.1.8.2.(1) Notation.

Definition of e_x

Information on the calculation of torsional moments can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Definition of W

Information on the definition of specified dead load, W, can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.3.(4) General Design of the SFRS. Information on the general design requirements for the SFRS can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.3.(6) General Design of Stiff Elements. Information on the general design requirements for stiff elements can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.3.(7)(b) and (c) Stiffness Imparted to the Structure from Elements Not Part of the SFRS. Information on stiffness imparted to the structure from elements not part of the SFRS can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.3.(8) Structural Modeling. Information on structural modeling can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.4.(2) and (3) Site Designation. It is preferable to determine the site designation as X_V on the basis of the average shear wave velocity, V_{s30}, calculated from in situ measurements of shear wave velocity. This site designation will typically result in a lower seismic demand than a site designation X_S determined using the energy-corrected average standard penetration resistance, $\bar{N}_{60}$, or the average undrained shear strength, $\bar{s}_u$. Further information on site designation can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.4.(3) Site Class. The V_{s30} ranges in Table 4.1.8.4.-B are retained from the NBC 2015. Where required for the application of a standard referenced in Subsection 4.1.8., the Site Class for a particular site designation X_v can be determined from Table 4.1.8.4.-B on the basis of the value of V_{s30}. Further information on Site Class can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.4.(6) Log–Log Interpolation. The value of S(T) for $T_i < T < T_j$ can be determined using log–log interpolation as follows:

$$\log(S(T)) = \log(S(T_i)) + \frac{\log(T) - \log(T_i)}{\log(T_j) - \log(T_i)}[\log(S(T_j)) - \log(S(T_i))] = A$$

$$S(T) = 10^A$$

where

log = logarithm to base 10.

A-Table 4.1.8.5.-A Serviceability Limit States for Earthquake. Information on serviceability limit states for earthquake can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-Table 4.1.8.6. Structural Irregularities.

Structural Irregularities

Information on structural irregularities can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Gravity-Induced Lateral Demand – Type 9 Irregularity

Uncoupled concrete and masonry shear walls where a large fraction of the overturning resistance is provided by axial compression, rather than through yielding of the longitudinal reinforcement, are less susceptible to amplified displacements due to gravity-induced lateral demands because the axial loads have a self-centering effect on the shear walls. Walls that are stronger than the foundation and other systems such as coupled walls, braced frames, and moment frames are more susceptible to amplified displacements due to gravity-induced lateral demands. A lower limit on α is thus specified for such systems. Further information on the impacts of gravity-induced lateral demands on the seismic response of buildings can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.7.(1) Dynamic Analysis Procedures. Information on dynamic analysis procedures can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-Table 4.1.8.9. Industrial-Type Steel Structures. Guidance on the height limits, system restrictions and additional analysis and design requirements for steel SFRSs in industrial-type structures, intended essentially to support equipment, tanks or an industrial process, can be found in Annex M, Seismic Design of Industrial Steel Structures, of CSA S16, "Design of steel structures."

A-4.1.8.9.(4) Vertical Variations in R_dR_o. Information on vertical variations in R_dR_o can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.9.(5) R_dR_o and Equivalent Systems. Information on the R_dR_o of equivalent systems can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.10.(5) and (6) Mid-rise Timber SFRSs. Information on structural irregularities in mid-rise wood construction and on how to determine the number of storeys for application in Sentences 4.1.8.10.(5) and (6) can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.10.(7) Gravity-Induced Lateral Demand – Type 9 Irregularity. Structural systems that include components such as inclined columns or horizontal floor cantilevers can induce lateral force demands on the SFRS under gravity loads. Buildings with such gravity-induced lateral demands on the SFRS are more likely to experience severe damage during strong ground shaking due to their tendency to drift only in one direction, leading to large residual displacements or instability. To determine if a building is susceptible to amplification of displacements due to gravity-induced lateral demands, the lateral resistance of the yielding mechanism to resist earthquake forces alone, Q_y, must be compared with the gravity-induced lateral demand, Q_G, at the same location. The force component selected for this comparison depends on the yielding mechanism for the SFRS. For example, for a coupled wall, the overturning moment resistance at the level of the expected plastic hinges should be compared with the overturning moment demand (at the same level) due to gravity loads alone, whereas for a steel-braced frame, the storey shear at the critical level of the yielding system should be compared with the storey shear demand (at the same level) due to the gravity loads alone. If the gravity-induced lateral demands exceed the limits prescribed in Sentence 4.1.8.10.(9), amplifications in seismic displacements due to gravity-induced lateral demands can only be identified through non-linear dynamic analyses using models that adequately represent the hysteretic behaviour of the SFRS. Further information on the impacts of gravity-induced lateral demands on the seismic response of buildings can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.10.(9) Gravity-Induced Lateral Demand – Non-linear Dynamic Analysis. Information on Non-linear Dynamic Analysis, including ground motion time histories, target response spectra and acceptance criteria, can be found in the

Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.10.(10)(a) Sloped Column Irregularity. The presence of inclined vertical members in a building leads to a coupling of its horizontal and vertical vibrational modes. As a result of this coupling, horizontal accelerations of the building cause vertical accelerations of the mass supported by the inclined vertical members. Vertical ground motions cause additional vertical accelerations of the mass.

The additional earthquake forces resulting from both the coupling of horizontal and vertical vibrational modes and the vertical ground motions can be determined using the Dynamic Analysis Procedure described in Article 4.1.8.12. with R_dR_o = 1.0. The structural model used in the analysis must account for the vertical accelerations of all mass supported by inclined vertical members and must include the SFRS, the inclined vertical members, and all structural framing elements that transfer inertial forces generated by the vertical accelerations of the mass supported by the inclined vertical members.

The additional earthquake forces are sensitive to the degree of coupling between the vertical and horizontal vibrational modes of the building. Thus, to determine the maximum additional earthquake forces for design, the range of possible stiffness values for all structural members must be considered.

Further information on the analysis of structures with a sloped column irregularity, including a simple procedure for scaling the analysis results to avoid having to perform multiple analyses with a range of stiffness values and vertical ground motions, can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.11.(3) Determination of the Fundamental Period, T_a. Information on the determination of the fundamental period, T_a, can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.12.(1)(a) Linear Dynamic Analysis. Information on Linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.12.(1)(b) Non-linear Dynamic Analysis. Information on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.12.(3) Ground Motion Time Histories. Information on ground motion time histories can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.12.(4)(a) Accidental Torsional Moments. Information on accidental torsional moments can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.13.(4) Deflections and Sway Effects. Information on deflections and sway effects can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(1) Diaphragms and Their Connections. Information on diaphragms and their connections can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(3) Ductile Diaphragms. Information on the design of struts, collectors, chords and connections for ductile diaphragms can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(4) Influence of Dynamic Diaphragm In-Plane Response.

Clause 4.1.8.15.(4)(a)

In lieu of carrying out a special study as stated in Subclause 4.1.8.15.(4)(a)(iii), the anticipated total deformation demand on the vertical elements of the SFRS, including inelastic deformations, may be taken as equal to $R_oR_d(\Delta_B + \Delta_D) - R_o\Delta_D$, i.e., the difference between the total storey drift including inelastic deformation effects and diaphragm deformations, $R_oR_d(\Delta_B + \Delta_D)$, and the diaphragm deformation under R_o times the seismic load, where R_o may be replaced by the actual overstrength of the SFRS

vertical elements. The design engineer must verify that the SFRS vertical elements have sufficient deformation capacity to accommodate the computed deformation demand. If the vertical elements of the SFRS do not have sufficient deformation capacity, the design forces for the vertical elements of the SFRS must be magnified by $R_d(1 + \Delta_D/\Delta_B)/(R_d + \Delta_D/\Delta_B)$. The calculation of the magnified design forces is iterative as the Δ_D/Δ_B ratio may change when using higher design forces for the vertical elements of the SFRS. Reducing the Δ_D/Δ_B ratio by increasing the stiffness of the roof diaphragm relative to that of the vertical elements of the SFRS may be considered to reduce the deformation demand on the vertical elements of the SFRS. Additional information can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Clause 4.1.8.15.(4)(b)

The dynamic response of the diaphragm with the vertical elements of the SFRS under seismic excitation involves several modes of vibration that affect both the amplitude and distribution of in-plane shears and bending moments in the roof diaphragm. The shape of the fundamental mode of vibration resembles the deflected shape of the diaphragm/vertical SFRS elements under a distributed lateral load while higher modes involve increasing numbers of zero crossings of the deflected shapes along the length of the diaphragm, similar to the modes of a simply supported beam with distributed mass. Shears and bending moments therefore deviate from the values obtained from the equivalent static force procedure essentially due to higher mode response. Modal contributions to shears and bending moments in the diaphragms can be obtained from a Linear Dynamic Analysis. The contribution from the higher modes is generally more pronounced when the Δ_D/Δ_B ratio, the period in the first mode, or the ratio S(0.2)/S(2.0) is increased. It also increases when the SFRS is designed with a higher R_d factor as inelastic deformations of the vertical elements of the SFRS attenuate the first mode response. Methods to take into account the inelastic higher mode effects on in-plane diaphragm shears and moments are discussed in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(5) Discontinuities. Information on elements supporting discontinuities can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(6) Vertical Variations in R_dR_o. Information on elements of the SFRS below the variation in R_dR_o can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(7) Concurrent Yielding. Information on the effects of concurrent yielding of elements can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.15.(8) Design Force in Elements. Information on the design force in elements can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.16.(1) Foundation Movement. The bearing stress distribution in soil or rock that is used to determine the factored overturning resistance of the foundation influences the rotation of the foundation, which occurs due to the forces applied by the SFRS. Generally, all foundations will rotate on soil or rock. In particular, footings (a type of foundation unit) often undergo uplift at one end, and if the factored bearing stress at the other end is only over a short length, then the uplift and rotation of the footing can be significant. CSA A23.3, "Design of concrete structures," contains design requirements for footings that rotate and uplift; see also the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)" for guidance and methods to account for foundation movement.

A-4.1.8.16.(2) Actual Lateral Load Capacity of the SFRS. The actual lateral load capacity of the SFRS includes the effects of member overstrengths similar to those used to determine the R_o factors. The applicable CSA design standards include requirements on calculating the overstrengths and capacities, which may be based on the members' nominal or probable resistance. The actual capacities are larger than the factored loads and factored resistances and, in many cases, can be significantly larger. Note that the foundations designed to develop the capacity of the SFRS will undergo movements and Sentence 4.1.8.16.(1) still applies.

A-4.1.8.16.(4) Overturning Resistance of the Foundation. For the special case where the foundation is a footing, and where it and the attached SFRS are not constrained against rotation, it is permitted, with certain limitations, to size the footing to have a factored overturning resistance less than the overturning capacity of the supported SFRS. This approach results in a smaller footing, increased footing rotations, increased drifts in the structure, and increased soil stresses, all of which are over and above those associated with footings sized to have a factored overturning resistance equal to or greater than the overturning capacity of

the SFRS. The footing itself must have a factored resistance capable of developing the required soil or rock reactions. An example of a footing and SFRS that are not constrained against rotation is an SFRS on a footing near the ground surface such that it can rotate freely and is attached to a gravity-load-resisting system (non-SFRS) that is laterally flexible and provides little lateral resistance. For this case, the SFRS is usually analyzed on its own and the resulting displacements are imposed on the non-SFRS elements in order to assess the effects on them. Cases where the footing and SFRS are attached to a system that has significant lateral stiffness require careful analysis and engineering judgement, or the footing can be capacity-designed.

Limiting the overturning moment on the foundation and the R_dR_o value provides some control on the increase in lateral displacement, drift and stress in the soil or rock. Cases that exceed these limits require special study.

For the common case where the SFRS and/or the footing are constrained in some way against rotation, the footing's factored resistance must be equal to or greater than the capacity of the supported SFRS. An example of an SFRS constrained against freely rotating with the footing is an SFRS attached to adjacent foundation walls by below-grade diaphragms. Examples of footings constrained against free rotation are footings that use soil anchors to resist overturning, footings on piles, and raft foundations. Note that Sentence 4.1.8.16.(1) still applies.

See CSA A23.3, “Design of concrete structures,” and the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.16.(6)(a) Interconnection of Foundation Elements. Information on the interconnection of piles or pile caps, drilled piers, and caissons can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.16.(7) Earthquake Lateral Pressures from Backfill or Natural Ground. Information on methods of computing the seismic lateral pressures from backfill or natural ground can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.16.(8)(a) Cyclic Inelastic Behaviour of Foundation Elements. Information on the cyclic inelastic behaviour of piles or pile caps, drilled piers, and caissons can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.16.(9) Alternative Foundation Ties. Alternative methods of tying foundations together, such as a properly reinforced floor slab capable of resisting the required tension and compression forces, may be used. Passive soil pressure against buried pile caps may not be used to resist these forces.

A-4.1.8.16.(10) Liquefaction. Information on liquefaction can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.17.(1) Slope Stability. Information on slope instability can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18. Elements of Structures, Non-structural Components and Equipment. Information on the requirements of Article 4.1.8.18. can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-Table 4.1.8.18. Non-structural Components and Equipment. The failure or detachment of non-structural components and equipment during an earthquake can present a major threat to life safety. The design requirements presented in Article 4.1.8.18. are intended to ensure that such components and their connections to the building will retain their integrity during strong ground shaking. Guidelines for the seismic risk reduction of such components are given in CSA S832, “Seismic risk reduction of operational and functional components (OFCs) of buildings.”

A-4.1.8.18.(7)(e) Post-installed Anchors. Information on the cyclic tension load testing of anchors referred to in Clause 4.1.8.18.(7)(e) can be found in International Code Council Evaluation Service (ICC-ES) Evaluation Reports. Additional information can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.8.18.(13) and 4.4.3.1.(1) Storage Racks. Free-standing storage racks contain materials typically loaded by forklift. Some are designed to store loaded pallets; however, in some cases, the stored material does not sit on a pallet. Information on storage

racks can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.18.(14) and (15) Glass Fallout and Failure. Information on glass fallout and testing for glass fallout can be found in AAMA 501.6, "Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System." Every surface other than inaccessible areas or areas where occupancy is prevented or access is prevented should be considered a "walking surface." Additional information can be found in ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures," in FEMA P-750, "NEHRP Recommended Seismic Provisions for New Buildings and Other Structures," and FEMA 450-1, "NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures," and related commentaries, and in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.18.(16) Elements of Structures, Non-structural Components and Equipment in Structures with Supplemental Energy Dissipation. Information on the requirements of Sentence 4.1.8.18.(16) can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.18.(18) Climatic Conditions. Climatic conditions leading to wetness or frost at the interface between the supporting base of the array and the roof surface may adversely affect the resistance provided by friction due to gravity loads.

A-4.1.8.19.(2) Design Review. It is strongly recommended that a design review of the seismically isolated structure and its isolation system be carried out by an independent team of professional engineers and geoscientists experienced in seismic analysis methods and the theory and application of seismic isolation. The design review should include, but not be limited to, the following:

(a) site-specific spectra,

(b) ground motion time histories,

(c) modeling and analyses,

(d) testing program and results, and

(e) final design of all structural framing elements and isolation system components.

A-4.1.8.19.(3)(a) Non-linear Dynamic Analysis. Three-dimensional Non-linear Dynamic Analysis is a complex process requiring special expertise. Guidance on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.19.(4) and 4.1.8.21.(5) Ground Motion Time Histories. Ground motion time histories and their horizontal and vertical components must be appropriately selected and scaled according to accepted practice. Further information on ground motion time histories can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.1.8.21.(2) Design Review. It is strongly recommended that a design review of the structure and the supplementary energy dissipation system be carried out by an independent team of professional engineers and geoscientists experienced in seismic analysis methods and the theory and application of supplementary energy dissipation. The design review should include, but not be limited to, the following:

(a) ground motion time histories,

(b) modeling and analyses,

(c) testing program and results, and

(d) final design of all structural framing elements and supplemental energy dissipation system components.

A-4.1.8.21.(4)(a) Non-linear Dynamic Analysis. Three-dimensional Non-linear Dynamic Analysis is a complex process requiring special expertise. Guidance on Non-linear Dynamic Analysis can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.2.1.(1) Subsurface Investigation. Where acceptable information on subsurface conditions already exists, the investigation may not require further physical subsurface exploration or testing.

A-4.2.2.3.(1) Responsibilities of the Designer as Defined in Part 4. In certain situations, such as when the design is highly technical, it may be necessary for the "other suitably qualified person" to be someone responsible to the designer. In such cases the *Chief Building Official* may wish to order that the review be done by the designer.

A-4.2.4.1.(1) Innovative Designs. It is important that innovative approaches to foundation design be carried out by a person especially qualified in the specific method applied and that the design provide a level of safety and performance at least equivalent to that provided for or implicit in the design carried out by the methods referred to in Part 4. Provision must be made for monitoring the subsequent performance of such structures so that the long-term sufficiency of the design can be evaluated.

A-4.2.4.1.(3) Ultimate Limit States for Foundations. Information on ultimate limit states for foundations, including terminology and resistance factors, can be found in the Commentary entitled Foundations in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.4.1.(5) Design of Foundations for Differential Movements. Information on the design of foundations for differential movements can be found in the Commentary entitled Foundations in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.4.4.(1) Depth of Foundations. When adfreezing has occurred and subsequent freezing results in soil expansion beneath this area, the resulting uplift effect is sometimes referred to as frost jacking.

A heated building that is insulated to prevent heat loss through the foundation walls should be considered as an unheated structure unless the effect of the insulation is taken into account in determining the maximum depth of frost penetration.

A-4.2.5.1.(1) Excavations. Information on excavations can be found in the Commentary entitled Foundations in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.6.1.(1) Shallow Foundations. Information on shallow foundations can be found in the Commentary entitled Foundations in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.7.1.(1) Deep Foundation Units. A deep foundation unit can be pre-manufactured or cast-in-place; it can be driven, jacked, jetted, screwed, bored or excavated; it can be of wood, concrete, steel or a combination thereof.

A-4.2.7.2.(1) Deep Foundations. Information on deep foundations can be found in the Commentary entitled Foundations in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

A-4.2.7.2.(2) Load Testing of Piles. ASTM D1143/D1143M, "Standard Test Methods for Deep Foundations Under Static Axial Compressive Load," defines routine load test procedures that have been extensively used.

A-4.3.1.1. Wood. The design criteria for wood, CAN/CSA 086 "Engineering Design in Wood", makes assumptions that the wood products being used are in a condition as intended by their grading. This includes the limits of moisture content as specified by the grade. However, conditions such as transportation, site storage, and construction conditions can impact the original design assumptions.

Design considerations should include and be specific to shrinkage that may occur due to changes in moisture content of the wood. This is of particular concern where the building height can be up to 6 storeys, such as being built under Article 3.2.2.50. and 3.2.2.58. The potential building movement due to shrinkage should be indicated to other design professionals for their considerations such as cladding systems, mechanical systems, hold-down devices for structural walls and connections to non-shrinking elements including firewalls and elevator shafts.

Many wood designs now incorporate mass timber elements as part of the primary structural elements or seismic force resistance systems. Such products may include glue or mechanically laminated wood elements such as Glulam, Cross and Dowel Laminated Timbers, or other proprietary products or systems which may not exhibit the properties assumed by the by-law or its referenced standards. Where such elements are used, compliance with CAN/CSA-O86 may not be sufficient to demonstrate compliance with the objective of the By-law. In such cases, where in the opinion of the *Chief Building Official* the potential consequence of failure is considered to be significant, they may require that such designs be supported by the third party review of the structural design under the most credible fire impaired or unimpaired scenarios. This will include the assessment of the

performance of the specified materials, fire-protective features, and expected behavior of the structure under each of these scenarios.

A-4.3.3.1.(1) Precast Concrete. CSA A23.3, “Design of concrete structures,” requires precast concrete members to conform to CSA A23.4, “Precast concrete – Materials and construction.”

A-4.3.4.1.(1) Welded Construction. Qualification for fabricators and erectors of welded construction is found in Clause 24.3 of CSA S16, “Design of steel structures.”

A-4.3.4.2.(1) Cold-Formed Stainless Steel Members. There is currently no Canadian standard for the design of cold-formed stainless steel structural members. As an interim measure, design may be carried out using the limit states design provisions of ASCE/SEI 8, “Specification for the Design of Cold-Formed Stainless Steel Structural Members,” except that load factors, load combinations and load combination factors shall be in accordance with Subsection 4.1.3.

A-4.3.6.1.(1) Design Basis for Glass. The load factors in Tables 4.1.3.2.-A and 4.1.3.2.-B must be applied to the adjusted wind load before designing in accordance with the referenced standard. Additional information is given in the Commentary entitled Wind Load and Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.4.2.1.(1) Design Basis for Storage Garages and Repair Garages. Although the scope of CSA S413, “Parking structures,” is limited to structural steel and reinforced concrete (including prestressed and post-tensioned), the intent of Sentence 4.4.2.1.(1) is to require any type of material used in the construction of storage garages and repair garages to conform to the performance level outlined in the standard.
See the Commentary entitled Live Loads in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

Part 5
Environmental Separation

Section 5.1. General

5.1.1. Scope

5.1.1.1. Scope

1) This Part is concerned with

a) the control of condensation

i) in *building* components and assemblies, and

ii) on *building* materials, components and assemblies, and

b) the transfer of heat, air, moisture and sound through

i) *building* materials, components and assemblies, and

ii) interfaces between *building* materials, components and assemblies.

(See Note A-5.1.1.1.(1).)

5.1.1.2. Maritime Climate

1) This Part includes special provisions to deal with the potentially damaging effects of Vancouver's maritime climate, including the possibility of rapid decay in structural members.

(See Note A-5.1.1.2.)

5.1.2. Application

5.1.2.1. Exposure to Exterior Space or the Ground and Separation of Dissimilar Environments

1) This Part applies, as described in Subsection 1.3.3. of Division A, to

a) *building* materials, components and assemblies exposed to exterior space or the ground, including those separating interior space from exterior space or separating interior space from the ground,

b) *building* materials, components and assemblies separating environmentally dissimilar interior spaces (see Note A-5.8.), and

c) site materials, components, assemblies and grading that may affect environmental loads on *building* materials, components and assemblies exposed to exterior space or the ground.

(See Note A-5.1.2.1.(1).)

2) *Buildings* or portions of *buildings* not required to provide environmental separation, not exposed to exterior environmental loads or intended only for summer seasonal use need not conform to this Part where it can be shown, to the satisfaction of the *Chief Building Official* that the health or safety of *building* users, the intended use of the *building* and the operation of *building* services will not be adversely affected. (See Note A-5.1.2.1.(2).)

5.1.2.2. Building Envelope Professional Requirements

1) The *Building Envelope Professional* shall conduct reviews, and provide letters as required in Sentences (2) and (3), on *buildings* or portions of *buildings* with a cladding system over wood framing or light steel framing

and on all residential *buildings* within the scope of Part 5 with respect to Section 5.4., 5.5. and 5.6. (See Note A-5.1.2.2.(1).)

2) The *Building Envelope Professional* shall, prior to issuance of a *building permit*, provide the *Chief Building Official* with a completed, signed and sealed commitment letter in the form attached as Schedule D at the end of this part.

3) The *Building Envelope Professional* shall, prior to issuance of an *occupancy permit*, provide the *Chief Building Official* with a completed, signed and sealed completion letter in the form attached as Schedule C-D at the end of this Part

5.1.3. Definitions

5.1.3.1. Defined Words

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

5.1.4. Resistance to Loads and Deterioration

5.1.4.1. Structural and Environmental Loads

(See Note A-5.1.4.1.)

1) *Building* materials, components and assemblies that separate dissimilar environments or are exposed to the exterior shall have sufficient capacity and integrity to resist or accommodate

a) all environmental loads, and effects of those loads, that may reasonably be expected having regard to

i) the intended use of the *building*, and

ii) the environment to which the materials, components and assemblies are subject, and

b) all structural loads, and effects of those loads, that may reasonably be expected.

2) Where *building* materials, components or assemblies perform more than one function, they shall satisfy the requirements of all of those functions. (See Note A-5.1.4.1.(2).)

3) Compliance with Clause (1)(a) shall be demonstrated by design complying with Subsection 5.2.1. and construction conforming to that design.

4) Compliance with Clause (1)(b) shall be demonstrated by design complying with Subsection 5.2.2., and construction conforming to that design, with regard to

a) materials, components and assemblies, and associated loads, that are identified in Part 4,

b) air pressure loads imposed on *air barrier systems*,

c) wind up-lift imposed on roofing, and

d) hydrostatic pressure imposed on the means of protection from moisture in the ground.

5) For materials, components, assemblies and loads to which Sentence (4) does not apply, compliance with Clause (1)(b) shall be demonstrated

a) by design complying with Subsection 5.2.2. for individual applicable loads and construction conforming to that design, or

b) in the case of common materials, components and assemblies, and their installation, by proven past performance over a period of several years for individual applicable loads.

(See Note A-5.1.4.1.(5).)

6) Materials, components and assemblies separating dissimilar environments and assemblies exposed to the exterior, including their connections, that are subject to structural loads as defined in Article 5.2.2.1. shall

a) transfer such loads to the *building* structure without adverse effects on the performance of other materials, components or assemblies,

b) not deflect to a degree that adversely affects the performance of other materials, components or assemblies (see Note A-5.1.4.1.(6)(b) and (c)), and

c) be designed, and constructed according to that design, to accommodate (see Note A-5.1.4.1.(6)(b) and (c))

i) the maximum relative structural movement that may reasonably be expected, and

ii) construction tolerances that may be reasonably expected.

(See Article 4.1.3.5., Sentence 4.1.3.3.(2) and Subsection 4.1.8. for information on different types of structural movements.) (See Note A-5.1.4.1.)

5.1.4.2. Resistance to Deterioration

(See Note A-5.1.4.2.)

1) Except as provided in Sentence (2), materials used in *building* components and assemblies that separate dissimilar environments, or in assemblies exposed to the exterior, shall be

a) compatible with adjoining materials, and

b) resistant to any mechanisms of deterioration that may reasonably be expected, given

i) the nature and function of the materials, and

ii) the exposure and climatic conditions in which they will be installed.

2) Material compatibility and deterioration resistance are not required where it can be shown that incompatibility or uncontrolled deterioration will not adversely affect any of

a) the health or safety of *building* users,

b) the intended use of the *building*, or

c) the operation of *building* services.

5.1.5. Other Requirements

5.1.5.1. Requirements in Other Parts of the Code

1) Structural, fire safety and energy efficiency requirements in other Parts of this By-law shall apply.

Section 5.2. Loads and Procedures

5.2.1. Environmental Loads and Design Procedures

5.2.1.1. Exterior Environmental Loads

1) Above ground climatic loads shall be determined according to Subsection 1.1.3.

2) Except as provided in Sentence (3), below ground exterior environmental loads not described in Subsection 1.1.3. shall be determined from existing geological and hydrological data or from site tests.

3) Where local design and construction practice has shown soil temperature analysis to be unnecessary, soil temperatures need not be determined. (See Note A-5.2.1.1.(3).)

5.2.1.2. Interior Environmental Loads

1) Interior environmental loads shall be determined in accordance with good practice as described in Sentence 6.2.1.1.(1) based on the intended use of the space. (See Note A-5.2.1.2.(1).)

5.2.1.3. Environmental Load and Transfer Calculations

1) Calculations related to the transfer of heat, air and moisture and the transmission of sound shall conform to good practice such as that described in the ASHRAE Handbooks.

2) For the purposes of any analysis conducted to indicate conformance to the thermal resistance levels required in Article 5.3.1.2., soil temperatures shall be determined based on annual average soil temperature, seasonal amplitude of variation and attenuation of variation with depth.

3) Wind load calculations shall conform to Subsection 4.1.7.

5.2.2. Structural Loads and Design Procedures

5.2.2.1. Determination of Structural Loads and Effects

1) Where materials, components or assemblies that separate dissimilar environments or are exposed to the exterior, or their connections, are required to be designed to withstand structural loads, these loads shall be determined in accordance with Part 4. (See also Subsection 2.2.5. of Division C.)

2) Except as provided in Article 4.1.8.18., the structural loads referred to in Sentence (1) and their related effects shall include

a) *dead loads* transferred from structural elements,

b) wind, snow, rain, hydrostatic and earth pressures,

c) earthquake effects for *post-disaster buildings*, depending on their intended function (see Note A-5.2.2.1.(2)(c)),

d) *live loads* due to use and *occupancy*, and

e) loads due to thermal or moisture-related expansion and contraction, deflection, deformation, creep, shrinkage, settlement, and differential movement.

3) Where materials, components or assemblies that separate dissimilar environments or are exposed to the exterior, or their connections, can be expected to be subject to loads or other effects not described in this Subsection or in Part 4, such loads or effects shall be taken into account in the design based on the most current and applicable information available.

5.2.2.2. Determination of Wind Load

(See Note A-5.2.2.2.)

1) This Article applies to the determination of wind load to be used in the design of materials, components and assemblies, including their connections, that separate dissimilar environments or are exposed to the exterior, where these are

a) subject to wind load, and

b) required to be designed to resist wind load.

2) Except as provided in Sentence (3), the wind load referred to in Sentence (1) shall be 100% of the specified wind load determined in accordance with Article 4.1.7.1.

3) Where it can be shown by test or analysis that a material, component, assembly or connection referred to in Sentence (1) will be subject to less than 100% of the specified wind load, the wind load referred to in Sentence (1) shall be not less than the load determined by test or analysis.

4) Except as provided in Sentences (5) and (6), the wind uplift resistance of membrane roofing assemblies shall be determined in accordance with the requirements of CAN/CSA-A123.21, “Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.” (See Note A-5.2.2.2.(4).)

5) Membrane roofing assemblies with proven past performance for the anticipated wind loads need not comply with Sentence (4). (See Note A-5.1.4.1.(5).)

6) The wind resistance of *vegetated roof assemblies* shall be determined in accordance with the requirements of CAN/CSA-A123.24, "Standard test method for wind resistance of vegetated roof assembly." (See Note A-5.2.2.2.(6).)

5.2.2.3. Design Procedures

1) Structural design shall be carried out in accordance with Subsection 4.1.3. and other applicable requirements in Part 4.

Section 5.3. Heat Transfer

(See Note A-5.3.)

5.3.1. Thermal Resistance of Assemblies

5.3.1.1. Required Resistance to Heat Transfer

(See Note A-5.3.1.1.)

1) Where a *building* component or assembly will be subjected to an intended temperature differential, the component or assembly shall include materials to resist heat transfer or a means to dissipate transferred heat in accordance with the remainder of this Subsection, and Part 10 of Division B.

2) Deleted.

5.3.1.2. Properties to Resist Heat Transfer or Dissipate Heat

(See Note A-5.3.1.2.)

1) Taking into account the conditions on either side of the environmental separator, materials and components installed to provide the required resistance to heat transfer or the means implemented to dissipate heat shall provide sufficient resistance or dissipation,

a) to minimize surface condensation on the warm side of the component or assembly,

b) in conjunction with other materials and components in the assembly, to minimize condensation within the component or assembly,

c) in conjunction with systems installed for space conditioning, to meet the interior design thermal conditions for the intended *occupancy*, and

d) to minimize ice damming on water-shedding roofs.

(See Note A-5.3.1.2.(1).)

5.3.1.3. Location and Installation of Materials Providing Thermal Resistance

1) Where a material required by Article 5.3.1.1. is intersected by a *building* assembly, penetrated by a high conductance component or interrupted by expansion, control or construction joints, and where condensation is likely to occur at these intersections, penetrations or interruptions, sufficient thermal resistance shall be provided so as to minimize condensation at these locations.

2) Materials providing required thermal resistance shall have sufficient inherent resistance to airflow or be positioned in the assembly so as to prevent convective airflow through and around the material. (See Note A-5.3.1.3.(2).)

Section 5.4. Air Leakage

5.4.1. Air Barrier Systems

(See Note A-5.4.1.)

5.4.1.1. Required Resistance to Air Leakage

(See Note A-5.4.1.1.)

1) Where a *building* component or assembly separates interior conditioned space from exterior space, interior space from the ground, or environmentally dissimilar interior spaces, the properties and position of the materials and components in those components or assemblies shall be such that they control air leakage or permit venting to the exterior so as to

a) provide *acceptable* conditions for the *building* occupants,

b) maintain appropriate conditions for the intended use of the *building*,

c) minimize the accumulation of condensation in and the penetration of precipitation into the *building* component or assembly,

d) control heat transfer to roofs where ice damming can occur,

e) minimize the ingress of airborne radon and other soil gases from the ground with an aim to controlling the indoor concentrations of these gases to an *acceptable* level, and

f) not compromise the operation of *building* services.

2) An *air barrier system* shall be designed and constructed to provide the principal resistance to air leakage to meet the requirements of Sentence (1).

3) The *air barrier system* shall incorporate air barrier assemblies that meet the appropriate Performance Class as defined in Table 5.4.1.1. (See Note A-5.4.1.1.(3).)

Table 5.4.1.1.
Maximum Air Leakage Rates for Air Barrier Assemblies
Forming Part of Sentences 5.4.1.1.(3) and (6) and 5.4.1.2.(1) and (2)

Performance Class	Maximum Air Leakage Rate, L/(s×m^2), at a Pressure Differential of 75 Pa
1	0.05
2	0.10
3	0.15
4	0.20
5	0.50

4) The *air barrier system* shall be designed and constructed to be continuous

a) across construction, control and expansion joints,

b) across junctions between different air barrier assemblies, and

c) around penetrations through air barrier assemblies.

(See Note A-5.4.1.1.(4).)

5) The structural design of air barrier assemblies, including junctions between air barrier assemblies, subject to air pressure loads shall comply with Article 5.1.4.1. and Subsection 5.2.2.

6) The maximum air leakage rates specified in Table 5.4.1.1. are permitted to be increased where it can be shown that the higher rate will not adversely affect any of

a) the health or safety of the *building* users,

b) the intended use of the *building*, or

c) the operation of *building* services.

7) An *air barrier system* is not required where it can be shown that uncontrolled air leakage will not adversely affect any of

a) the health or safety of *building* users,

b) the intended use of the *building*, or

c) the operation of *building* services.

(See Note A-5.4.1.1.(7).)

5.4.1.2. Air Barrier Assemblies

1) Except as provided in Sentences (2) and (3), air barrier assemblies not in contact with the ground shall

a) conform with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," and

b) meet the selected Performance Class of Table 5.4.1.1.

(See Note A-5.4.1.2.(1).)

2) Air barrier assemblies not evaluated in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," shall be designed and constructed

a) to meet or exceed the selected Performance Class of Table 5.4.1.1., and

b) with at least one air barrier material intended to provide the primary resistance to air leakage that meets the requirements of CAN/ULC-S741, "Standard for Air Barrier Materials – Specification."

(See Note A-5.4.1.2.(2).)

3) Air barrier assemblies covered in Subsections 5.9.2., 5.9.3. and 5.9.4. shall meet the air barrier performance criteria defined in those Subsections.

4) Below-grade air barrier assemblies in contact with the ground shall minimize the ingress of airborne radon and other soil gases. (See Note A-5.4.1.2.(4).)

Section 5.5. Vapour Diffusion

5.5.1. Vapour Barriers

5.5.1.1. Required Resistance to Vapour Diffusion

(See Note A-5.5.1.1.)

1) Where a *building* component or assembly is subjected to differentials in temperature and water vapour pressure, the properties and position of the materials and components in those components or assemblies shall be such that they control vapour diffusion or permit venting to the exterior so as to minimize the accumulation of condensation in the *building* component or assembly.

2) A vapour barrier shall be installed to provide the principal resistance to water vapour diffusion.

3) Delete.

5.5.1.2. Vapour Barrier Properties and Installation

(See Note A-5.3.1.2.)

1) The vapour barrier shall have sufficiently low permeance and shall be positioned in the *building* component or assembly so as to

a) minimize moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, or

b) reduce moisture transfer by diffusion, to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions, to a rate that will not allow sufficient accumulation of moisture to cause deterioration or otherwise adversely affect any of

i) the health or safety of *building* users,

ii) the intended use of the *building*, or

iii) the operation of *building* services.

(See Note A-5.5.1.2.(1).)

2) Coatings applied to gypsum board to provide required resistance to vapour diffusion shall conform to the requirements of Sentence (1) when tested in accordance with CAN/CGSB-1.501-M, "Method for Permeance of Coated Wallboard."

3) Coatings applied to materials other than gypsum board to provide required resistance to vapour diffusion shall conform to the requirements of Sentence (1) when tested in accordance with ASTM E96/E96M, "Standard Test Methods for Water Vapor Transmission of Materials," by the desiccant method (dry cup).

Section 5.6. Precipitation

5.6.1. Protection from Precipitation

5.6.1.1. Required Protection from Precipitation

(See Note A-5.6.1.1.)

1) Where a *building* component or assembly is exposed to precipitation, the component or assembly shall

a) minimize ingress of precipitation into the component or assembly, and

b) prevent ingress of precipitation into interior space.

2) Deleted.

5.6.1.2. Installation of Protective Materials

1) Except as required by Sentences (2) and (4), where protective materials are applied to assemblies to provide the required protection from precipitation, they shall be installed so as to shed precipitation or otherwise minimize its entry into the assembly and prevent its penetration through the assembly. (See Note A-5.6.1.2.(1).) (See also Clause 5.3.1.2.(1)(d).)

2) A *vegetated roof assembly* shall be permitted if

a) the *vegetated roof assembly* conforms to the requirements of Article 3.1.14.4.,

b) gravity loads on the *building* structure are determined by ASTM E 2397/E 2397M-19 "Standard Practice for Determination of *Dead loads* and *Live loads* Associated with Vegetative (Green) Roof Systems",

c) the roof that supports the vegetated roof system is waterproof (see Note A-1.4.1.1. of Division A),

d) the *vegetated roof assembly* is designed and constructed with a root barrier, or the roofing membrane is resistant to root and rhizome penetration when tested in accordance with ANSI/SPRI VR-1, "Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs", and

e) the *vegetated roof assembly* is designed and constructed with water retention materials to support vegetative growth, and with drainage materials to convey water to *roof drains*. (See Note A-5.6.1.2.(2).)

3) Flashings, drips, or overhangs shall be incorporated to deflect accumulated water from the *building* face where there are changes in planes of walls and roofs, changes in cladding material, or window or door heads or sills. (See Note A-5.6.1.2.(3).)

4) A roof assembly shall resist the entry of water into the *building*, and where the roof assembly incorporates a membrane, the roof assembly shall be designed and constructed to conform to the requirements of Article 5.2.2.2.

5) Each material, component, or assembly, including electrical services, that penetrates through a roof assembly shall pass through a flashing that can be sealed against both air leakage and the weather, and which is suitable for its purpose.

6) Ballasted membrane roofs not subject to the requirements in Sentence 5.2.2.2.(4) shall be designed and constructed to resist wind loads.

5.6.2. Sealing, Drainage, Accumulation and Disposal

5.6.2.1. Sealing and Drainage

(See Note A-5.6.2.1.)

1) Materials, components, assemblies, joints in materials, junctions between components and junctions between assemblies exposed to precipitation shall be

a) designed to shed precipitation or, where a waterproofing roof assembly is concerned, sealed to prevent ingress of precipitation, and

b) drained to direct precipitation to the exterior.

2) Deleted.

5.6.2.2. Accumulation and Disposal

1) Where water, snow or ice can accumulate on a *building*, provision shall be made to minimize the likelihood of hazardous conditions arising from such accumulation.

2) Where precipitation can accumulate on sloped or horizontal assemblies, provision shall be made for drainage conforming with Article 2.4.10.4. of Division B of Book II (Plumbing Systems) of this By-law.

3) Where downspouts are provided and are not connected to a sewer, provisions shall be made to

a) divert the water from the *building*, and

b) prevent soil erosion.

4) Junctions between vertical assemblies, and sloped or horizontal assemblies, shall be designed and constructed to minimize the flow of water from the sloped or horizontal assembly onto the vertical assembly.

5) Where a roof or balcony is entirely enclosed by parapet walls, there shall be a sufficient number of overflow outlets installed in the parapet walls in order to properly drain the roof or balcony in the event that any rainwater conductors become obstructed. (See Note A-5.6.2.2.(5).)

6) Where *roof drains* connected to a *drainage system* are used to satisfy the requirements in this Section, they shall be suitable for the type of roof assembly and shall be sealed against the weather following the requirements of Article 5.6.1.2.

Section 5.7. Surface and Ground Water

(See Note A-5.7.)

5.7.1. Site Factors

5.7.1.1. Application

1) This Subsection applies to the location of *buildings*, the grading of *building* sites, the directing of water away from *building* assemblies, and the provision of means for drainage.

5.7.1.2. Required Protection

1) The *building* shall be located, the *building* site shall be graded, or water shall be directed away from *building* assemblies so as to prevent or accommodate the accumulation of surface water against the *building* or adjacent *buildings*.

2) Drainage shall be provided to direct water away from assemblies separating interior space from the ground, except

a) where the assembly is designed in accordance with Subsection 5.7.2. to withstand continuous hydrostatic pressure, or

b) Deleted.

(See Note A-5.7.1.2.(2).)

5.7.2. Protection against Hydrostatic Pressure

5.7.2.1. Application

1) This Subsection applies to waterproofing materials, components, assemblies and systems applied to *building* assemblies that separate dissimilar environments and are subjected to hydrostatic pressure.

5.7.2.2. Design of Building Elements Under Hydrostatic Loads

1) Waterproofing materials, components, assemblies and systems described in Article 5.7.2.1. shall be designed in accordance with Subsection 5.1.4.

2) Hydrostatic design loads shall be determined in accordance with Subsection 5.2.2.

5.7.2.3. Required Protection

1) Waterproofing materials, components, assemblies and systems described in Article 5.7.2.1. shall comply with Article 5.7.3.2.

5.7.3. Protection against Ground Water

5.7.3.1. Application

1) This Subsection applies to the protection of *building* assemblies that separate interior space from the ground.

5.7.3.2. Required Protection

1) Except as provided in Article 5.7.3.4., *building* assemblies described in Article 5.7.3.1. shall be protected by waterproofing in accordance with Article 5.7.3.3. so as to prevent the ingress of water into the *building* or the accumulation of water against the *building*.

2) Deleted.

5.7.3.3. Waterproofing

1) Waterproofing materials, components, assemblies, or systems installed to provide the required protection shall form a continuous and impervious barrier to the ingress of water and be capable of accommodating

a) imperfections, construction joints, control joints and expansion joints (see Note A-5.7.3.3.(1)(a)),

b) junctions between different *building* assemblies, and

c) elements penetrating *building* assemblies.

5.7.3.4. Where Dampproofing is Permitted

1) Except as prohibited by Sentence (3), vertical *building* assemblies that separate interior space from the ground are permitted to be dampproofed where #14603

a) such assemblies are not subjected to hydrostatic pressure,

b) the substrate is cast-in-place concrete, and

c) a drainage layer is installed between the *building* assembly and the soil.

(See Note A-5.7.3.4.(1).)

2) Joints, junctions and penetrations shall be designed and constructed to maintain the continuity of the dampproofing.

3) Dampproofing is not permitted as an alternative to the requirements of Article 5.7.3.2. for *buildings* and located in whole or in part within the *groundwater protection area*. #14603

Section 5.8. Sound Transmission

(See Note A-5.8.)

5.8.1. Protection from Airborne Noise

5.8.1.1. Required Protection

1) Except as provided in Sentence (2), a *dwelling unit* shall be separated from every other space in a *building* in which noise may be generated by

a) a separating assembly and adjoining constructions, which, together, provide an *apparent sound transmission class (ASTC)* rating not less than 47, or

b) a separating assembly that provides a *sound transmission class (STC)* rating of not less than 50 and adjoining constructions that conform to Article 9.11.1.4.

2) Construction separating a *dwelling unit* from an elevator shaft or a refuse chute shall have an STC rating not less than 55.

5.8.1.2. Determination of Sound Transmission Ratings

(See Note A-5.8.1.2.)

1) The STC ratings of separating assemblies shall be determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."

2) The ASTC ratings of separating assemblies and adjoining constructions shall be

a) determined in accordance with ASTM E413, "Classification for Rating Sound Insulation," using the results from measurements carried out in accordance with ASTM E336, "Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings," or

b) calculated in accordance with

i) the detailed method described in Article 5.8.1.4., or

ii) the simplified method described in Article 5.8.1.5.

5.8.1.3. Compliance with Required Ratings

1) Compliance with the required STC ratings shall be demonstrated through

a) measurements carried out in accordance with Sentence 5.8.1.2.(1), or

b) the construction of separating assemblies conforming to those presented in Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable.

2) Compliance with the required ASTC ratings shall be demonstrated through

a) measurements or calculations carried out in accordance with Sentence 5.8.1.2.(2), or

b) the construction of separating assemblies conforming to those presented in Table 9.10.3.1.-A or 9.10.3.1.-B, as applicable, that have an STC rating of not less than 50 in conjunction with flanking assemblies constructed in accordance with Article 9.11.1.4.

5.8.1.4. Detailed Method for Calculating ASTC

(See Note A-5.8.1.4.)

1) The sound transmission loss measured in accordance with ASTM E90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements," shall be used in lieu of the sound reduction index required in ISO 15712-1, "Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms."

2) The vibration reduction index for the junctions between separating assemblies shall be

a) determined using the equations presented in Annex E of ISO 15712-1, "Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms," or

b) measured in accordance with Parts 1 to 4 of ISO 10848-1, "Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document."

3) The normalized flanking level difference shall be measured in accordance with Parts 1 to 4 of ISO 10848-1, "Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document."

4) The direct sound reduction index for the separating assembly in situ shall be determined using Clause (a) or (b), depending on the type of construction:

a) for a separating wall or floor assembly with lightweight wood or steel framing, the index shall be taken as equal to the sound transmission loss, without correction;

b) for a separating wall or floor assembly that behaves like a homogeneous panel, the index shall be determined in accordance with the detailed method for structure-borne transmission presented in ISO 15712-1, "Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms" (see Note A-5.8.1.4.(4)(b)).

5) The flanking sound reduction index for each flanking path at each edge of the separating assembly shall be determined using Clause (a), (b) or (c), depending on the type of construction:

a) for a separating wall or floor assembly with lightweight wood or steel framing and connected flanking assemblies with lightweight wood or steel framing, the index shall be taken as equal to the normalized flanking level difference re-normalized for the ASTC field situation in accordance with Annex F of ISO 15712-1, "Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms,"

b) for a separating wall or floor assembly that behaves like a homogeneous panel and connected flanking assemblies that behave like a homogeneous panel, the index shall be determined in accordance with the detailed method for structure-borne transmission presented in ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms” (see Note A-5.8.1.4.(4)(b)),

c) for a mixture of assemblies with lightweight wood or steel framing and assemblies that behave like a homogeneous panel, the index shall be determined in accordance with Clause (a) or (b) (see Note A-5.8.1.4.(4)(b)).

6) Once the pertinent indices and measurements referred to in Sentences (1) to (5) have been determined based on the type of construction, the apparent sound reduction index shall then be determined in accordance with ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms.”

7) The ASTC shall be calculated in accordance with ASTM E413, “Classification for Rating Sound Insulation,” using the apparent sound reduction index determined in Sentence (6), which shall be treated as equivalent to the values of apparent sound transmission loss measured in accordance with ASTM E336, “Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.”

5.8.1.5. Simplified Method for Calculating ASTC

(See Note A-5.8.1.4.)

1) The STC rating shall be used in lieu of the weighted sound reduction index required in ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms.”

2) The vibration reduction index for the junctions between separating assemblies shall be

a) determined using the equations presented in Annex E of ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms,” or

b) measured in accordance with Parts 1 to 4 of ISO 10848-1, “Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document.”

3) The weighted normalized flanking level difference shall be determined in accordance with ASTM E413, “Classification for Rating Sound Insulation,” using the results from measurements carried out in accordance with Parts 1 to 4 of ISO 10848-1, “Acoustics – Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms – Part 1: Frame document.”

4) The direct weighted sound reduction index for the separating assembly shall be taken as equal to the STC, without correction.

5) The weighted flanking sound reduction index for each flanking path at each edge of the separating assembly shall be determined using Clause (a) or (b), depending on the type of construction:

a) for a separating wall or floor assembly with lightweight wood or steel framing and connected flanking assemblies with lightweight wood or steel framing, the index shall be taken as equal to the weighted normalized flanking level difference re-normalized for the ASTC field situation in accordance with Annex F of ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms” ;

b) for a separating wall or floor assembly that behaves like a homogeneous panel and connected flanking assemblies that behave like a homogeneous panel, the index shall be determined in accordance with the simplified method for structure-borne transmission presented in ISO 15712-1, “Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms” (see Note A-5.8.1.4.(4)(b)).

6) Once the pertinent indices and measurements referred to in Sentences (1) to (5) have been determined based on the type of construction, the ASTC shall then be calculated in accordance with ISO 15712-1, "Building Acoustics - Estimation of Acoustic Performance of Buildings From the Performance of Elements - Part 1: Airborne Sound Insulation Between Rooms."

Section 5.9. Standards

5.9.1. Applicable Standards

5.9.1.1. Compliance with Applicable Standards

1) Except as provided in Sentence (2) and elsewhere in this Part, materials and components, and their installation, shall conform to the requirements of the applicable standards in Table 5.9.1.1. where those materials or components are

a) incorporated into environmental separators or assemblies exposed to the exterior, and

b) installed to fulfill the requirements of this Part.

(See Note A-5.9.1.1.(1).)

2) The requirements for flame-spread ratings contained in thermal insulation standards shall be applied only as required in Part 3.

Table 5.9.1.1.
Standards Applicable to Environmental Separators and Assemblies Exposed to the Exterior
Forming Part of Sentence 5.9.1.1.(1)

Issuing Agency	Document Number	Title of Document
ANSI	A135.6	Engineered Wood Siding
ASME	B18.6.1	Wood Screws (Inch Series)
ASTM	A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM	A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM	A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM	C4	Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile
ASTM	C73	Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)
ASTM	C126	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
ASTM	C212	Standard Specification for Structural Clay Facing Tile
ASTM	C412M	Standard Specification for Concrete Drain Tile
ASTM	C444M	Standard Specification for Perforated Concrete Pipe
ASTM	C553	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

ASTM	C612	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM	C700	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM	C726	Standard Specification for Mineral Wool Roof Insulation Board
ASTM	C834[1]	Standard Specification for Latex Sealants
ASTM	C840	Standard Specification for Application and Finishing of Gypsum Board
ASTM	C920[1]	Standard Specification for Elastomeric Joint Sealants
ASTM	C991	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings
ASTM	C1002	Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM	C1177/C1177M	Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM	C1178/C1178M	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
ASTM	C1184[1]	Standard Specification for Structural Silicone Sealants
ASTM	C1280	Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
ASTM	C1311[1]	Standard Specification for Solvent Release Sealants
ASTM	C1330[1]	Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
ASTM	C1396/C1396M[2]	Standard Specification for Gypsum Board
ASTM	C1658/C1658M[3]	Standard Specification for Glass Mat Gypsum Panels
ASTM	D1227/D1227M	Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM	D2178/D2178M	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM	D3019/D3019M[4]	Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered
ASTM	D4479/D4479M	Standard Specification for Asphalt Roof Coatings – Asbestos-Free
ASTM	D4637/D4637M	Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane
ASTM	D4811/D4811M	Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing
ASTM	D6878/D6878M	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
ASTM	E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation

ASTM	E 2397/E 2397M	Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems
BNQ	BNQ 3624-115	Polyethylene (PE) Pipe and Fittings for Soil and Foundation Drainage
CGSB	CAN/CGSB-11.3-M	Hardboard
CGSB	CAN/CGSB-12.1	Safety Glazing
CGSB	CAN/CGSB-12.2-M	Flat, Clear Sheet Glass
CGSB	CAN/CGSB-12.3-M	Flat, Clear Float Glass
CGSB	CAN/CGSB-12.4-M	Heat Absorbing Glass
CGSB	CAN/CGSB-12.8	Insulating glass units
CGSB	CAN/CGSB-12.9	Spandrel glass
CGSB	37-GP-9Ma	Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing
CGSB	CAN/CGSB-37.50-M	Hot-Applied, Rubberized Asphalt for Roofing and Waterproofing
CGSB	CAN/CGSB-37.54	Polyvinyl Chloride Roofing and Waterproofing Membrane
CGSB	CAN/CGSB-37.58-M	Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing
CGSB	CAN/CGSB-41.24	Rigid Vinyl Siding, Soffits and Fascia
CGSB	CAN/CGSB-51.32-M	Sheathing, Membrane, Breather Type
CGSB	CAN/CGSB-51.33-M	Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction
CGSB	CAN/CGSB-51.34-M	Vapour Barrier, Polyethylene Sheet for Use in Building Construction
CGSB	CAN/CGSB-93.1-M	Sheet, Aluminum Alloy, Prefinished, Residential
CGSB	CAN/CGSB-93.2-M	Prefinished Aluminum Siding, Soffits, and Fascia, for Residential Use
CSA	A23.1	Concrete materials and methods of concrete construction
CSA	CAN/CSA-A82	Fired masonry brick made from clay or shale
CSA	CAN3-A93-M	Natural Airflow Ventilators for Buildings
CSA	CAN/CSA-A123.2	Asphalt-Coated Roofing Sheets
CSA	A123.3	Asphalt Saturated Organic Roofing Felt
CSA	CAN/CSA-A123.4	Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems
CSA	A123.5	Asphalt shingles made from glass felt and surfaced with mineral granules
CSA	CAN/CSA-A123.16	Asphalt-coated glass-base sheets
CSA	A123.17	Asphalt Glass Felt Used in Roofing and Waterproofing
CSA	CAN/CSA-A123.21	Standard test method for the dynamic wind uplift resistance of membrane-roofing systems
CSA	A123.23	Product specification for polymer-modified bitumen sheet, prefabricated and reinforced

CSA	CAN/CSA-A123.24	Standard test method for wind resistance of vegetated roof assembly
CSA	A123.51	Asphalt shingle application on roof slopes 1:6 and steeper
CSA	A165.1	Concrete block masonry units
CSA	A165.2	Concrete brick masonry units
CSA	A165.3	Prefaced concrete masonry units
CSA	CAN/CSA-A179	Mortar and Grout for Unit Masonry
CSA	CAN/CSA-A220 Series	Concrete Roof Tiles
CSA	CAN/CSA-A371	Masonry Construction for Buildings
CSA	A3001	Cementitious Materials for Use in Concrete
CSA	B182.1	Plastic drain and sewer pipe and pipe fittings
CSA	G40.21	Structural quality steel
CSA	CAN/CSA-G401	Corrugated steel pipe products
CSA	CAN/CSA-O80 Series	Wood preservation
CSA	O118.1	Western Red Cedar Shakes and Shingles
CSA	O118.2	Eastern White Cedar Shingles
CSA	O121	Douglas fir plywood
CSA	O141	Softwood Lumber
CSA	O151	Canadian softwood plywood
CSA	O153	Poplar plywood
CSA	O325	Construction sheathing
CSA	O437.0	OSB and Waferboard
HPVA	ANSI/HPVA HP-1	American National Standard for Hardwood and Decorative Plywood
SPRI	ANSI/SPRI VR-1	Procedure for Investigating Resistance to Root or Rhizome Penetration on Vegetative Roofs
ULC	CAN/ULC-S701.1	Standard for Thermal Insulation, Polystyrene Boards
ULC	CAN/ULC-S702.1	Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification
ULC	CAN/ULC-S703	Standard for Cellulose Fibre Insulation (CFI) for Buildings
ULC	CAN/ULC-S704.1	Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced
ULC	CAN/ULC-S705.1	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification
ULC	CAN/ULC-S705.2	Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application
ULC	CAN/ULC-S706.1	Standard for Wood Fibre Insulating Boards for Buildings
ULC	CAN/ULC-S710.1	Standard for Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification

ULC	CAN/ULC-S711.1	Standard for Bead-Applied Two Component Polyurethane Air Sealant Foam, Part 1: Material Specification
ULC	CAN/ULC-S717.1	Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties

Notes to Table 5.9.1.1.:
(1) See Note A-Table 5.9.1.1.
(2) The flame-spread rating of gypsum board shall be determined in accordance with CAN/ULC-S102 in lieu of ASTM E84 as indicated in ASTM C1396/C1396M.
(3) The flame-spread rating of gypsum panels shall be determined in accordance with CAN/ULC-S102 in lieu of ASTM E84 as indicated in ASTM C1658/C1658M.
(4) For the purpose of compliance with Part 5, ASTM D3019/D3019M shall only apply to the non-fibered and non-asbestos-fibered types of asphalt roll roofing.

5.9.2. Windows, Doors and Skylights

5.9.2.1. General

1) This Subsection applies to windows, doors and skylights, including their components, that separate

a) interior space from exterior space, or

b) environmentally dissimilar interior spaces.

2) For the purpose of this Subsection, the term “skylight” refers to unit skylights, roof windows and tubular daylighting devices.

3) Windows, doors and skylights, including their components, that are required to have a *fire-protection rating* need not conform to the requirements of this Subsection. (See Note A-5.9.2.1.(3).)

5.9.2.2. Applicable Standards

(See Note A-5.9.2.2.)

1) Except as permitted in Sentences (5) and 5.9.2.3.(1), windows, doors, skylights, including their components, shall conform to the requirements in

a) AAMA/WDMA/CSA 101/I.S.2/A440, “North American Fenestration Standard/Specification for windows, doors, and skylights” (Harmonized Standard), and

b) except as permitted in Sentence (4), CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-, North American Fenestration Standard/Specification for windows, doors, and skylights.”

2) Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement referenced in Clause (1)(b) so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed.

3) Windows, doors and skylights shall conform to the performance grades selected in Sentence (2) when tested in accordance with the Harmonized Standard referenced in Clause (1)(a).

4) For the purposes of conformance with Clause (1)(b), loads and procedures from Section 5.2 may be used instead of the loads and procedures set out in the standard. (See Note 5.9.2.2.(4).)

5) A door designated as a “Limited Water” door in accordance with the standard referenced in Clause (1)(a) shall not be used unless the door

a) separates a *dwelling unit* from an unconditioned *storage garage* or a carport,

b) is designed with a clear width, a clear and level space, a door-opening device and a door closer in conformance with Subsection 3.8.3. (see Article 3.8.3.6.), or

c) meets the criteria in Sentence 9.27.3.8.(3) such that flashing would not be required.

5.9.2.3. Structural and Environmental Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components that do not conform to Article 5.9.2.2. shall be designed and constructed in accordance with Subsection 5.1.4., Section 5.4. and Section 5.6. (See Note A-5.9.2.3.(1).)

5.9.2.4. Heat Transfer

1) Windows, doors and skylights shall meet the heat transfer performance requirements stated in Section 5.3. (See Note A-5.3.1.2.)

2) Except as provided in Sentence (3), all metal-framed glazed assemblies separating interior conditioned space from interior unconditioned space or exterior space shall incorporate a thermal break to minimize condensation.

3) Metal-framed glazed assemblies need not comply with Sentence (2) where these assemblies are

a) storm windows or doors, or

b) windows or doors that are required to have a fire-protection rating.

(See Note A-5.9.2.4.(3).)

5.9.3. Other Fenestration Assemblies

(See Note A-5.9.3.)

5.9.3.1. General

1) For the purpose of this Subsection, the term "other fenestration assemblies" refers to curtain walls, window walls, storefronts and glazed architectural structures. (See Note A-5.9.3.1.(1).)

2) Other fenestration assemblies and their components that are required to have a *fire-protection rating* need not conform to the requirements of this Subsection. (See Note A-5.9.2.1.(3).)

5.9.3.2. Structural and Environmental Loads

1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Subsection 5.1.4. (See Note A-5.9.3.2.(1).)

5.9.3.3. Heat Transfer

1) Other fenestration assemblies and their components shall meet the heat transfer performance requirements stated in Section 5.3. (See Note A-5.9.3.3.(1).)

2) Other fenestration assemblies using metal framing that separate interior conditioned space from interior unconditioned space or exterior space shall incorporate a thermal break to minimize condensation.

5.9.3.4. Air Leakage

1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Section 5.4.

2) Except as provided in Sentence (3), other fenestration assemblies and their components shall have an air leakage characteristic, measured at an air pressure difference of 75 Pa, when tested in accordance with ASTM E283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen," that is not greater than

a) 0.2 L/(s×m^2) for fixed portions, including any opaque portions, and

b) 1.5 L/(s×m^2) for operable portions.

(See Note A-5.9.3.4.(2).)

3) The following systems need not comply with Sentence (2):

a) interior windows and interior doors that do not serve as environmental separators,

b) vehicular access doors (garage doors),

c) storm windows and storm doors,

d) commercial entrance systems,

e) revolving doors,

f) smoke and relief air vents,

g) site-built door systems, and

h) commercial steel doors.

(See Note A-5.9.3.4.(3).)

5.9.3.5. Water Penetration

1) Other fenestration assemblies and their components shall be designed and constructed in accordance with Section 5.6.

5.9.4. Exterior Insulation Finish Systems

5.9.4.1. Structural Loads, Heat Transfer, Air Leakage, Vapour Diffusion and Water Penetration

1) Exterior insulation finish systems and their components shall comply with

a) Subsection 5.1.4. and Sections 5.3. to 5.6., and

b) CAN/ULC-S716.1, "Standard for Exterior Insulation and Finish Systems (EIFS) - Materials and Systems," where covered in the scope of that standard.

(See Note A- 5.9.4.1.(1).)

Section 5.10. Objectives and Functional Statements

5.10.1. Objectives and Functional Statements

5.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 5.10.1.1. (See Note A-1.1.2.1.(1).)

Table 5.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 5
Forming Part of Sentence 5.10.1.1.(1)

Provision	Functional Statements and Objectives[1]
5.1.4.1. Structural and Environmental Loads	
(1)	(a) [F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[F20-OS3.1] Applies to snow fences and sloped glazing.
	[F61-OH4]
	(a) [F60,F61,F63-OS2.2,OS2.3]
	(a) [F20,F51,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	(b) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(b) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(b) [F20-OH4]

(4)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
(5)	(a) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(a) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(b) [F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	(b) [F20,F21,F22-OH1.1,OH1.2,OH1.3]
(6)	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	(a) [F20-OS2.1,OS2.3] (b),(c) [F21,F22-OS2.3]
	(b),(c) [F22-OH4]
5.1.4.2. Resistance to Deterioration	
(1)	[F80,F81-OH1.1,OH1.2,OH1.3]
	[F80,F81-OS3.1] Applies to floor assemblies.
	[F80,F81-OH4] Applies to floor assemblies.
	[F80,F81-OS2.3]
	[F80,F81-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.2.1.1. Exterior Environmental Loads	
(2)	[F40,F20-OH1.1] [F20-OH1.2,OH1.3]
	[F20-OS2.1]
5.2.1.2. Interior Environmental Loads	
(1)	[F51,F55,F61,F63-OH1.1,OH1.2]
	[F55,F61,F63-OS2.3]
	[F51,F61,F63,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.2.1.3. Environmental Load and Transfer Calculations	
(1)	[F56-OH3.1] Applies to sound transmission calculations.
	[F61,F51,F63,F55-OH1.1,OH1.2] [F51,F61-OH1.3] Applies to heat, air and moisture transfer calculations.
	[F61,F51,F63-OS2.3] Applies to heat, air and moisture transfer calculations.
(3)	[F61,F63,F55-OH1.1,OH1.2] [F61,F55-OH1.3]
	[F20-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	[F20-OS2.1]
5.2.2.1. Determination of Structural Loads and Effects	
(1)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]

	[F20,F21,F22-OH4]
(3)	[F20-OS2.1] [F21,F22-OS2.3,OS2.4]
	[F20,F21,F22-OH1.1,OH1.2,OH1.3]
	[F20,F21,F22-OH4]
5.2.2.2. Determination of Wind Load	
(2)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
(3)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
(4)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,OS2.3]
(6)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,OS2.3]
5.2.2.3. Design Procedures	
(1)	[F20-OS2.1] [F22-OS2.3,OS2.4]
	[F20,F22-OH1.1,OH1.2,OH1.3]
	[F20,F22-OH4]
5.3.1.1. Required Resistance to Heat Transfer	
(1)	[F63-OH1.1] [F51,F63-OH1.2]
	[F63-OS2.3]
	[F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.3.1.2. Properties to Resist Heat Transfer or Dissipate Heat	
(1)	(a),(b) [F51,F63-OH1.1] (c) [F51-OH1.2]
	(b),(d) [F51,F63-OS2.3]
	(b) [F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	(d) [F30-OS3.1]
5.3.1.3. Location and Installation of Materials Providing Thermal Resistance	
(1)	[F51,F63-OH1.1]
	[F63-OS2.3]
(2)	[F51,F63-OH1.1,OH1.2]

	[F63-OS2.3]
	[F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.4.1.1. Required Resistance to Air Leakage	
(1)	(a),(b),(f) [F51,F52,F54,F55-OH1.2] (a),(b),(c),(e) [F40,F55-OH1.1] (c) [F55,F61,F63-OH1.3]
	(c),(d) [F61,F62,F63,F55-OS2.3]
	(d) [F55,F62-OS3.1]
	(f) [F55,F62-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(2)	[F40-OH1.1] [F52,F54-OH1.2] [F51,F55,F61,F63-OH1.1,OH1.2,OH1.3]
	[F61,F63-OS2.3]
	[F51,F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(3)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(4)	[F61,F51,F63,F55-OH1.1,OH1.2] [F55,F61-OH1.3]
	[F61,F63-OS2.3]
	[F61,F51,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.4.1.2. Air Barrier Assemblies	
(1)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(2)	[F55-OH1.1,OH1.2,OH1.3]
	[F55-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
(4)	[F55-OH1.1]
5.5.1.1. Required Resistance to Vapour Diffusion	
(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.5.1.2. Vapour Barrier Properties and Installation	

(1)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
(3)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.6.1.1. Required Protection from Precipitation	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.6.1.2. Installation of Protective Materials	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,OS2.3]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(5)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(6)	[F20,F55,F61-OH1.1,OH1.2,OH1.3]
	[F20,F55,F61-OS2.1,OS2.3]
5.6.2.1. Sealing and Drainage	
(1)	[F61,F62-OH1.1,OH1.2,OH1.3]
	[F61,F62-OS2.3]
5.6.2.2. Accumulation and Disposal	
(1)	[F30-OS3.1]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(3)	[F61-OH1.1,OH1.2,OH1.3]
	[F60-OS2.3] [F21-OS2.2]
	(b) [F21-OP2.6]
(4)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(6)	[F61-OH1.1,OH1.2,OH1.3]

	[F61-OS2.3]
5.7.1.2. Required Protection	
(1)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.3]
(2)	[F60-OH1.1,OH1.2,OH1.3]
	[F60-OS2.2,OS2.3]
5.7.3.2. Required Protection	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.7.3.3. Waterproofing	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.7.3.4. Where Dampproofing is Permitted	
(1)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
(2)	[F61-OH1.1,OH1.2,OH1.3]
	[F61-OS2.3]
5.8.1.1. Required Protection	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
5.8.1.2. Determination of Sound Transmission Ratings	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
5.8.1.4. Detailed Method for Calculating ASTC	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]
(3)	[F56-OH3.1]
(4)	[F56-OH3.1]
(5)	[F56-OH3.1]
(6)	[F56-OH3.1]
(7)	[F56-OH3.1]
5.8.1.5. Simplified Method for Calculating ASTC	
(1)	[F56-OH3.1]
(2)	[F56-OH3.1]

(3)	[F56-OH3.1]
(4)	[F56-OH3.1]
(5)	[F56-OH3.1]
(6)	[F56-OH3.1]
5.9.1.1. Compliance with Applicable Standards	
(1)	[F20,F22,F51,F54,F55,F61,F63,F80-OH1.1,OH1.2] [F41,F55-OH1.1] [F55,F61,F80-OH1.3]
	[F20,F80-OS2.1] [F20,F22,F51,F61,F63,F80-OS2.3] [F51-OS2.5]
	[F20-OS2.2] [F80-OS2.3]
	[F80,F61,F63-OS3.1]
	[F80,F61,F63-OH4] Applies to floor assemblies.
	(a) [F61,F63-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
	[F20,F80-OP2.1,OP2.3] [F22,F80-OP2.4]
	[F42-OH2.5]
5.9.2.2. Applicable Standards	
(1)	[F20,F55,F61,F63-OH1.1,OH1.3] [F20,F55,F61,F63,F81-OH1.2]
	[F20,F55,F61-OS2.3]
	[F20,F55,F61-OP2.3]
5.9.2.4. Heat Transfer	
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.9.3.3. Heat Transfer	
(2)	[F63-OH1.1,OH1.2]
	[F63-OS2.3]
5.9.3.4. Air Leakage	
(2)	[F55,F63-OH1.1,OH1.2,OH1.3]
	[F55,F63-OS2.3]
	[F55-OS1.4] Applies where required life safety systems are incorporated in environmental separators.
5.9.4.1. Structural Loads, Heat Transfer, Air Leakage, Vapour Diffusion and Water Penetration	
(1)	(b) [F61,F62-OH1.1,OH1.2,OH1.3]
	(b) [F61,F62-OS2.3]

Notes to Table 5.10.1.1.:

(1) See Parts 2 and 3 of Division A.

SCHEDULE D

Forming Part of Sentence 5.1.2.2.(2), Division B of the Building By-law

Building Permit Number (for CoV Use)

COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted before issuance of a *building permit*.
ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re:

Name of Project (Print)

Address of Project (Print)

The undersigned *Building Envelope Professional* has been retained with respect to the above referenced *project*, and gives a commitment of responsibility for *Building Envelope Professional* design review and enhanced *field review* for components and assemblies as required in Article 5.1.2.2. in Part 5 of Division B, of the Building By-law, and as the *Building Envelope Professional* in their professional discretion considers to be necessary, for the *project* designed by,

Name of registered professional signing for 'Architectural' items of Schedule B letter (Print)

who is providing the *Chief Building Official* with a Schedule B 'ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW' letter covering 'Architectural' items. The undersigned will sign and provide copies of all reports to the *registered professional* responsible for 'Architectural' items, and copies of these reports shall also be available on site, for review by the City of Vancouver District Building Inspector. The undersigned undertakes to notify the *Chief Building Official* in writing as soon as practical if their contract is terminated at any time.

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm; _____and I sign this letter on behalf of the firm.
(Print Name of Firm)

NOTE:

The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of the Province of British Columbia qualified by virtue of training or experience to provide *building* enclosure services.

Certified Professional's Stamp and Signature (if applicable)

CRP Initials

SCHEDULE C-D

Forming Part of Sentence 5.1.2.2.(3), Division B of the Building By-law

Building Permit Number (for CoV Use)

COMPLETION OF BUILDING ENVELOPE PROFESSIONAL REVIEW

Notes:

i) This letter must be submitted after the completion of the *project* at final inspection.
ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
iii) In this letter the words in italics have the same meaning as in the Building By-law

To: The *Chief Building Official*

Re:

Name of Project (Print)

Address of Project (Print)

I have fulfilled my obligations for *Building Envelope Professional* design review and enhanced *field review* as per my previously submitted letter of COMMITMENT FOR BUILDING ENVELOPE PROFESSIONAL REVIEW. The components and assemblies of the *project* reviewed substantially comply with Article 5.1.2.2. in Part 5 of Division B, of the Building By-law, and with the plans and supporting documents, including all amendments thereto, which were *accepted* by the City of Vancouver in support of the application for the *building permit*.

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

(If the *Building Envelope Professional* is a member of a firm, complete the following.)

I am a member of the firm; _____and I sign this letter on behalf of the firm.
(Print Name of Firm)

NOTE:

The above letter must be signed by a *Building Envelope Professional*. The Building By-Law defines a *Building Envelope Professional* to mean a person who is a member of the Architectural Institute of British Columbia or the Association of Professional Engineers and Geoscientists of the Province of British Columbia qualified by virtue of training or experience to provide building enclosure services.

Certified Professional's Stamp and Signature (if applicable)

CRP Initials

Notes to Part 5
Environmental Separation

A-5 Environmental Separation. The requirements provided in Part 5 pertain to the separation of environmentally dissimilar spaces. Most obvious is the need to separate indoor conditioned spaces from unconditioned spaces, the outdoors or the ground. There are also cases where separation is needed between interior spaces which are intended to provide different environments. (See also Notes A-5.1.1.1.(1) and A-5.1.2.1.(1).)

A-5.1.1.1.(1) Scope. Part 5 provides explicit requirements related to the transfer of heat, air, moisture and sound in various forms. Control of the ingress of radon and other soil gases is addressed by the requirements related to air leakage.

A-5.1.1.2. Maritime Climate. The effects of Vancouver's maritime climate are well documented. The City's prolonged stretches of near continuous rainfall, combined with driving winds produce extended periods of wetting of building exteriors. This extended wetting combined with very mild year round temperatures means that there are limited periods in which the drying of an envelope assembly might occur. These factors create an environment where the possibility of moisture induced deterioration of materials is very high. The choice of appropriate materials and assemblies for building envelopes is therefore extremely important in Vancouver.

Consistent application of basic water management principles; deflection, drainage, drying and durability of materials throughout the design and construction process is critical for a successful building envelope assembly in Vancouver's climate. Although excess moisture in an envelope assembly can come from construction sources, exterior sources such as rainwater, or interior humidity sources, it has been shown that most performance problems in Vancouver have resulted from a failure to control exterior sources. In Vancouver, the first consideration in envelope design should be the deflection of incident rain with elements such as roof overhangs and the use of flashings with drip edges to direct water away from a building face. The ability to effectively drain water, which does penetrate through the cladding, should be the next consideration for successful envelope assemblies. Since many materials used in the construction of building envelope assemblies are susceptible to deterioration or decay if they remain wet, the ability of the assembly to allow for drying should be considered in the design. However, as the potential for drying in this climate is relatively limited, it should not be relied upon as the primary mechanism, and it should be confirmed that materials placed in an exterior envelope assembly do not contain excess moisture before the assembly is enclosed. Lastly, where the probability exists that materials may be exposed to moisture sources, it is critical to choose materials which are durable enough to withstand the moisture until it is dissipated.

Selection and specification of performance criteria for components such as windows should require that the components are also capable of meeting the overall envelope performance requirements. In addition, the integration of components into the overall envelope assembly should be carefully considered in the drafting of design documents and throughout the construction process, particularly at the interfaces between components such as windows and the adjacent wall system. All envelope details should be clearly shown in the construction documents, using a progressive series of three dimensional details where correct layering and overlapping of materials needs to be clarified. For critical building envelope assembly details or new and unique assemblies, full-scale mock-ups and testing on site are extremely valuable in confirming the performance of an assembly and in establishing construction standards for the balance of the envelope construction.

The requirements in Part 5 outline a performance standard for the building envelopes, but good design practice should go beyond the requirements in these regulations. Issues such as the quality of detailing, the compatibility of materials used in assemblies, and a design that allows for the simplicity of on-going maintenance are concerns that a professional designer should take into account in the design of a successful building envelope assembly.

Guidance with respect to building science principles and envelope assembly performance for maritime climates is available from a variety of sources. The Canadian Building Digest series and many other publications from the National Research Council (NRC) and in particular from the Institute for Research in Construction (IRC) are valuable resources. Canada Mortgage and Housing Corporation (CMHC) has also published a wide variety of documents which are useful in understanding building science principles and the application of these principles to residential design and construction. Locally, courses in building envelope basics, offered as the educational component towards a Building Envelope Professional accreditation, are administered by the Architectural Institute of BC. Regular seminars on building envelope issues are also offered on an industry wide basis by the BC Building Envelope Council.

A-5.1.2.1.(1) Application. Subsection 1.3.3. of Division A specifies that Part 5 applies to all buildings except those within the scope of Part 9 but not including all Group C multi-family buildings and Artist Live/Work Studios that are more than 2 storeys in

building height or more than 600 m2 in building area excluding firewalls or the National Farm Building Code of Canada 1995. Because of their intended use, many buildings need only provide a limited degree of separation from the outdoor environment, the ground, or between interior spaces. The provisions in Part 5 are written to allow exemptions for these buildings.

Part 5 applies to building elements that separate dissimilar environments and to site conditions that may affect environmental loading on the building envelope.

The provisions address

- the design and construction, or selection, of building components, such as windows and doors,
- the design and construction of building assemblies, such as walls, floors and roofs,
- the design and construction of the interfaces between the above-mentioned elements, and
- the design or selection, and installation, of site materials, components and assemblies, such as backfill and drainage, and grading.

Part 5 applies not only to building elements that separate indoor space from outdoor space, but also to those elements that separate indoor space from the ground and that separate adjacent indoor spaces having significantly different environments.

Indoor spaces that require separation include interior conditioned spaces adjacent to indoor unconditioned spaces, and adjacent interior conditioned spaces that are intended to provide different environments. An extreme example of the last would be a wall that separates an indoor ice rink from a swimming pool.

Some building elements are exposed to exterior environmental loads but do not separate dissimilar environments. Solid guards on exterior walkways are one example. Such constructions are subject to the application of Part 5.

A-5.1.2.1.(2) Exemptions. This sentence is intended to allow for the exemption of the application of Part 5 to buildings or parts of buildings where it can be shown that due to the intended use of a building, the full provisions of Part 5 are not necessary. As an example, buildings such as open parking garages, stadia, and certain park buildings intended for summer use would only require a limited degree of separation from the exterior environment. Any proposed exemptions should be discussed with the City of Vancouver prior to implementation.

A-5.1.2.2.(1) Building Envelope Professional Reviews Scope of Application and Letters of Commitment and Completion. The specific areas of focus for which a Building Envelope Professional is required to perform reviews are Sections 5.4., 5.5. and 5.6. The duties are described as Building Envelope Professional design review and enhanced field review. The design review is required to be completed by a Building Envelope Professional. This review is intended to ascertain that the design for which they will be giving a commitment of responsibility for review in the field substantially complies with Part 5 with respect to Sections 5.4., 5.5. and 5.6.

The term enhanced field review is used to differentiate the level of review for which a Building Envelope Professional is responsible, from that which a registered professional signing for architectural items in Schedules B would be responsible. The requirements in Part 5 outline a minimum performance standard, but these requirements cannot address the specific detail concerns which experience has shown are the primary source of problems which have resulted in the deterioration of building envelopes. Building Envelope Professional enhanced field review is intended to address this concern. It requires that the professional performs field reviews at a sufficient frequency and reviews a substantial number of the details, which could be potential problem sources, in order to ascertain that the performance requirements of Part 5 are satisfied. While a professional may not be able to see all of the details, the level of duty intended for this enhanced field review is to review as many details as possible rather than just a representative sampling.

An additional duty of the Building Envelope Professional involves the review of moisture content present in envelope assemblies prior to enclosure. Exterior walls, in buildings of structural light framing systems, should not be enclosed when there is sufficient moisture present to initiate deterioration. While wood may have been delivered to a construction site kiln dried, exposure to rain during construction may raise the moisture content to an unacceptable level (above 19 per cent). Water may also have collected in elements of wall assemblies, such as steel stud tracks, and may lead to deterioration if not dried out prior to the wall assembly being enclosed.

The Building Envelope Professional is required to assure that all wood framing, structural members, and sheathing do not exceed 19% moisture content, and all other materials are dry, prior to the wall assembly being enclosed.

The Articles in Section 5.4 do not define the air tightness limits of a completed assembly, but only that of the components in an assembly. Therefore, it is a critical responsibility of the Building Envelope Professional to conduct sufficient design and field review work in order to be able to ascertain that the continuity of the air barrier system meets the performance requirements of this Part.

The Building Envelope Professional is required to perform sufficient design and field review work to ascertain that the installed vapour barrier system meets the performance requirements of Part 5. The Building Envelope Professional is required to confirm adequate completeness of the system in order to demonstate that vapour diffusion is retarded at an appropriate wall location and that all inappropriate barriers to diffusion are eliminated.

Preventing inappropriate barriers to diffusion requires careful attention to detail. While it is often unintended, envelope assemblies may end up with more than one functional vapour barrier. As it can never be ensured that an exterior envelope assembly will always be free of moisture, the drying mechanism must not be blocked, or the trapped moisture may lead to deterioration of moisture sensitive materials. Drying potential in the system requires that vapour, driven by a vapour pressure differential (i.e. from high interior vapour pressure to low exterior vapour pressure) be allowed to pass to a location in the assembly which is open to exterior air (such as a cavity) where drying may occur. Plywood sheathing for instance has sufficiently low permeance that care must be taken in the design of an assembly to allow vapour to pass through the sheathing if it is not intended to act as a vapour barrier. Caution may also be needed with the over use of impermeable sheet membrane materials at details such as windows. If the application is too extensive, the potential for moisture diffusion out of the assembly may be locally impeded, with a resultant increase in the likelihood of deterioration.

The Building Envelope Professional is required to perform sufficient design and field review work to ascertain that the installed exterior cladding system meets the performance requirements of Part 5. The Building Envelope Professional is required to confirm that the cladding system will provide continuous precipitation protection, the drainage paths are complete and the flashings as installed over the complete exterior envelope will function properly.

A-5.1.4.1. Application of Structural Design to Other Building Elements. Part 4, as currently written, applies primarily to buildings as a whole and to structural members. Requirements defining structural loads and design to accommodate or resist those loads, however, apply not only to buildings as a whole and components that are traditionally recognized as structural members, but also apply to other elements of the building that are subject to structural loading. This is addressed to some extent in Part 4 by the requirements that pertain, for example, to wind loads on cladding. A range of structural loads and effects, as defined in Subsection 4.1.2., may be imposed on non-loadbearing elements such as backing walls, roofing, interior partitions and their connections. These must generally be addressed using the same load determination and structural design procedures as used for structural members.

Responsibility for the structural design of buildings as a whole and their structural members is commonly assigned to the engineer of record. The application of Part 4 reflects this, and as such, “non-structural” elements are not explicitly identified in the Part 4 provisions. Rather the application of Part 4 to these elements is specified in cross-references from other Parts of the By-law, e.g. Part 5, which recognizes the fact that the structural design of these elements is often carried out by engineers other than the engineer of record.

Part 4 does not generally apply to the structural design of building services, such as heating, ventilating, air-conditioning, plumbing, electrical, electronic or fire safety systems, though these may be subject to structural loads. It does, however, apply to the design of the connections of building services to address earthquake loads (see Article 4.1.8.18.).

A-5.1.4.1.(2) Materials, Components and Assemblies with Multiple Functions. Where materials, components or assemblies are used to fulfill multiple functions, the designer may have to take into account their function with regard to structural loads, heat transfer, air leakage, vapour diffusion, and protection from precipitation, surface and ground water, and sound transmission. Materials should be selected taking into account the environmental loads to which they will be subjected, their physical and chemical characteristics, and their installation. Design and construction details should satisfy all intended functions and ensure continuity within and between assemblies, without adversely impacting adjacent materials, components or assemblies. The designer should also anticipate unintended consequences when materials that may fulfill multiple functions are used. For example, building membranes consisting of modified bitumen compounds, which are commonly used to control both water ingress and air leakage, also typically have low vapour transmission characteristics. Similarly, extruded polystyrene boards, which are used as thermal insulation, may also act as a component of an air barrier assembly, thus requiring wind loads to be considered.

An increasing number of manufactured systems are being used to serve more than one (and sometimes all) of the functions of an environmental separator: examples include pre-engineered building systems, exterior insulation finish systems, insulated

metal panel systems, windows, other fenestration assemblies, and insulated precast concrete wall panels. These systems consist of combinations of pre-manufactured and/or site-built components, which are supposed to be assembled in a prescribed manner.

Ensuring compliance with one Section of Part 5 may impact compliance with other Sections of Part 5: for example, air barriers that are integral to some systems may also act as vapour barriers and impact condensation control. By extension, ensuring compliance with the requirements of Part 5 may impact compliance with other Parts of the By-law: for example, increasing the thickness of the insulation to improve an assembly's thermal performance may impact its compliance with Part 3 with regard to fire resistance.

Compliance with a standard listed in Section 5.9. does not ensure that a system is appropriate for the intended application. The designer should consider all relevant criteria, beyond the standard tests, when selecting an appropriate product for a project.

A-5.1.4.1.(5) Past Performance as Basis for Compliance with Respect to Structural Loads. As discussed in Note A-5.1.4.1., a range of structural loads and effects can be imposed on materials, components and assemblies in environmental separators and assemblies exposed to the exterior. In many instances, compliance with Sentence 5.1.4.1.(1) for structural loads must be determined based on the loads and calculation methods described in Part 4 as specified in Sentence 5.1.4.1.(3) and the referenced Subsection 5.2.2., e.g. for cladding. In practice, compliance for some materials, components or assemblies of environmental separators and assemblies exposed to the exterior is determined by relying on provisions governing the use of alternative solutions (such as Clause 1.2.1.1.(1)(b) of Division A).

For some very common building elements and installations, however, there is a very large body of evidence of proven performance over a long period of time. In these cases, imposing the degree of analysis, or documentation of performance, required by Part 4 or Section 2.3. of Division C would be unnecessary and onerous. Clause 5.1.4.1.(5)(b) is intended to address these particular cases. Because the constructions are so widely accepted throughout the industry and the body of evidence is so substantial (though not necessarily documented in an organized fashion), there should be no question that detailed analysis or documentation is unnecessary.

Whether compliance of a particular material, component or assembly may be determined based on past performance depends not only on the type of material, component or assembly, but also on its intended function, the particular loads to which it will be subject and the magnitude of those loads. Because the possible combinations and permutations are infinite, only guidelines can be provided as to when past performance is a reasonable basis for determining compliance.

In determining compliance based on past performance, the period of past performance considered should be a substantial number of years. For example, 30 years is often used to do life-cycle cost analysis of the viability of investments in building improvements. This period is more than long enough for most deficiencies to show up. There should be no question as to the structural adequacy of a material, component or assembly that has been successfully used in a given application for such a period.

The determination of compliance may be based on past performance only where the function of the material, component or assembly is identical to that of the materials, components or assemblies used as a reference, and where the expected loads do not exceed those imposed on the reference materials, components or assemblies. For example, the acceptance of gypsum board, and its fastening, to serve as part of the backing wall supporting cladding cannot be based on the performance of gypsum board that has served only as an interior finish.

The determination of compliance may be based on past performance only where the properties of the material, component or assembly are identical or superior to those of the materials, components or assemblies used as a reference. For example, where a component of a certain gauge of a particular metal has provided acceptable performance, the same component made of the same metal or a stronger one would be acceptable.

Compliance with respect to various loads may be determined individually. A particular material may have to be designed to Part 4 to establish acceptable resistance to wind or earthquake loads, for example, but past performance may be adequate to determine that the material and normal fastening will support the material's dead load and will resist loads imposed by thermal and moisture-related expansion and contraction.

Past performance is a reasonable basis for determining compliance for lighter materials, components or assemblies not subject to wind load; for example, semi-rigid thermal insulation installed in wall assemblies where other materials, components or assemblies are installed to resist air pressure loads.

Past performance is an appropriate basis for determining compliance for some smaller elements that will be subject to wind loads but are continually supported or fastened behind elements that are designed for wind loads, for example, standard flashing over wall penetrations.

It should be noted that this particular approach to demonstrating compliance pertains only to the resistance or accommodation of structural loads described in Part 4. The resistance or accommodation of environmental loads, resistance to deterioration, and material compatibility must still be addressed in accordance with Part 5.

A-5.1.4.1.(6)(b) and (c) Accommodating Movement. It is well understood that the deflection of the backing assembly in a wall can have significant effects on the performance of the cladding. For example, CSA S304, "Design of masonry structures," specifies the maximum deflection criteria for backing assemblies to masonry veneer. Clauses 5.1.4.1.(6)(b) and (c) are written in very general terms in recognition of the fact that not only can the deflection of cladding affect the performance of the backing assembly, but that the excessive deflection of any element has the potential to adversely affect the performance of any adjacent element. Similarly, inter-storey drift has the potential to adversely affect the performance of components and assemblies of environmental separators. CSA O86, "Engineering design in wood," specifies a method for calculating building movement due to changes in moisture content. The effects of movement should be avoided or accommodated.

A-5.1.4.2. Deterioration. Environmental loads that must be considered include but are not limited to: sound, light and other types of radiation, temperature, moisture, air pressure, acids and alkalis.

Mechanisms of deterioration include:

- structural (impact, air pressure)
- hygrothermal (freeze-thaw, differential movement due to thermal expansion and contraction, ice lensing)
- electrochemical (oxidation, electrolytic action, galvanic action, solar deterioration)
- biochemical (biological attack, intrusion by insects and rodents).

Information on the effects of deformations in building elements can be found in the Commentary entitled Effects of Deformations in Building Components in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Resistance to deterioration may be determined based on rational analysis, such as hygrothermal modeling, field performance, accelerated testing, or compliance with guidelines provided by evaluation agencies recognized by the authority having jurisdiction. Designers of buildings covered in Part 5 can find design guidance in the NRC publication entitled "Guideline on Design for Durability of Building Envelopes," and in CSA S478, "Durability in buildings," which presents updated methodologies for analyzing resistance to deterioration that provide quantitative results to support informed design decisions.

It is noted that the effects of future climate change and their potential impact on the durability of buildings are not fully known and, as such, are still being researched and studied. How future climate change and the issues of climate resilience are incorporated in building design should be carefully considered within the context of existing Code provisions related to structural design, fire and life safety, etc.

It is also noted that CSA S478 contains requirements for actions beyond the scope of the British Columbia Building Code, which may not be the responsibility of the designer, builder or authority having jurisdiction. These include requirements relating to quality assurance, inspection, maintenance, minimum design service lives and potential impacts of climate change, which are not addressed in the Code. The reference herein to CSA S478 is not intended to imply that the designer, builder or authority having jurisdiction adopt, apply or enforce any of these requirements.

Building components should be designed with some understanding of the length of time over which they will effectively perform their intended function. Actual service life will depend on the materials used and the environment to which they are exposed. The design should take into consideration these factors, the particular function of the component and the implications of premature failure, the ease of access for maintenance, repair or replacement, and the cost of repair or replacement.

Many buildings are designed such that access for maintenance, repair or replacement is not possible without damaging—or seriously risking damaging—other building elements. This can become a considerable deterrent to proper maintenance thus compromising the performance of the subject materials, components and assemblies, or other elements of the building. In cases where it is known or expected that maintenance, repair or replacement is likely to be required for certain elements before such time as the building undergoes a major retrofit, special consideration should be given to providing easy access to those elements. Anchorage points for maintenance personnel should be considered during the design of multi-storey buildings, including those of wood-frame construction, as adding them post-construction can be difficult.

Where the use of a building or space, or the services for a building or space, are changed significantly, an assessment of the impact of the changes on the environmental separators should be conducted to preclude premature failures that could create hazardous conditions.

A-5.2.1.1.(3) Soil Temperatures. In theory, soil temperatures are needed to determine the conformance of a design to the requirements related to heat transfer and vapour diffusion. In practice, standard construction in a particular area may have proven to perform quite adequately and detailed calculations of soil temperature are unnecessary. (See also Sentence 5.2.1.3.(2).)

A-5.2.1.2.(1) Interior Environmental Loads. The interior environmental conditions required depend on the intended use of the spaces in the building as defined in the building program. Spaces in different types of buildings and different spaces within a single building may impose different loads on the separators between interior and exterior spaces and between adjacent interior spaces. The separators must be designed to withstand the expected loads.

A-5.2.2.1.(2)(c) Determination of Structural Loads and Effects. As regards materials, components and assemblies and their interfaces that are installed in buildings to which Part 5 applies, the effects of earthquake loads on their ability to resist or accommodate environmental loads are generally only taken into account in the design of post-disaster buildings. For all other buildings, damage to building components during seismic events is anticipated and these buildings are not intended to be functional after the event. However, for post-disaster buildings, seismic effects must be taken into account in the design for environmental separation, as these buildings are required to have an adequate degree of functionality after the design event to meet their intended function (see Article 4.1.8.13. for deflections and drift limits for post-disaster buildings).

However, it is important to note that earthquake effects must be taken into account in the seismic design of all building materials, components and assemblies and their interfaces covered by Article 4.1.8.18. to address life safety and the structural protection of buildings.

A-5.2.2.2. Resistance to Wind and Other Air Pressure Loads. The wind load provisions apply to roofing and other materials subject to wind-uplift loads.

Note that, although Article 5.2.2.2. is specifically concerned with wind loads and directly references only one Article from Part 4, Sentence 5.2.2.1.(1) references all of Part 4 and would invoke Article 4.1.7.10. for example, which is concerned with air pressure loads on interior walls and partitions.

A-5.2.2.2.(4) Membrane Roofing Systems. Wind loads for membrane roofing systems must be calculated in accordance with Part 4 (see Note A-1.4.1.1. of Division A concerning roof terminology). The tested uplift resistance and factored load should satisfy the requirements of the Commentary entitled Limit States Design in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

The test method described in CAN/CSA-A123.21, “Standard test method for the dynamic wind uplift resistance of membrane-roofing systems,” applies only to sheet membrane roofing systems whose components' resistance to wind uplift is achieved by fasteners or adhesives. It does not apply to liquid-applied membranes or to membrane roofing systems that use ballasts, such as gravel or pavers, to secure the membrane against wind uplift.

In the case of sheet membrane roofing systems in which the waterproof membrane is attached to the structural deck using mechanical fasteners, the wind-induced forces and the roofing system's response are time- and space-dependent and, thus, dynamic in nature. Further information on the design and evaluation of such systems can be found in “A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs,” published by NRC.

The wind uplift resistance obtained from the test method in CAN/CSA-A123.21 is limited to configurations with specific fastener or adhesive patterns. To extrapolate the test data to non-tested configurations, refer to ANSI/SPRI WD-1, “Wind Design Standard Practice for Roofing Assemblies,” for a rational calculation procedure. However, in using this extrapolation procedure, wind loads should be calculated in accordance with the By-law. NRC's guide for wind design referenced above provides further guidance and examples of wind load calculations.

Wind resistance of ballasted roofs may be calculated using ANSI/SPRI RP-4, “Wind Design Standard for Ballasted Single-ply Roofing Systems”. However, its methods are based on wind speeds, not wind pressures. Conversely, wind pressures, not wind speeds, are used in Appendix C of this By-law. Therefore, a registered professional skilled in the work of Part 4 should use the ANSI/SPRI standard in conjunction with wind speeds listed in Table C-1, applying wind loads calculated in accordance with Subsection 4.1.7. of Division B (see the commentary on Wind Effects in Appendix C of Division B). Where ballast is used to

resist other structural loads in a building, a registered professional is responsible to review these, particularly in replacement roofing.

Technical Bulletin Volume 40 "Design of Loose-Laid Gravel Stone Ballasted Roofs" published by the Canadian Roofing Contractors Association (CRCA) provides some guidance for using the ANSI/SPRI standard to determine ballast requirements. Note that the exposure categories are different from those used in this By-law. A registered professional may select the appropriate ballast size and weight guidelines based on roof zones and zone dimensions.

The ballast values published in CRCA Technical Bulletin Volume 40 are minimum values that will address many roof designs where the roof deck is air-impermeable. If the roof deck is air-permeable, or if flow control drains are present (these may retain water on the roof, thereby introducing added buoyancy), the design may require higher ballast weights (and correspondingly higher volumes). A registered professional should verify that the structural design of the building can accommodate the necessary ballast weight, together with anticipated live loads including those loads imposed on the building during construction.

While gravel ballast is commonly used on protected membrane roof systems, wind scour can dislodge rocks from the roof, rendering them a public safety hazard. Consequently, a roof may need to be designed with higher parapets or with a different ballast material, such as concrete pavers. See also CRCA Technical Bulletin Volume 35 "Ballast For Protected Membrane Roofing" on ballast design requirements for protected membrane roofs.

A-5.2.2.2.(6) Vegetated Roof Assemblies. When a vegetated system is added on the top of a membrane roofing assembly, a *vegetated roof assembly* is formed. The test methods described in CAN/CSA-A123.24, "Standard test method for wind resistance of vegetated roof assembly," determine both the wind uplift resistance and the wind flow resistance of the *vegetated roof assembly*. If the wind uplift resistance of the membrane roofing assembly used in the *vegetated roof assembly* has already been determined in accordance with the requirements of CAN/CSA-A123.21, "Standard test method for the dynamic wind uplift resistance of membrane-roofing systems," as required by Sentence 5.2.2.2.(4), then this resistance can be used as an acceptable conservative wind uplift resistance of the *vegetated roof assembly*; in such cases, only the wind flow resistance of the *vegetated roof assembly* has to be determined in accordance with CAN/CSA-A123.24. However, if any variations in the components or methods of construction of the membrane roofing assembly used in the *vegetated roof assembly* are made after the wind uplift resistance was determined in accordance with the requirements of CAN/CSA-A123.21, then the wind uplift resistance of the *vegetated roof assembly* must be determined in accordance with CAN/CSA-A123.24.

A-5.3. Heat Transfer. In addressing issues related to health and safety, Section 5.3. calls up levels of thermal resistance needed to minimize condensation on or within environmental separators, and to ensure thermal conditions appropriate for the building use. Energy regulations, where they exist, specify levels of thermal resistance required for energy efficiency or call up energy performance levels, which relate to levels of thermal resistance. Where Part 5 calls for levels of thermal resistance higher than those required by the energy regulations, the requirements of Part 5 take precedence.

A-5.3.1.1. Required Resistance to Heat Transfer. The control of heat flow is required wherever there is an intended temperature difference across the building assembly. The use of the term "intended" is important since, whenever interior space is separated from exterior space, temperature differences will occur.

The interior of an unheated warehouse, for example, will often be at a different temperature from the exterior due to solar radiation, radiation from the building to the night sky and the time lag in temperature change due to the thermal mass of the building and its contents. If this temperature difference is not "intended," no special consideration need be given to the control of heat flow.

If the warehouse is heated or cooled, thus making the temperature difference "intended," some consideration would have to be given to the control of heat flow.

It should be noted, however, that in many cases, such as with adjacent interior spaces, there will be an intended temperature difference but the difference will not be great. In these cases, the provisions to control heat flow may be little or no more than would be provided by any standard interior separator. That is, materials typically used in the construction of partitions may provide the separation needed to meet the requirements of Section 5.3. without adding what are generally considered to be "insulating" materials.

A-5.3.1.2. Material and Component Properties and Condensation. Total prevention of condensation is generally unnecessary and its achievement is rarely a certainty at design conditions. Part 5, therefore, requires that condensation be minimized. The occurrence of condensation should be sufficiently rare, or the quantities accumulated should be sufficiently small and dry rapidly enough, to avoid material deterioration and the growth of mould and fungi.

The Harmonized North American Fenestration Standard, AAMA/WDMA/CSA 101/I.S.2/A440, “North American Fenestration Standard/Specification for windows, doors, and skylights,” identifies procedures to determine the condensation resistance and thermal transmittance of windows, doors and skylights though testing for condensation resistance is presented as optional in the standard. As such, a fenestration product that meets the standard's requirements on air leakage, water penetration, uniform load and other performance requirements may not meet the condensation resistance performance level needed for a given application. Only the physical test procedure presented in CSA A440.2, “Fenestration energy performance,” can be used to establish the temperature index (I) value, which denotes condensation resistance performance evaluation criteria. It is recommended that designers specify I values for a given application to minimize the potential for condensation. Further guidance on the selection of the correct I value is provided in CSA A440.3, “User guide to CSA A440.2:19, Fenestration energy performance.”

The scope of AAMA/WDMA/CSA 101/I.S.2/A440, which is referenced in Subsection 5.9.2., includes skylights and tubular daylighting devices (TDD). Where skylights and TDDs pass through unconditioned space, their wells and shafts may become the environmental separator and would therefore have to comply with the requirements of Part 5.

A-5.3.1.2.(1) Use of Thermal Insulation or Mechanical Systems for Environmental Control. The level of thermal resistance required to avoid condensation on the warm side of an assembly or within an assembly (at the vapour barrier), and to permit the maintenance of indoor conditions appropriate for the occupancy depends on

- the occupancy,
- the exterior design air temperature,
- the interior design air temperature and relative humidity,
- the capacity of the heating system, and
- the means of delivering heat.

To control condensation on the interior surface of an exterior wall, for example, the interior surface must not fall below the dew point of the interior air. If, for instance, the interior air is 20°C and 35% RH, the dew point will be 4°C. If the interior air is 20°C and 55% RH, the dew point will be 11°C.

Where the exterior design temperature is mild, such as in the City of Vancouver, the interior RH during the heating season may well be around 55%. With an exterior temperature of -7°C, the materials in the environmental separator would have to provide a mere RSI 0.082 to avoid condensation on the interior surface. Depending on the specific properties of the material, this RSI might be provided by 10-mm plywood. Therefore, materials generally recognized as thermal insulation would not be required only to limit condensation on the warmer side of the building envelope.

In certain areas, design conditions may be different. In these cases, maintaining temperatures inboard of the vapour barrier above the dew point will require insulation or increased heat delivery to the environmental separator. Direct delivery of heat over the entire surface of the environmental separator is generally impractical. Indirect heat delivery may not be possible without raising the interior air temperatures above the comfort level. In any case, increased heat delivery would often entail excessive energy costs.

In addition to controlling condensation, interior surface temperatures must be warm enough to avoid occupant discomfort due to excessive heat loss by radiation. Depending on the occupancy of the subject spaces, this may require the installation of insulation even where it is not needed to control condensation.

A-5.3.1.3.(2) Position of Materials Providing Thermal Resistance. For a material providing thermal resistance to be effective, it must not be short-circuited by convective airflow through or around the material. The material must therefore be either

- the component of the air barrier system providing principal resistance to air leakage, or
- installed in full and continuous contact with a continuous low air permeance component.

A-5.4.1. Air Barrier Systems. An air barrier system is required in most buildings to control air movement through the environmental separator to minimize

- the condensation of airborne moisture within the environmental separator,
- discomfort from drafts,

- the infiltration of dust, soil gases, and other pollutants,
- interference in the performance of building services, such as HVAC and plumbing,
- the infiltration of exterior precipitation, and
- the loss of airborne heat energy.

The requirements for air barrier systems in Part 5 address all of these issues, except the loss of airborne heat energy, which is an energy performance issue and, as such, is addressed in the NECB. Failure to manage the issues addressed in Part 5 can lead to serious health or safety hazards.

The most significant issues are those with the potential to cause moisture-related material deterioration, such as rot and corrosion, which can lead to the failure of component connections. Where the environmental separator is subject to high moisture levels, mould can grow if spores and organic materials are present.

A-5.4.1.1. Locations Where an Air Barrier System Is Required. Where the hygrothermal environments in adjacent interior spaces are sufficiently different, an air barrier system is required to control the airflow between the spaces in order to maintain the different environments. Examples of such adjacent spaces include skating arenas adjoining swimming pools, and industrial office spaces adjoining industrial production spaces.

An air barrier system is also required in building assemblies in contact with the ground to control the ingress of radon and other soil gases, such as methane.

In addition to an air barrier system, other measures may be required in certain regions to reduce the radon concentration to a level below the guideline specified by Health Canada. Further information on protection from radon ingress can be found in:

- "Radon: A Guide for Canadian Homeowners" (CMHC/HC),
- "Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres)" (HC), and
- EPA 625/R-92/016, "Radon Prevention in the Design and Construction of Schools and Other Large Buildings."

A-5.4.1.1.(3) Air Leakage Performance Classes for Air Barrier Assemblies. The selection of a Performance Class for an air barrier assembly is intended to ensure that the air leakage performance level of the assembly is sufficient to minimize condensation and reduce the uncontrolled movement of air across the environmental separator.

The accumulation of condensation within a building assembly as a result of air leakage through the environmental separator depends on the following:

- the air leakage rate of the air barrier assembly,
- the location of the accumulation of condensation within the building assembly, and
- the drying potential of the building assembly (i.e., its ability to release moisture through vapour diffusion and surface evaporation, both inward and outward).

Critical to the rates of both drying and the accumulation of condensation is the location where moisture may occur within the building assembly. The location and amount of accumulation of condensation due to air leakage are influenced by the materials used in the building assembly and the temperatures within the assembly. The location of insulation within the building assembly is critical and can directly influence whether condensation occurs and how much moisture condensation actually accumulates.

The drying potential of the building assembly is dependent on the water vapour permeance of the various layers in the building assembly (e.g., exterior sheathing, sheathing membrane, unvented cladding, vapour barrier).

CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," contains requirements and test methods for air barrier assemblies used in high- and low-rise buildings. The standard classifies the air leakage performance of air barrier assemblies on the basis of air leakage rate, building height, and wind pressure loading. The approach in the standard is consistent with limit states design principles to allow for the direct incorporation of test results into the overall structural design of the building.

Unlike ASTM E2357, "Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies," CAN/ULC-S742 measures air leakage under two temperature conditions:

(1) at ambient temperatures with no temperature differential across the test assembly, and

(2) with the exterior side of the test assembly at a temperature of −20°C and the interior side at a temperature of +20°C (i.e., with a temperature differential of 40°C across the test assembly).

This difference makes the testing approach in CAN/ULC-S742 more appropriate for the climate in most regions of Canada.

CAN/ULC-S742 does not address the structural transfer of air pressure loads from air barrier assemblies to adjoining air barrier assemblies or the primary structure. Nevertheless, this transfer of loads must be addressed by the designer.

The Performance Class of an air barrier assembly is selected on the basis of the following:

- the moisture loads on the building assembly due to the hygrothermal characteristics of the air,
- the ability of the materials and components of the building assembly to absorb and distribute moisture,
- the ability of the building assembly to dissipate moisture before it can lead to harm to the occupants or damage to the materials and components of the building assembly, and
- the moisture tolerance of the materials from which the building assembly is constructed.

Air barrier assemblies with lower air leakage rates are typically necessary where the drying potential of the building assembly is low and/or the moisture sensitivity of components of the building assembly is high.

Before selecting the appropriate Performance Class, the designer should consider formal study, analysis and/or modeling to establish performance criteria for each air barrier assembly. Further guidance can be found in the NRC publication entitled "Guideline on Design for Durability of Building Envelopes." This recommendation is particularly important for buildings with

- higher than normal operating hygrothermal characteristics, e.g., museums, swimming pools and laboratories,
- building assemblies made from materials and components with lower than normal moisture tolerances, e.g., wood and other organic materials, or
- occupancies with a low tolerance for the potential health risks associated with condensation, e.g., hospitals, long-term care facilities and laboratories.

In such cases, Performance Classes with lower air leakage rates should be selected.

A-5.4.1.1.(4) Continuity of Air Barrier Systems. An air barrier system can only function properly if all the materials, components and assemblies intended to provide the air barrier functions are continuously connected and structurally capable of resisting applied loads. Historically, most failures of air barrier systems in buildings have been directly related to improper or insufficient connections between adjacent air barrier materials, components and assemblies.

A-5.4.1.1.(7) Locations Where an Air Barrier System Is Not Required. In Canada, there are few buildings intended for human occupancy where the interior space is conditioned but an air barrier system is not required. Any exemption from installing an air barrier system would depend on the level of interior conditioning provided, the ventilation level, the protection provided for the building's occupants, and the tolerance of the building's construction to the accumulation of condensation and potential precipitation ingress.

In some industrial buildings, limited conditioning (e.g., radiant heating) is provided, and ventilation levels are sufficient to reduce the relative humidity to a level at which condensation will not accumulate to an unacceptable degree. Conversely, some industrial buildings, due to the processes they contain, operate at very high temperatures and high ventilation levels. In such cases, the building envelope may be maintained at temperatures required to avoid condensation. In both of these examples, either the ventilation levels or protective means required in the work environment would protect the building's occupants from unacceptable levels of pollutants.

A-5.4.1.2.(1) Low-Sloped Membrane Roof Assemblies. For low-sloped membrane roof assemblies, CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," provides pre-tested prescriptive solutions that have an air leakage rate not exceeding 0.2 L/(s×m^2). The air leakage rate of low-sloped membrane roof assemblies not identified in CAN/ULC-S742 should be determined in accordance with ASTM D8052/D8052M, "Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies."

A-5.4.1.2.(2) Air Barrier Assemblies Not Evaluated in Accordance with CAN/ULC-S742. Air barrier assemblies that have not been evaluated in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," must nevertheless provide the air leakage performance required for the selected Performance Class. Field testing may be required to verify their performance.

Field assessment of the air leakage characteristics of both the primary air barrier assemblies and the connections between adjacent air barrier assemblies can be a useful tool in establishing whether the acceptable minimum performance level is met.

Field testing of installed air barrier assemblies can be conducted in accordance with test standards such as

- ASTM E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors," and
- ASTM E1186, "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems."

Even though some test standards are intended for specific types of air barrier assemblies (e.g., windows and doors), the test methodology used to assess air leakage rates may be acceptable for use with other types of air barrier assemblies. However, with this approach, it is important to establish rational acceptance criteria that reflect the test methodology and the types of air barrier assemblies being tested.

Qualitative testing can be used to identify locations in air barrier assemblies where air leakage is occurring so that field repairs can be made to improve the assembly's airtightness performance. ASTM E1186 provides guidance on a number of approaches for identifying locations of air leakage, including the following:

- infrared scanning,
- smoke tracer observation,
- airflow measurement,
- sound detection,
- tracer gas detection, and
- liquid leak detection.

Each of these techniques has benefits and limitations, as described in the standard. The most suitable approach for a particular situation is selected by the testing agency on the basis of their experience in relation to the type of construction being assessed and the weather conditions at the time of testing. Regardless of the approach selected, the testing of air barrier assemblies must be properly coordinated with the construction process so that any air leaks identified can be addressed without adversely affecting progress.

A-5.4.1.2.(4) Testing of Below-Grade Air Barrier Assemblies. To ensure that they minimize the ingress of radon and other soil gases, below-grade air barrier assemblies in contact with the ground can be tested in accordance with CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," using the air leakage limit for Performance Class 1 or a more stringent limit. In such air barrier assemblies, as in all air barrier assemblies, penetrations and junctions are the most likely locations for air leakage. These points of weakness must be properly detailed and constructed to minimize the ingress of soil gases.

A-5.5.1.1. Required Resistance to Vapour Diffusion. Resistance to vapour diffusion is required to reduce the likelihood of condensation within building assemblies, and the consequent potential for material deterioration and fungal growth. Deterioration such as rot and corrosion can lead to the failure of building components and connections, and interfere with the performance of building services. Some fungi can have very serious effects on health.

In Canada, relatively few buildings that are subject to temperature and vapour pressure differences would be constructed or operated in such a manner that the control of vapour diffusion would not need to be addressed in their design. Assemblies enclosing certain industrial spaces, as described in Note A-5.4.1.1.(7) for example, may be exempt.

For residential spaces, and most other spaces that are conditioned for human occupancy, a means of vapour diffusion control is generally agreed to be necessary, even in milder climates. The questions in those cases pertain to the degree of control needed.

The word "minimize" is used in Sentence 5.5.1.1.(1) because not all moisture accumulation in an assembly need be of concern. Incidental condensation is normal but should be sufficiently rare and in sufficiently limited quantities, and should dry rapidly enough, to avoid material deterioration and the growth of mould or fungi. Here are some references regarding the effects of fungi on health:

- "Fungal Contamination in Public Buildings: Health Effects and Investigation Methods," Health Canada
- "Guidelines on Assessment and Remediation of Fungi in Indoor Environments," New York City Department of Health and Mental Hygiene (NYCDH)

A-5.5.1.2.(1) Vapour Barrier Materials and Installation. In the summer, many buildings are subject to conditions where the interior temperature is lower than the exterior temperature. Vapour transfer during these periods is from the exterior to the interior. In general, in Canada, the duration of these periods is sufficiently short, the driving forces are sufficiently low, and assemblies are constructed such that any accumulated moisture will dissipate before deterioration will occur.

Buildings such as freezer plants, however, may operate for much of the year at temperatures that are below the ambient exterior temperature. In these cases, the "warm" side of the assembly would be the exterior and a detailed analysis on an annual basis is required.

Steady state heat transfer and vapour diffusion calculations may be used to determine acceptable permeance levels for the vapour barrier and to identify appropriate positions for the vapour barrier within the building assembly.

A-5.6.1.1. Required Protection from Precipitation. Windows, cast-in-place concrete walls, and metal and glass curtain wall systems are examples of components and assemblies that, when properly designed and constructed, are expected to prevent the ingress of precipitation into a building. Assemblies such as roofs and veneer walls consist of materials specifically intended to screen precipitation.

Components and assemblies separating interior conditioned space from the exterior are generally required to provide protection from the ingress of precipitation. Components and assemblies separating interior unconditioned space from the exterior may or may not be required to provide protection from the ingress of precipitation. Buildings such as stadia, parking garages and some seasonally occupied buildings, for example, may not require complete protection from the ingress of precipitation. The degree of protection will depend to a large extent on the materials selected for the building elements that will be exposed to precipitation.

The word "minimize" is used in Sentence 5.6.1.1.(1) because not all moisture ingress or accumulation in an assembly need be of concern. The penetration of wind-driven rain past the cladding may not affect the long-term performance of the assembly, provided the moisture dries out or is drained away before it initiates any deterioration of building materials. When the design service life of a material or component is longer than the design service life of the overall assembly, taking into account the expected exposure to moisture, initiating deterioration of the material should not be of concern. That is to say, provided the material or component continues to provide the necessary level of performance for its intended service life and does not adversely affect the service life of the assembly of which it is a part, the deterioration of the material or component is not an issue.

A-5.6.1.2. Protective Material.

Draining Moisture with Protective Materials

The City of Vancouver's past experience has shown that it is virtually impossible to make face sealed walls work in the Vancouver climate, in anything beyond a very low exposure condition. The intent of Section 5.6. is to illustrate to the designer that a rainscreen design is the minimum acceptable option for vertical exterior envelope assemblies in Part 5 buildings. Where there is a slope in any element of the envelope, it should be considered a roof and treated accordingly.

Where the system is a mass wall construction type, and does not include a cladding, all joints between panels (and junctions to other elements such as windows) are required to be two-stage or rainscreen joints with an appropriate means to drain any accumulated moisture to the exterior.

Exterior Cladding over Structural Light Framing

Exterior cladding shall be installed over a cavity with all the necessary through wall flashings designed to drain accumulated moisture to the exterior, where the wall system incorporates exterior cladding over structural light wood or steel framing systems,. This cavity, a water shedding plane on the interior side of the cavity and a complete air barrier system to achieve pressure moderation, constitute the primary elements of a required rainscreen design. Compartmentalization of the cavity, in particular at corners, is required to achieve effective pressure moderation. Where the cladding material is stiffer than the supporting light frame structure, such as in a stucco application, the compartmentalization should include though wall flashing at each floor. The design of the cavity should minimize the potential for water to bridge across this gap and maximize the free air space.

While there is agreement on the need for a cavity, current research is not conclusive on the optimal width of a cavity to maximize drying potential, however a conservative approach would suggest that the widest allowable cavity would be prudent in this environment, where drying is an issue. As other Sections of this By-law limit a cavity in a wall to 25 mm before requiring fire blocks, a 19 mm (3/4") cavity is the minimum width recommended which will satisfy this requirement, while still maximizing the drying potential for an assembly with insulation in the stud space. [See Clause 3.1.11.2.(2)(d)]

Where the envelope system employs a full membrane application on the outside of the sheathing and where all of the insulation is installed outboard, then the width of the cavity may be reduced, since the drying potential is not as critical in this configuration. Research has shown that a 10 mm gap is sufficient to prevent liquid water from bridging across a cavity. Therefore, a cavity width of 12 mm (1/2") is the minimum recommended for this configuration, provided that the application of the cladding and the insulation is constructed so that the Building Envelope Professional can assure that this 12 mm (1/2") gap can be maintained.

Exterior columns, beams, walkways, guardrails, or other elements, which do not form a direct continuation of the building enclosure, may not be required to be constructed as rainscreen assemblies. For this approach to be acceptable, these elements must be totally constructed with pressure treated lumber and sheathing (field treated at cuts and boltholes) or other durable materials, with corrosion resistant fasteners and be provided with proper ventilation.

Exterior Insulation Finish Systems

Subject to specific limitations, the required cavities in Exterior Insulation Finish Systems may be reduced in dimension provided they form part of a pressure moderated rainscreen system. This approach would not be acceptable where the application is over wood framing.

A-5.6.1.2.(1) Ice Damming. Water leakage through water-shedding roofs is often due to the formation of ice dams at the eaves, which can be limited by controlling the transfer of heat to the roof through a combination of insulation and venting to dissipate heat. See Clause 5.3.1.2.(1)(d).

A-5.6.1.2.(2) Integrity and Performance of Vegetated Roof Assemblies. The integrity of some assemblies installed to provide the required protection from the ingress of precipitation in vegetated roofing systems can be compromised due to an inadequate resistance to the penetration of plant roots and rhizomes. Additional information on vegetated roofing systems and the performance of protective materials can be found in the German Landscape Research, Development and Construction Society's (FLL) “Guidelines for the Planning, Construction and Maintenance of Green Roofing” and in the National Roofing Contractors Association's “The NRCA Vegetative Roof Systems Manual” and in the standards published in the “Roofing Practices Manual” by the Roofing Contractors Association of British Columbia.

A *vegetated roof assembly* is intended to both grow and flourish, and is often used to control the rate of rainwater discharged through a *storm drainage system*. Maintenance of a *vegetated roof assembly* is necessary. This includes removal of dead vegetation that does not compost quickly, to reduce fire risk, and regular removal of biomass from around roof drains, to prevent clogging and ponding.

A-5.6.1.2.(3) Flashings, Drips or Overhangs. As the first principle for water management in a building envelope is deflection, the appropriate use of flashings, drips or overhangs is a critical part of any precipitation protection system. The 1996 CMHC survey of envelope failures in B.C. found a striking inverse relationship between the length of overhang, and the percentage of walls which experienced water induced problems. Roof overhangs perform a more complex function than that as a simple ‘umbrella’ shielding the wall below. Studies have shown that a large proportion of the precipitation incident on any building face will be deposited on an overhang at the top of a wall due to wind movement and water deposition patterns. If the overhang includes a means to shed this water, a large portion of the precipitation can be deflected without it ever touching the rest of the building face. Proper detailing and lapping of flashings with other materials is also critical to prevent the ingress of precipitation where there are changes in planes of walls and roofs, changes in cladding material, or window or door heads and sills.

Information on the installation of flashing to drain water to the exterior of roof or wall assemblies may be found in a number of publications including, but not limited to:

- “Roofing Practices Manual,” Roofing Contractors Association of British Columbia • “Best Practice Guide: Flashings,” Canada Mortgage and Housing Corporation
- “Technical Notes,” Masonry Institute of British Columbia
- “Architectural Sheet Metal Manual,” Sheet Metal and Air-Conditioning Contractors National Association, Inc.

A-5.6.2.1. Sealing and Drainage. A number of different design solutions can provide an environmental separator with the minimum performance level necessary to effectively control environmental and structural loads and their effects. An appropriate solution is selected on the basis of the applied load characteristics, the performance achieved by the solution, and its durability over the design service life. It is incumbent on the designer to balance the performance of a particular design solution against the required performance level, the risk of failure, and the consequences of failure for the building and its users.

Article 5.6.2.1. recognizes that acceptable solutions can use various strategies and single or multiple elements within the design to control precipitation. However, as indicated by research and the documentation of failures, some of these solutions are more effective than others.

One solution—a face-sealed assembly—relies on a continuous watertight surface on the outside of a building to control all precipitation over the life of the building; there is no redundancy in this design. The watertight surface can be difficult to both design and construct, and its long-term durability depends on proper preventive maintenance over its service life. This solution has a well-documented history of unsatisfactory performance in most regions of Canada.

A solution with redundancy in its design provides more effective and reliable resistance to water penetration. For example, in a rainscreen assembly, multiple water-resistive layers are combined with means to drain any water that has penetrated the outer layer and means to redirect this water to the exterior before it can affect moisture-sensitive materials within the assembly. Another solution—a mass wall assembly—accumulates and stores moisture, which is re-released to the exterior when conditions allow. Depending on the solution selected, means to facilitate the drying of materials may be incorporated in the assembly.

In selecting an acceptable solution for precipitation control, it is important to consider the structural and environmental loads that are referenced in Subsection 5.1.4. The resistance provided by the design solution must exceed these loads and their effects. The greater the intensity of the load, the higher the performance level required to provide the necessary resistance and an acceptable level of risk. Design considerations that should be addressed include the following:

- intended building use(s),
- building exposure during service life (height, orientation and surrounding terrain),
- building exposure during construction,
- current and future local climate characteristics affecting wetting and drying, including

–wind loads,

–precipitation loads (including wind-driven precipitation loads),

–relative humidity,

–temperature variations, and

–solar exposure,

- imposed load intensity, both in isolation and in combination (type, number, magnitude, frequency and duration),
- material types and moisture tolerances,
- resistance to the mechanisms of deterioration,
- effects of deformations, displacements and deflections of the building structure, and of materials, components and assemblies,
- constructability of materials, components and assemblies,
- expected construction tolerances,
- level of maintenance required to maintain resistance to loads and deterioration,
- intended service life of materials, components and assemblies, and
- reliability of materials, components and assemblies.

All the materials in an environmental separator must be able to resist the mechanisms of deterioration that are expected to occur over the design service life of the separator. For example, with respect to deterioration caused by moisture, a material used in a design must not be exposed to moisture in sufficient quantity and/or for sufficient length of time to reduce its ability to perform its required function(s) to a level below the required performance level. This concern is particularly important for materials that are known to be susceptible to moisture deterioration.

An environmental separator must also be designed to be suitably resistant to failure caused by

- uncertainty or variation in load intensity,

- uncertainty in the effects of loads on materials, components and assemblies,
- uncertainty in the predicted service lives of materials, components and assemblies, and
- construction deficiencies that can reasonably be anticipated.

The building structure and the environmental separator are mutually dependent in managing precipitation. The choice of materials for the building structure and the structural support/backing for the environmental separator can influence the choice of materials, components and assemblies for the environmental separator. Materials, components and assemblies with higher performance levels may be required for the environmental separator where the building structure and the structural support/backing have lower material strengths, undergo higher in-service movements (e.g., shrinkage or deflection), or have lower resistance to deterioration.

The design and construction of details at penetrations, at joints and junctions between assemblies, and at transitions between planes are of critical importance to the long-term performance and durability of the environmental separator. Designers should provide sufficient detail on drawings to illustrate how the design solution for precipitation control is to be integrated into the building (see Subsection 2.2.5. of Division C).

A-5.6.2.2.(5) Overflow Outlets.

Where a roof or balcony is entirely enclosed by parapet walls there is a likelihood of drains becoming obstructed with materials such as leaves falling during heavy autumn rains. It is recommended that a secondary means of drainage such as scuppers be provided. Overflow outlets should be installed in the parapet walls in sufficient number and at an appropriate height to drain the roof or balcony, to avoid water backing up into moisture sensitive assemblies, and to prevent structural collapse from ponding.

Refer also to Division B of Book II (Plumbing Systems), Sentence 2.4.10.4.(2). (For climate resiliency requirements see CAN/CSA-A123.26, “Performance requirements for climate resilience of low slope membrane roofing systems”, together with the Standards published in the “Roofing Practices Manual” by the Roofing Contractors Association of British Columbia.)

A-5.7. Protection from Interior Sources of Water. Protection similar to that prescribed in Section 5.7. may be required where interior assemblies are in contact with water (such as site-built showers, steam rooms, swimming pool areas) and where adjacent interior spaces need to be protected from the transfer of water through these assemblies.

A-5.7.1.2.(2) Drainage. Water should be directed away from the building and, ultimately, to a municipal drainage system, drainage ditch, swale, or other acceptable water management means. This can be accomplished by setting the building grade higher than the surrounding grades, by sloping the grade away from the building, by installing a surface water drainage system, or by a combination of these approaches. The chosen approach should follow generally accepted guidelines, such as the Rational Method of Stormwater Design by David B. Thompson, or other design methods acceptable to the authority having jurisdiction.

A-5.7.3.3.(1)(a) Imperfections. Examples of imperfections include shrinkage cracks, air holes, honeycombing, form-tie cone holes, and form joint ridges.

A-5.7.3.4.(1) Dampproofing. Dampproofing refers to the application of a material or materials to an environmental separation assembly to protect it and the interior space against the transfer of moisture due to the mechanisms of water vapour transmission, capillary action and pressure differences other than hydrostatic pressure.

A dampproofed assembly should be designed such that it can provide short-term resistance to the ingress of water due to occasional hydrostatic pressure from ground water.

A-5.8. Required Protection from Noise. Section 5.8. applies to the separation of dwelling units from other dwelling units and from spaces where noise may be generated with regard to sound transmission irrespective of Clause 5.1.2.1.(1)(b), which deals with the separation of dissimilar environments. It is understood that, at any time, there is the potential for sound levels to be quite different in adjoining dwelling units.

A-5.8.1.2. Using ASTC in lieu of STC. A designer may choose to use an ASTC rating of equal or higher numerical value than the required STC to show compliance where STC ratings are required.

An ASTC measurement or calculation will always yield a value equal to or lower than the STC for the same configuration, as the ASTC includes flanking transmission.

A-5.8.1.4. Methods of Calculating ASTC. The technical concepts, terminology, and calculation procedures relating to the detailed and simplified ASTC calculation methods are discussed in detail, with numerous worked examples, in the NRC

publication entitled “Guide to Calculating Airborne Sound Transmission in Buildings.” This Guide includes references to readily-available sources of pertinent data.

For many common constructions, the calculations required by Article 5.8.1.4. can be performed using software tools, such as soundPATHS, which is available on the NRC's website.

The simplified calculation method may not always identify the prominent flanking paths. Furthermore, it corresponds more closely with the results of the detailed calculation method where the separating assembly and the flanking constructions are both constructed according to the same method, i.e. either both are lightweight construction (steel or wood framing) or both are heavyweight construction (masonry or concrete).

A-5.8.1.4.(4)(b) Assemblies that Behave Like Homogeneous Panels. Examples of assemblies that behave like homogeneous panels include cast-in-place concrete, precast concrete, precast hollow-core concrete, concrete block masonry, and mass timber panels. For the purpose of calculating the ASTC rating for construction using mass timber panel walls or floor assemblies in accordance with the detailed method described in Sentence 5.8.1.4.(4), a mass timber panel behaves as a homogeneous panel, notwithstanding that it has an average structural loss factor greater than 0.03. Further information on the calculation of the ASTC rating for mass timber panel assemblies can be found in the NRC publication entitled “Guide to Calculating Airborne Sound Transmission in Buildings.”

A-5.9.1.1.(1) Selection of Materials and Components and Compliance with Referenced Standards. It is important to note that Sentence 5.9.1.1.(1) is stated in such a way that the selection of materials and components is not limited to those traditionally recognized as serving particular functions or those for which a standard is identified in Table 5.9.1.1. This approach permits more flexibility than is provided by similar requirements in Part 9. As long as the selected material meets the performance requirements stated elsewhere in Part 5, the material may be used to serve the required function.

However, where the selected material or component, or its installation, falls within the scope of any of the standards listed in Table 5.9.1.1., the material, component or installation must comply with that standard. For example, if some resistance to heat transfer is required between two interior spaces and standard partition construction will provide the necessary resistance, the installation of one of the “thermal insulation” materials identified in the standard list is not required. If, on the other hand, one decides to install glass fibre insulation, the material must conform to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.”

A-Table 5.9.1.1. Selection and Installation of Sealants. Analysis of many sealant joint failures indicates that the majority of failures can be attributed to improper joint preparation and deficient installation of the sealant and various joint components. The following ASTM guidelines describe several aspects that should be considered when applying sealants in unprotected environments to achieve a durable application:

- ASTM C1193, “Standard Specification for Use of Joint Sealants,” and
- ASTM C1472, “Standard Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width.”

The sealant manufacturer's literature should always be consulted for recommended procedures and materials.

A-5.9.2.1.(3) Airtightness and Watertightness of Windows, Doors, Skylights, Other Fenestration Assemblies and their Components Required to have a Fire-Protection Rating. The airtightness and watertightness requirements are waived for these products when used in such an application, in recognition of the fact that the availability of assemblies that meet both the requirements of the applicable standards and the requirements for fire resistance may be limited. However, control of air and water leakage should not be ignored: measures should be taken to attempt to comply with applicable requirements.

A-5.9.2.2. Manufactured Windows, Doors and Skylights.

Two Compliance Paths. It is intended that any fenestration product that conforms to this Subsection may choose to comply with either Article 5.9.2.2. or Article 5.9.2.3. Even if a product is in scope of the standards referenced in Article 5.9.2.2. (NAFS and the Canadian Supplement to NAFS), the compliance path in Article 5.9.2.3. may be used. However, it is not intended that the compliance path in Article 5.9.2.2. be used where fenestration products are not within the scope of the referenced standards.

Design Values

CSA A440S1, “Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, North American Fenestration Standard/Specification for windows, doors, and skylights,” requires that the individual performance levels achieved by the product for structural resistance, water penetration resistance and air leakage resistance be reported on the product's performance label.

Storm Doors and Windows

Where storm doors and storm windows are not incorporated in a rated window or door assembly, they should be designed and constructed to comply with the applicable requirements of Part 5 regarding such properties as appropriate air leakage and structural loads.

Forced Entry Test

Even though the performance label on rated windows, doors and skylights does not explicitly indicate that the product has passed the forced entry resistance test, products are required to pass this test in order to be rated.

A-5.9.2.2.(4) Loads and Procedures. For windows within the scope of the "Canadian Supplement" referred to in Sentence 5.9.2.2.(1), structural and wind loads are included and may be calculated in accordance with that standard. As an alternative, structural and wind loads from Section 5.2. may be used to select fenestration products that are appropriate for the point of

installation. Values derived from the referenced standard, which uses a simplified calculation method, are typically higher than those derived from calculations done in conformance with Section 5.2.

A-5.9.2.3.(1) Installation and Field Testing of Windows, Doors and Skylights.

Installation

The installation details of windows, doors, skylights and their components must be appropriately designed and implemented for the building envelope assembly to perform acceptably overall. The proper design of the installation details provides the information necessary to integrate the structure and air, vapour and moisture barrier functions of windows, doors and skylights into the overall design of the building envelope assembly. Construction should be carried out in accordance with these details to achieve an appropriate level of long-term performance. Further guidance on installation detailing can be found in CSA A440.4, "Window, door, and skylight installation."

Field Testing

It is recommended that the performance of installed windows, doors and skylights be field tested early in the envelope construction phase so that any discontinuities can be readily identified and corrected before construction of the building envelope assembly is completed. Additional field testing during subsequent construction phases to monitor installation consistency is also recommended. Field test procedures should be carried out in accordance with test standards such as ASTM E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors," and ASTM E1105, "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference." Further guidance can be found in CSA A440.4, "Window, door, and skylight installation," which also includes performance requirements developed in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, "North American Fenestration Standard/Specification for windows, doors, and skylights," to be used when performing field testing.

A-5.9.2.4.(3) Heat Transfer through Fire-Rated Glazed Assemblies. Thermal bridging through fire-rated glazed assemblies should not be ignored; measures should be taken to minimize condensation consistent with the intent of Sentence 5.9.2.4.(2).

A-5.9.3. Testing Standards for Other Fenestration Assemblies. Subsection 5.9.3. references ASTM test methods. The following AAMA standards can also be used to evaluate the performance characteristics of other fenestration assemblies:

- AAMA 501, "Methods of Test for Exterior Walls,"
- AAMA 501.1, "Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure,"
- AAMA 501.2, "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems,"
- AAMA 501.4, "Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drifts,"
- AAMA 501.5, "Test Method for Thermal Cycling of Exterior Walls," and
- AAMA 501.6, "Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System."

• ASTM E 331, “Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.”

• ASTM E 547, “Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.”

A-5.9.3.1.(1) Terminology for Other Fenestration Assemblies.

Curtain Wall

A curtain wall is considered to be a continuous wall cladding assembly (which may include fenestration and opaque portions) that is hung away from the edge of the primary floor structure. Curtain wall assemblies do not generally support vertical loads other than their own weight. Anchorage is typically provided by anchors that connect back to the floor structure. Curtain wall assemblies can be either “stick built,” meaning each main unit is assembled on-site, or a “unitized” system, meaning factory-assembled main units are installed and connected together on-site.

Window Wall

A window wall is considered to be a wall cladding assembly (which may include fenestration and opaque portions) that spans from the top of a primary floor structure to the underside of the next higher primary floor structure. Window wall assemblies do not generally support vertical loads other than their own weight. Primary provision for anchorage occurs at head and sill connections with the adjoining floor structure. Window wall assemblies may include separate or integral floor edge covers.

Storefront

A storefront is considered to be a non-residential assembly (which may include fenestration and opaque portions) consisting of one or more elements that could include doors, windows and curtain wall framing. Storefronts do not generally support vertical loads other than their own weight. Storefront profiles are typically narrow, rectilinear framing members that hold a combination of pocket glazing and applied glazing stops to securely retain the infills. Vertical framing members typically span the height of one floor or are retained within a structural punched opening.

Storefront assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

Glazed Architectural Structures

Glazed architectural structures are considered glazing assemblies that are supported in a non-traditional manner, such as corner-clamped, point-supported, linear-supported and edge-clamped glazing. Structural support systems can include, but are not limited to, tension cables, tension rods, steel and glass. Glazed architectural structures do not generally support vertical loads other than their own weight. These assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

Skylights that are not covered by AAMA/WDMA/CSA 101/I.S.2/A440, “North American Fenestration Standard/Specification for windows, doors, and skylights,” are considered glazed architectural structures.

A-5.9.3.2.(1) Structural and Environmental Loads. The applicable laboratory test method for demonstrating adequate structural performance of other fenestration assemblies is ASTM E330/E330M, “Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.”

A-5.9.3.3.(1) Resistance to Condensation. Notwithstanding that other fenestration assemblies are not fully covered under the testing scope of CSA A440.2, “Fenestration energy performance,” the test method described therein can be used to evaluate their resistance to condensation, with technical modifications to accommodate differences in the size and configuration of the specimen. It is also common practice to use one cold cycle of AAMA 501.5, “Test Method for Thermal Cycling of Exterior Walls,” to assess the potential for condensation. Both methods can be used for mock-ups in laboratory performance evaluations, however, only the test method in CSA A440.2 should be used if a Temperature Index is required. In most cases, the project specification documents establish the hygrothermal conditions (i.e., exterior temperature, interior temperature, interior relative humidity) for which the potential for condensation should be minimized. Under these conditions, the aforementioned test methods can be used to aid in the selection of the appropriate system performance to minimize the potential for interior surface condensation. In all cases, care should be taken in the construction and configuration of the specimen, as these parameters may have an impact on its thermal performance and resistance to condensation. These parameters may include, without limitation, interior wall construction and finishes, heating systems, ventilation systems, etc., to simulate the actual in-service conditions as closely as practicable.

A-5.9.3.4.(2) Air Leakage.

Air Leakage Rate and Test Pressure

A lower air leakage rate and/or higher differential test pressure can be selected for specific applications of other fenestration assemblies where tight control of airflow is required to prevent interstitial condensation (e.g., in concealed spaces), improve thermal comfort (e.g., in hospitals, seniors' residences), or prevent the migration of airborne contaminants (e.g., in food and drug research, manufacturing applications, biological laboratories). It is typical of other fenestration assemblies to be used as the sole building envelope component; where this is the case, a correspondingly higher degree of airtightness may be required.

In addition, higher test pressure differentials can be used to evaluate assemblies with low air leakage, such as non-operable or fixed fenestration systems whose air leakage rates are not easily measurable at the lower standard pressure differentials.

Standard Test Methods

The applicable laboratory test method for determining the rate of air leakage is ASTM E283, “Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.” If field testing for air leakage is to be conducted, the applicable test method is ASTM E783, “Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.”

A-5.9.3.4.(3) Systems Excluded from Air Leakage Requirements. The systems listed in Sentence 5.9.3.4.(3) perform different functions than other fenestration assemblies and are therefore exempted from complying with the air leakage requirements.

A-5.9.4.1.(1) Exterior Insulation Finish Systems (EIFS). The reference to CAN/ULC-S716.1, “Standard for Exterior Insulation and Finish Systems (EIFS) - Materials and Systems,” in Clause 5.9.4.1.(1)(b) does not preclude the use of other component materials that may also meet the intent of the Code. For example, using mineral-fibre insulation in lieu of other rigid insulation types, mechanical fastening methods for the insulation component in lieu of adhesive, or a type of water-resistive barrier other than a liquid-applied water-resistive barrier could be acceptable.

The following two companion standards facilitate the application of and conformance with CAN/ULC-S716.1:

- CAN/ULC-S716.2, “Standard for Exterior Insulation and Finish Systems (EIFS) - Installation of EIFS Components and Water Resistive Barrier,” and
- CAN/ULC-S716.3, “Standard for Exterior Insulation and Finish System (EIFS) - Design Application.”

Additional information on EIFS design and installation can be found in the EIFS Council of Canada's “EIFS Practice Manual” and the manufacturer's literature.

EIFS Selection

CAN/ULC-S716.1 provides minimum performance criteria for EIFS materials and systems that are tested under specific laboratory test protocols identified in the standard. However, compliance with this standard does not ensure that a system is appropriate for all projects. When selecting an EIFS product, designers should consider all relevant criteria—not only those covered by the tests in CAN/ULC-S716.1—including, but not limited to,

- building exposure
- local climate characteristics (wind, precipitation, temperature variations, solar exposure)
- intended building use
- intended resistance to damage and deterioration
- construction tolerances
- constructability

Design and Construction of EIFS Drainage Cavity

The drainage capacity and thermal performance of the EIFS assembly can be affected by the dimensions and configuration of the EIFS drainage cavity.

EIFS are installed over other building materials such as sheathing and primary structural components, which have various construction installation tolerances. Designers should take into consideration the cumulative effects of construction tolerances

and sequencing when specifying the drainage method and the cavity dimensions and configuration in order to ensure adequate drainage.

Designers should also take into account the impact of air movement, which varies depending on cavity size and the extent of venting, on the EIFS' thermal performance when reviewing the overall thermal performance of the building envelope. ASTM C1363, “Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus,” presents one method for assessing the thermal performance of assemblies.

Where an Exterior Insulation Finish System (EIFS) is used, design review and enhanced field review is required to be conducted by a Building Envelope Professional who has specialized training and experience with EIFS. The professional is required to review the project specific design, and confirm that the whole system including the required thermal expansion/contraction joints, joints around doors or windows, or any other penetrations of the finish will allow for drainage back to the exterior, without reliance on surface sealing. The professional is also responsible for reviewing the pressure moderating system including compartmentalization, vent location, sizing, and confirming the required stiffness of the substrate, using calculations based on the manufacturer’s data or by testing demonstrating that sufficient pressure equalization has been achieved as defined by the Institute for Research in Construction, Construction Technology Update No. 17; “Pressure Equalization in Rainscreen Wall Systems,” July 1998.

The quality provisions of the CCMC Technical Guide for “Exterior Insulation and Finish Systems (EIFS) Class PB Masterformat Section 07240”, Section 7.0 “Quality Assurance Program” must be adhered to. Buildings are required to be designed incorporating devices such as davit bases or other design elements, so that any required maintenance could be provided without causing undue damage to the EIFS.

Part 6
Heating, Ventilating and Air-conditioning

Section 6.1. General

6.1.1. Application

6.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

6.1.1.2. Application

1) This Part applies to systems and equipment for heating, ventilating and air-conditioning services.

6.1.2. Definitions

6.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

6.1.3. Plans and Specifications

6.1.3.1. Required Plans and Specifications

1) Plans, specifications and other information for heating, ventilating and air-conditioning systems shall conform to Subsection 2.2.6. of Division C.

Section 6.2. Planning

6.2.1. General

6.2.1.1. Good Engineering Practice

(See Note A-6.2.1.1.)

1) Heating, ventilating and air-conditioning systems, including mechanical refrigeration equipment, shall be designed, constructed and installed in conformance with good engineering practice such as that described in, but not limited to,

a) the ASHRAE Handbooks and Standards,

b) the HRAI Digest,

c) the Hydronics Institute Manuals,

d) the NFPA Standards,

e) the SMACNA Manuals,

f) the ACGIH manual entitled “Industrial Ventilation: A Manual of Recommended Practice for Design,”

g) CSA B214, “Installation code for hydronic heating systems,”

h) CAN/CSA-Z317.2, “Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities,”

i) EPA 625/R-92/016, “Radon Prevention in the Design and Construction of Schools and Other Large Buildings,” and

j) ASHRAE Guideline 12, “Minimizing the Risk of Legionellosis Associated with Building Water Systems.”

2) Indoor design temperatures for residential *buildings* shall be those established in Article 9.33.3.1.

6.2.1.2. Outdoor Design Conditions

1) The outdoor conditions to be used in designing heating, ventilating and air-conditioning systems shall be determined in conformance with Subsection 1.1.3. (See Note A-6.2.1.2.(1).)

2) Reserved

3) Reserved

6.2.1.3. Expansion, Contraction and System Pressure

1) Heating and cooling systems shall be designed to allow for expansion and contraction of the heat transfer fluid and to maintain the system pressure within the rated working pressure limits of all components of the system.

6.2.1.4. Structural Movement

(See Note A-6.2.1.4.)

1) *Mechanical systems* and equipment shall be designed and installed to accommodate the maximum relative structural movement provided for in the construction of the *building*.

6.2.1.5. Installation Standards

1) Except as provided in Articles 6.9.4.2. and 6.3.1.4., the installation of heating and air-conditioning equipment, including mechanical refrigeration equipment, and including provisions for mounting, clearances and air supply, shall conform to the Safety Standards Act and pursuant regulations.

2) A solid-fuel burning *boiler* accepted for use under section 10 of the Safety Standards Act satisfies section 4.1 of CAN/CSA-B365, “Installation Code for Solid-Fuel-Burning Appliances and Equipment.”

6.2.1.6. Installation – General

1) Equipment requiring periodic maintenance and forming part of a heating, ventilating or air-conditioning system shall be installed with provision for access for inspection, maintenance, repair and cleaning. (See Note A-6.2.1.6.(1).)

2) Mechanical equipment shall be provided with guards so as to prevent injury.

3) Heating, ventilating or air-conditioning systems shall be protected from freezing if they may be adversely affected by freezing temperatures.

6.2.1.7. Asbestos

1) Asbestos shall not be used in HVAC systems and equipment.

6.2.2. Incinerators

6.2.2.1. Applicable Standard

1) The design, construction, installation and *alteration* of every indoor incinerator shall conform to NFPA 82, “Standard on Incinerators and Waste and Linen Handling Systems and Equipment.”

6.2.3. Solid Fuel Storage

6.2.3.1. Solid Fuel Storage Bins

1) A storage bin for solid fuel shall not be located above a sewer opening or drain opening.

2) Storage bins for solid fuel shall be designed and constructed so that the air temperature in the bin or the surface temperature of any part of the floor or walls is below 50°C.

Section 6.3. Ventilation Systems

6.3.1. Ventilation

6.3.1.1. Required Ventilation

1) Except as provided in Sentence (4), all *buildings* shall be ventilated in accordance with this Section.

2) Except in storage garages covered by Article 6.3.1.3., outdoor air shall be supplied to *buildings* for ventilation purposes in accordance with one of the following Sections of ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality," as a minimum:

a) Section 6.2, Ventilation Rate Procedure, excluding the exception stated in Section 6.2.7.1.2 and note H of Table 6.2.2.1,

b) Section 6.3, Indoor Air Quality Procedure, or

c) Section 6.4, Natural Ventilation Procedure, excluding residential occupancies.

3) Except in storage garages covered by Article 6.3.1.3., exhaust ventilation shall be provided in accordance with Section 6.5, Exhaust Ventilation, of ANSI/ASHRAE 62, "Ventilation for Acceptable Indoor Air Quality," as a minimum.

4) Self-contained heating-season mechanical ventilation systems serving only one *dwelling unit* shall comply with Subsection 9.32.3.

5) For *suites* in *buildings* conforming to Part 10, the outdoor air required by Sentence (2) shall be supplied directly to each *suite* by mechanical ventilation through ducting. (See Note A-6.3.1.1.(5).)

6.3.1.2. Crawl Spaces and Attic or Roof Spaces

1) Unconditioned and unoccupied crawl spaces and attic or roof spaces shall be ventilated by natural or mechanical means as required by Part 5. (See Note A-6.3.1.2.(1).)

6.3.1.3. Ventilation of Storage Garages

1) Except as provided in Sentences (4) and (6), an enclosed storage garage for five or more motor vehicles shall have a mechanical ventilation system designed to

a) limit the concentration of carbon monoxide to not more than 100 parts per million parts of air,

b) limit the concentration of nitrogen dioxide to not more than 3 parts per million parts of air, where the majority of the vehicles stored are powered by diesel-fuelled engines, or

c) provide, during operating hours, a continuous supply of outdoor air at a rate of not less than 3.9 L/s for each square metre of floor area (see Article 3.3.1.21.).

(See Note A-6.3.1.3.(1).) (See also Sentence 3.3.5.4.(4).)

2) Mechanical ventilation systems provided in accordance with Clause (1)(a) shall be controlled by carbon monoxide monitoring devices, and systems provided in accordance with Clause (1)(b) shall be controlled by nitrogen dioxide or other *acceptable* monitoring devices. (See Note A-6.3.1.3.(2).)

3) Mechanical ventilation systems provided in accordance with Sentence (1) shall be designed such that the pressure in the storage garage is less than the pressure in adjoining *buildings* of other *occupancy*, or in adjacent portions of the same *building* having a different *occupancy*.

4) In storage garages subject to the requirements of Sentences (1) and (2), where motor vehicles are parked by mechanical means, the ventilation requirements may be reduced by one half.

5) Except as provided in Sentence (6), ticket and attendant booths of storage garages shall be pressurized with a supply of uncontaminated air.

6) The requirements of Sentences (1) to (5) shall not apply to open-air *storeys* in a storage garage.

6.3.1.4. Heat Recovery Ventilators

1) Heat recovery ventilators with rated capacities of not less than 25 L/s and not more than 200 L/s shall be installed in accordance with Subsection 9.32.3.

6.3.1.5. Indoor Air Contaminants

(See Note A-6.3.1.5.)

1) Air contaminants of concern within *buildings* shall

a) be removed insofar as is possible at their points of origin, and

b) not be permitted to accumulate in concentrations greater than those permitted by applicable by-laws or regulatory enactments or, in the absence of such requirements, by good engineering practice such as that described in the publications listed in Sentence 6.2.1.1.(1), measured using the methodology described therein.

2) Systems serving spaces that contain sources of contamination and systems serving other occupied parts of the *building* but located in or running through spaces that contain sources of contamination shall be designed in such a manner as to prevent the spread of such contamination to other occupied parts of the *building*.

3) Heating, ventilating and air-conditioning systems shall be designed to minimize the growth and spread of bio-contaminants.

6.3.1.6. Commercial Cooking Equipment

1) Except as provided in Sentences (2) and (3), Article 3.6.3.1. and Article 3.6.3.5., systems for the ventilation of commercial cooking equipment shall be designed, constructed and installed to conform to NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations."

2) The exhaust from a commercial cooking unit shall discharge through an ecology unit or *acceptable* equipment complying with Sentence (4), where the exterior wall termination of the exhaust is within 3 m of a *lane*, property line or *street* property line. (See Note A-6.3.1.6.(2).)

3) The exhaust from a commercial cooking unit which is discharged from an exterior wall termination shall not a) be discharged in a location or manner which causes a concentrated stream of air to fall directly onto pedestrians, b) be discharged in a location or manner which causes exhaust to accumulate in an area with outdoor seating, and c) generate a sound pressure level which exceeds noise levels permitted by the Noise Control By-law. (See Note A-6.3.1.6.(3).)

4) Equipment provided in compliance with Sentence (3) shall

a) remove 99.97% of the grease entering the equipment,

b) be of continuously welded 1.5 mm thick carbon steel or 1.1 mm stainless steel,

c) prevent the leakage of flame, smoke, or grease from the equipment at normal or abnormal temperatures,

d) limit the temperature rise of adjacent *combustible* materials to no more than 97°C above room temperature, and

e) limit the temperature of exhaust air at the exhaust outlet to no more than 138°C. (See Note A-6.3.1.6.(4).)

6.3.2. Air Duct Systems

6.3.2.1. Application

1) This Subsection applies to the design, construction and installation of air duct distribution systems serving heating, ventilating and air-conditioning systems other than those in *dwelling units* covered by Part 9.

6.3.2.2. Drain Pans

(See Note A-6.3.2.2.)

1) HVAC systems that generate condensate or introduce liquid water into the airstream in the ducts shall be equipped with drain pans that are

a) designed in accordance with Section 5.10, Drain Pans, of ANSI/ASHRAE 62.1, "Ventilation for Acceptable Indoor Air Quality,"

b) provided with an outlet that is piped to the outside of the airstream in a location where condensate can be safely disposed of,

c) installed so that water does not stagnate and drains from the pan, and

d) designed and installed so as to be accessible for cleaning and maintenance.

2) Drain pans and associated piping shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

6.3.2.3. Materials in Air Duct Systems

1) All ducts, duct connectors, associated fittings and plenums used in air duct systems shall be constructed of materials as described in Article 3.6.5.1.

2) Ducts that are used in a location where they may be subjected to excessive moisture shall have no appreciable loss of strength when wet and shall be resistant to moisture-induced corrosion.

3) All ductwork and fittings shall be constructed and installed as recommended in SMACNA Manuals and ASHRAE Standards.

4) All duct materials shall be suitable for exposure to the temperature and humidity of the air being carried and shall be resistant to corrosion caused by contaminants in the air being conveyed in the duct.

6.3.2.4. Connections in Air Duct Systems

1) Air duct systems shall have tight-fitting connections throughout.

6.3.2.5. Duct Coverings and Linings

(See Note A-6.3.2.5.)

1) Coverings, linings and associated adhesives and insulation used in air ducts, plenums and other parts of air duct systems shall comply with Article 3.6.5.4.

2) Duct linings shall be installed so that they will not interfere with the operation of volume or balancing dampers or of fire dampers, fire stop flaps and other closures.

6.3.2.6. Clearance of Ducts and Plenums

1) The clearance of ducts and plenums from *combustible* materials shall comply with Article 3.6.5.6.

6.3.2.7. Interconnection of Systems

1) In a care or *residential occupancy*, air from one *suite* shall not be circulated to any other *suite* or to a public corridor.

2) Except as permitted by Sentences (3) and 6.3.2.10.(6), air duct systems serving storage garages shall not be directly interconnected with other parts of the *building*.

3) Exhaust ducts referred to in Sentence 6.3.2.10.(10) are permitted to exhaust through an enclosed storage garage prior to exhausting to the outdoors, provided

a) the storage garage's exhaust system runs continuously,

b) the capacity of the storage garage's exhaust system is equal to or exceeds the volume of the exhaust entering the garage, and

c) a leakage rate 1 smoke/fire damper rated in accordance with CAN/ULC-S112.1, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems," is provided near the duct outlet location in the storage garage to prevent air from the storage garage from entering the exhaust ductwork system in the event the *building*'s exhaust fan is shut down.

6.3.2.8. Makeup Air

(See Note A-6.2.1.1.)

1) In ventilating systems that exhaust air to the outdoors, provision shall be made for the admission of a supply of makeup air in sufficient quantity so that the operation of the exhaust system and other exhaust equipment or combustion equipment is not adversely affected.

2) Makeup air facilities required by Sentence (1) shall be interlocked with the exhaust devices they serve so that both operate together.

3) Where makeup air facilities are intended to introduce air directly from the outdoors to occupied parts of the *building* in winter, they shall incorporate means of tempering that air to maintain the indoor design temperature.

6.3.2.9. Supply, Return, Intake and Exhaust Air Openings

1) Supply, return and exhaust air openings located less than 2 m above the floor in rooms or spaces in *buildings* shall be protected by grilles having openings of a size that will not allow the passage of a 15 mm diam sphere.

2) Outdoor air intakes shall be located so that

a) **reserved**,

b) they are separated a minimum distance from sources of contaminants in accordance with Table 6.3.2.9.

Table 6.3.2.9.
Minimum Distances of Air Intakes from Sources of Contaminants
Forming Part of Sentence 6.3.2.9.(2)

Source of Contaminants	Minimum Distance of Outdoor Air Intake, m
Garage entry of a garage for 5 or more motor vehicles, automobile loading area and drive-in queue	4.5
Truck loading area or dock, and bus parking	7.6
Driveway, *street*, and parking space	1.5
Thoroughfare, arterial road, freeway, and highway	7.6
Garbage storage/pick-up area and dumpsters	4.5
Discharge from evaporative heat rejection systems	7.6
Sanitary vent	3.5
Kitchen cooking exhaust	3.0
Vent for combustion products	3.0

3) Outdoor air intakes shall be installed not less than 0.3 m above roofs, landscape grades or other surfaces, taking into account anticipated snow accumulation levels.

4) Exterior openings for outdoor air intakes and exhaust outlets shall be shielded from the entry of snow and rain and shall be fitted with corrosion-resistant screens of mesh having openings not larger than 15 mm, except where experience has shown that climatic conditions require larger openings to prevent the screen openings from icing over.

5) Screens required in Sentence (4) shall be accessible for maintenance.

6) *Combustible* grilles, diffusers and other devices covering supply, return, intake and exhaust openings shall comply with Article 3.6.5.7.

6.3.2.10. Exhaust Ducts and Outlets

1) Except as provided in Sentence (2), exhaust ducts of non-mechanical ventilating systems serving separate rooms or spaces shall not be combined.

2) Exhaust ducts of non-mechanical ventilating systems serving similar occupancies may be combined immediately below the point of final delivery to the outdoors, such as at the base of a roof ventilator.

3) Exhaust ducts of ventilating systems shall have provision for the removal of condensation where this may be a problem.

4) Exhaust outlets shall be designed to prevent backdraft under wind conditions.

5) Except as permitted in Sentence (6), exhaust systems shall discharge directly to the outdoors. (See Note A-6.3.2.10.(5) and (6).)

6) Exhaust systems are permitted to exhaust into a storage garage, provided

a) they serve rooms that are accessible only from that storage garage,

b) the exhaust contains no contaminants that would adversely affect the air quality in the storage garage (see Note A-6.3.2.10.(6)(b)), and

c) they are designed in accordance with Sentence 6.3.2.7.(3).

(See Note A-6.3.2.10.(5) and (6).)

7) Exhaust ducts connected to laundry-drying equipment shall be

a) independent of other exhaust ducts,

b) accessible for inspection and cleaning, and

c) constructed of a smooth corrosion-resistant material.

(See Note A-6.3.2.10.(7) and (8).)

8) Where collective venting of multiple installations of laundry-drying equipment is used, the ventilation system shall

a) be connected to a common exhaust duct that is vented by one central exhaust fan,

b) include an interlock to activate the central exhaust fan when laundry-drying equipment is in use, and

c) be provided with make-up air.

(See Note A-6.3.2.10.(7) and (8).)

9) Exhaust ducts or vents connected to laundry-drying equipment shall discharge directly to the outdoors.

10) Except as provided in Sentence (12) and except for self-contained systems serving individual *dwelling units*, exhaust ducts serving rooms containing water closets, urinals, basins, showers or slop sinks shall be independent of other exhaust ducts.

11) Except as provided in Sentence (12) and except for self-contained systems serving individual *dwelling units*, exhaust ducts serving rooms containing residential cooking equipment shall be independent of other exhaust ducts.

12) Two or more exhaust systems described in Sentences (10) and (11) may be interconnected or connected with exhaust ducts serving other areas of the *building*, provided

a) the connections are made at the inlet of an exhaust fan, and all interconnected systems are equipped with suitable back pressure devices to prevent the passage of odours from one system to another when the fan is not in operation, or

b) the exhaust ducts discharge to a shaft that is served by an exhaust fan having a capacity that is equal to or greater than the combined capacity of the exhaust fans discharging to the plenum multiplied by the operation diversity factor, provided that the exhaust fan serving the shaft operates continuously (see Note A-6.3.2.10.(12)(b)).

13) Where exhaust ducts containing air from conditioned spaces pass through or are adjacent to unconditioned spaces, the ducts shall be constructed to prevent condensation from forming on the inside or outside of the ducts.

6.3.2.11. Return-Air System

1) Return-air systems shall comply with Article 3.6.5.8.

2) Where a ceiling space is used as a return-air plenum, the requirements of Article 3.6.4.3. shall apply.

3) A *public corridor* or *exit* shall not be used as a return-air plenum.

6.3.2.12. Underground Ducts

1) Underground ducts shall

a) be constructed and installed to provide interior drainage from and access to all low points,

b) not be connected directly to a sewer, and

c) be installed and constructed of materials recommended by ASHRAE and SMACNA Standards and HRAI Manuals.

2) A clean-out or pump-out connection shall be provided in an underground duct system at every low point of the duct system.

6.3.2.13. Filters

1) Air filters for air duct systems shall conform to the requirements for Class 2 air filter units as described in CAN/ULC-S111, “Standard Method of Fire Tests for Air Filter Units.”

2) When electrostatic-type filters are used, they shall be installed so as to ensure that the electric circuit is automatically de-energized when filter access doors are opened or, in *dwelling units*, when the *furnace* circulation fan is not operating.

6.3.2.14. Cleaning Devices

1) Ventilation required by Sentence 6.3.1.1.(1) shall be provided by a ventilation system designed to include filtration devices with a Minimum Efficiency Reporting Value (MERV) of 13, as defined by ANSI/ASHRAE 52.2, prior to introduction of outdoor air into indoor occupied spaces.

6.3.2.15. Evaporative Heat Rejection Systems

(See Article 2.2.11.6. of Division B of Book II (Plumbing Systems) of this By-law.)

1) Evaporative heat rejection systems shall

a) incorporate a drift eliminator or other means to minimize the dispersion of entrained water droplets, and

b) have a design discharge velocity that does not exceed the maximum discharge velocity recommended by the manufacturer.

2) Evaporative heat rejection systems shall be designed so that water continuously circulates through all parts of the system that are normally wetted when the system is operating.

3) Evaporative heat rejection systems and their components shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms and that are compatible with disinfectants, biocides and other cleaning agents.

4) Evaporative heat rejection systems shall be installed such that

a) no discharge air bypasses the drift eliminator or other means referred to in Clause (1)(a), and

b) the systems are accessible for cleaning, inspection and maintenance.

5) Except as provided in Sentence (6), air discharged from evaporative heat rejection systems shall discharge away from the *building*, so as to not re-enter it, to a distance not less than

a) 2.15 m above sidewalks and driveways,

b) 7.6 m from outdoor air intakes,

c) 3 m horizontally or vertically from exterior doors and operable windows, and

d) 3 m horizontally or vertically from occupiable outdoor spaces, excluding maintenance spaces.

(See Note A-6.3.2.15.(5) and (6).)

6) Air discharged from evaporative heat rejection systems in health care facilities shall discharge away from the *building* in compliance with CAN/CSA-Z317.2, "Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities." (See Note A-6.3.2.15.(5) and (6).)

7) Air intakes of evaporative heat rejection systems shall incorporate protective measures to minimize the entrainment of vegetation and other organic matter.

8) Make-up water connections shall be equipped with backflow prevention devices that conform to Article 2.6.2.1. of Division B of Book II, (Plumbing Systems), of this By-law. (See Note A-6.3.2.15.(8) and (9).)

9) Water treatment systems and equipment for controlling the proliferation of disease-causing micro-organisms shall

a) be provided in accordance with Section 8.2.4. of ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with *Building* Water Systems," and

b) include means for drainage, dilution, cleaning, and application of chemicals for the control of scale, corrosion and biological contamination.

(See Note A-6.3.2.15.(8) and (9).)

10) Drains, overflows and blow-downs shall be connected to the *building*'s drainage system in accordance with Clause 2.4.2.1.(1)(e) of Division B of Book II, (Plumbing Systems), of this By-law.

11) Evaporative heat rejection systems shall be provided with access openings, service platforms, fixed ladders and fall-restraint connections to allow inspection, maintenance and testing, and a sampling port shall be installed at a point in the recirculation loop just prior to the point where treatment chemicals are injected.

6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers

1) Evaporative air coolers, misters, atomizers, air washers and humidifiers shall be designed in accordance with Sections 9 and 10 of ASHRAE Guideline 12, "Minimizing the Risk of Legionellosis Associated with Building Water Systems."

2) Systems referred to in Sentence (1) shall

a) be designed so that water continuously circulates through all parts of the system that are normally wetted when the system is operating, and

b) incorporate a method of preventing water stagnation within the system itself and the internal plumbing when the system is not operating.

(See Note A-6.3.2.16.(2).)

3) All components of systems referred to in Sentence (1), including filters and evaporation media, shall be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

4) Associated sumps shall

a) be constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms,

b) include auxiliary drains to prevent the overflow of water into ductwork, and

c) be installed so that they can be flushed, drained, cleaned and disinfected.

5) Where misters, atomizers or air washers are used in ductwork, the affected duct section shall be

a) designed to ensure drainage of unevaporated and accumulated water, and

b) constructed of corrosion-resistant, non-porous materials that do not promote the proliferation of disease-causing micro-organisms.

6) Make-up water connections shall be equipped with backflow prevention devices that conform to Article 2.6.2.1. of Division B of Book II, (Plumbing Systems), of this By-law. (See Note A-6.3.2.16.(6).)

6.3.2.17. Fans and Associated Air-Handling Equipment

1) Fans for heating, ventilating and air-conditioning systems shall be located and installed so that their operation

a) does not adversely affect the draft required for proper operation of fuel-fired *appliances*, and

b) does not allow the air in the duct system to be contaminated by air or gases from the *boiler* room or *furnace* room.

2) Fans and associated air-handling equipment, such as air washers, filters and heating and cooling units, when installed on the roof or elsewhere outside the *building*, shall be of a type designed for outdoor use.

6.3.2.18. Vibration Isolation Connectors

1) Vibration isolation connectors in air duct systems shall comply with Article 3.6.5.2.

6.3.2.19. Tape

1) Tape used for sealing joints in air ducts, plenums and other parts of air duct systems shall comply with Article 3.6.5.3.

6.3.3. Chimneys and Venting Equipment

6.3.3.1. Requirement for Venting

1) Except as provided in Articles 6.3.3.2. and 6.3.3.3., the products of combustion from oil-, gas- and solid-fuel-burning *appliances* shall be vented in conformance with the requirements in the applicable *appliance* installation standard listed in Article 6.2.1.5.

2) Except as provided in Article 6.2.1.5., vented products of combustion, other than those referred to in Sentence (1), shall be discharged away from the *building*, so as not to re-enter it, to a distance not less than

a) 2.15 m above sidewalks and driveways,

b) 3 m from outdoor air intakes,

c) 3 m horizontally or vertically from doors and operable windows, and

d) 3 m horizontally or vertically from occupiable outdoor spaces, excluding maintenance spaces.

(See Note A-6.3.3.1.(2).)

6.3.3.2. Masonry or Concrete Chimneys

1) Rectangular masonry or concrete *chimneys* not more than 12 m in height shall conform to Part 9 if they serve

a) *appliances* with a combined total rated heat output of 120 kW or less, or

b) fireplaces.

2) Masonry or concrete *chimneys* other than those described in Sentence (1) shall be designed and installed in conformance with the appropriate requirements in NFPA 211, "Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances."

6.3.3.3. Metal Smoke Stacks

1) Single wall metal smoke stacks shall be designed and installed in conformance with NFPA 211, "Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances."

6.3.3.4. Access Ladders

1) Access ladders for *chimneys*, when provided, shall consist of steel or bronze rungs, built into the walls of the *chimneys*.

2) Rungs for external ladders shall begin at not less than 2.5 m from ground level.

6.3.4. Ventilation for Laboratories

6.3.4.1. Application

1) This Subsection applies to laboratories where dangerous goods, including *flammable liquids* and *combustible liquids*, are used in normal laboratory operations in quantities or in a manner that creates a fire or explosion hazard.

6.3.4.2. General Ventilation

1) A laboratory shall be provided with continuous mechanical ventilation designed to ensure that dangerous goods vapours and particles

a) do not accumulate in the laboratory,

b) are prevented from migrating to other parts of the *building*,

c) do not accumulate in the ventilation system,

d) are exhausted to the outdoors, and

e) are not returned to the *building*.

2) A ventilation system required by this Subsection shall be provided with monitoring devices to

a) indicate that the ventilation system is in operation, and

b) sound an alarm if the ventilation system is malfunctioning.

3) A ventilation system required by this Subsection shall be maintained in conformance with Article 5.5.4.1. of Division B of the Fire By-law.

6.3.4.3. Enclosure Exhaust Ventilation

1) The ventilation system for a power-ventilated enclosure required by Sentence 5.5.4.2.(1) of Division B of the Fire By-law shall

a) conform to NFPA 91, "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,"

b) provide continuous exhaust ventilation at an air velocity sufficient to prevent the accumulation of *combustible* or reactive deposits in the power-ventilated enclosure and its exhaust duct system,

c) confine dangerous goods vapours and particles to the area where they are generated and exhaust them to the outdoors,

d) not return the exhausted air to the *building*, and

e) be provided with well identified control switches that are

i) located outside of the power-ventilated enclosure, and

ii) readily accessible in case of an emergency.

6.3.4.4. Enclosure Construction

1) The power-ventilated enclosure required by Sentence 5.5.4.2.(1) of Division B of the Fire By-law and its exhaust duct system shall

a) except as provided in Sentences (2) and (3), be constructed of *noncombustible* materials compatible with and chemically resistant to the dangerous goods vapours and particles being exhausted, and

b) be provided with access doors to permit inspection and maintenance of the fan assembly and exhaust ducts.

2) *Combustible* materials are permitted in systems described in Clause (1)(a) if

a) such materials are required by the corrosive or reactive properties of the dangerous goods being used, and

b) their flame-spread rating is not more than 25.

3) The flame-spread rating required by Sentence (2) is permitted to be greater than 25 if an automatic fire suppression system is provided inside the power-ventilated enclosure and its exhaust duct system.

Section 6.4. Heating Systems

6.4.1. Heating Appliances, General

6.4.1.1. Location of Appliances

1) Except for *appliances* installed in *dwelling units*, fuel-fired heating *appliances* shall be located, enclosed or separated from the remainder of the *building* in conformance with Section 3.6. (See also Subsection 9.10.10.)

6.4.1.2. Appliances Installed Outside the Building

1) Fuel-fired *appliances* installed outside a *building* shall be designed and constructed for outdoor use.

6.4.2. Unit Heaters

6.4.2.1. Clearances

1) Every unit heater using either steam or hot water as the heating medium shall be installed such that the clearances between the appliance and adjacent *combustible* material conform to Table 6.7.1.2.

6.4.3. Radiators and Convectors

6.4.3.1. Lining or Backing

1) A *noncombustible* lining or backing shall be provided for every steam or hot water radiator and convector

a) located in a recess or concealed space, or

b) attached to the face of a wall of *combustible* construction or encapsulated mass timber construction.

2) Every steam or hot water radiator and convector shall be installed so as to conform to the clearance requirements of Table 6.7.1.2.

Section 6.5. Thermal Insulation Systems

6.5.1. Insulation

6.5.1.1. Insulation and Coverings

(See Note A-6.3.2.5.)

1) Insulation and coverings on pipes shall comply with Article 3.6.5.5.

2) Insulation and coverings on pipes shall be composed of material that will withstand deterioration from softening, melting, mildew and mould at the operating temperature of the system.

3) Exposed piping or equipment subject to human contact shall be insulated so that the temperature of the exposed surface does not exceed 52°C. (See Note A-6.5.1.1.(3).)

Section 6.6. Refrigeration and Cooling Systems

6.6.1. Refrigerating Systems and Equipment for Air-conditioning

6.6.1.1. Cooling Units

1) Where a cooling unit is combined with a fuel-fired *furnace* in the same duct system, the cooling unit shall be installed

a) in parallel with the heating *furnace*,

b) upstream of the *furnace* provided the *furnace* is designed for such application, or

c) downstream of the *furnace* provided the cooling unit is designed to prevent excessive temperature or pressure in the refrigeration system.

Section 6.7. Piping Systems

6.7.1. Piping for Heating and Cooling Systems

6.7.1.1. Piping Materials and Installation

1) Piping shall be made from materials designed to withstand the effects of temperatures and pressures that may occur in the system. (See Articles 3.1.5.19., 3.1.9.1., 9.10.9.6. and 9.10.9.7. for fire safety requirements.)

2) Every pipe used in a heating or air-conditioning system shall be installed to allow for expansion and contraction due to temperature changes.

3) Supports and anchors for piping in a heating or air-conditioning system shall be designed and installed to ensure that undue stress is not placed on the supporting structure.

6.7.1.2. Clearances

1) Clearances between *combustible* material and bare pipes carrying steam or hot water shall conform to Table 6.7.1.2.

Table 6.7.1.2.
Clearance Between Steam or Hot Water Pipes and Combustible Material
Forming Part of Articles 6.4.2.1. and 6.7.1.2., and Sentence 6.4.3.1.(2)

Steam or Water Temperature, °C		Minimum Clearance, mm
Up to 95		No clearance
Above 95 to 120		15
Above 120		25

6.7.1.3. Surface Temperature

1) The exposed surface temperature of a steam or hot water radiator shall not exceed 70°C unless precautions are taken to prevent human contact. (See Note A-6.5.1.1.(3).)

6.7.1.4. Protection

1) Where a pipe carrying steam or hot water at a temperature above 120°C passes through a *combustible* floor, ceiling or wall, the construction shall be protected by a sleeve of metal or other *noncombustible* material not less than 50 mm larger in diameter than the pipe.

6.7.1.5. Piping in Shafts

1) Where piping for heating or air-conditioning systems is enclosed in a shaft, the requirements of Article 3.6.3.1. for shafts shall apply.

6.7.2. Storage Bins

6.7.2.1. Storage Bins

1) Service pipes passing through a storage bin for solid fuel shall be protected or so located as to avoid damage to the pipes.

2) Except for fuel-thawing pipes, every pipe designed to operate at a temperature of 50°C or above shall be located where solid fuel cannot be stored in contact with it.

Section 6.8. Equipment Access

6.8.1. Openings

6.8.1.1. Access Openings

1) Any covering of an access opening through which a person could enter shall be openable from the inside without the use of keys where there is a possibility of the opening being accidentally closed while the system or equipment is being serviced.

6.8.1.2. Openings in Air Duct Systems

1) Air duct systems shall have no openings other than those required for the proper operation and maintenance of the system.

2) Access openings shall be provided in duct systems to allow the removal of material that may accumulate in plenums and ducts.

6.8.1.3. Odour Removal Equipment

1) When odour removal equipment of the adsorption type is used, it shall be

a) installed to allow access so that adsorption material can be reactivated or renewed, and

b) protected from dust accumulation by air filters installed on the inlet side.

2) Facilities for flushing and drainage shall be provided where filters are designed to be washed in place.

Section 6.9. Fire Safety Systems

6.9.1. General

6.9.1.1. Fire Safety Requirements

1) The fire safety characteristics of heating, ventilating and air-conditioning systems shall comply with Subsection 3.6.5.

2) Characteristics referred to in Sentence (1) include but are not limited to

a) use of *combustible* materials in duct systems,

b) flame-spread ratings and smoke-developed ratings of duct and pipe materials and coverings,

c) installation of equipment relative to property lines, and

d) requirements for fire dampers and fire stop flaps.

6.9.1.2. Hazardous Gases, Dusts or Liquids

1) Except as provided in Subsection 6.3.4., systems serving spaces that contain hazardous gases, dusts or liquids shall be designed, constructed and installed to conform to the requirements of the Fire By-law and all applicable by-laws or regulatory enactments or, in the absence of such regulations or bylaws, to good engineering practice such as that described in the publications of the National Fire Protection Association. (See Note A-6.9.1.2.(1).)

2) When indoor piping for Class I flammable liquids is installed in a trench, the trench shall be

a) provided with positive ventilation to the outdoors, or

b) designed to prevent the accumulation of flammable vapours.

6.9.1.3. Commercial Cooking Equipment

1) Fire protection systems for commercial cooking equipment referred to in Sentence 6.3.1.6.(1) using vegetable oil or animal fat shall conform to

a) ANSI/CAN/UL/ULC 300, “Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment,” or

b) ULC/ORD-C1254.6, “Fire Testing of Restaurant Cooking Area Fire Extinguishing System Units.”

6.9.2. Dampers and Ductwork

6.9.2.1. Fire Dampers

1) Fire dampers shall conform to Article 3.1.8.10.

6.9.2.2. Smoke Detectors

1) Air handling systems shall incorporate *smoke detectors* where and as required by Article 3.2.4.12.

6.9.2.3. Exhaust Ducts and Outlets

1) Where an exhaust duct system is used for smoke removal in a high *building*, the requirements of Article 3.2.6.6. shall apply.

2) Where exhaust duct systems from more than one fire compartment are connected to an exhaust duct in a vertical service space, the requirements of Article 3.6.3.4. shall apply.

6.9.2.4. Ducts in Exits

1) Where ducts penetrate fire separations separating *exits* from the remainder of the *building*, they shall be in accordance with Article 3.4.4.4.

6.9.3. Carbon Monoxide Alarms

6.9.3.1. Carbon Monoxide Alarms

1) This Article applies to every *building* that contains an *assembly occupancy*, a *care occupancy* with individual *suites* or containing sleeping rooms or bed spaces not within a *suite*, a *residential occupancy*, a *business and personal services occupancy*, or a *mercantile occupancy*, and that

a) is served by or contains a fuel-burning appliance, or

b) contains a storage garage.

2) Carbon monoxide (CO) alarms installed in a *residential occupancy* or a *care occupancy* as required by this Article shall

a) conform to CSA 6.19, "Residential carbon monoxide alarming devices,"

b) be equipped with an integral alarm that satisfies the audibility requirements of CSA 6.19, "Residential carbon monoxide alarming devices,"

c) have no disconnect switch between the overcurrent device and the CO alarm, where the CO alarm is powered by the electrical system serving the *suite* (see Note A-6.9.3.1.(2)(c)), and

d) be installed as recommended by the manufacturer.

3) Except as permitted by Sentence (9), where a fuel-burning *appliance* is installed in a *suite* of *residential occupancy* or in a *suite* of *care occupancy*, a CO alarm shall be installed

a) inside each sleeping room or bed space, or

b) outside each sleeping room or bed space, within 5 m of each door serving a sleeping room or bed space, measured following corridors and doorways.

4) Except as permitted by Sentence (9), where a fuel-burning *appliance* serves a *residential occupancy* or a *care occupancy* and is installed in a service room that is not in a *suite* of *residential occupancy* nor in a *suite* of care occupancy, a CO alarm shall be installed

a) either inside each sleeping room or bed space, or if outside, within 5 m of each door serving a sleeping room or bed space, measured following corridors and doorways, in every *suite* of *residential occupancy* or *suite* of care occupancy that shares a wall or floor/ceiling assembly with the *service room*, and

b) in the *service room*.

5) Except as permitted by Sentence (9), for each *suite* of *residential occupancy* or *suite* of *care occupancy* that shares a wall or floor/ceiling assembly with a storage garage or that is adjacent to an attic or crawl space to which the *storage garage* is also adjacent, a CO alarm shall be installed

a) inside each sleeping room or bed space, or

b) outside each sleeping room or bed space, within 5 m of each bedroom door serving a sleeping room or bed space, measured following corridors and doorways.

6) CO alarms installed in an *assembly occupancy*, a *business and personal services occupancy*, or a *mercantile occupancy* as required by this Article shall conform to

a) CAN/CSA-6.19, "Residential Carbon Monoxide Alarming Devices," notwithstanding the scope of that standard,

b) UL 2034, “Standard for Single and Multiple Station Carbon Monoxide Alarms,” notwithstanding the scope of that standard, or

c) good engineering practice. (See Note A-6.9.3.1.(6).)

7) Except as permitted by Sentence (9), where a fuel-burning *appliance* serves an *assembly occupancy*, *business and personal services occupancy*, or *mercantile occupancy*, a CO alarm shall be,

a) where the fuel-burning *appliance* is part of a system that could circulate or distribute CO to a *suite* of *assembly occupancy*, *business and personal services occupancy* or *mercantile occupancy*, installed

i) on each *storey* of each *suite* that may be exposed, and

ii) in a *suite* containing an *assembly major occupancy*, each classroom and dedicated gathering room or space, and

b) installed in the room or space in which the fuel-burning *appliance* is located. (See Note A-6.9.3.1.(7).)

8) Except as permitted by Sentence (9), for each *suite* of *assembly occupancy*, *business and personal services occupancy*, or *mercantile occupancy* that shares a wall or floor/ceiling assembly with either a *storage garage* or a *service room* containing a fuel-burning *appliance*, or that is adjacent to either an attic or crawl space to which the *storage garage* or a *service room* containing a fuel-burning *appliance* is also adjacent, a CO alarm shall be installed

a) on each *storey* of the adjacent *suite*,

b) where the adjacent *suite* contains an *assembly major occupancy*, each classroom and dedicated room or space, and

c) in each *service room* containing a fuel-burning *appliance*. (See Note A-6.9.3.1.(8).)

9) CO detectors are permitted to be installed in lieu of CO alarms required by this Article provided the CO detectors

a) sound audible signals within the location they serve, as described in Sentences (3) to (5), (7) and (8),

b) are installed in conformance with CAN/ULC-S524, “Installation of Fire Alarm Systems,” and

c) form part of the fire alarm system.

6.9.4. Ash Storage

6.9.4.1. Ash Storage Bins

1) Every ash storage bin shall be constructed of *noncombustible* material.

2) Every opening in an ash storage bin shall be protected by a tight-fitting metal door with metal frame securely fastened to the bin.

6.9.4.2. Fireplaces

1) Fireplaces shall conform to the requirements of Section 9.22.

Section 6.10. Objectives and Functional Statements

6.10.1. Objectives and Functional Statements

6.10.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 6.10.1.1. (See Note A-1.1.2.1.(1).)

Table 6.10.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 6
Forming Part of Sentence 6.10.1.1.(1)

Provision	Functional Statements and Objectives(1)
6.2.1.1. Good Engineering Practice	
(1)	(a) to (e) [F31,F51-OP1.1]
	(a) to (c),(e) to (i) [F40,F50,F51,F52,F54,F63-OH1.1]
	(a) to (c),(e) to (h) [F50,F51,F52,F54,F63-OH1.2,OH1.3]
	[F31,F50,F51,F52,F54,F63-OS3.2,OS3.4]
	(d) [F01-OS1.1]
6.2.1.2. Outdoor Design Conditions	
(2)	[F40,F50-OH1.1]
(3)	[F40,F43,F44,F50-OH1.1]
	[F44-OS3.4]
6.2.1.3. Expansion, Contraction and System Pressure	
(1)	[F20-OS3.2]
6.2.1.4. Structural Movement	
(1)	[F23-OS3.1]
	[F51,F63,F50-OH1.1,OH1.2,OH1.3]
6.2.1.5. Installation Standards	
(1)	[F43-OS1.1]
	[F43-OS3.4]
	[F43-OP1.1]
6.2.1.6. Installation – General	
(1)	[F82-OS1.1]
	[F82-OS3.4]
	[F82-OP1.1]
(2)	[F31-OS3.1]
(3)	[F81-OS3.2,OS3.3,OS3.4]
	[F81-OS1.1]
6.2.1.7. Asbestos	
(1)	[F43-OH1.1]
6.2.2.1. Applicable Standard	
(1)	[F81-OS1.1]
6.2.3.1. Solid Fuel Storage Bins	

(1)	[F30-OH2.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.3.1.1. Required Ventilation	
(2)	[F50,F41,F52,F53,F63-OH1.1]
(3)	[F40,F41,F50,F52,F53,F63-OH1.1]
(5)	[F50-OH1.1]
6.3.1.2. Crawl Spaces and Attic or Roof Spaces	
(1)	[F61,F63,F41-OH1.1,OH1.3]
6.3.1.3. Ventilation of Storage Garages	
(1)	[F50,F44-OS3.4]
(2)	[F44-OS3.4]
(3)	[F44-OS3.4]
(4)	[F50,F44-OS3.4]
(5)	[F50,F44-OH1.1]
	[F50,F44-OS3.4]
6.3.1.5. Indoor Air Contaminants	
(1)	[F44-OS3.4]
	[F44-OH1.1]
(2)	[F44-OH1.1]
(3)	[F52-OH1.1]
6.3.1.6. Commercial Cooking Equipment	
(1)	[F01,F44-OS1.1]
	[F01,F44-OP1.1]
(2)	[F44-OS1.1,OH5]
(3)	[F01,F44-OS1.1]
	[F01,F44-OP1.1]
	[F56-OH3]
6.3.2.2. Drain Pans	
(1)	[F41,F44,F50,F82-OH1.1]
(2)	[F40,F41,F44,F50-OH1.1]
6.3.2.3. Materials in Air Duct Systems	
(2)	[F20,F80-OH1.1,OH1.2]
(3)	[F81,F44-OS3.4]

	[F81-OH1.1]
(4)	[F20,F80-OH1.1,OH1.2]
6.3.2.4. Connections in Air Duct Systems	
(1)	[F81-OH1.1,OH1.2]
	[F81,F44-OS3.4]
6.3.2.5. Duct Coverings and Linings	
(2)	[F81-OH1.1,OH1.2]
	[F81-OS1.1]
	[F81-OP1.1]
6.3.2.7. Interconnection of Systems	
(1)	[F44-OS1.1]
	[F40-OH1.1]
(2)	[F81,F44-OH1.1]
	[F81,F44-OS1.1]
	[F81,F44-OP1.1]
(3)	[F81,F44-OH1.1]
6.3.2.8. Makeup Air	
(1)	[F50,F81-OH1.1]
	[F44,F81-OS3.4]
(2)	[F81-OH1.1]
	[F81,F44-OS3.4]
(3)	[F81-OH1.2]
6.3.2.9. Supply, Return, Intake and Exhaust Air Openings	
(1)	[F30-OS3.1]
	[F81-OH1.2]
(2)	[F81-OH1.1]
	[F81,F44-OS3.4]
	[F41,F44-OH1.1]
(3)	[F44,F81-OH1.1]
	[F44,F81-OS3.4]
(4)	[F81-OH1.1]
(5)	[F82,F81-OH1.1]
	[F82-OS3.4]
6.3.2.10. Exhaust Ducts and Outlets	
(1)	[F44-OH1.1]
(2)	[F44-OH1.1]

(3)	[F81-OH1.1]
	[F81-OH1.2]
(4)	[F81-OH1.1]
	[F81-OH1.2]
(5)	[F81-OH1.1]
(6)	[F81-OH1.1]
(7)	[F81-OS1.1]
(8)	[F52-OH1.1]
	[F01-OS1.1]
	[F01-OP1.1]
(9)	[F52-OH1.1]
(10)	[F81-OH1.1]
(11)	[F81,F44-OH1.1]
	[F81,F44-OS1.1]
(12)	[F81,F44-OH1.1]
(13)	[F81-OH1.2]
	[F81,F44-OH1.1]
6.3.2.11. Return-Air System	
(3)	[F10-OS1.5]
6.3.2.12. Underground Ducts	
(1)	(a) [F44,F81-OH1.2,OH1.3]
	(b) [F44,F81-OH1.1]
	(c) [F44,F81-OH1.1]
(2)	[F81-OH1.1,OH1.2,OH1.3]
6.3.2.13. Filters	
(1)	[F80-OS1.1]
	[F80-OP1.1]
(2)	[F30-OS3.3]
	[F81,F43-OH1.1]
6.3.2.14. Cleaning Devices	
(1)	[F40,F50-OH1.1]
(2)	[F40,F43,F44,F50-OH1.1]
	[F44-OS3.4]
6.3.2.15. Evaporative Heat Rejection Systems	
(1)	[F40,F41,F50-OH1.1]
(2)	[F40,F41,F50-OH1.1]

(3)	[F40,F41,F50-OH1.1]
(4)	[F40,F41,F50-OH1.1]
(5)	[F40,F41-OH1.1]
(6)	[F40,F41-OH1.1]
(7)	[F40,F41-OH1.1]
(8)	[F46-OH2.2]
(9)	[F41,F44-OH1.1]
(10)	[F46,F81-OH2.1]
(11)	[F40,F41,F50,F82-OH1.1]
	[F82-OS3.1]
6.3.2.16. Evaporative Air Coolers, Misters, Atomizers, Air Washers and Humidifiers	
(1)	[F44,F50-OH1.1]
(2)	[F40,F41,F50-OH1.1]
(3)	[F40,F41,F50-OH1.1]
(4)	[F40,F41,F50-OH1.1]
	[F40,F41,F50,F82-OH1.1]
(5)	[F40,F41,F50-OH1.1]
(6)	[F46-OH2.2]
6.3.2.17. Fans and Associated Air-Handling Equipment	
(1)	[F81,F44-OH1.1]
	[F81,F44-OS3.4]
(2)	[F81-OH1.1]
6.3.3.1. Requirement for Venting	
(2)	[F40,F44,F50-OH1.1]
6.3.3.2. Masonry or Concrete Chimneys	
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.3.3.3. Metal Smoke Stacks	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.3.3.4. Access Ladders	
(1)	[F20,F80-OS3.1]
(2)	[F30-OS3.1]
6.3.4.2. General Ventilation	
(1)	[F01-OS1.1]

	[F01-OP1.1]
	[F02-OP1.2]
	[F02-OS1.2] [F81,F82-OS1.1]
(2)	[F11,F81-OS1.1]
6.3.4.3. Enclosure Exhaust Ventilation	
(1)	(a),(c),(d) [F01-OS1.1]
	(b) [F02-OP1.2]
	(e) [F12-OP1.1,OP1.2]
	(a) [F02-OP1.2]
	(b) [F02-OS1.2] [F81-OS1.1]
	(e) [F12-OS1.1,OS1.2]
	(a) [F02-OS1.2]
	(a) [F01-OS1.1]
6.3.4.4. Enclosure Construction	
(1)	(a) [F02-OS1.2] Applies to portion of By-law text: "… be constructed of *noncombustible* materials …"
	(b) [F02-OP1.2]
	(a) [F02-OP1.2] Applies to portion of By-law text: "… be constructed of *noncombustible* materials …"
	(a) [F80-OS3.4] Applies to portion of By-law text: "… be constructed of … materials … chemically resistant to the dangerous goods vapours and particles being exhausted …"
	(b) [F02-OS1.2] [F82-OS1.1]
	(a) [F80-OS1.1] Applies to portion of By-law text: "… be constructed of … materials … chemically resistant to the dangerous goods vapours and particles being exhausted …"
	(a) [F01-OS1.1] Applies to portion of By-law text: "… be constructed of … materials compatible with … the dangerous goods vapours and particles being exhausted …"
(3)	[F02-OS1.2]
	[F02-OP1.2]
6.4.1.2. Appliances Installed Outside the Building	
(1)	[F81-OP1.1]
	[F81-OH1.1]
	[F81-OS1.1]
6.4.2.1. Clearances	
(1)	[F01-OP1.1]
	[F01-OS1.1]
6.4.3.1. Lining or Backing	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]

6.5.1.1. Insulation and Coverings	
(2)	[F20,F30-OS3.2,OS3.4]
(3)	[F31-OS3.2]
6.6.1.1. Cooling Units	
(1)	[F43,F81-OS3.4]
6.7.1.1. Piping Materials and Installation	
(1)	[F20-OS3.2,OS3.4]
(2)	[F21-OH1.1]
(3)	[F20-OS2.2]
6.7.1.2. Clearances	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.7.1.3. Surface Temperature	
(1)	[F31-OS3.2]
6.7.1.4. Protection	
(1)	[F01-OS1.1]
	[F01-OP1.1]
6.7.2.1. Storage Bins	
(1)	[F30,F31,F43-OS3.2,OS3.4]
(2)	[F01-OS1.1]
	[F01-OP1.1]
6.8.1.1. Access Openings	
(1)	[F36-OS3.6]
6.8.1.2. Openings in Air Duct Systems	
(1)	[F81-OH1.1,OH1.2]
	[F81,F44-OS3.4]
(2)	[F82-OS1.1]
6.8.1.3. Odour Removal Equipment	
(1)	[F82-OH1.1]
(2)	[F82-OH1.1]
6.9.1.2. Hazardous Gases, Dusts or Liquids	
(1)	[F01-OP1.1]
	[F01-OS1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]

6.9.1.3. Commercial Cooking Equipment	
(1)	[F02,F81-OS1.2]
	[F02,F81-OP1.2]
6.9.3.1. Carbon Monoxide Alarms	
(2)	(a),(b),(d) [F44-OS3.4] (c) [F81-OS3.4]
(3)	[F44-OS3.4]
(4)	[F44-OS3.4]
(5)	[F44-OS3.4]
6.9.4.1. Ash Storage Bins	
(1)	[F01-OS1.1]
	[F01-OP1.1]
(2)	[F01-OS1.1]
	[F01-OP1.1]

Notes to Table 6.10.1.1.:
(1) See Parts 2 and 3 of Division A.

Notes to Part 6
Heating, Ventilating and Air-conditioning

A-6.2.1.1. Good Engineering Practice.

Building Pressurization

New buildings tend to be considerably more airtight than older ones. Consequently, these buildings may have a reduced pressurization requirement compared to the normal requirement in order to limit drafts and provide a reasonable level of comfort.

The humidification and relative pressurization of buildings and individual spaces in buildings can be significant factors in compromising the ongoing performance of the building envelope and other environmental separators.

In new construction, HVAC designers should take this issue into consideration and confer with those responsible for the design of the environmental separators so as to limit unintended effects on the environmental separators. In existing buildings, the ability of the environmental separators to resist or accommodate increases in pressure differential or moisture loading should be considered before changes are made to the HVAC system.

Legionella Control

HVAC designers should either develop a water management plan or complete a formal risk and hazard assessment to determine what measures are required for the control of legionella. The risk and hazard assessment should include inspections of the building and its surroundings to locate potential sources of legionella and to identify equipment or systems that could promote the growth and spread of legionella. The assessment should also evaluate the risk to building occupants that is associated with any identified equipment or systems, taking into account their design, location and operating conditions.

Further information on minimizing the growth and spread of legionella can be found in the following publications:

- ANSI/ASHRAE 188-2018, “Legionellosis: Risk Management for Building Water Systems,”
- “Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings” (U.S. Centers for Disease Control and Prevention, 2017),
- “Legionella and Legionnaires' Disease: A Policy Overview” (European Agency for Safety and Health at Work, 2011),
- “Legionella and the Prevention of Legionellosis” (World Health Organization, 2007),
- “Legionnaires' Disease: Technical Guidance: Part 1: The Control of Legionella Bacteria in Evaporative Cooling Systems, and Part 3: The Control of Legionella Bacteria in Other Risk Systems” (U.K. Health and Safety Executive, 2013), and
- “Recognition, Evaluation and Control of Legionella in Building Water Systems” (American Industrial Hygiene Association, 2020).

Radon Control

Measures may be necessary to reduce the radon concentration to a level below the guideline specified by Health Canada.

Further information on reducing the indoor concentration of radon can be found in the following Health Canada publications:

- “Guide for Radon Measurements in Public Buildings (Schools, Hospitals, Care Facilities, Detention Centres),” and
- “Radon: A Guide for Canadian Homeowners.”

A-6.2.1.2.(1) Outdoor Design Conditions. In the past, the practice of ventilating buildings with outdoor air assumed that the outdoor air was of better quality than the indoor air. It has become evident that the outdoor air in some areas of Canada may not be of an acceptable quality for ventilating buildings unless certain particles and gases are first removed or reduced. In order to manage the air quality of a building’s indoor environment, thus reducing the potential for adverse effects on occupants’ health, the quality of outdoor air for building ventilation purposes must be addressed.

A-6.2.1.4. Structural Movement. This Article is intended to remind designers and installers of mechanical systems of one aspect of the "good engineering practice" referred to in Article 6.2.1.1.

In determining how to accommodate structural movement, there are two important principles to bear in mind:

- The prime concern of the Building By-law is the safety of people in and around the building, as opposed to protection of the mechanical systems and equipment.

- The nature of the accommodation will vary with the type of movement being considered, taking into account particularly how often the movement is likely to be encountered over the life of the building.

For example, a gas line supported on columns that also support a crane must be installed in such a way that the movement of the columns, which occurs many times daily, does not cause the lines to break, thus creating a hazard. Even if the gas line installation could somehow be designed to break in a non-hazardous manner, it would hardly be recognized as good engineering practice if movement that occurs so frequently could disrupt the operation of the mechanical system.

On the other hand, earthquakes occur far less frequently and it would not be surprising to have a non-critical mechanical system fail as a result of an earthquake. However, even in this situation, the failure must occur in a manner that does not create a hazard to building occupants. For example, heavy mechanical equipment should be properly anchored so that it does not topple on building occupants during an earthquake. The design of the anchors should take into account accelerations consistent with the seismic data given in Appendix C for the location of the building. Part 4 provides guidance on the calculation of the loads such equipment would exert on the building structure during an earthquake; these same loads can be used in designing the anchors.

Some mechanical equipment can be an important component of post-disaster life safety systems. In these cases, the measures needed to accommodate the movements caused by an earthquake become even more critical since failure of the equipment would not be acceptable.

Clearly, complying with this requirement will, in most cases, necessitate close coordination between the mechanical designer and the structural designer.

For additional information on the types of structural movement that may be encountered, see Article 4.1.3.5., Sentence 4.1.3.3.(2) and Subsection 4.1.8.

A-6.2.1.6.(1) Installation – General. Ducts or pipes without dampers or valves are generally not considered to constitute "equipment" and are therefore not subject to this requirement.

A-6.3.1.1.(5) Ventilation Air Supplied to Suites. The indirect supply of required outdoor ventilation air to normally occupied spaces through corridor pressurization or other indirect systems is not permitted.

A-6.3.1.2.(1) Ventilation and Venting of Crawl Spaces and Attic or Roof Spaces. The cross-reference to Part 5 pertains to unconditioned and unoccupied crawl spaces, and attic or roof spaces, which are effectively within the building envelope. That is, unconditioned and unoccupied attic or roof spaces are located between the roof deck and roofing above, and the insulation, air barrier system and vapour barrier below. Unconditioned and unoccupied crawl spaces are located between the ground cover below and the insulation, air barrier system and vapour barrier above. Venting of these spaces has implications for the performance of the building envelope rather than having direct effects on indoor conditions. The ventilation of conditioned or occupied crawl spaces and attic or roof spaces must comply with Part 6.

The requirements in Part 5 are stated in terms of loads that must be resisted rather than in terms of building elements. Thus, the By-law user will not find explicit references in Part 5 to crawl spaces, or attic or roof spaces. Part 5 makes reference to the need for venting environmental separators, i.e., the dissipation of heat or moisture.

Sentence 6.3.1.2.(1) requires that crawl spaces be ventilated either by natural (above-grade only) or mechanical means. High moisture levels within the crawl space can lead to problems such as the formation of mould, lifting of flooring or long-term damage to structural components.

Crawl space ventilation cannot be expected to correct moisture-related problems caused by other factors like inadequate surface drainage from the foundation walls or improper protection against moisture from the ground. These conditions must be properly addressed so that crawl space ventilation can meet its intended objectives.

Several factors favour the use of mechanical ventilation rather than reliance on natural drafts. Local conditions, such as areas with high water tables, may dictate the need for mechanical ventilation to remove excessive moisture.

Crawl spaces should be maintained at a negative pressure relative to the conditioned area above to prevent the migration of moisture into occupied areas. This can be achieved through the use of an exhaust fan and relying on air transfer through floor penetrations, such as pipes.

A-6.3.1.3.(1) Storage Garages. Car dealership showrooms are not considered as storage garages.

A-6.3.1.3.(2) Ventilation of Storage Garages. Storage garages are ventilated to protect occupants from exposure to carbon monoxide and other vehicular exhaust fumes. In certain cases, such as small two- or three-bay storage garages that are used for occasional vehicle storage, and where occupants are not present, carbon monoxide or nitrogen dioxide monitoring devices may be omitted if the ventilation system is interlocked with a local light switch or other controls to ensure continuous system operation whenever the area is occupied. In any event, the ventilation system capacity must be designed to limit the concentrations of carbon monoxide or nitrogen dioxide at or below the prescribed values.

A-6.3.1.5. Indoor Air Contaminants.

Contaminants of Concern

Indoor air can contain complex mixtures of contaminants of concern such as formaldehyde, legionella, mould and emissions from building materials. While some contaminants may be knowingly introduced—as in the case of processing and manufacturing environments—others may be unintentionally released into indoor environments. "Industrial Ventilation: A Manual of Recommended Practice for Design," published by the ACGIH, and the "Exposure Guidelines for Residential Indoor Air Quality," published by Health Canada, are useful references on the control of contaminants in industrial workplace environments and residential settings, respectively. These and other guidelines and manuals should be interpreted while keeping in mind the settings and purposes for which they were developed compared to those to which they will be applied. Note that such documents do not necessarily consider the interactions between various contaminants.

Minimizing the Growth and Spread of Bio-contaminants

Bio-contaminants, such as bacteria, mould, mildew, fungi, viruses, and pollen, can thrive in or be spread by sources like drain pans, spray-water air-washers, contaminated filters, poorly maintained cooling coils, water incursion into ductwork, high humidity and stagnant water, potentially causing a wide range of adverse health effects including respiratory allergic reactions, asthma, and diseases ranging from influenza to legionellosis.

Some of the control measures are as follows:

(a) Air-handling equipment should be accessible for the maintenance of filters, cooling coils and condensate drain pans located below the cooling coils. Access doors should be large and easy to open to facilitate thorough and regular maintenance.

(b) If moisture is added to building ventilation air to maintain humidity levels in a designated range, humidifiers that inject steam or water vapour into central air-handling units or main supply ducts are normally used. Injection nozzles should not be located in air-handling unit plenums or ductwork that is insulated with internal fibrous lining. If the lining becomes wet, conditions conducive to the growth and spread of bio-contaminants will result.

(c) HVAC systems that generate condensate or introduce liquid water into the airstream in the ducts require adequate drainage of excess water and, in some cases, a means of capturing air-entrained water droplets. These measures reduce the potential for bio-contaminants, including legionella, to proliferate in stagnant water and for water droplets containing bio-contaminants to be introduced into the airstream and contaminate the indoor environment. (See also Article 6.3.2.2.)

The above only addresses built-in features of an HVAC system that can help to minimize the growth and spread of bio-contaminants. Even more important than the built-in features is a program of regular maintenance and cleaning of those portions of the system where such growth is likely to occur.

A-6.3.1.6.(2) Commercial Cooking Equipment. Refer to the City of Vancouver's Kitchen Ventilation Guidelines for further information. Included is information on Design Considerations for Development Permit, Vancouver Coastal Health policy, checklists for inspections, and requirements for maintenance. This guideline is available on the City of Vancouver website.

A-6.3.1.6.(3) Commercial Cooking Equipment. The termination is also to be designed to the satisfaction of the Director of Planning. Where there is a canopy or awning, the discharge should be located above the canopy or awning. The exhaust and make-up air locations should be determined respectful of existing discharge, make-up air, operable window, and door locations of neighbouring properties. In some cases, the Director of Planning may not approve exhaust or make-up air wall terminations on street frontages. Wall terminations should be located where they have the least impact on nearby properties, suites, amenity

areas, the public realm, windows, and building design. Generally, roof terminations are preferred and wall terminations should be located in the lane.

A-6.3.1.6.(4) Ecologizers and Alternative Technologies. It is not the intention of the Article 6.3.1.6.(2) to prohibit technologies other than ecologizers. Other technologies that are capable of demonstrating an equivalent or better level of performance to devices listed to ULC-S647, "Standard for Exhaust Cleaning and Recirculation Assemblies for Commercial and Institutional Kitchen Exhaust Systems," may be permitted at the discretion of the *Chief Building Official* provided that an acceptable technical demonstration of performance has been provided as part of a building permit submission. Such devices must also comply with all applicable metro Vancouver regulations related to air emissions, odour, and low level ozone.

A-6.3.2.2. Stagnant Water in Drain Pans. It is important to eliminate stagnant water as it can promote the proliferation of disease-causing micro-organisms, such as legionella.

Of particular concern is the potential for legionella bacteria in water to become airborne in water droplets or mist that can be inhaled by humans or can contaminate other water sources or systems.

A-6.3.2.5. Duct Coverings and Linings. The TIAC "Mechanical Insulation Best Practices Guide" is a comprehensive source of information on the selection, installation and proper use of thermal insulation materials. (Note that Section 4 of this Guide is not included in the scope of this Note as it contains information on proprietary products, which are not within the mandate of the Code.)

A-6.3.2.10.(5) and (6) Exhausting to Garages. A frequent practice in the design of ventilation systems serving buildings which have associated parking garages is to discharge exhaust air from the building to the garage in order to reduce the cost of heating the garage or reduce the length of the exhaust ducts. However, this practice entails a certain amount of risk since, when the exhaust system is not running, stack effect may turn the exhaust outlets into intakes and exhaust fumes (including carbon monoxide) can be drawn from the garage into the building. Incorporating a backdraft damper at the exhaust outlet provides some additional protection but backdraft dampers are generally not regarded as being very reliable. Therefore this practice is only permitted in very limited circumstances.

A-6.3.2.10.(6)(b) Air Contaminants. For the purpose of Clause 6.3.2.10.(6)(b), washroom exhaust air is not considered to contain contaminants that would adversely affect the air quality in the storage garage.

A-6.3.2.10.(7) and (8) Exhaust Ducts Connected to Laundry-Drying Equipment. Clothes dryers are a major cause of fires in buildings often due to a build-up of lint in the system, which then ignites or obstructs the venting or ventilation. Proper cleaning and regular maintenance of lint traps is directly proportional to the ease of access to the lint traps. It is therefore important to ensure that lint traps in multiple installations of laundry-drying equipment are installed in such a way as to allow easy access for inspection, maintenance, repair and cleaning.

A-6.3.2.10.(12)(b) Operation Diversity Factor. The operation diversity factor has to be assessed for each specific application. Good engineering practice (see Article 6.2.1.1.) design guidelines can provide information on the subject. Figure A-6.3.2.10.(12)(b), which originates from ASHRAE handbooks, provides an example of factors that can be used for general applications.

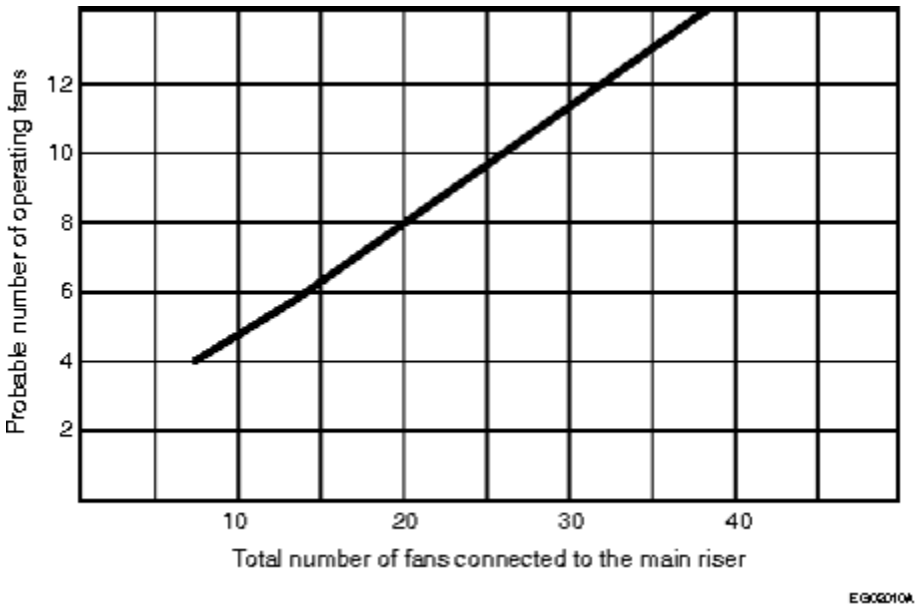


Figure A-6.3.2.10.(12)(b)

Operation diversity factor

A-6.3.2.15.(5) and (6) Minimum Distances. Ensuring adequate distance between the air discharge locations of evaporative heat rejection systems and certain outdoor spaces and building components minimizes the potential for contamination of the air of occupiable spaces. For example, if a building's ventilation air intake were located too close to an air discharge location of an evaporative heat rejection system, warm discharge air and associated drift, which could contain biological contaminants, could be introduced to the indoor environment through the air intake.

The minimum distances stated in Sentences 6.3.2.15.(5) and (6) may need to be increased where warranted by local conditions such as prevailing winds, adjacent structures, or special processes being carried out, any of which would make further analysis necessary. (See also Sentence 6.3.3.1.(2).)

A-6.3.2.15.(8) and (9) Assessment of System and Make-Up Water. The chemical characteristics of the water in the evaporative heat rejection system and of the make-up water should be assessed to select a suitable water treatment system.

A-6.3.2.16.(2) Prevention of Water Stagnation. Common strategies to prevent water stagnation include flushing, providing an inactivity drain, and periodic activation, even with no load.

A-6.3.2.16.(6) Assessment of Make-Up Water. The chemical characteristics of the make-up water should be assessed to ensure that any chemicals added to a system referred to in Sentence 6.3.2.16.(1) for precipitation control, disinfection or another purpose will not adversely affect the system.

A-6.3.3.1.(2) Requirement for Venting. Sentence 6.3.3.1.(2) requires that vented products of combustion from appliances be discharged a minimum distance away from certain outdoor spaces and building components in cases where the vented products could contaminate the air of occupiable spaces. These minimum distances may need to be increased due to local conditions such as prevailing winds, adjacent structures, special processes being carried out, specific contaminants or effluent discharges, all of which would require further analysis.

“Occupiable outdoor spaces” refers to areas that could be occupied for a duration of more than fifteen minutes at any time, but does not include maintenance spaces. Occupiable outdoor spaces are located adjacent to an indoor space and are considered to be an extension of this indoor space: e.g. main entries, balconies, patios, decks, green roofs and other public assembly areas. Although sidewalks and driveways are mentioned in the provision, these areas are not considered as occupiable outdoor spaces since they are used as transport routes to and from the building, and people are not expected to remain there for extended periods of time.

The requirements of Sentence 6.3.3.1.(2) are not meant to override similar requirements found in the installation standards referenced in Article 6.2.1.5. that address identical situations.

A-6.5.1.1.(3) Temperature of Exposed Piping. Piping carrying steam, high-temperature hot water, or another heat transfer fluid at high temperature is usually insulated to reduce heat losses as an economy measure. Above a temperature of approximately 52°C, however, a bare pipe can cause a burn to human skin coming in contact with the pipe. According to ASTM C1055, "Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries," skin can be in contact with a surface at a temperature of 52°C for up to 60 s without experiencing irreversible damage. If pipes above this temperature are normally out of reach of all persons other than maintenance personnel or are properly guarded, it would be expected that no insulation would be needed for public safety.

A-6.9.1.2.(1) NFPA Publications Pertaining to the Heating, Ventilating and Air-Conditioning of Spaces Containing Hazardous Gases, Dusts or Liquids.

NFPA 30, "Flammable and Combustible Liquids Code"

NFPA 30A, "Code for Motor Fuel Dispensing Facilities and Repair Garages"

NFPA 32, "Standard for Drycleaning Facilities"

NFPA 33, "Standard for Spray Application Using Flammable or Combustible Materials"

NFPA 34, "Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids"

NFPA 35, "Standard for Manufacture of Organic Coatings"

NFPA 36, "Standard for Solvent Extraction Plants"

NFPA 40, "Standard for the Storage and Handling of Cellulose Nitrate Film"

NFPA 51, "Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes"

NFPA 51A, "Standard for Acetylene Cylinder Charging Plants"

NFPA 55, "Compressed Gases and Cryogenic Fluids Code"

NFPA 61, "Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities"

NFPA 68, "Standard on Explosion Protection by Deflagration Venting"

NFPA 69, "Standard on Explosion Prevention Systems"

NFPA 85, "Boiler and Combustion Systems Hazards Code"

NFPA 86, "Standard for Ovens and Furnaces"

NFPA 88A, "Standard for Parking Structures"

NFPA 91, "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids"

NFPA 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations"

NFPA 204, "Standard for Smoke and Heat Venting"

NFPA 303, "Fire Protection Standard for Marinas and Boatyards"

NFPA 307, "Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves"

NFPA 409, "Standard on Aircraft Hangars"

NFPA 415, "Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways"

NFPA 484, "Standard for Combustible Metals"

NFPA 654, "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids"

NFPA 655, "Standard for Prevention of Sulfur Fires and Explosions"

NFPA 664, “Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities”

NFPA “Fire Protection Guide to Hazardous Materials”

A-6.9.3.1.(2)(c) Carbon Monoxide Alarms. Battery-powered carbon monoxide alarms are acceptable provided that they are installed as recommended by the manufacturer.

A-6.9.3.1.(6) Carbon Monoxide Devices. Although the scope of CAN/CSA-6.19, “Residential Carbon Monoxide Alarming Devices,” and UL 2034, “Standard for Single and Multiple Station Carbon Monoxide Alarms,” is limited to carbon monoxide alarms for residential applications, their use may be appropriate in some other locations where they are not subject to excessive contaminants or risk of damage, such as in classrooms and meeting spaces. The designer is also given the option to follow good engineering practice. For example, some carbon monoxide devices used in storage garages may be suitable for use in other applications.

A-6.9.3.1.(7) Spaces Served by a Fuel-Burning Appliance. Where a fuel-burning appliance such as a furnace circulates or distributes air to a space there is the potential for leakage of combustion products into the duct system which could then circulate combustion products including carbon monoxide (CO) to that space, so a CO alarm is required to protect occupants of that space. Fuel-burning appliances such as a boiler do not have the same potential of the system circulating or distributing CO to the spaces served via the piping system. In both examples of a fuel-burning furnace and a fuel-burning boiler, a CO alarm is required in the service room containing the appliances.

A-6.9.3.1.(8) Adjacent Suites. Suites that share a common attic or crawl space with a storage garage or service room, as well as suites that share a common wall or floor/ceiling assembly with a storage garage or service room are considered adjacent for the application of Sentence (8).

Part 7
Plumbing Services

Section 7.1. General

7.1.1. Scope

7.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

7.1.1.2. Application

1) This Part applies to the design, construction, extension, *alteration*, renewal or repair of *plumbing systems*.

7.1.2. Design and Installation

7.1.2.1. Conformance

1) Every *plumbing system* shall be designed and installed in conformance with the Vancouver Building By-law Book II (Plumbing Systems), that being the National Plumbing Code of Canada as amended by Subsection 7.1.5.

2) References to the following documents in the Vancouver Building By-law Book II (Plumbing Systems) shall be replaced as follows:

a) references to the National Building Code of Canada and the National Energy Code of Canada for Buildings shall be replaced with the Vancouver Building By-law, and

b) references to the National Fire Code of Canada shall be replaced with the Vancouver Fire By-law.

3) Compliance with the Vancouver Building By-law Book II (Plumbing Systems) may be achieved using alternative solutions as described in Clause 1.2.1.1.(1)(b) of Division A of this By-law, using the objectives and functional statements attributed to the applicable acceptable solutions in Division B of the Vancouver Building By-law Book II (Plumbing Systems).

7.1.3. Required Facilities

7.1.3.1. All Buildings Except Dwelling Units

1) *Buildings* shall be equipped with plumbing facilities as required in Subsection 3.7.2. and Article 3.8.2.8.

7.1.3.2. Dwelling Units

1) *Dwelling units* shall be equipped with plumbing facilities as required in Section 9.31.

7.1.4. Definitions

7.1.4.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

7.1.5. Unique to Vancouver Requirements

7.1.5.1. Division A

1) The provisions of Part 1 of Division A of the 2020 National Plumbing Code shall be amended by

a) striking out Subsection 1.2.1. and substituting:

"1.2.1. Compliance with this By-law

1.2.1.1. Compliance with this By-law

1) Compliance with this By-law shall be achieved by

a) complying with the applicable acceptable solutions in Division B (see Note A-1.2.1.1.(1)(a)), or

b) except as required by Sentence (3), using alternative solutions, *accepted* by the *Chief Building Official* under Section 2.3 of Division C, that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Note A-1.2.1.1.(1)(b)).

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2) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.

3) An alternative solution shall not be used in place of an acceptable solution if the acceptable solution expressly requires conformance to a provincial enactment other than Book I (General) or Book II (Plumbing Systems) of the Vancouver Building By-law.

1.2.1.2. Responsibility of Owner

(Refer to Book I (General) of this By-law.) ",

b) adding a new Subsection 1.2.3.:

"1.2.3. Installation of Plumbing Systems

(Refer to Book I (General) of this By-law.)",

c) striking out Article 1.3.4.1. and substituting:

"1.3.4.1. Application of Parts 1, 2 and 3

1) Parts 1, 2 and 3 of Division C apply to all *plumbing systems* covered in this By-law. (See Article 1.1.1.1.) ",

d) in Sentence 1.4.1.2.(1),

i) striking out the defined term for "*Building**" and substituting:

"***Building**** means any structure used or intended for supporting or sheltering any use or *occupancy*, including any *float home* or *marina* and any retaining structures greater than 1.2 m in height.", and

ii) adding the following defined terms in alphabetical order:

"***Acceptable**** means acceptable to the *Chief Building Official*. ",

"***Accredited laboratory*** means a laboratory approved by the BC Provincial Health Officer for drinking water microbiology testing. ",

"***Alert*** means a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof. ",

"***Alternate water source system*** means a system designed to collect, treat, and use non-*potable* water from alternate water sources in lieu of *potable* water, but excludes a system in a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*, and excludes the use of rain barrels of up to a cumulative capacity of 500 L. ",

"***Blackwater*** means waste water from water closets, urinals and other sanitary fixtures designed for carrying human waste, kitchen sinks, utility sinks, medical sinks, laboratory sinks, and industrial processes, but does not include *clear-water waste*. ",

"***Bottle trap*** means a *trap* that retains water in a closed chamber and that seals the water by submerging the inlet pipe in the liquids or by a partition submerged in the liquids. ",

"***Chief Building Official**** means the *City Building Inspector*, and any person authorized to act on behalf of the *City Building Inspector*. ",

"***City**** means the City of Vancouver.",

"***City Building Inspector**** means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter.",

"***City Engineer**** means the person appointed as such by City Council pursuant to the provisions of the Vancouver Charter. ",

"***Cooling tower*** means a direct (open circuit) cooling tower, indirect (closed circuit) cooling tower, evaporative condenser, adiabatic cooler which recirculates non-evaporated water, or fluid cooler that is part of a recirculated *water system* incorporated into a

building's cooling, industrial process, refrigeration, or energy production system, and may comprise one or more cooling tower cells. (See Note A-1.4.1.2.(1).) ",

"***Decorative water feature*** means a human-made fountain, waterfall, cascade, spray or the like that uses water for architectural, decorative or aesthetic effects, is not intended for human contact, and is located indoors or outdoors, but excludes a fish pond, natural body of water, natural waterfall, a feature in or associated with a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*, or a regulated activity under the BC Pool Regulation. (See Note A-1.4.1.2.(1).)",

"***E. coli*** means *Escherichia coli*.",

"***Emergency once through cooling equipment**** means *once through cooling equipment* that is not normally operated and is only activated in the event of a sudden, unforeseen failure of an otherwise properly designed, operated and maintained primary cooling system.",

"***Existing building**** means a *building* lawfully constructed and completed under a permit before submission of the current *permit* application.",

"***Float home**** means any structure incorporating a floatation system, intended for use or *occupancy* or being used or occupied for residential purposes, containing one *dwelling unit* only, and not primarily intended for, or useable in, navigation, but does not include any *water craft* designed or intended for navigation.",

"***Greywater*** means waste water from all sources except *blackwater* and *clear-water waste*.",

"***Groundwater**** means a free standing body of water in the ground.",

"***Groundwater protection area**** means those lands in the *City* which are located in the areas shown shaded on the map attached to this By-law as Diagram C. (See Book I, Division A, Figure A-1.4.1.2.(1)-F for Diagram C: groundwater Protection Area.) #14603

"***Maintenance once through cooling equipment**** means *once through cooling equipment* that is not normally operated and is only activated to temporarily supplement or replace the primary cooling system during scheduled maintenance on the primary cooling system. ",

"***Marina**** means any structure or installation, including marina walkways, which provides moorage space for *water craft.*",

"***Once through cooling equipment**** means equipment that produces a cooling effect by transfer of heat to water that is only circulated once through the equipment and is then discharged, and includes but is not limited to commercial and industrial air conditioners, refrigerators, freezers, coolers and ice machines. ",

"***Operating permit**** means permission or authorization in writing by the *Chief Building Official* to install or retain existing equipment or systems for which an operating permit is required under this By-law.",

"***Owner**** means a registered owner, a holder of an agreement for sale and purchase and, in the case of Crown-owned lands, owner shall mean the occupier.",

"***Perimeter drainage water*** means water collected from the *foundation* of a structure.",

"***Permit**** means permission or authorization in writing by the *Chief Building Official* to perform work regulated by this By-law and, in the case of an *occupancy permit*, to occupy any *building* or part thereof, but does not include an *operating permit*.",

"***Press-connect*** means a permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion resistant grip ring, with the joint made with a pressing tool and jaw or ring that complies with the manufacturer's installation instructions.",

"***Public low pressure sewer system*** means a public sewer in which gravity is insufficient to convey waste water and organic refuse, and pumps on private property are used to provide such force.",

"***Rainwater*** means rainfall and other natural precipitation, and includes *storm water*.",

"***Residential occupancy**** (Group C) means the *occupancy* or use of a *building* or part thereof by persons for whom sleeping accommodation is provided but who are not harboured for the purpose of receiving care or treatment and are not involuntarily detained.",

"***Subsurface investigation**** means the appraisal of the general subsurface conditions at a *building* site by analysis of information gained by such methods as geological surveys, in situ testing, sampling, visual inspection, laboratory testing of samples of the subsurface materials and groundwater observations and measurements.", and #14488

"***Water craft**** means any boat, hull, barge, or houseboat which is afloat, whether self-propelled or not, and includes pleasure and commercial craft.",

e) in Sentence 1.4.2.1.(1), adding the following abbreviations in alphabetical order:

"**CFU** colony forming unit(s)",

"**IDF** Intensity-Duration-Frequency",

"**MPN** most probable number", and

"**NTU** nephelometric turbidity unit(s)", and

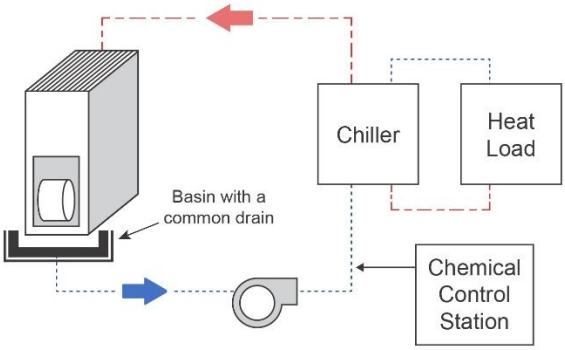
f) in Note A-1.4.1.2.(1), adding the following in alphabetical order:

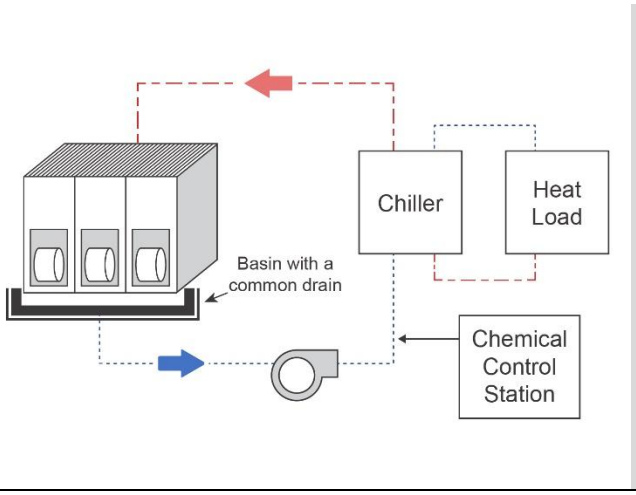
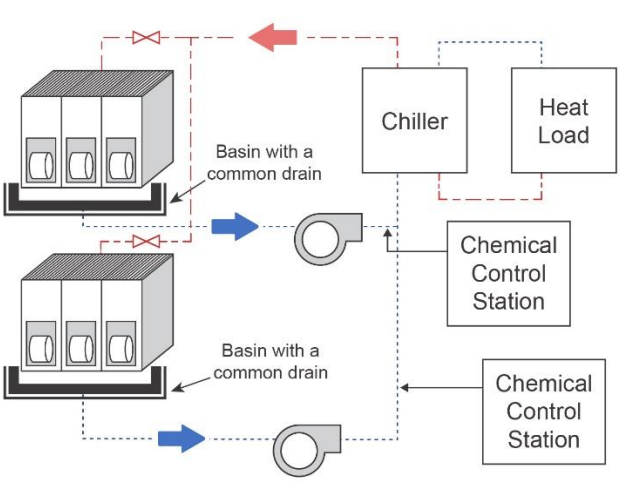
"**Cooling Tower** From a Legionnaires' disease prevention perspective, the fluid flow of interest is the water sprayed, evaporated, collected and recirculated within a *cooling tower* (the so-called "external circuit"). It is this water that requires appropriate treatment to keep *Legionella pneumophila* levels controlled.

For a *cooling tower* with multiple cells, if all of the cells share the same basin and the same recirculated water, the whole unit can be considered one *cooling tower*. See sample mechanical configurations in Table A-1.4.1.2.(1). However, as a cautionary note for large systems, even with the same water flowing to all parts, it has been found by New York City's Department of Health and Mental Hygiene that different locations within the same *cooling tower* can test positive and others can test negative for *Legionella pneumophila*.

For buildings with multiple cooling tower structures, in certain, rare configurations, and at the sole discretion of the *Chief Building Official*, it may be determined that the multiple cooling tower structures can be considered as one *cooling tower* for the purpose of this defined term. To be considered as one *cooling tower*, the recirculating water loops of the multiple cooling tower structures must share the same recirculated water and treatment and the recirculating loops must always operate together. The *Chief Building Official* must be satisfied with the equipment owner's reasoning and supporting evidence that there is a reasonable basis to presume that the water quality should be identical at all times across the multiple cooling tower structures. This assessment would consider the location, size, condition and mechanical configuration of the cooling towers, including valves and pipes; differences in exposure to sunshine, heat sources, neighbouring buildings, potential pollution sources, and mechanical equipment, such as exhaust fans; the control system and operational philosophy for the cooling towers; water quality data and compliance history; and maintenance records.

Table A-1.4.1.2.(1)
Examples of Cooling Tower Configurations and Operating Permit Requirements
Forming Part of Note A-1.4.1.2.(1)

Number of Cells	Number of Operating Permits	Mechanical and Plumbing Configuration
1	1	

3	1	
6	2	

", and

"**Decorative Water Feature** A living or green wall is not considered a *decorative water feature*, but should be reviewed to identify hazards and to establish procedures to reduce risks. To preclude the growth of *Legionella*, consideration should be given to including non-chemical water treatment (such as UV), maintaining water temperature below 20°C, and removing organic matter from the water. Water flow should be behind the plant material and airflow should be directed toward the living wall to minimize aerosolization into the occupied space.".

7.1.5.2. Division B

1) The provisions of Part 1 of Division B of the 2020 National Plumbing Code shall be amended by

a) in Sentence 1.3.1.2.(1), striking out "editions" and substituting "editions or versions",

b) in Table 1.3.1.2., inserting the following rows in alphanumerical order:

"

ANSI/ASHRAE	188-2018	Legionellosis: Risk Management for Building Water Systems	2.2.10.6.(8)

",

“

ASHRAE	Guideline 12-2023	Managing the Risk of Legionellosis Associated with Building Water Systems	A-2.2.11.6.

”,
“

ASME/CSA	A112.4.4-2022/CSA B481.5:22	Grease Removal Devices	2.2.3.2.(3)

”,
“

ASME/CSA	A112.14.3-2022/CSA B481.1:22	Hydromechanical Grease Interceptors	2.2.3.2.(3)

”,
“

ASME/CSA	A112.6.9-2022/CSA B79.9:22	Siphonic Roof Drains	2.3.6.1.(6) 2.4.10.14.(1)

”,
“

ASME	B16.51-2021	Copper and Copper Alloy Press-Connect Pressure Fittings	2.2.7.9.(1)

”,
“

ASPE/ANSI	ASPE/ANSI 45-2018	Siphonic Roof Drainage	2.4.10.14.(1)

”,
“

ASTM	A778/A778M-24	Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products	2.2.6.14.(1)

”,
“

ASTM	D8429-21	Standard Test Method for *Legionella pneumophila* in Water Samples Using Legiolert	2.2.1.7.(2)

”,
“

ASTM	F3226/F3226M-19	Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems	2.2.6.17.(1) 2.2.7.9.(1)

”,

“

BC		Engineers and Geoscientists Act	2.7.6.1.(1)
BC		Heritage Conservation Act	A-2.4.2.5.(9)
BC	B.C. Reg. 133/2022	Contaminated Sites Regulation	A-2.4.2.5.(9)
BC	B.C. Reg. 296/2010	Pool Regulation	1.4.1.2.(1) of Division A

”,

“

CoV		Engineering Design Manual[4]	2.4.2.5.(5) A-2.4.2.5.(5)	#14488
COV		Protection of Trees By-law[4]	A-2.4.2.5.(9)	#14488
CoV		Sewer and Watercourse By-law[4]	2.4.4.2.(1)	
CoV		Standards of Maintenance By-law[4]	A-2.4.2.4.(2)	
CoV		Street and Traffic By-law[4]	A-2.4.2.4.(2)	
CoV		Zoning and Development By-law[4]	2.4.2.5.(1) 2.4.2.5.(2) A-2.4.2.5.(1)	

”,

CSA	CAN/CSA-Z317.13-17	Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities	A-2.2.11.6.(9)

“,

“

”,EPA		ENERGY STAR® Program Requirements Product Specification for Clothes Washers[4]	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements Product Specification for Residential Dishwashers[4]	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements Product Specification for Commercial Dishwashers[4]	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements Product Specification for Automatic Commercial Ice Makers[4]	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements Product Specification for Commercial Steam Cookers[4]	2.2.11.1.(1)
EPA		ENERGY STAR® Program Requirements Product Specification for Commercial Ovens[4]	2.2.11.1.(1)

”,

“

IAPMO		Water Demand Calculator(4)	2.6.3.1.(2) 2.6.3.2.(5) 2.6.3.4.(6) 2.7.6.2.(2)
IAPMO	ANSI/CAN/IAPMO Z1001-2021	Prefabricated Gravity Grease Interceptors	2.2.3.2.(3)
IAPMO	IAPMO/ANSI/CAN Z1117-2022	Standard for Press Connections	2.2.6.17.(1) 2.2.7.9.(1)
ISO	11731:2017	Water Quality — Enumeration of *Legionella*	2.2.1.7.(2)
ISO/IEC	17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories	2.2.1.7.(2)

”,

“

NSF	NSF/ANSI 14-2017	Plastics Piping System Components and Related Materials	2.7.2.1.(2)
NSF	NSF/ANSI 55-2022	Ultraviolet Microbiological Water Treatment Systems	2.2.11.3.(3)
NSF	NSF/ANSI 61-2023	Drinking Water System Components – Health Effects	2.2.6.10.(1) 2.2.6.11.(1) 2.2.6.12.(1) 2.2.6.13.(1) 2.2.6.14.(1) 2.2.6.16.(1) 2.2.6.17.(1)
NSF	NSF/ANSI 350-2023	Onsite Residential and Commercial Water Reuse Treatment Systems	2.7.1.2.(3)

”, and

“

PSPC	MD 15161-2013	Control of *Legionella* in Mechanical Systems	A-2.2.11.6.(8) A-2.2.11.6.(9)

”,

c) in Table 1.3.1.2., deleting the rows associated with

i) ARCSA/ASPE/ANSI 63-2013,

ii) CCBFC NRCC-CONST-56438E,

iii) CSA CAN/CSA-B126.0-13,

iv) CSA CAN/CSA-B126.1-13,

v) CSA/ICC CSA B805-18/ICC 805-2018, and

vi) NSF NSF Pro 151-8-1-95,

d) in Table 1.3.1.2., striking out the “Issuing Agency”, “Document Number” and “Title of Document” associated with the following rows:

i) “CCBFC NRCC-CONST-56435E National Building Code of Canada 2020”, and substituting

“

CoV		Book I (General) of the By-law

”, and

ii) "CCBFC NCC-CONST-56437E National Fire Code of Canada 2020", and substituting

"

CoV		Fire By-law(4)

",

e) in Table 1.3.1.2., striking out the "By-law Reference" associated with:

i) "CSA CAN/CSA-B128.1-06 Design and Installation of Non-Potable Water System", and substituting

"

2.7.2.1.(1) 2.7.4.1.(7) 2.7.5.2.(1)(c) 2.7.8.2.(2)

", and

ii) "CSA CAN/CSA-B483.1-07 Drinking Water Treatment Systems", and substituting "2.2.10.17.(4)",

f) in Table 1.3.1.2., adding to the "Notes to Table 1.3.1.2." the following in numerical order:

"(4) The current version in effect.", and

g) in Sentence 1.3.2.1.(1), inserting the following in alphabetical order:

"**BC** Province of British Columbia (gov.bc.ca)",

"**CoV** City of Vancouver (www.vancouver.ca)",

"**EPA** United States Environmental Protection Agency (www.epa.gov)",

"**IEC** International Electrotechnical Commission (www.iec.ch)",

"**ISO** International Organization for Standardization (www.iso.org)", and

"**PSPC** Public Services and Procurement Canada (www.tpsgc-pwgsc.gc.ca)".

2) The provisions of Part 2 of Division B of the 2020 National Plumbing Code shall be amended by

a) in Section 2.2., adding a new Article 2.2.1.7., Article 2.2.1.8., and Article 2.2.1.9:

"2.2.1.7. Microbiological Testing

1) *E. coli* testing shall be conducted by an *accredited laboratory*.

2) *Legionella pneumophila* testing shall be conducted by a laboratory

a) accredited to ISO/IEC 17025, "General requirements for the competence of testing and calibration laboratories," or equivalent,

b) using a method in accordance with Table 2.2.1.7. to identify all serogroups of *Legionella pneumophila*, and

c) enrolled in a bi-annual external proficiency testing program for recognized approval for identifying *Legionella* in environmental water samples.

Table 2.2.1.7.
Acceptable Laboratory Methods to Test for *Legionella pneumophila*
Forming Part of Sentence 2.2.1.7.(2)

***Legionella pneumophila* Testing Requirement**	**Acceptable Laboratory Method to Test for *Legionella pneumophila***	
	ISO 11731, "Water Quality — Enumeration of *Legionella*," or equivalent	**ASTM D8429, "Standard Test Method for *Legionella pneumophila* in Water Samples Using Legiolert"**
Cooling towers		

System start-up Clause 2.2.11.6.(7)(c)	Yes, acceptable for all *Legionella pneumophila* testing requirements	No
Regular testing Clause 2.2.11.6.(7)(d)		Yes
Re-testing after an exceedance Sentence 2.2.11.6.(8)		No
Decorative water features		
System start-up & annual testing Clauses 2.2.11.7.(7)(c) and (d)		No
Re-testing after an exceedance Sentence 2.2.11.7.(8)		No
Alternate water source systems		
Commissioning Article 2.7.5.2.		No
Regular testing Article 2.7.7.1.		Yes
Re-testing after an exceedance Sentence 2.7.4.1.(5) Sentence 2.7.7.3.(1)		No

4) The owner of a *cooling tower* or *decorative water feature* shall ensure that the laboratory conducting *Legionella pneumophila* testing for the *cooling tower* or *decorative water feature* has agreed to give immediate notice to the owner, the *Chief Building Official*, and the local medical health officer if the result exceeds a standard set out in Table 2.2.11.6. or 2.2.11.7. that requires such notice to be given.

2.2.1.8. Maintenance Logs

1) When a maintenance log is required by Book II (Plumbing Systems) of this By-law, it shall include

a) the address and location of the equipment, device, apparatus, or system,

b) the *operating permit* number assigned to the equipment, device, apparatus, or system,

c) emergency contact information and the name and contact information of the owner of the equipment, device, apparatus, or system,

d) the location of any safety data sheets,

e) the location of the operating manual for the equipment, device, apparatus, or system and, as applicable, the location of the water management plan,

f) except when included with the operating manual, a single line schematic plan of the equipment, device, apparatus, or system, reflective of the current configuration, and including water sampling locations,

g) details of any changes or alterations made to the equipment, device, apparatus, or system at any time,

h) a record of inspections and any maintenance performed within the last 24 months,

i) a record of operational disruptions within the last 24 months and the corrective actions taken,

j) if water treatment chemicals are used, a record of the chemical treatments applied and dosages within the last 24 months,

k) a record of all water quality results from analyses performed within the last 24 months, and

l) if *Legionella pneumophila* tests are conducted, the name of the person and company collecting the sample and the name of the company conducting the laboratory test.

2) A maintenance log described in Sentence (1) shall be

a) kept on site with the corresponding equipment, device, apparatus, or system,

b) maintained in an electronic or paper-based format, and

c) made available on such request to the *Chief Building Official*.

2.2.1.9. Operating Manuals

1) When an operating manual is required by Book II (Plumbing Systems) of this By-law, it shall include

a) the address and location of the system or equipment for which the operating manual is required,

b) contact details for the system or equipment designer,

c) a simplified process flow diagram,

d) a schematic of the system or equipment showing the locations of all substantial components,

e) instructions on operating, maintaining, and inspecting the system or equipment,

f) required frequency of maintenance and inspections,

g) instructions on deactivating and restarting the system or equipment for repair or other purposes,

h) safety data sheets, and

i) for *alternate water source systems*, details on the corrective action that shall be taken if the water quality fails to meet the standards set out in Table 2.7.7.1.

2) The operating manual described in Sentence (1) shall be

a) supplied to the owner or representative of the *owner*, and

b) made available on such request to the *Chief Building Official*.",

b) in Article 2.2.3.1., adding a new Sentence (6):

"**6)** A *bottle trap* may be used on a laboratory sink or other *fixture* equipped with corrosion resistant fittings.",

c) in Article 2.2.3.2., striking out Sentence (3), and substituting:

"**3)** Grease interceptors shall be selected and installed in conformance with

a) CSA B481.0, "Material, Design, and Construction Requirements for Grease Interceptors" and CSA B481.3, "Sizing, Selection, Location, and Installation of Grease Interceptors,"

b) ASME A112.14.3/CSA B481.1, "Hydromechanical Grease Interceptors,"

c) ASME A112.14.4/CSA B481.5, "Grease Removal Devices," or

d) ANSI/CAN/IAPMO Z1001, "Prefabricated Gravity Grease Interceptors."

(See Note A-2.2.3.2.(3).)",

d) in Section 2.2., striking out Articles 2.2.6.10. to 2.2.6.14., inclusive, and substituting:

"2.2.6.10. Stainless Steel Pipe

1) Stainless steel pipe shall conform to

a) ASME B36.19M, "Stainless Steel Pipe,"

b) ASTM A 312/A 312M, "Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes," and

c) NSF/ANSI 61, "Drinking Water System Components – Health Effects."

2) Only grade 304/304L or 316/316L stainless steel pipe shall be used.

2.2.6.11. Stainless Steel Butt Weld Pipe Fittings

1) Stainless steel butt weld pipe fittings shall conform to

a) ASME B16.9, “Factory-Made Wrought Buttwelding Fittings,”

b) ASTM A403/A403M, “Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings”, and

c) NSF/ANSI 61, “Drinking Water System Components – Health Effects.”

2) Stainless steel butt weld pipe fittings shall be made of a material that matches the grade of the pipe material used.

2.2.6.12. Stainless Steel Pipe Flanges

1) Stainless steel pipe flanges shall conform to

a) ASME B16.5, “Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard,”

b) NSF/ANSI 61, “Drinking Water System Components – Health Effects,” and

c) ASTM A182/A182M, “Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service,” or ANSI/AWWA C228, “Stainless-Steel Pipe Flanges for Water Service – Sizes 2 in. through 72 in. (50 mm through 1,800 mm).”

2) Stainless steel pipe flanges shall be made of a material that matches the grade of the pipe material used.

2.2.6.13. Stainless Steel Threaded Fittings

1) Stainless steel threaded fittings shall be schedule 40s or greater conforming to NSF/ANSI 61, “Drinking Water System Components – Health Effects,” and

a) ASTM A182/A182M, “Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service,” or

b) ASTM A351/A351M, “Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.”

2) Stainless steel threaded fittings shall be made of a material that matches the grade of the pipe material used.

2.2.6.14. Stainless Steel Tube

1) Stainless steel tube shall conform to

a) ASME B16.9, “Factory-Made Wrought Buttwelding Fittings,”

b) ASTM A269/A269M, “Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service” or ASTM A778/A778M, “Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products”, and

c) NSF/ANSI 61, “Drinking Water System Components – Health Effects.”

2) Only grade 304/304L or 316/316L stainless steel tube shall be used.”,

e) in Section 2.2., adding a new Article 2.2.6.16. and Article 2.2.6.17.:

“2.2.6.16. Welded Stainless Steel

1) Welded stainless steel piping assemblies shall conform to NSF/ANSI 61, “Drinking Water System Components – Health Effects.”

2) Welding of stainless steel pipe for *plumbing systems* shall use a gas tungsten arc welding process or a gas metal arc welding process.

2.2.6.17. Stainless Steel Press-Connect Fittings

1) Stainless steel *press-connect* fittings shall conform to

a) ASTM F3226/F3226M “Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems” or IAPMO/ANSI/CAN Z1117 “Standard for Press Connections” and

b) NSF/ANSI 61, “Drinking Water System Components – Health Effects.” ”,

f) in Section 2.2., adding a new Article 2.2.7.9.:

"2.2.7.9. Press-Connect Water Fittings

1) Except as required by Sentence 2.2.6.17.(1), *press-connect* fittings for *water distribution systems* shall conform to

a) ASME B16.51 "Copper and Copper Alloy Press-Connect Pressure Fittings,"

b) ASTM F3226/F3226M "Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems," or

c) IAPMO/ANSI/CAN Z1117 "Standard for Press Connections." ",

g) in Article 2.2.10.6.:

i) striking out Sentence (2) and substituting:

"**2)** Except as provided in Sentence (8), supply fittings and individual shower heads shall have an integral means of limiting the maximum water flow rate to that specified in Table 2.2.10.6. (See Note A-2.2.10.6.(2).)

Table 2.2.10.6
Water Flow Rates from Supply Fittings
Forming Part of Sentence 2.2.10.6.(2)

Supply Fittings	Maximum Water Flow Rate, L/min
Lavatory supply fittings	
private	5.7
public	1.9
Kitchen supply fittings (except for pre-rinse spray valves)	
non-residential	8.3
residential	6.8(1)
Pre-rinse spray valves(2)	4.8
Shower heads(3)	7.6

Notes to Table 2.2.10.6.:
(1) May be temporarily increased to a maximum flow rate of 8.3 L/min but must default to the lower flow rate upon release of the activation mechanism or closure of the faucet valve.
(2) A pre-rinse spray valve means a handheld device for use with commercial dishwashing and ware washing equipment that sprays water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning and sanitizing the items. Each pre-rinse spray valve shall be equipped with an automatic shut-off.
(3) A shower head means any fitting that transmits water for the purposes of showering and includes rain heads, rain tiles, rain systems, waterfalls, body sprays and jets.",

ii) striking out Sentence (5) and substituting:

"**5)** Except as provided in Sentence (8), each lavatory in a public washroom shall be equipped with a device capable of automatically shutting off the flow of water when the lavatory is not in use. (See Note A-2.2.10.6.(4) and (5).)", and

iii) adding a new Sentence (8):

"**8)** The requirements of Sentences (2) and (5) do not apply to

a) any part of a *building* classified as Group B *occupancy* by Part 3 of Division B of Book I (General) of this By-law,

b) first aid rooms,

c) emergency eye washes or emergency showers, or

d) a *plumbing fixture* specifically identified in a *building's* water management plan that both conforms to ANSI/ASHRAE 188, "Legionellosis: Risk Management for Building Water Systems" and is signed by a registered professional.",

h) striking out Article 2.2.10.17. and substituting:

"2.2.10.17. Water Treatment Systems

(See Article 2.6.2.1 and Note A-2.2.10.17.)

1) Except as provided in Sentence (3), a point-of-entry water treatment device or apparatus may be connected to the *City* water system at the discretion of the *Chief Building Official* and, if permitted

a) an *operating permit* shall be obtained, and the owner of the point-of-entry water treatment device or apparatus shall comply with the requirements of this Sentence,

b) the *operating permit* number assigned to a point-of-entry water treatment device or apparatus shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the point-of-entry water treatment device or apparatus in a location that is conspicuously visible and constructed of a durable, weather resistant material,

c) the *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*, and

d) a maintenance log conforming to Article 2.2.1.8. shall be maintained for each point-of-entry water treatment device or apparatus.

2) Except as provided in Sentence (3), an existing point-of-entry water treatment device or apparatus shall comply with Clauses (1)(a), (b), (c) and (d).

3) The requirements in Sentences (1) and (2) do not apply to a *building* used exclusively for *residential occupancy* containing no more than 8 principal *dwelling units*.

4) Point-of-use devices, including their disposable parts, used in *potable* water treatment systems shall conform to CAN/CSA-B483.1, "Drinking Water Treatment Systems." ",

i) adding a new Subsection 2.2.11.:

2.2.11. Building Appliances and Mechanical Systems

2.2.11.1. Building Appliances

1) Except when a clothes washer is supplied by an *alternate water source system*, appliances listed in Table 2.2.11.1. shall comply with the applicable Energy Star program requirements.

Table 2.2.11.1.
Appliance Energy Star Program Requirements
Forming Part of Sentence 2.2.11.1.(1)

Appliance	Energy Star Program Requirements
Residential clothes washer(1)	Product Specification for Clothes Washers
Commercial clothes washer(1)	Product Specification for Clothes Washers
Residential dishwasher(2)	Product Specification for Residential Dishwashers
Commercial dishwasher(2)	Product Specification for Commercial Dishwashers
Commercial ice maker(4)	Product Specification for Automatic Commercial Ice Makers
Commercial steam cooker(5)	Product Specification for Commercial Steam Cookers
Combination oven(6)	Product Specification for Commercial Ovens

Notes to Table 2.2.11.1.:
(1) "Residential clothes washer" and "commercial clothes washer" are as defined by the Energy Star Program Requirements Product Specification for Clothes Washers.
(2) "Residential dishwasher" is as per the definition of "dishwasher" by the Energy Star Program Requirements Product Specification for Residential Dishwashers.
(3) "Commercial dishwasher" is as per the definition of "dishwashing machine" by the Energy Star Program Requirements Product Specification for Commercial Dishwashers. Dishwashers intended for laboratory applications are exempted.
(4) "Commercial ice maker" is as per the definition of "automatic commercial ice maker" by the Energy Star Program Requirements Product Specification for Automatic Commercial Ice Makers.
(5) "Commercial steam cooker" is as per the definition of "commercial steam cooker" by the Energy Star Program Requirements Product Specification for Commercial Steam Cookers.
(6) "Combination oven" is as per the definition of "combination oven" by the Energy Star Program Requirements Product Specification for Commercial Ovens.

2) Except when a clothes washer is supplied by an *alternate water source system*, clothes washers with a top-loading design that are designed for use in applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries, shall not be installed.

2.2.11.2. Reserved

2.2.11.3. Vehicle Wash Facilities

1) Except when a vehicle wash facility is supplied by an *alternate water source system*, the maximum flow rate of a spray wand, foam brush or similar plumbing fixture used at a vehicle wash facility shall not exceed 11.4 L/min.

2) Where a machine cleans a vehicle at a vehicle wash facility,

a) except when a vehicle wash facility is supplied by an *alternate water source system*, a water recycling system that recycles and reuses at least 60% of the water and rinse water shall be installed, used and maintained, and

b) discharge shall be directed to an *interceptor* dedicated exclusively to the vehicle wash facility and designed to trap oil, gasoline, sand, grit and similar materials. (See Article 2.4.4.3.)

3) Where a vehicle wash facility is supplied by an *alternate water source system*, disinfection of the non-*potable* water shall be provided at the vehicle wash facility at point-of-use by ultraviolet light and conform to NSF/ANSI 55, "Ultraviolet Microbiological Water Treatment Systems," Class A.

2.2.11.4. Non-recirculating Applications

1) Except as provided in Sentence (3), the *City* water system shall not be connected to

a) *once through cooling equipment*,

b) a venturi-type flow-through vacuum generator or aspirator in which running water is used solely for the venturi effect,

c) a vacuum pump that uses water to cool the pump or to create a seal and recirculates less than 60% of the water that passes through the pump,

d) a non-recirculating wet-hood scrubber,

e) machinery powered by water,

f) a non-recirculating water feature, ornamental fountain, or swimming pool,

g) a non-recirculating system or equipment that uses water for thermal conditioning of building surfaces or roofs, except that this does not apply to emergency fire protection of buildings, or

h) a non-recirculating system or equipment that uses water for melting or thawing.

(See also Sentence 2.4.4.2.(2).)

2) Except as provided in Sentences (3) and (4), all equipment, machinery, appliances or fixtures listed in Clauses (1)(a) through (d) that are connected to the *City's* water system shall be disconnected.

3) *Emergency once through cooling equipment* or *maintenance once through cooling equipment* may be connected to the *City* water system or may retain an existing connection to the *City's* water system at the discretion of the *Chief Building Official* and, if permitted

a) an *operating permit* shall be obtained, and the owner of the *once through cooling equipment* shall comply with the requirements of this Sentence,

b) the *operating permit* number assigned to the *once through cooling equipment* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the *once through cooling equipment* in a location that is conspicuously visible and constructed of a durable, weather resistant material,

c) the *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*,

d) a water meter shall be installed on the *potable* water supply to the *once through cooling equipment* and shall be capable of recording the volume of *potable* water being supplied, and

e) the *once through cooling equipment* shall be capable of activating an *alert* whenever *potable* water is supplied to the *once through cooling equipment*. (See Note A-2.2.11.4.(3).)

4) Where, in the opinion of the *Chief Building Official* in consultation with the *City Engineer*, the cost of disconnecting *once though cooling equipment* from the *City's* water system and replacing it with other cooling equipment is unreasonable, taking into account any relevant factors, which may include the following

a) the current water flow rate compared to the expected reduction in water consumption if the equipment is disconnected,

b) where the equipment is in its life cycle,

c) the potential impact the disconnection and replacement of the equipment, including any required renovations, will have on business operations,

d) the cost to replace the equipment relative to the expected reduction in water and sewer costs, and

e) where applicable, the cost to replace the equipment relative to the operational size, the *once through cooling equipment* may retain an existing connection to the *City's* water system at the discretion of the *Chief Building Official* until a specified expiry date and, if permitted, Clauses 2.2.11.4.(3)(a) through (c) shall apply.

2.2.11.5. Geoexchange Systems

1) Make-up water for a closed loop geoexchange (geothermal) ground heat exchanger shall be provided by a feeder tank isolated from the domestic water supply.

2) The use of a direct connection to the domestic water supply as a source of make-up water for a closed loop geoexchange (geothermal) ground heat exchanger is prohibited.

3) Methanol shall not be used for geoexchange (geothermal) applications.

4) An open loop geoexchange (geothermal) system serving a *building* used exclusively for residential occupancy containing no more than 8 principal *dwelling units* shall not be installed.

5) An open loop geoexchange (geothermal) system shall not discharge into the sewer.

2.2.11.6. Cooling Towers

(See Note A-2.2.11.6.)

1) An *operating permit* shall be obtained for the installation of a *cooling tower*, or the retention of an existing *cooling tower*, and the owner of the *cooling tower* shall comply with the requirements of this Article.

2) In order to obtain an *operating permit* for the installation of a *cooling tower*, a service contract must be in place with a qualified service provider to perform maintenance of the *cooling tower* for a minimum of 1 year.

3) The *operating permit* number assigned to the *cooling tower* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the cooling tower in a location that is conspicuously visible and constructed of a durable, weather resistant material.

4) The owner of a *cooling tower*, or their authorized representative, shall notify the *Chief Building Official*, in the form prescribed by the *Chief Building Official*,

a) within 5 days of any start-up or shut down of a *cooling tower*,

b) within 5 days of any *Legionella pneumophila* test result from a *cooling tower*, or sooner as required by Sentence (8), and

c) within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*.

5) A maintenance log conforming to Article 2.2.1.8. shall be maintained for each *cooling tower* and, if a laboratory result fails to meet a standard defined in Table 2.2.11.6., the maintenance log shall also include a

description of the extent of the deviation from the standard, the corrective action taken, a record of any required notification, and the outcome of the corrective action, including all applicable dates and times.

6) Reserved.

7) *Legionella pneumophila* testing shall be conducted

a) in accordance with Article 2.2.1.7.,

b) on water samples collected at a point in the recirculation loop just prior to the point where treatment chemicals are injected, or where this is not feasible, from a location representative of water in the system,

c) no less than 48 hours and no more than 5 days after completion of system start-up and disinfection,

d) at minimum, while the *cooling tower* is in operation, each calendar month of operation, with not more than 33 days between samples, and

e) as required by Sentence (8).

8) If a laboratory test shows that a *Legionella* result exceeds a standard set out in Table 2.2.11.6., the owner of a *cooling tower*, or their authorized representative, shall undertake the response set out in Table 2.2.11.6. (See Note A-2.2.11.6.(8).)

Table 2.2.11.6.
Required Response to Failure to Meet *Legionella* Standards for *Cooling Towers*
Forming Part of Sentence 2.2.11.6.(8)

Test Type	Test Result	Required Response
Legionella pneumophila[1]	10 or more CFU per mL and less than or equal to 1,000 CFU per mL or 10 or more MPN per mL and less than or equal to 1,000 MPN per mL	1. Within 24 hours, give notice to the *Chief Building Official* and a) shut down the *cooling tower* system and perform offline cleaning and disinfection, or b) perform online remedial treatment[2] and within 7 days shut down the *cooling tower* system and perform offline cleaning and disinfection; and 2. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a *Legionella pneumophila* test[1].
	Greater than 1,000 CFU per mL or Greater than 1,000 MPN per mL	1. Immediately, give notice[4] to the *Chief Building Official*, the medical health officer and the *owner*; 2. Immediately, the laboratory[3] shall also give notice[4] to the owner of the *cooling tower*, the *Chief Building Official* and the medical health officer; 3. Immediately, implement measures that will eliminate water dispersion by aerosol from the affected *cooling tower* system and then perform offline cleaning and disinfection of the system before putting the system back into service; and 4. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a *Legionella pneumophila* test[1].

Notes to Table 2.2.11.6.:
[1] The *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.
[2] Online remedial treatment is also known as "running disinfection."
[3] See Sentence 2.2.1.7.(3).
[4] For the person giving the immediate notice to the *Chief Building Official*, the *owner*, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.

9) Offline cleaning and disinfection of a *cooling tower* shall be carried out

a) a minimum of once every calendar year,

b) for any start-up at any time, and

c) as required by Sentence (8). (See Note A-2.2.11.6.(9).)

10) When a *cooling tower* has been shut down for more than 3 days, it shall be drained within 5 days of being shut down, or when this is not practical during shut downs of short duration, stagnant water shall be pre-treated with an appropriate biocide regimen before start-up, allowing for proper contact time according to the supplier's recommendations.

11) If a *cooling tower* is removed or its use is permanently discontinued, it shall be safely drained, thoroughly sanitized, and the make-up water line shall be disconnected and capped.

2.2.11.7. Decorative Water Features

1) An *operating permit* shall be obtained for the installation of a *decorative water feature*, or the retention of an existing *decorative water feature*, and the owner of the *decorative water feature* shall comply with the requirements of this Article.

2) The following shall be posted in a location that is conspicuously visible:

a) the *operating permit* number assigned to the *decorative water feature*, on a sign or plate that is a minimum of 8.5 in by 11 in in size, constructed of a durable, weather resistant material and securely fastened to the *decorative water feature* or its associated mechanical equipment, and,

b) an advisory that the *decorative water feature* is not intended for human access, located around the perimeter of, or near an obvious access point to, the *decorative water feature*, using graphical symbols or words written in letters at least 100 mm high. (See Note A-2.2.11.7.(2)(b).)

3) The owner of a *decorative water feature*, or their authorized representative, shall notify the *Chief Building Official*, in the form prescribed by the *Chief Building Official*,

a) within 5 days of any start-up of a *decorative water feature* that had been shut down for 3 or more consecutive days,

b) within 5 days of any *decorative water feature* shut down for 3 or more consecutive days,

c) within 5 days of any *Legionella pneumophila* test result from a *decorative water feature*, or sooner as required by Sentence (8), and

d) within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*.

4) Where an outdoor *decorative water feature* is provided as an auxiliary system to a *building*, then the outdoor *decorative water feature* shall be considered part of the *building* for the purposes of this Article.

5) A maintenance log conforming to Article 2.2.1.8. shall be maintained for each *decorative water feature* and, if a laboratory result fails to meet a standard defined in Table 2.2.11.7., the maintenance log shall also include a description of the extent of the deviation from the standard, the corrective action taken, a record of any required notification, and the outcome of the corrective action, including all applicable dates and times.

6) Reserved.

7) *Legionella pneumophila* testing shall be conducted

a) in accordance with Article 2.2.1.7.,

b) on water samples collected at a point representative of water that is aerosolized, or where this is not feasible or aerosolization is not obvious, from a location

i) prior to the point where treatment chemicals are injected in a recirculating system, or

ii) representative of water in the system in a non-recirculating system,

c) no less than 48 hours and no more than 5 days after completion of start-up and disinfection,

d) at minimum, once each calendar year before July 1, unless the *decorative water feature* is shut down and drained for the entirety of the period of January 1 to July 1 of that calendar year,

e) as required by Sentence (8).

8) If a laboratory test shows that a *Legionella* result exceeds a standard set out in Table 2.2.11.7., the owner of a *decorative water feature*, or their authorized representative, shall undertake the response set out in Table 2.2.11.7.

Table 2.2.11.7.
Required Response to Failure to Meet *Legionella* Standards for *Decorative Water Features*
Forming Part of Sentence 2.2.11.7.(8)

Test Type	Test Result	Required Response
Legionella pneumophila(1)	10 or more CFU per mL and less than or equal to 1,000 CFU per mL	1. Within 24 hours, give notice to the *Chief Building Official*, shut down the *decorative water feature* and perform offline cleaning and disinfection; and 2. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a *Legionella pneumophila* test(1).
	Greater than 1 000 CFU per mL	1. Immediately, give notice(3) to the *Chief Building Official*, the medical health officer and the owner; 2. Immediately, the laboratory(2) shall also give notice(3) to the owner of the *decorative water feature*, the *Chief Building Official* and the medical health officer; 3. Immediately, implement measures that will eliminate water dispersion by aerosol from the affected *decorative water feature* and then perform offline cleaning and disinfection of the system before putting the feature back into service; and 4. No less than 48 hours and no more than 5 days after cleaning and disinfection, perform a *Legionella pneumophila* test(1).

Notes to Table 2.2.11.7.:
(1) The *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.
(2) See Sentence 2.2.1.7.(3).
(3) For the person giving the immediate notice to the *Chief Building Official*, the *owner*, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.

9) Offline cleaning and disinfection of a *decorative water feature* shall be carried out

a) as recommended by the manufacturer, and at minimum of once every calendar year,

b) for any start-up after having been shut down for 3 or more consecutive days, and

c) as required by Sentence (8).

10) When a *decorative water feature* has been shut down for 3 or more consecutive days, it shall be drained within 5 days of being shut down.

11) If a *decorative water feature* is removed or its use is permanently discontinued, it shall be safely drained, thoroughly sanitized, and the make-up water line shall be disconnected and capped.",

j) in Article 2.3.6.1., adding a new Sentence:

"**6)** Siphonic roof drainage systems shall be tested in accordance with ASME A112.6.9/CSA B79.9 "Siphonic Roof Drains"."

k) adding a new Article 2.4.2.4. and Article 2.4.2.5.:

"2.4.2.4. Connections to Storm Drainage Systems

1) Except as provided in Sentence (2), *building* and site drainage shall connect to a *storm drainage system*.

2) *Building* and site drainage need not connect to a *storm drainage system* if

a) on-site *rainwater* management practices are employed and overflow is connected to a *storm drainage system*, and

b) *rainwater* does not create a hazardous condition or discharge upon or impact other lands or sites.

(See Note A-2.4.2.4.(2).)

3) For *buildings* located in whole or in part within the *groundwater protection area*, the drainage system shall be designed to not intercept, collect or divert any subsurface water outside of the *building* assembly. #14603

(See Note A-2.4.2.4.(3).)

2.4.2.5. Rainwater Management

1) Except as provided in Sentence (2), all *buildings* shall manage *rainwater* on-site through one of the applicable compliance pathways in Table 2.4.2.5.-A, in which

a) "small site pathway" means Sentence (4) applies, and Sentences (5), (6), (7) and (8) do not apply, and

b) "engineered pathway" means Sentences (5), (6), (7) and (8) apply, and Sentence (4) does not apply.

Table 2.4.2.5.-A
Compliance Pathways for On-Site Rainwater Management
Forming Part of Sentence 2.4.2.5.(1)

Site Area (m^2)	Net Floor Space Ratio(1)	Compliance Pathway
No greater than 1000	No greater than 1.0	Small site pathway
	Greater than 1.0	Engineered pathway
Greater than 1000	Any	Engineered pathway

Notes to Table 2.4.2.5.-A:
(1) As computed according to the Zoning and Development By-law after any applicable exclusions. #14488

2) The requirements of this Article do not apply to

a) "laneway houses" or "infill" as defined by the Zoning & Development By-law, when the site area is no greater than 1000 m^2,

b) "accessory buildings" as defined by the Zoning & Development By-law,

c) *float homes*,

d) *marinas*,

e) retaining structures, or

f) temporary *buildings* approved according to Subsection 1.6.8. of Division C.

3) The *Chief Building Official* shall be provided with a document demonstrating that the *rainwater* management requirements of Sentence (1) have been satisfied, in the form prescribed by the *Chief Building Official*.

4) Except as provided in Sentence (9), a detention tank shall be installed with

a) the minimum active storage capacity specified in Table 2.4.2.5.-B.,

b) an orifice plate with the diameter specified in Table 2.4.2.5.-B.,

c) overflow protection,

d) one or more *cleanouts* providing access to the outlet and overflow, and

e) for subsurface detention tanks, the capability of supporting the design depth of cover and surface loads.

(See Note A-2.4.2.5.(4).)

Table 2.4.2.5.-B
Detention Tank Specifications for the Small Site Pathway
Forming Part of Sentence 2.4.2.5.(4)

Site Area (m^2)	Minimum Active Storage Capacity (L)	Orifice Plate Diameter (mm)
No greater than 400	3,400	30
Greater than 400 to no greater than 500	3,900	35
Greater than 500 to no greater than 750	4,600	45
Greater than 750 to no greater than 1000	7,200	50

5) Except as provided in Sentences (8) and (9), *rainwater* from the site area shall be detained with controlled discharge to a public *combined sewer*, public *storm sewer* or designated public *storm water* disposal location, and the minimum detention volume shall be calculated with the Modified Rational Method

a) using the following formula:

$$V = Q_p \times D - Q_o \frac{D + t_c}{2}$$

where

V = minimum detention storage volume in L,

Q_p = peak runoff rate for the duration D in L/s,

D = duration of rainfall in s,

Q_o = maximum discharge flow rate in L/s, and

t_c = time of concentration of the drainage catchment, determined according to the City of Vancouver Engineering Design Manual, in s,

b) iterating for a range of values of D in Clause (a)

i) with a maximum of a 15 min increment, and

ii) until the value of V in Clause (a) reaches a maximum value, confirmed by iterating values of D for an additional 60 min, and

c) applying from the City of Vancouver Engineering Design Manual:

i) the post-development, 2100 IDF curve with a 10 year return period,

ii) the minimum inlet time specified, and

iii) the applicable runoff coefficients to derive a composite runoff based on the percentages of different surfaces of the site area.

(See Note A-2.4.2.5.(5).)

6) Except as provided in Sentences (8) and (9), the detention volume calculated in Sentence (5) shall be held in detention storage

a) designed to control discharge in 2 stages, at

i) no greater than 5 L / s / hectare for the first stage, for a volume of water equivalent to what would be present if water 15 mm deep covered the portion of the site area without landscaping, and

ii) no greater than 25 L / s / hectare after the first stage, and

b) installed with

i) no orifice smaller than 25 mm in diameter when an orifice is used,

ii) overflow protection, and

iii) one or more *cleanouts* providing access to the outlets and overflow.

(See Note A-2.4.2.5.(6).)

7) An operations and maintenance manual conforming to Article 2.2.1.9. is required for the equipment employed to satisfy the requirements of Sentences (5) and (6).

8) When an *existing building* will remain on the same property at the time the occupancy permit is issued, the site area used in Sentences (5) and (6) may be reduced to be proportional to the ratio of the *buildings'* greatest horizontal area within the outside surface of exterior walls.

9) The *Chief Building Official* max relax the requirements of Sentences (4), (5) and (6) in accordance with Sentence 1.5.2.10.(2) of Division C if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official* by a *subsurface investigation* that excavation is precluded or limited by soil contamination or other factors, and

b) it is impractical, in the opinion of the *Chief Building Official*, to meet the *rainwater* management requirements of Sentences (4), (5) or (6).

(See Note A-2.4.2.5.(9).)",

#14488

l) striking out Article 2.4.3.6. and substituting:

"2.4.3.6. Drains Serving Elevator Pits

1) Where a drain is provided in an elevator pit,

a) if the elevator pit extends below the minimum elevation of the underside of a *building's* lowest floor system or the top of the *building's* lowest concrete slab, it shall be connected directly to a sump located outside the elevator pit, and

b) if the drain is subject to backflow, the drain pipe shall have a *backwater valve*.

(See Note A-2.4.3.6.(1).)",

m) striking out Article 2.4.4.2. and substituting:

"2.4.4.2. Sewer Discharge

1) Sanitary and storm discharge shall conform to the Sewer and Watercourse By-law.

2) Except within health care facilities or for medical sterilization devices, no system or equipment shall be installed that allows for the use of *potable* water to temper or dilute condensate discharged to the sewer.",

n) in Sentence 2.4.5.2.(2), striking out the term "floor drain" or "floor drains" wherever it appears and substituting "drain" or "drains," respectively,

o) striking out Article 2.4.5.3. and substituting:

"2.4.5.3. Connection of Subsoil Drainage Pipe to a Storm Drainage System

1) A *subsoil drainage pipe* shall be connected to a sump. (See Note A-2.4.5.3.(1).)

2) The sump referred to in Sentence (1) shall be connected to a *storm sewer* or to a *combined sewer*.

3) The sump referred to in Sentence (1) shall not be connected to a *sanitary sewer*.",

p) in Article 2.4.6.3.:

i) striking out Sentence (1) and substituting:

"**1)** Except as permitted by Sentence (9), piping that is too low to drain into a *building sewer* by gravity shall be drained to a sump or receiving tank provided that

a) *fixtures* located above the public sewer connection shall drain by gravity, and

b) any overflow piping shall drain to the public sewer connection by gravity except overflow piping from an *alternate water source system*.",

ii) striking out Sentence (6) and substituting:

"**6)** Where there is a *building trap*, the discharge pipe from the equipment shall be connected to the *building drain* downstream of the *trap* and *backwater valve*.", and

iii) adding a new Sentence (9):

"**9)** The requirements of Sentence (1) do not apply

a) to *buildings* connected to a *public low pressure sewer system*, or

b) to any *fixture* installed after occupancy of a *building*.",

q) striking out Article 2.4.10.8. and substituting:

"2.4.10.8. Hydraulic Loads on Sanitary Building Drains or Sewers

1) Except as permitted by Sentence (2), the hydraulic load that is drained to a *sanitary building drain* or a *sanitary building sewer* shall conform to Table 2.4.10.6.-C.

2) The requirements of Sentence (1) do not apply to a *sanitary building sewer* for a *building* connected to a *public low pressure sewer system*.",

r) adding a new Article 2.4.10.14.:

"2.4.10.14. Design of Siphonic Roof Drainage Systems

1) Siphonic roof drainage systems are to be designed in accordance with ASPE/ANSI 45 "Siphonic Roof Drainage," and ASME A112.6.9/CSA B79.9, "Siphonic Roof Drains." ",

s) in Article 2.5.6.3., adding a new Sentence (5):

"**5)** The *vent pipe* from a water closet or any *fixture* that has an integral siphonic flushing action may be connected to the vertical leg of its drainage pipe.",

t) in Article 2.6.1.1., adding two new Sentences:

"**3)** In a hot *water distribution system* with a recirculation loop, the temperature of the water being recirculated shall not be less than 49°C at any point of the system.

4) The recirculation loop described in Sentence (3) may be replaced by a self-regulating heat tracing system.",

u) in Article 2.6.1.6.,

i) striking out Table 2.6.1.6. and substituting:

"**Table 2.6.1.6.**
Water Usage per Flush Cycle
Forming Part of Sentence 2.6.1.6.(3)

Fixtures	**Maximum Water Usage per Flush Cycle, Lpf**
Water closets(1)	4.8
Urinals	1.9

Notes to Table 2.6.1.6.:
(1) The full flush mode of a dual-flush toilet shall not exceed 4.8 L.", and

ii) striking out Sentence (4) and substituting:

"**4)** A maximum flush cycle of 6.0 L may be permitted for a water closet where, in the opinion of the *Chief Building Official*, the existing *plumbing system* cannot accommodate and cannot be updated to accommodate the required flush cycle.",

v) striking out Article 2.6.1.12. and substituting:

"2.6.1.12. Service Water Heaters

1) *Storage-type service water heaters* shall operate at a temperature not lower than 60°C. (See Note A-2.6.1.12.(1).)

2) Drain water heat recovery units shall only be used to supply *service water heaters*.",

w) in Article 2.6.2.1.,

i) appending to the end of Sentence (2): "(See Article 2.2.10.17.)", and

ii) adding a new Sentence (4):

"**4)** Residential landscape irrigation systems that apply herbicides, fungicides, insecticides, fertilizers, soil amendments or other chemicals or pesticides by means of irrigation water are prohibited.",

x) in Article 2.6.3.1., striking out Sentence (2) and substituting:

"**2)** *Potable water systems* shall be designed, fabricated and installed in accordance with good engineering practice, such as that described in the ASHRAE Handbooks and ASPE Plumbing Engineering Design Handbooks, and for *dwelling units*, may be sized using the IAPMO Water Demand Calculator. (See Note A-2.6.3.1.(2).)",

y) in Article 2.6.3.2. adding a new Sentence (5):

"**5)** Notwithstanding the provisions of Sentences (1) through (4), the determination of hydraulic load is not a requirement for *water distribution systems* in *dwelling units* that have been designed in accordance with the IAPMO Water Demand Calculator.",

z) striking out Article 2.6.3.3. and substituting:

"**2.6.3.3. Static Pressure**

1) Where the static pressure at any *fixture* or supplied to a residential landscape irrigation system may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* or for the residential landscape irrigation system to 550 kPa.",

aa) in Article 2.6.3.4.,

i) striking out Sentence (2) and substituting:

"**2)** Except as provided in Sentences (3) and (6), the *nominal pipe size* of a supply pipe that serves a *fixture* shall conform to Table 2.6.3.2.-A." , and

ii) adding a new Sentence (6):

"**6)** The *nominal pipe size* of a supply pipe that serves a *fixture* in a *dwelling unit* shall conform to

a) the IAPMO Water Demand Calculator, or

b) except as provided in Sentence (3), Table 2.6.3.2.-A.",

bb) striking out Section 2.7. and substituting:

"Section 2.7. Non-Potable Water Systems

2.7.1. Connection

2.7.1.1. General

1) A non-*potable* water system shall not be connected to a *potable* water system.

2) For the purpose of this Section

a) all non-*potable* water systems shall comply with Subsections 2.7.1., 2.7.2. and 2.7.3.,

b) an *alternate water source system* installed prior to January 1, 2019 shall comply with Subsection 2.7.4., and

c) an *alternate water source system* installed on or after January 1, 2019 shall comply with Subsections 2.7.5., 2.7.6., 2.7.7., and 2.7.8.

2.7.1.2. Non-Potable Water Sources

1) Except as prohibited by Sentence (2), a non-*potable water system* shall collect only

a) *rainwater*,

b) *clear-water waste*,

c) *greywater* as permitted by Sentence (3), or

d) a combination thereof.

2) A non-*potable water system* shall not collect

a) runoff from a public road,

b) runoff from an area on which fertilizer is used or stored,

c) *groundwater*,

d) *perimeter drainage water*,

e) *greywater* not permitted by Sentence (3), or

f) *blackwater*.

3) A non-*potable water system* may collect *greywater* if it conforms to NSF/ANSI 350, "Onsite Residential and Commercial Water Reuse Treatment Systems," Class R (single-family residential), and the treated water is used within the same *dwelling unit* from which the *greywater* is collected.

2.7.1.3. Non-Potable Water Uses

1) Except as provided in Sentences (2) and (5), a non-*potable water system* may use treated non-*potable* water for any of the uses set out in Columns A or B of Table 2.7.1.3.

2) An *alternate water source system* shall use treated non-*potable* water in lieu of *potable* water for all of the uses set out in Column A of Table 2.7.1.3.

3) Non-*potable* water shall not be used in lieu of *potable* water for any other uses.

Table 2.7.1.3.
Uses for Treated Non-Potable Water
Forming Part of Sentences 2.7.1.3.(1), (2) and (3)

Non-*potable* Water Source	Uses for Treated Non-*potable* Water	
	Column A	Column B
Rainwater	Water closets, urinals and trap primers	Irrigation of non-food purpose plants, clothes washers, vehicle wash facilities(1), make-up water for hydronic systems, make-up water for *cooling towers*, adiabatic cooling systems, and tempering of discharge.
Clear-water waste		
Greywater (conforming to Sentence 2.7.1.2.(3))	-	Water closets, urinals and clothes washers.
Groundwater	Not permitted	
Perimeter drainage water		
Blackwater		

Notes to Table 2.7.1.3.:
(1) See Article 2.2.11.3

4) Where the static pressure at any *fixture* in a non-*potable* water system may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* to 550 kPa.

5) Non-*potable water systems* shall not be used to supply *fixtures* in healthcare facilities.

2.7.2. Identification

2.7.2.1. Piping and Outlet Identification

1) Except as required by Sentence (2), all non-*potable* water pipes shall be identified and marked in accordance with CAN/CSA-B128.1, "Design and Installation of Non-*potable* Water Systems."

2) All non-*potable* water distribution pipes with a *nominal pipe size* of 2 in and smaller shall be purple in colour and conform to the requirements of NSF/ANSI 14, "Plastics Piping System Components and Related Materials."

3) Non-*potable* water outlets shall be identified by a sign or plate in a location that is conspicuously visible and constructed of a durable, weather resistant material. (See Note A-2.7.2.1.(3).)

2.7.3. Location

2.7.3.1. Pipes

1) Non-*potable* water piping shall not be located directly above

a) areas where food, drink or products that are intended for human consumption are prepared, handled, dispensed or stored, or

b) a non-pressurized or pressurized *potable* water tank.

2.7.3.2. Outlets

1) An outlet from a non-*potable water system* shall not be located where it can discharge into

a) a sink or lavatory,

b) a *fixture* into which an outlet from a *potable water system* is discharged, or

c) a *fixture* that is used for the preparation, handling or dispensing of food, drink or products that are intended for human consumption.

(See Note A-2.7.3.2.(1).)

2.7.4. Alternate Water Source Systems Installed Prior to January 1, 2019

2.7.4.1. Requirements for Alternate Water Source Systems Installed Prior to January 1, 2019

1) An *operating permit* shall be obtained, and the owner of the *alternate water source system* shall comply with the requirements of this Subsection.

2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the *alternate water source system* in a location that is conspicuously visible and constructed of a durable, weather resistant material.

3) The *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*.

4) Water quality shall comply with the water quality standards, testing, documentation, and reporting requirements set out in Articles 2.7.7.1. and 2.7.7.2.

5) If a test result shows that the water quality fails to meet any of the standards set out in Table 2.7.7.1., the owner of an *alternate water source system*, or their authorized representative, shall undertake the response set out in Table 2.7.4.1.

Table 2.7.4.1.
Required Response to Failure to Meet Water Quality Standards for *Alternate Water Source Systems* Installed Prior to January 1, 2019
Forming Part of Sentence 2.7.4.1.(5)

Parameter	Test Result	Required Response
E. coli(1)	100 or more CFU per 100 mL or 100 or more MPN per 100 mL	1. Immediately, supply the *alternate water source system* with *potable* water only; 2. Within 24 hours, give notice to the *Chief Building Official* and the *owner*; and 3. Within 5 days, but no less than 48 hours after any cleaning or disinfection, perform an *E. coli* test(1) and, if the water quality standard for *Legionella pneumophila* had been exceeded, a *Legionella pneumophila* test(1).
Legionella pneumophila(1)	10 or more CFU per mL or 10 or more MPN per mL	
Turbidity	> 15 NTU	
Temperature	> 25°C	

Notes to Table 2.7.4.1.:
(1) The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

6) The *alternate water source system* shall be maintained in accordance with any manufacturer's specifications.

7) If the *alternate water source system* is in use, cross connection control tests shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems."

8) A maintenance log shall be maintained in accordance with Sentence 2.7.8.2.(3).

9) An *alternate water source system* commissioned after January 1, 2019 shall comply with the requirements of Article 2.7.5.2.

2.7.4.2. No Other Requirements

1) *Alternate water source system*s installed prior to January 1, 2019 need not comply with any other requirements set out in Subsections 2.7.5. through 2.7.8.

2.7.5. Alternate Water Source Systems

2.7.5.1. Occupancy

1) Before *occupancy* of a *building* is permitted, an *alternate water source system* shall be commissioned within 8 weeks of occupancy in accordance with Article 2.7.5.2., and an *operating permit* shall be obtained in accordance with Article 2.7.5.3.

2) After an *alternate water source system* has been commissioned, the requirements of Subsections 2.7.7. and 2.7.8. shall be met.

3) An *alternate water source system* shall be considered commissioned on the date that the final water sample was collected to fulfill the requirements of Article 2.7.5.2.

2.7.5.2 Commissioning

1) In order to commission an *alternate water source system*

a) the treated non-*potable* water shall be tested for *E. coli*, turbidity and *Legionella pneumophila*,

i) in accordance with Article 2.2.1.7.,

ii) on water samples collected from the sampling port required by Article 2.7.6.6.,

iii) weekly for a period of 4 weeks for *E. coli* and turbidity, and

iv) once for *Legionella pneumophila*,

b) test results shall be provided to the *Chief Building Official*, and

c) a cross connection control test shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems" and witnessed by the *Chief Building Official*.

2) Except as required by Sentence (3), if a water sample required by this Article fails to meet any of the standards set out in Table 2.7.7.1., an additional water sample for *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.

3) If a *Legionella pneumophila* sample required by this Article fails to meet the standard set out in Table 2.7.7.1., an additional water sample for *Legionella pneumophila* and *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.

2.7.5.3. Operating Permit

1) An *operating permit* shall be obtained, and the owner of the *alternate water source system* shall comply with the requirements of this Subsection.

2) The *operating permit* number assigned to the *alternate water source system* shall be posted on a sign or plate that is a minimum of 8.5 in by 11 in in size and securely fastened to the *alternate water source system* in a location that is conspicuously visible and constructed of a durable, weather resistant material.

3) The *Chief Building Official* shall be notified within 30 days of any changes to the information that was last provided to the *City* with regard to the *operating permit*, in the form prescribed by the *Chief Building Official*.

2.7.5.4. Continued Operation

1) Once an *operating permit* has been issued, an *alternate water source system* shall operate continuously unless written approval to discontinue its use has been obtained from the *Chief Building Official* or *City Engineer*.

2.7.6. Design

2.7.6.1. Professional Design

1) An *alternate water source system* shall be designed by a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act, and shall be designed to prioritize the use of non-*potable* water.

2.7.6.2. Pipe Sizing

1) Except as required by Sentence (2), non-*potable* distribution piping shall be sized according to Subsection 2.6.3.

2) *Dwelling units* within a *building* with an *alternate water source system* shall be equipped with

a) tank type water closets, and

b) non-*potable* distribution piping sized in conformance with the IAPMO Water Demand Calculator.

2.7.6.3. Continuity of Supply and Backflow Prevention

1) A secondary water supply shall be provided.

2) Where a non-*potable water system* is supplied by a *potable water system*, the *potable water system* shall be protected in accordance with Article 2.6.2.1.

3) Where a *fixture* combines water from a non-*potable* rainwater harvesting system and *potable* water at the *fixture* supply fitting, the *potable water system* shall be protected by a *backflow preventer* as described in Sentence 2.6.2.1.(3).

2.7.6.4. Storage Tanks

(See Article 2.4.2.2. and Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

1) Provision shall be made upstream of the storage tank to remove the accumulation of particulates and impurities before they enter the storage tank.

2) Storage tanks shall be secured to prevent tampering and unintended or unauthorized entry either by a lockable device or another *approved* method, and all penetrations shall be sealed to prevent insect or vermin entry.

3) Water shall be withdrawn a minimum of 0.3 m from the base of the storage tank.

4) Storage tanks in *alternate water source systems* shall be equipped with an overflow that directs excess rainwater to

a) a public *storm sewer*,

b) a public *combined sewer*,

c) a *storm water* management system, or

d) a designated *storm water* disposal location.

5) Where the storage tank outlet is located below the level of the adjoining *street*, the storage tank overflow required by Sentence (4) shall

a) terminate with an indirect connection that is not located within the *building*, or

b) be equipped with a *backwater valve*.

2.7.6.5. Water Metering

(See Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

1) A water meter shall be installed and located within 1.5 m of the *potable* water make-up supply and shall be capable of recording the volume of *potable* water being supplied.

2) A water meter shall be installed and located on the non-*potable* water outlet prior to distribution and shall be capable of recording the volume of non-*potable* water being supplied to the distribution piping.

3) Water meters required by Sentences (1) and (2) shall be capable of displaying volumes in units of L or cubic m.

2.7.6.6. Water Quality Sampling and Alerts

(See Article 2.2.1.7. and Note A-2.7.6.4., 2.7.6.5. and 2.7.6.6.)

1) A sampling port, and provision for continuous in-line measurements required in order to conform with Table 2.7.7.1., shall be installed and located downstream of the water meter at the non-*potable* water outlet and prior to distribution.

2) All monitoring devices referred to in Sentence (1) above shall be capable of activating an *alert* that is designed to activate continuously for the duration of the *alert* condition whenever the water quality fails to meet the standards set out in Table 2.7.7.1.

2.7.6.7. Power Interruption

1) If a *building* is required to have an emergency system generator, provision shall be made for the continued operation of any mandatory uses for non-*potable* water described in Sentence 2.7.1.3.(2) in the event of a power interruption.

2.7.7. Water Quality Standards

2.7.7.1. Water Quality Standards, Testing, and Documentation

1) Water quality shall meet the standards set out in Table 2.7.7.1.

2) Water quality shall be tested as set out in Table 2.7.7.1.

3) All test results shall be documented as set out in Table 2.7.7.1., and documentation shall be retained for no less than 24 months.

Table 2.7.7.1.
Water Quality Standards, Testing, and Documentation
Forming Part of Sentences 2.7.7.1.(1), (2), and (3)

Applicability	Parameter	Standard	Testing Type and Frequency	Testing Result Documentation Requirement
Any non-*potable* water source	Temperature	< 20°C	Continuous	Daily[1]
	Turbidity	< 10 NTU	Daily[1], and 1 sample tested by a laboratory every 2 calendar months with not more than 63 days between samples	Daily[1], plus all laboratory tests
	E. coli[2]	< 100 CFU per 100 mL or < 100 MPN per 100 mL	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
	Legionella pneumophila[2]	< 10 CFU per mL or < 10 MPN per mL	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
Rainwater from surfaces that allow the passage of vehicular traffic or where hydrocarbon-based fuels or hazardous materials are stored	Benzene	< 0.005 mg/L	1 sample tested every 2 calendar months with not more than 63 days between samples	All laboratory tests
	Toluene	< 0.024 mg/L		
	Ethylbenzene	< 0.0016 mg/L		
	Xylenes (total)	< 0.02 mg/L		
	Total suspended solids	< 20 mg/L		

Notes to Table 2.7.7.1.:
[1] For the purpose of this Table, the term "daily" shall mean once per day when the *building* is normally occupied.
[2] The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

2.7.7.2. Water Quality Reporting

1) Water quality reports shall be submitted by the owner of *an alternate water source system*, or their authorized representative, to the *Chief Building Official* before the end of the second month following the issuance of an *operating permit*, and then every 2 calendar months thereafter, and shall include

a) all documentation required by Sentence 2.7.7.1.(3) and

b) except as provided in Sentence 2.7.4.2.(1), readings from the water meters required by Article 2.7.6.5.

2.7.7.3. Required Response to Failure to Meet Water Quality Standards

1) If a test result shows that the water quality fails to meet a standard set out in Table 2.7.7.1., the owner of an *alternate water source system*, or their authorized representative, shall undertake the response set out in Table 2.7.7.3.

Table 2.7.7.3.
Required Response to Failure to Meet Water Quality Standards for *Alternate Water Source Systems*
Forming Part of Sentence 2.7.7.3.(1)

Parameter	Test Result	Required Response
Turbidity	Between 10 and 15 NTU	Take the appropriate corrective action as set out in the operating manual.
Temperature	20°C to 25°C	
Total suspended solids	Between 20 and 45 mg/L	
E. coli[1]	100 or more CFU per 100 mL or 100 or more MPN per 100 mL	1. Immediately, supply *the alternate water source system* with *potable* water only;

Legionella pneumophila(1)	10 or more CFU per mL or 10 or more MPN per mL	2. Within 24 hours, give notice to the *Chief Building Official* and the *owner*; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 5 days, but no less than 48 hours after any cleaning or disinfection, perform an *E. coli* test(1) and, if the water quality standard for *Legionella pneumophila* had been exceeded, a *Legionella pneumophila* test(1).
Turbidity	> 15 NTU	
Temperature	> 25°C	
Benzene	> 0.005 mg/L	1. Immediately, supply the *alternate water source system* with *potable* water only; 2. Within 24 hours, give notice to the *Chief Building Official* and the *owner*; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 3 days of the corrective action, perform a test for benzene, toluene, ethylbenzene and xylenes (total).
Toluene	> 0.024 mg/L	
Ethylbenzene	> 0.0016 mg/L	
Xylenes (total)	> 0.02 mg/L	
Total suspended solids	> 45 mg/L	1. Immediately, supply the *alternate water source system* with *potable* water only; 2. Within 24 hours, give notice to the *Chief Building Official* and the *owner*; 3. Take the appropriate corrective action as set out in the operating manual; and 4. Within 3 days of the corrective action, perform a test for total suspended solids.

Notes to Table 2.7.7.3.:
(1) The *E. coli* and *Legionella pneumophila* test shall conform to the requirements of Article 2.2.1.7.

2.7.8. Operating Manual and Maintenance

2.7.8.1. Operating Manual

1) An operating manual conforming to Article 2.2.1.9. is required for an *alternate water source system*, and shall be sealed by a registered professional.

2.7.8.2. Maintenance

1) *Alternate water source systems* shall be maintained in accordance with the operating manual and any manufacturer's specifications.

2) Cross connection control tests shall be performed as required by CAN/CSA-B128.1, "Design and Installation of Non-Potable Water Systems."

3) A maintenance log conforming to Article 2.2.1.8. shall be maintained, and shall also include

a) the documentation required by Sentence 2.7.7.1.(3), and

b) if a water quality test fails to meet a standard defined in Table 2.7.7.1., a description of the extent of the deviation from the standard, the corrective action taken, a record of any required notification, and the outcome of the corrective action, including all applicable dates and times.",

cc) in Table 2.8.1.1.:

i) adding in correct alphanumerical order the following new rows:

"

2.2.1.7. Microbiological Testing	
(1)	[F40,F41,F43,F81,F82-OS3.4,OH5]
(2)	[F40,F41,F43,F81,F82-OS3.4,OH5]
(3)	[F30,F40,F41,F43,F81,F82-OS3.1,OS3.4,OH1.1,OH2.1,OH2.3,OH5]

",

“

2.2.6.16. Welded Stainless Steel	
(1)	[F80-OH2.1,OH2.2,OH2.3]
(2)	[F80-OH2.1,OH2.2,OH2.3]
2.2.6.17. Stainless Steel Press-Connect Fittings	
(1)	[F20-OP5]

”,
“

2.2.7.9. Press-Connect Water Fittings	
(1)	[F20-OP5]

”,
“

2.2.11.1. Building Appliances	
(1)	[F130-OE1.2]
(2)	[F130-OE1.2]
2.2.11.3. Vehicle Wash Facilities	
(1)	[F130-OE1.2]
(2)	(a) [F130-OE1.2] (b) [F81-OS1.1,OH2.1] [F43-OH5]
(3)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
2.2.11.4. Non-recirculating Applications	
(1)	[F81,F82,F130-OP5,OE1.2]
(2)	[F81,F82,F130-OP5,OE1.2]
2.2.11.5. Geoexchange Systems	
(1)	[F46,F81,F130-OH2.2,OH5,OP5,OE1.2]
(2)	[F46,F81,F130-OH2.2,OH5,OP5,OE1.2]
(3)	[F40,F43,F46-OS3.4,OH2.4,OH5]
(4)	[F72,F81,F82-OS3.4,OH2.1,OP5]
(5)	[F72,F81,F82-OS3.4,OH2.1,OP5]
2.2.11.6. Cooling Towers	
(1)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(2)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(4)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(5)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(7)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(8)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(9)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(10)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(11)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
2.2.11.7. Decorative Water Features	
(1)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]

(2)	[F30-OS3.1,OS3.4,OH2.2,OH2.4,OH5]
(3)	[F40,F41,F43,F46,F81,F82-OS3.4,OH1.1,OH2.2,OH5,OP5]
(5)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]
(7)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(8)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(9)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(10)	[F40,F41,F43,F81,F82-OS3.4,OH1.1,OH5]
(11)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH1.1,OH2.2,OH5,OP5,OE1.2]

",

"

2.4.2.4. Connections to Storm Drainage Systems	
(1)	[F30,F62,F81,F82-OS3.1,OP5]
2.4.2.5. Rainwater Management	
(4)	[F40,F62,F80,F81-OP5,OE1.2]
(5)	[F40,F62,F80,F81-OP5,OE1.2]
(6)	[F40,F62,F80,F81-OP5]
(7)	[F80,F81,F82-OP5,OS3.4]

", and

"

2.4.10.14. Design of Siphonic Roof Drainage Systems	
(1)	[F81-OH2.1]

",

ii) adding under "**2.2.3.1. Traps**" the following new row:

"

(6)	[F81-OH1.1]

",

iii) adding under "**2.2.10.6. Valves, and Supply and Waste Fittings**" the following new row:

"

(8)	[F40,F41,F43,F46,F71,F81,F82-OS3.4,OH1.1,OH2.3,OH5]

",

iv) striking the rows associated with "**2.2.10.17. Water Treatment Systems**" and substituting:

"

2.2.10.17. Water Treatment Systems	
(1)	[F46,F70-OH2.2]
	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
	[F40,F41,F43,F46,F70,F80,F81,F82-OS3.4,OH2.1,OH2.2,OH2.3,OH2.4,OH5,OP5,OE1.2]
(2)	[F46,F70-OH2.2]

	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]
	[F40,F41,F43,F46,F70,F80,F81,F82-OS3.4,OH2.1,OH2.2,OH2.3,OH2.4,OH5,OP5,OE1.2]
	[F46-OH2.2]
(4)	[F30-OS3.1] [F46,F70-OS3.4]
	[F20,F30-OS2.1]

",

v) striking the rows associated with "**2.4.4.2. Cooling of Hot Water or Sewage**" and substituting:

"

2.4.4.2. Sewer Discharge	
(1)	[F81-OH2.1]
(2)	[F130-OE1.2]

",

vi) striking the rows associated with "**2.4.5.3. Connection of Subsoil Drainage Pipe to a Sanitary Drainage System**" and substituting:

"

2.4.5.3. Connection of Subsoil Drainage Pipe to a Storm Drainage System	
(1)	[F81-OH2.1]
(2)	[F81-OH2.1]
(3)	[F81-OH2.1]

",

vii) adding under "**2.4.6.4. Protection from Backlow**" the following new row:

"

(6)	[F81-OH2.1]

",

viii) adding under "**2.6.1.1. Design**" the following new rows:

"

(3)	[F40-OH1.1]
(4)	[F40-OH1.1]

",

ix) adding under "**2.6.1.12. Service Water Heaters**" the following new row:

"

(2)	[F30,F31-OS3.1,OS3.2] [F46-OH1.1,OH2.2]

",

x) adding under "**2.6.2.1. Connection of Systems**" the following new row:

"

(4)	[F40,F43,F46,F81-OS3.4,OH2.2,OH5]

", and

xi) striking the rows associated with "**2.7.1.1. General**", "**2.7.1.2. Identification and Marking**", "**2.7.1.3. Location of Pipes**", "**2.7.1.4. Location of Outlets**", "**2.7.2.2. Permitted Applications**", "**2.7.2.3. Roof Design**", "**2.7.2.4. Non-Potable Rainwater Harvesting System Design**" and substituting:

"

2.7.1.1. General	
(1)	[F46-OH2.2]
2.7.1.2. Non-Potable Water Sources	
(1)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(3)	[F40,F43,F46,F81-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.1.3. Non-Potable Water Uses	
(1)	[F130-OE1.2]
(2)	[F130-OE1.2]
(3)	[F46,F70-OS3.4,OH2.2,OH2.3]
(4)	[F81-OS3.2]
(5)	[F40-OH2.2]
2.7.2.1. Piping and Outlet Identification	
(1)	[F46-OH2.2]
(2)	[F46-OH2.2]
(3)	[F46-OH2.2]
2.7.3.1. Pipes	
(1)	[F46-OH2.2]
2.7.3.2. Outlets	
(1)	[F46-OH2.2]
2.7.4.1. Requirements for Alternate Water Source Systems Installed Prior to January 1, 2019	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F81-OH2.2]
(3)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(4)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(5)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(6)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(7)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
2.7.5.1. Occupancy	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(2)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.2. Commissioning	
(1)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
2.7.5.3. Operating Permit	
(1)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
(3)	[F40,F41,F43,F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.5.4. Continued Operation	

(1)	[F81,F82,F130-OH5,OP5,OE1.2]
2.7.6.1. Professional Design	
(1)	[F46,F81,F82,F130-OS3.4,OH2.1,OH2.2,OH5,OE1.2]
2.7.6.2. Pipe Sizing	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F71,F72-OH2.1,OH2.3]
2.7.6.3. Continuity of Supply and Backflow Prevention	
(1)	[F71,F72-OH2.1,OH2.3]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(3)	[F46-OH2.2]
2.7.6.4. Storage Tanks	
(1)	[F40,F81-OH2.1,OH2.3]
(2)	[F40,F81-OH2.1,OH2.3]
(3)	[F40,F81-OH2.1,OH2.3]
(4)	[F81-OH2.2] [F81-OP5]
(5)	[F81-OH2.2] [F81-OP5]
2.7.6.5. Water Metering	
(1)	[F130-OE1.2]
2.7.6.6. Water Quality Sampling and Alerts	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5]
(2)	[F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.6.7. Power Interruption	
(1)	[F71,F72,F81-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.1. Water Quality Standards, Testing, and Documentation	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
(2)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
(3)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.2. Water Quality Reporting	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.7.3. Required Response to Failure to Meet Water Quality Standards	
(1)	[F40,F43,F71,F72,F81,F82-OS3.4,OH2.1,OH2.3,OH5]
2.7.8.1. Operating Manual	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]
2.7.8.2. Maintenance	
(1)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]
(2)	[F46,F81,F82-OS3.4,OH2.1,OH2.2,OH5]
(3)	[F82-OS3.4,OH2.1,OH2.3,OH5,OE1.2]

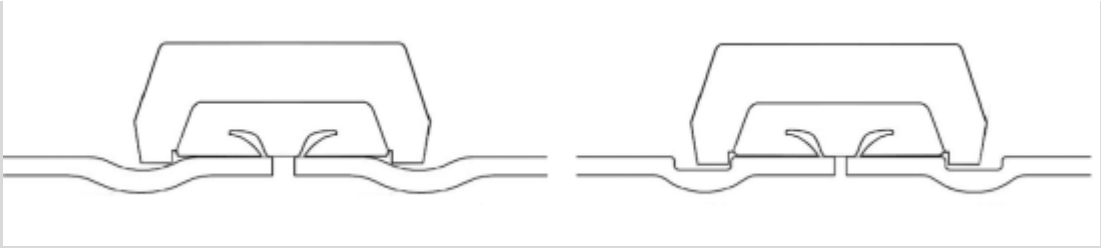
", and

dd) in the Notes to Part 2:

i) striking out Note A-2.7.1.1., Note A-2.7.1.1.(1), Note A-2.7.2.1.(1) and A-2.7.2.4.(3) and (4) Treatment for Use, Note A.2.7.2.3.(1) Pedestrian Traffic, Note A-2.7.2.3.(2) Roofing and Conveyance Materials, and A-2.7.2.4.(1) Good Engineering Practice,

ii) inserting the following in correct alphanumerical order:

"**A-2.2.10.4.(1) Fittings in Pressure Piping Applications.** Piping used in pressure applications are to be grooved and constructed using tools specifically designed for that piping material. It is important that all groove profiles are to meet the fitting manufacturer's guidelines and conform to CSA-B242 "Groove and Shoulder-Type Mechanical Pipe Couplings." Overly shallow roll grooved or cut connections may result in reduced working pressures at the joint or the failure of the connection due to insufficient engagement of the coupling or from slippage at the joint. Conversely, grooves or cuts that are overly deep may result in failures of the pipe stemming from corrosion or stress concentrations at the joints.



Note: Image is exaggerated for clarity

Figure A-2.2.10.4.(1)
Insufficient Key Engagement of Fitting in Roll Grooved Connection",

"**A-2.2.10.17. Water Treatment Systems.** The potential risk for substances to be introduced into the drinking water that may endanger health must be considered. All proposals to install point-of-entry water treatment devices shall address:

- Seismic and environmental concerns,
- Monitoring and tampering detection,
- Protection of the city water supply and interface with the existing distribution system,
- Notification of end users and record keeping,
- Chemical storage and security, and
- Spill containment and procedures in the event of an equipment malfunction such as incorrect dosing.

For proposed new installations, the *Chief Building Official* will require:

- A technical report from a registered professional with appropriate qualifications and training identifying the context of installation, performance specifications of the proposed equipment, and the technical basis for the installation and means to protect the general public and end users,
- A piping diagram of the proposed water distribution system showing the type of existing piping and equipment, and
- A letter from the owner(s) stating that all end users have been informed of the proposal to introduce such chemicals into the drinking water and a sign has been posted in a conspicuous place 30 days before the proposed date of installation detailing the scope of the installation, the name of the chemicals being introduced and the relevant safety data sheets (SDS)."**,**

"**A-2.2.11.4.(3) Non-Recirculating Applications.** Non-recirculating water systems, such as *once-through cooling equipment*, waste large volumes of drinking water. Only in exceptional circumstances will a request for an *operating permit* be considered, such as a life safety application for which a registered professional has formally documented that there is no practical alternative to once through cooling.",

"**A-2.2.11.6. *Cooling Tower* Start-up and Shut-down.** It is not the intention that the undefined terms "start-up" and "shut down" within Clause (4)(a), Clause (7)(c), Clause (9)(b) or Sentence (10) be interpreted to include a brief shutdown for the purposes of physical cleaning, system maintenance or inspection, or a "Standby (wet)" mode of *cooling tower* operation as defined by ASHRAE Guideline 12-2023. Operating a *cooling tower* in a "Standby (wet)" mode should include maintaining the water treatment program and circulating water to control biological growth, as described in ASHRAE Guideline 12-2023.",

"**A-2.2.11.6.(8) Required Response to Failure to Meet Legionella Standards.** This Sentence is based on Public Services and Procurement Canada's standard MD 15161, "Control of *Legionella* in Mechanical Systems.",

"**A-2.2.11.6.(9) Offline Cleaning and Disinfection.** The terms "cleaning" and "disinfection" have the meanings defined by Public Services and Procurement Canada's standard MD 15161, "Control of *Legionella* in Mechanical Systems."

More frequent *cooling tower* cleaning and disinfection may be necessary, especially for buildings with or near vulnerable populations. For health care facilities, refer to CAN/CSA-Z317.13, "Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities" Clause 6.4.2.",

"**A-2.2.11.7.(2)(b) Health Advisory.** Examples of acceptable graphical symbols include

Figure A-2.2.11.7.(2)(b)
Examples of acceptable graphical symbols",

"**A-2.4.3.6.(1) Elevator Pit Drains.** Protection from sewer gases is required in accordance with Articles 2.4.5.1. and 2.4.5.5.",

"**A-2.4.2.4.(2) Water Flow and Hazardous Conditions.** Refer to the *Street and Traffic By-law* and *Standards of Maintenance By-law* for restrictions on water flow to streets, sidewalks, driveways, stairways and landings, and for prohibitions on ponding or entrance of water into a *building*.",

#14488

"**A-2.4.2.4.(3) Groundwater Protection Area.** The intent is to preserve existing groundwater levels sustain natural watercourse baseflows, and preserve sewer capacity.

#14603

"**A-2.4.2.5.(4) Small Site Pathway.** The detention tank "minimum active storage capacity" excludes the volume below the orifice and above the emergency overflow. The overflow must bypass the outlet flow control mechanism. The orifice flow control should have appropriate debris protection to prevent blockages. The detention tank should be inspected and cleaned regularly following the manufacturer's instructions.",

"**A-2.4.2.5.(5) Minimum Detention Volume Calculation**.

Example: Determination of the minimum detention volume
(Convert units as required.)

Step No. 1: Assemble calculation inputs

a) Site characteristics (example)

Site area	=	0.25 hectares
Post-development runoff coefficient, C	=	0.75

b) City of Vancouver IDF projections

Return period	=	10 years (from Sentence (5))
Time of concentration, t_c	=	5 min
IDF curve	=	2100 (RCP 8.5 Moderate Projection)
IDF Coefficient A	=	26.651
IDF Coefficient B	=	-0.482

Step No. 2: Calculate 10-year unit flow target

Flow target	=	25 L/s/hectare (from Sentence (6))
Maximum discharge flow rate, Q_O	=	0.00625 m^3/s (calculated as = Flow target x Site area)

Step No. 3: Calculate peak post-development flow

Peak rainfall intensity, i	=	88 mm/h (calculated as = A x t_c^B)
Uncontrolled peak flow, Q_{POST}	=	0.0460 m^3/s (calculated as = Site area x C x i)

Step No. 4: Iterate for a range of storm durations to determine the peak storage requirement

Event duration, D (min)	Post-development rainfall intensity, i (mm/hr)	Post-development peak flow, Q_{POST} (m^3/s)	Required detention volume, V (m^3)
5	88	0.046	11.9
20	45	0.024	23.6
35	35	0.018	30.3
50	29	0.015	35.2
65	26	0.013	39.0
80	23	0.012	42.1
95	21	0.011	44.7
110	20	0.010	46.9
125	19	0.010	48.8
140	18	0.009	50.4
155	17	0.009	51.8
170	16	0.008	53.0
185	15	0.008	54.0
200	15	0.008	54.9
215	14	0.008	55.6
230	14	0.007	56.2
245	14	0.007	56.8
260	13	0.007	57.2
275	13	0.007	57.5
290	12	0.007	57.8
305	12	0.006	58.0
320	12	0.006	58.1
335	12	0.006	58.1
350	11	0.006	58.1
365	11	0.006	58.0
380	11	0.006	57.9
395	11	0.006	57.7

The minimum detention volume required to satisfy Sentences (5) and (6) is therefore 58.1 m^3.

More advanced modelling software may be used in place of the Modified Rational Method, applying the storm distributions and durations defined in the City of Vancouver Engineering Design Manual.",

#14488

"**A-2.4.2.5.(6) Detention Storage Calculations and Considerations**

Example: Determination of the first stage detention volume

Step No. 1: Assemble calculation inputs

Site characteristics (example)

Site area	=	0.25 hectares
Ground-level landscaped area	=	0.05 hectares
Vegetated roof assembly	=	0.02 hectares
Portion of site area without landscaping	=	0.18 hectares (calculated)

Step No. 2: Calculate "first stage" volume

First stage volume = 27 m^3
(calculated as = 15 mm x Portion of site area without landscaping)

This is the volume to be released at no greater than 5 L / s / hectare.

Considerations for detention storage and flow control

Detention storage can be provided by detention tanks, roof-based detention methods, or other vegetated or non-vegetated detention or retention systems designed to meet the criteria.

The overflow must bypass the outlet flow control mechanism(s). An orifice or other flow control device may be used. An orifice must meet the minimum diameter requirement. The outlet flow control mechanism(s) should have appropriate debris protection to prevent blockages. The equipment or structure used for detention storage should be inspected and cleaned regularly following the operations and maintenance manual instructions.",

#14488

"**A-2.4.2.5.(9) Relaxation to Rainwater Management Requirements.** When an *owner* ascertains that site conditions preclude compliance with the rainwater management requirements of this Article, the *Chief Building Official* may relax a portion or all of the requirements of the "Engineered pathway" or the "Small site pathway." Generally, the *Chief Building Official* may:

- consult with the *City Engineer*,
- consider evidence provided by the *owner* (Table A-2.4.2.5.(9)), and
- determine whether the *owner* has made a reasonable attempt to meet a portion or all of the rainwater management requirements by installing infrastructure above-ground or as part of the *building*.

The decision to relax requirements shall be made by the *Chief Building Official*.

Table A-2.4.2.5.(9)
Examples of Documentation That May Be Provided
By the *Owner* to the *Chief Building Official*
Forming Part of Note A-2.4.2.5.(9)

Potential Site Condition Precluding Compliance with Rainwater Management Requirements	Examples of Documentation Provided by the *Owner* Regarding a Relaxation to Rainwater Management Requirements
Archaeological resources	*Archaeological Impact Assessment*, prepared in conformance with the Heritage Conservation Act.
Artesian groundwater conditions	Hydrogeological or geotechnical engineering report.
Contamination	*Notification of Likely or Actual Migration*, prepared in conformance with the Contaminated Sites Regulation.
Geotechnical limitations	Geotechnical engineering report.
A tree protected by the *Protection of Trees By-law*	Certification by an arborist

#14488

”,

“**A-2.7.2.1.(3) Non-*potable* Water Outlet Identification.** An example of an acceptable graphical symbol is:

Figure A-2.7.2.1.(3)
Example of an ~~of~~ acceptable graphical symbol

It is suggested that public education material also be posted to assist with risk perception and acceptance of treated non-*potable* water use.”, and

“**A-2.7.6.4, 2.7.6.5. and 2.7.6.6. Non-*potable* Water System Design.**

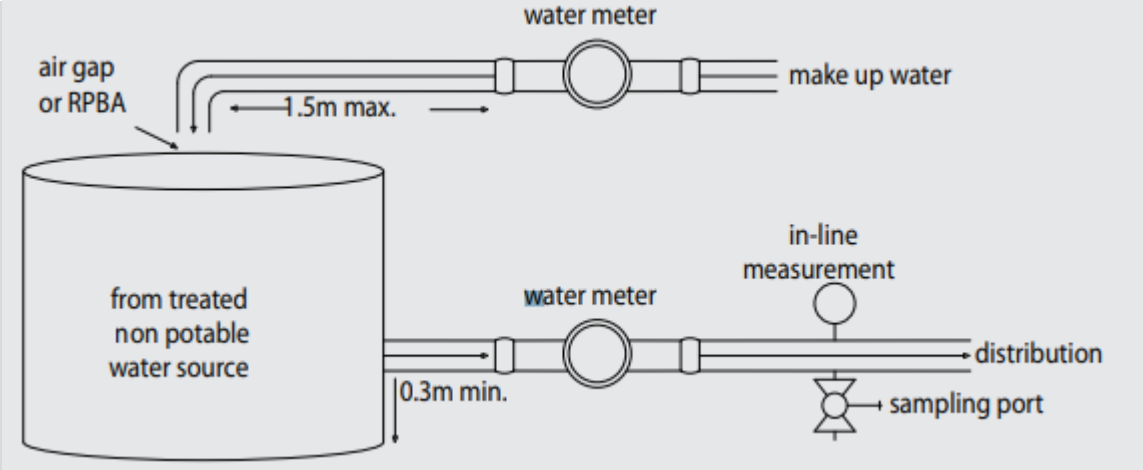


Figure A-2.7.6.4., 2.7.6.5. and 2.7.6.6.
Schematic example of a non-*potable* water system”,

iii) striking out Note A-2.2.3.2.(3) and substituting:

"**A-2.2.3.2.(3) Grease Interceptors.** Metro Vancouver provides resources on-line for grease interceptor selection and sizing. CSA B481.4, "Maintenance of grease interceptors," is considered to represent good practice regarding procedures for the maintenance of grease interceptors.", and

iv) striking out Note A-2.6.1.12.(1) and substituting:

"**A-2.6.1.12.(1) Service Water Heaters.** Storing hot water at temperatures below 60°C in the hot water tank or in the delivery system may lead to the growth of *Legionella* bacteria.".

7.1.5.3. Division C

1) The provisions of Part 1 of Division C of the 2020 National Plumbing Code shall be amended by:

a) adding the following sections in alphanumeric order:

"Section 1.3. Interpretation, Intent and Prohibitions

(Refer to Book I (General) of this By-law.) ",

"Section 1.4. Obligations of the Owner and Contractor

(Refer to Book I (General) of this By-law.) ",

"Section 1.5. Authority of the Chief Building Official

(Refer to Book I (General) of this By-law.) ",

"Section 1.6. Permits, Applications and Fees

(Refer to Book I (General) of this By-law.) ",

"Section 1.7. Permission to Occupy Buildings

(Refer to Book I (General) of this By-law.) ",

"Section 1.8. Street Regulations

(Refer to Book I (General) of this By-law.) ",

"Section 1.9. Temporary Occupancy of a Street for Construction Purposes

(Refer to Book I (General) of this By-law.) ", and

"Section 1.10. Addressing Buildings and Parcels of Land

(Refer to Book I (General) of this By-law.) ", and

b) adding Notes to Part 1:

"Notes to Part 1

(Refer to Book I (General) of this By-law.) ".

2) The provisions of Part 2 of Division C of the 2020 National Plumbing Code shall be amended by:

a) striking out "Section 2.2." and "Section 2.3." and substituting:

"Section 2.2. Administration

(Refer to Book I (General) of this By-law.) ",

"Section 2.3. Alternative Solutions

(Refer to Book I (General) of this By-law.) ", and

b) striking out the Notes to Part 2 and substituting:

"Notes to Part 2

(Refer to Book I (General) of this By-law.) ".

3) The provisions of Division C of the 2020 National Plumbing Code shall be amended by adding a new Part 3:

"Part 3 Appeals, Offences and Penalties and Transition Provisions

(Refer to Book I (General) of this By-law.) ".

Section 7.2. Objectives and Functional Statements

7.2.1. Objectives and Functional Statements

7.2.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 7.2.1.1. (See Note A-1.1.2.1.(1).)

Table 7.2.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 7
Forming Part of Sentence 7.2.1.1.(1)

Provision	Functional Statements and Objectives(1)
7.1.2.1. Conformance	
(1)	[F30-OS3.1] [F31-OS3.2] [F43-OS3.4]
	[F70-OH2.2] [F72-OH2.1]

Notes to Table 7.2.1.1.:
(1) See Parts 2 and 3 of Division A.

Part 8
Safety Measures at Construction and Demolition Sites

Section 8.1. General

8.1.1. Scope

8.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

2) This Part applies to fire safety and the protection of the public during the construction, *alteration* or demolition of every *building*, including any incompleted or abandoned *building*.

3) Fire safety at construction and demolition sites shall conform to Subsection 8.2.6. and Section 5.6. of Division B of the Fire By-law.

8.1.1.2. Definitions

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

8.1.1.3. Deconstruction and Demolition Procedures

1) Measures shall be taken during demolition to protect the public in conformance with Section 5.6. of Division B of the Fire By-law.

8.1.2. Application

8.1.2.1. Application

1) Where a *building* is undergoing construction, *alteration* or demolition, measures shall be taken at the *building* site in conformance with this Code. (See Note A-8.1.2.1.(1).)

8.1.3. Construction Safety Program

8.1.3.1. Requirements for Construction Safety Program

1) Unless otherwise provided in Article 8.1.3.2., before the commencement of any construction a *Construction Safety Program* shall be submitted to the *Chief Building Official*.

2) A *Construction Safety Program* shall include

a) the names and emergency phone numbers of the constructor, the coordinating registered professional and the *Construction Safety Officer*,

b) details of the construction procedures relating to site access, traffic control, scaffolding and swing stages, protection at *excavations*, hoisting equipment (including its location and scheduling), fire protection facilities, material storage, waste material disposal, control of dust and debris, protection at the perimeters of all floor levels, barricades, covered walkways and any other details required by the *City Engineer*, the *Chief Building Official* or any other city official having jurisdiction, and

c) a *construction* site plan showing the location on the site of the equipment, facilities and safety measures detailed in the *Construction Safety Program* in accordance with Clause (b).

3) The *Construction Safety Program* shall be amended from time to time to reflect the current stage of construction.

8.1.3.2. Exemptions

1) A *Construction Safety Program* is not required for minor interior *alterations* contained within a *suite* or for minor *alterations* or additions to a *building* contain only one *dwelling unit* and its contained *ancillary residential suites*, except that the *Chief Building Official* may require a *Construction Safety Program* if, in the opinion of the *Chief Building Official*, the work may cause a hazard for persons occupying the *building*, construction workers or the public.

8.1.3.3 Posting Requirements

1) No construction shall commence until a copy of the *Construction Safety Program* which complies with this subsection is posted on the *project* site in accordance with Sentence (2).

2) The copy of the *Construction Safety Program* required by Sentence (1) shall be

a) posted on a plywood board measuring no less than 600 mm by 600 mm, which is staked into the ground, protected from the weather and visible from the *street*, or

b) posted on the exterior of the principal *construction* site shelter.

3) Notwithstanding the exceptions of 8.1.4.1.(1), a copy of the *Construction Safety Program* shall be posted on the *project* site at all times during construction.

8.1.4. Construction Safety Officer

8.1.4.1. Requirement for Construction Safety Officer

1) Except for a *building* containing only 2 primary *dwelling units* and their contained *ancillary residential units*, where construction of a *building* includes the services of a *Coordinating Registered Professional*, a full-time *Construction Safety Officer* shall be present on the *project* site at all times during construction.

8.1.4.2. Requirement for Site Reviews

1) During construction, the *Construction Safety Officer* shall carry out site reviews at least twice daily to ensure that work is proceeding safely and in conformance with the *Construction Safety Program*.

2) After each site review, the *Construction Safety Officer* shall post a copy of the site review in a location adjacent to the posted copy of the *Construction Safety Program*.

8.1.4.3. Site Safety Meetings Required

1) The *Construction Safety Officer* shall hold regular construction site safety meetings at least monthly with the constructor and a representative of each trade.

8.1.4.4. Safety Meeting Minutes

1) The *Construction Safety Officer* shall keep minutes of the construction site safety meetings held in accordance with Article 8.1.4.3. and copies of those minutes shall be provided to the *coordinating registered professional* and shall be available at the *construction* site for inspection by the *Chief Building Official*.

8.1.4.5. Violation of Construction Safety Program

1) If the *Construction Safety Officer* observes that a procedure set out in the *Construction Safety Program* is not being followed, the *Construction Safety Officer* shall immediately inform the appropriate trades safety coordinator or, if that person is unavailable at the site, the supervisor of the appropriate sub-contractor.

2) If corrective measures are not taken immediately by the person informed in accordance with Sentence (1), the *Construction Safety Officer* shall promptly inform the constructor or an agent of the constructor.

Section 8.2. Protection of the Public

8.2.1. Fencing and Barricades

8.2.1.1. Covered Walkways

1) If *construction* of a *building* may cause a hazard for persons using the adjacent sidewalk, work shall not commence until a covered walkway has been provided on the sidewalk in accordance with Article 8.2.1.2.

2) Despite the provisions of Sentence (1) a covered walkway is not required on a sidewalk if

a) the work is carried out entirely behind fencing, boarding or barricades, at least 1.8 m high and complying with Sentences 8.2.1.3.(2) and (3), which separate the *construction* site from the sidewalk, or

b) the *building* is located no less than 2 m from a sidewalk used by pedestrians, except that the *Chief Building Official* may require a covered walkway for a site which contains a *project* located more than 2 m from a sidewalk if, in the opinion of the *Chief Building Official*, site conditions so warrant.

8.2.1.2. Covered Way Construction

1) A covered walkway shall

a) have a clear height of not less than 2.5 m,

b) have a clear width of not less than 1.5 m or the width of the public way, whichever is the lesser,

c) be designed and constructed to support safely all loads that may be reasonably expected to be applied to it, but in no case less than 2.4 kPa on the roof,

d) have a weathertight roof sloped towards the site or, if flat, be equipped with a splash board not less than 300 mm high on the *street* side,

e) be totally enclosed,

i) on the *construction* site side with a structure having a reasonably smooth surface facing the public way,

ii) on the *construction* site side of the sidewalk, and

iii) walls with a smooth surface facing the sidewalk,

f) have a railing 1 070 mm high measured from the walking surface and located on the *street* side where the covered way is supported by posts on the *street* side of the sidewalk,

g) constructed with sufficient lighting to enable the public to walk safely through any walkway which, and

h) is constructed on a sidewalk which is illuminated by overhead *street* lighting at night.

8.2.1.3. Fencing, Boarding or Barricades

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1) When a construction or demolition activity may constitute a hazard to the public and is located 2 m or less from a public way, a strongly constructed fence, boarding or barricade not less than 1.8 m high shall be erected between the site and the public way or open sides of a *construction* site.

2) Fencing, boarding, and barricades erected in conformance with Sentence (1) or Article 8.2.1.1.(2) shall have a reasonably smooth surface facing the public way and shall be without openings, except those required for access to the *construction* site.

3) Access openings through fencing, boarding, or barricades erected in conformance with Sentence (1) or Article 8.2.1.1.(2) shall be equipped with gates that shall be

a) kept closed and locked when the *construction* site is unattended, and

b) maintained in place until completion of the *construction* or demolition activity.

8.2.1.4. Special Hazards

1) If an unusual hazard exists on a *construction* site, security guards shall be posted 24 hours a day and 7 days a week, to prevent public access to the area where the unusual hazard is located.

8.2.1.5. Work Shutdown

1) All hazardous areas on a *project* site shall be secured against unauthorized entry at all times.

2) If workers are not present on a construction site during normal working hours, the hazardous part of the construction site shall be protected by

a) all windows, doors and other openings located within 3 m of the ground which may give access to the *building* shall be secured with boarding or barricades, or

b) fencing, boarding or barricades shall be constructed around the entire site in accordance with Article 8.2.1.3.

8.2.2. Excavation

8.2.2.1. Water Removal

1) *Excavations* shall be kept reasonably clear of water.

8.2.2.2. Protection of Adjoining Property

(See Note A-8.2.2.2.)

1) If the stability of adjoining *buildings* or adjacent municipal infrastructure may be endangered by the work of excavating, adequate underpinning, shoring and bracing shall be provided to prevent

a) damage to, or movement of, any part of the adjoining *building*, and

b) the creation of a hazard to the public.

8.2.3. Use of Streets or Public Property

8.2.3.1. Safe Passage Past Site

1) Except as provided in Article 8.2.3.2., provisions shall be made at all times for the safe passage of pedestrian and vehicular traffic past the site.

2) Material or equipment shall not be placed on any *street* or other public property except as authorized.

3) Except as provided in Sentence (4), where a sidewalk exists adjacent to the site it shall be kept clear of obstructions at all times.

4) Where construction operations necessitate the obstruction of a sidewalk, a temporary sidewalk shall be provided and it shall be kept clear of obstruction at all times.

8.2.3.2. Overhead Activities

1) Operations such as the hoisting of major components onto a tall *building* or other overhead activities that constitute a hazard to pedestrians below from which the public cannot be protected by barricades, covered ways or similar means shall not be carried out until the *street* or other public way is closed.

8.2.3.3. Barricades

1) Excavations in *streets* or public property shall

a) be adequately barricaded, and

b) have warning signs or lights installed on each section of the barricades referred to in Clause (a).

8.2.3.4. Restoration and Repair

1) All sidewalks, *streets* or other public property that have been damaged shall be restored to a safe condition.

2) All obstructions on sidewalks, *streets* or other public property shall be removed when the need for such obstructions is ended.

8.2.3.5. Warning Lights

1) Warning lights shall be placed and shall be in operation during the hours of darkness at all obstructions on *streets* or other public ways.

8.2.3.6. Maintenance of Public Ways

1) *Public ways* adjacent to *projects* shall be cleaned and maintained to the satisfaction of the *City Engineer*., the *General Manager, Real Estate and Facilities Management*, or the *General Manager, Park Board,* as the case may be.

2) No person shall place, park or leave *construction* vehicles on *public ways* or *City* property.

3) No person shall place or leave *construction* materials, overspills, debris, excavated materials or mud on *public ways* or *City* property.

4) No person shall dump or discharge waste water from *construction* activities or vehicle wash water from concrete trucks or dump trucks on *public ways* or *City* property.

8.2.4. Traffic Control

8.2.4.1. Protection of the Public on Public Ways

1) If work on a *project* site creates a traffic hazard on or adjacent to a *public way*, traffic control measures for the duration of the hazard shall include

a) persons to direct *construction* workers,

b) persons to direct vehicle and pedestrian traffic,

c) appropriate warning signs indicating the presence of *construction* work and flagpersons.

d) warning signs indicating any lane closures,

e) if there is a lane closure of a vehicle travel lane, retro reflective lane control devices set up in a gradual taper to close the vehicle travel lane,

f) if there is a lane closure of a vehicle travel lane at night, yellow flashing lights mounted on retro reflective barricades at the closure point of the vehicle travel lane,

g) retro reflective lane control devices surrounding the closed portion of any *public way*, and

h) at night, retro reflective barricades with yellow flashing lights in front of any construction material or equipment which is not marked with retro reflective sheeting.

2) If work on a *construction* site creates a hazard to bicycle traffic on a bikeway for more than 15 minutes, traffic control measures for the duration of the hazard must include

a) a safe delineated continuous path for bicycle traffic or a safe alternative delineated path for pedestrian traffic,

b) persons to supervise and direct bicycle traffic past the hazard, and

c) if a safe alternative pedestrian path is provided, a bicycle dismount sign at either end of the path.

8.2.4.2. Traffic Control and Hazard Signs

1) Traffic control and traffic hazard signs shall be

a) at least 75 cm by 75 cm,

b) backed with retro reflective sheeting,

c) marked with black text or symbols on an fluorescent orange background for hazard signs, and

d) marked with black text or symbols on a white background for traffic control signs.

8.2.4.3. Lane Control Devices

1) A lane control device shall be

a) a fluorescent red or orange plastic tubular marker 100 cm in diameter marked with two 8 cm retro reflective bands,

b) a fluorescent red or orange plastic cone 45 cm or 70 cm in diameter at the base with a 15 cm retro reflective band, or

c) a fluorescent red or orange plastic flexible drum with two 10 inch retro reflective bands.

8.2.4.4. Traffic Control Person

1) A person directing traffic on a *public way* shall

a) carry written proof of completion of a traffic control course approved under the authority of the Workers' Compensation Act of British Columbia or the British Columbia Safety Council,

b) wear personal protective equipment approved under the authority of the Workers' Compensation Act of British Columbia including a safety vest, hard hat, reflective wrist straps, and safety footwear approved under the authority of the Canadian Standards Association,

c) use a traffic control paddle consisting of a "STOP" sign marked with white letters on a retro reflective red background and a "SLOW" sign marked with black letters on a retro reflective yellow background, and

d) use a flashlight that includes a red signaling hood for night traffic conditions.

8.2.4.5. Construction Vehicle Traffic Hazard

1) If the location or use of a vehicle related to a *construction* site creates a traffic hazard on a *public way* adjacent to a *construction* site, the vehicle shall display

a) a 360 degree yellow flashing light,

b) four way flashers, and

c) a flashing arrow board.

8.2.5. Waste Material

8.2.5.1. Control of Waste Material

1) Waste material or other material shall not be permitted to fall freely from one storey to another.

8.2.5.2. Removal of Waste Material

1) Waste material shall be removed as quickly as possible by means of

a) appropriate containers,

b) an enclosed shaft or chute conforming to Sentence 8.2.5.4.(1), or

c) a hoisting apparatus if large pieces or objects are involved.

8.2.5.3. Enclosures for Waste Material

1) Waste material removed in accordance with Sentence 8.2.5.2.(1) shall be deposited in a container which is

a) designed to ensure that waste material cannot escape from the container, and

b) secure and inaccessible to the public.

8.2.5.4. Chutes for Waste Material

1) The chute described in Clause 8.2.5.2.(1)(b) shall be closed if it is inclined more than 45° to the horizontal.

8.2.5.5. Disposal of Waste Material

1) Except as provided in Sentence (2), all waste material on a *construction* site shall be sorted, diverted and disposed of in a manner satisfactory to the *Chief Building Official.* (See Note A-8.2.5.5.(1).)

2) Sentence (1) does not apply to

a) proposed work of a value of $50,000 or less, and

b) corrective measures or immediate measures carried out by the *Chief Building Official* in accordance with Articles 1.5.3.4. and 1.5.3.5. of Division C.

8.2.6. Fire Safety Measures

8.2.6.1. Application

(See Note A-8.2.6.1.)

1) This Subsection applies to fire safety for *projects* undergoing *construction* and adjacent *projects*.

8.2.6.2. Protection of Adjacent Buildings

(See Note A-8.2.6.2.)

1) Protection shall be provided for adjacent *buildings* that could be exposed to fire originating from *buildings* undergoing *construction*.

8.2.6.3. Fire Safety Plan

1) Before the commencement of *construction*, a fire safety plan for the *project* site shall be submitted to and *accepted* by the *Chief Building Official.*

2) Unless otherwise required by Sentence (3), a fire safety plan shall conform with the requirements of the Fire By-law and shall include

a) measures to reduce fire hazards in and around the *building* (See Note A-8.2.6.3.(2)(a)), and

b) a maintenance program for firefighting measures required by the Fire By-law.

3) Where *construction* occurs in an *existing building* that is required to have a fire safety plan conforming to the Fire By-law, the existing fire safety plan shall be modified to incorporate the *alterations* to the *existing building*.

8.2.6.4. Access for Firefighting

1) Unobstructed access to fire hydrants, portable extinguishers and fire department connections for standpipe and *sprinkler systems* shall be maintained on all *construction* sites.

2) Firefighters shall be provided with unobstructed access to all levels of the *building.*

3) Firefighters shall be provided with unobstructed access to all elevators, hoists or lifts in the *building.*

4) Firefighters shall be provided with unobstructed access to access routes for fire department vehicles.

5) Where a *project* site is enclosed by fencing, boarding or barricades, firefighters shall be provided with 24 hour emergency access for fire department equipment and personnel.

8.2.6.5. Portable Extinguishers

1) Portable extinguishers shall be provided in unobstructed locations in all areas where

a) hot work operations are carried out,

b) *combustibles* are stored,

c) internal combustion engines are located,

d) *flammable liquids* and *combustible liquids* or gases are stored or handled, and

e) temporary fuel-fired equipment is used.

2) Portable extinguishers required by Sentence (1) shall have a minimum rating of

a) 2-A:10-B:C on moveable equipment, and

b) 4-A:40-B:C in all other locations.

8.2.6.6. Standpipe Systems

(See Note A-8.2.6.6.)

1) Where a standpipe system is installed in a *building* under *construction*, the standpipe system shall be installed progressively, in conformance with Subsection 3.2.5. of Division B of this By- law, in occupied portions of a *building.*

2) Where a standpipe system is to be installed progressively in unoccupied portions of a *building* under *construction*, a permanent or temporary standpipe system is permitted, and the standpipe system shall have

a) conspicuously marked and readily accessible fire department connections on the outside of the *building* at *street* level

b) at least one hose outlet at each floor,

c) pipe size, hose valves and water supply conforming to Subsection 3.2.5. of Division B of this By-law,

d) as a minimum, secure supports and restraints on alternate floors,

e) at least one hose valve for attaching fire department hose at each intermediate landing or floor level in the *exit* stairway, and

f) valves which are kept closed and protected from mechanical damage at all times.

3) A standpipe system installed in accordance with Sentence (2) shall be progressively installed so that it is no more than one floor below the highest forms, staging, and similar *combustible construction* materials at all times.

4) A temporary standpipe system shall remain in service until the installation of the permanent standpipe system is complete.

5) If a *building* equipped with a standpipe system is being deconstructed or demolished floor by floor, the standpipe system, together with all fire department connections and valves, shall be maintained in operable condition at all times on all *storeys*, except for the *storey* located immediately below the *storey* being deconstructed or demolished.

8.2.6.7. Hot Surface Applications

1) Roofing operations and other surface applications that involve heat sources and hot processes shall be considered hot works and shall conform to the requirements in the Fire By-law.

2) Bitumen kettles shall not be located on roofs, and shall be

a) provided with a close-fitting cover constructed of steel with a minimum thickness of No. 14 sheet metal gauge,

b) under constant supervision when in operation, and

c) maintained free of excessive residue.

3) Mops used to spread bitumen shall be stored in a safe location at a safe distance away from *buildings,* when not in use.

8.2.6.8. Ignition Sources

(See Note A-8.2.6.8.)

1) Internal combustion engines, temporary heating equipment and other equipment capable of causing ignition shall be kept at a safe distance away from *combustible* materials.

2) The clearance between *combustible* materials and temporary heating equipment, including *flues*, shall be in conformance with Part 6 or in conformance with the minimum clearances shown on certified heating equipment.

8.2.6.9. Utility Services to Buildings under Construction

1) Except as required in Sentence (3) and except for water supplies for firefighting, utility services shall be terminated at a point located outside the *building* undergoing *deconstruction* or *demolition*.

2) A utility service provider whose service connections will be affected by *construction,* shall be notified before any service connections are terminated in accordance with Sentence (1).

3) If it is necessary to maintain any utility service, during *deconstruction* or *demolition*, the utility service shall be

a) relocated as necessary, and

b) protected from damage.

4) Temporary electrical installations shall be installed in conformance with the British Columbia Electrical Safety Regulation.

8.2.6.10. Fuel Supply Installation

1) Fuel supplies for heating equipment and internal combustion engines shall conform to

a) CAN/CSA-B139-M, "Installation Code for Oil-Burning Equipment," or

b) the British Columbia Gas Safety Regulation.

8.2.6.11. Safety of Fuel Tanks and Piping at Construction Sites

1) Fuel tanks and piping at a *deconstruction* or *demolition* site which contain or may have contained *flammable liquids* or *combustible liquids* or vapours shall be decommissioned in conformance with the Fire By-law.

2) Fuel tanks and piping at a *deconstruction* or *demolition* site which contain or may have contained *flammable liquids* or *combustible liquids* or vapours shall be drained or vented and removed prior to the deconstruction or demolition of a *building,* except as permitted by Sentence (3).

3) Where it is impracticable to remove fuel tanks or piping from the *construction* site prior to *deconstruction* or *demolition* of a *building*, such equipment shall be tagged for identification and removed as soon as conditions permit.

4) Fuel tanks and piping referred to in Sentences (1), (2) and (3) shall be purged with inert materials prior to *deconstruction or demolition* of a *building.* (See Note A-8.2.6.11.(4).)

8.2.6.12. Fire Separations in Partly Occupied Buildings

1) Where part of a *building* under *construction* is occupied, the occupied part of the *building* shall be separated from the part of the *building* under construction by a *fire separation* having a *fire-resistance rating* of no less than 1 h.

8.2.6.13. Protection During Fire Protection System Shutdown

1) Except as permitted in Sentence (2), where a fire protection system is provided, it shall remain operational throughout the entire *building* during *construction*.

2) If any portion of a fire protection system is temporarily shut down during *construction*, protection of the *building* shall comply with the Fire By-law.

8.2.6.14. Requirement for Fire Watch

1) If a *building* is partly occupied and part of the *building* is undergoing *deconstruction* or *demolition,* a fire watch shall be maintained at all times, unless the *building* is provided with an active fire alarm system.

2) A fire watch as required by Sentence (1) shall include:

a) a complete tour of inspection of the *project* at least once every hour,

b) facilities to provide a fire warning to occupants, to the satisfaction of the *Chief Building Official,* and

c) facilities to communicate with the fire department in the event of fire, to the satisfaction of the *Chief Building Official*.

8.2.6.15. Smoking Restrictions on Construction Sites

1) Smoking shall only be permitted on *construction* sites in accordance with the Fire By-law.

8.2.6.16. Egress from Buildings under Construction

1) In *buildings* under *construction*, there shall be at least one *exit* which is accessible and usable at all times.

2) In *buildings* under *construction* there shall be least one stairway maintained in usable condition at all times.

8.2.6.17. Fire Warning in Buildings under Construction

1) Facilities shall be provided to alert persons on a *project* to the presence of a fire and such facilities shall be audible throughout the *building.*

8.2.6.18. Storage and Use of Dangerous Goods on Construction Sites

1) *Combustible* liquids and *flammable liquids* shall be stored and used in conformance with the Fire By-law.

2) Dangerous goods and materials shall be stored and used in conformance with the Fire By-law.

3) Dangerous goods and materials shall be stored and used in conformance with the British Columbia Gas Safety Regulations.

8.2.6.19. Temporary Enclosures on Construction Sites

1 Fabrics and films used to temporarily enclose *buildings* shall be securely fastened to prevent contact with heaters or other ignition sources.

8.2.6.20. Storage of Combustible Refuse

1) *Combustible* refuse shall be stored a safe distance away from *buildings,* and at a safe location. (See also Subsection 8.2.5.)

8.2.6.21. Shut-off of Utility Services at Excavation Sites

1) Except as provided in Article 8.2.6.22., before *excavation* begins, utility services shall be shut off, and terminated outside the limits of the *excavation* and the terminations shall be labeled so as to be easily identifiable. (See also Sentence 8.2.6.9. (1).)

2) A utility service provider whose service connections will be affected by *construction* shall be notified before any service connections are terminated in accordance with Sentence (1).

3) If it is necessary to maintain any utility service, during *excavation*, the utility service shall be

a) relocated as necessary, and

b) protected from damage.

8.2.6.22. Maintaining Existing Utility Services

1) Existing utility services may be left within the area of the *excavation* if

a) the service company consents to the location of the services before the *excavation* begins,

b) a method of *excavation* is adopted which ensures that the services are not damaged, and the services are provided with temporary support."

Section 8.3. Objectives and Functional Statements

8.3.1. Objectives and Functional Statements

8.3.1.1. Attributions to Acceptable Solutions

1) For the purpose of compliance with this Code as required in Clause 1.2.1.1.(1)(b) of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 8.3.1.1. (See Note A-1.1.2.1.(1).)

Table 8.3.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 8
Forming Part of Sentence 8.3.1.1.(1)

Provision	Functional Statements and Objectives[1]
8.1.1.3. Deconstruction and **Demolition Procedures**	
(1)	[F01-OS1.1]
	[F30-OS5.1,OS5.3,OS5.8] [F34-OS5.5] [F31,F32,F43,F44-OS5.6]
8.1.2.2. Protection from Risk	
(1)	[F01-OS1.1]
	[F30-OS5.1,OS5.3,OS5.8] [F34-OS5.5] [F31,F32,F43,F44-OS5.6]
8.1.3.1. Requirements for Construction Safety Program	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
(2)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.3.3. Posting Requirements	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
(2)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.1. Requirements for Construction Safety Officer	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.2. Requirements for Site Reviews	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.3 Site Safety Meeting Required	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.1.4.4. Safety Meeting Minutes	
(1)	[F12, F30-OS5.1, OS5.2, OS5.3, OD5.4, OS5.5, OS5.6, OS5.7]
8.2.1.2. Covered Walkway Construction	
(1)	(a),(b),(d) to (g) [F30-OS5.1,OS5.2] [F34-OS5.5]

	(c) [F20-OS5.7]
8.2.1.3. Fencing, Boarding or Barricades	
(1)	[F30-OS5.1,OS5.3,OS5.6] [F34-OS5.5]
(2)	[F34-OS5.5] [F30-OS5.3]
(3)	[F34-OS5.5]
8.2.1.4. Special Hazards	
(1)	[F34-OS5.5]
8.2.1.5. Work Shutdown	
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(1)	[F60-OS5.8]
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8.2.2.2. Protection of Adjoining Property	
(1)	(a) [F21-OP4.1]
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8.2.3.1. Safe Passage Past Site	
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8.2.3.2. Overhead Construction Activities	
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8.2.3.3. Barriers	
(1)	[F30-OS5.1,OS5.3,OS5.2] [F34-OS5.5]
8.2.3.4. Restoration and Repair of Streets or City Property	
(1)	[F30-OS5.3]
(2)	[F30-OS5.3,OS5.2]
8.2.3.5. Warning Lights	
(1)	[F30-OS5.3,OS5.2]
8.2.4.1. Protection of Public on Public Ways	
(1)	[F30-OS5.2]
8.2.4.2. Traffic Controls and Hazard Signs	
(1)	[F30-OS5.2]
8.2.4.3. Traffic Lane Control Devices	

(1)	[F30-OS5.2]
8.2.4.4. Traffic Control Devices	
(1)	[F30-OS5.2]
8.2.4.5. Construction Vehicle Traffic	
(1)	[F30-OS5.2]
8.2.5.1. Control of Waste Material	
(1)	[F30-OS5.1]
8.2.5.2. Removal of Waste Material	
(1)	[F30-OS5.1,OS5.3]
8.2.5.3. Enclosures for Waste Material	
(1)	[F30-OS5.1,OS5.3] [F34-OS5.6]
8.2.5.4. Chutes for Waste Material	
(1)	[F30-OS5.1]
8.2.6.2. Protection of Adjacent Buildings	
(1)	[F12-OS1.2, OP3.1]
8.2.6.4. Access to Firefighting	
(1)	[F12-OS1.2, OP3.1]
8.2.6.5. Portable Extinguisher	
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8.2.6.6. Standpipe Systems	
(1)	[F12-OS1.2, OP3.1]
8.2.6.7. Hot Surface Application	
(1)	[F03-OS1.1][F31-OS5.6]
8.2.6.8. Ingnition Source	
(1)	[F03-OS1.2]
8.2.6.12. Fire Separation in Partly Occupied Buildings	
(1)	[F03-OS1.2]
8.2.6.14. Requirements for Fire Watch	
(1)	[F11-OS5.9]
8.2.6.15. Smoke Restrictions on Construction Sites	
(1)	[F02-OS1.1]

8.2.6.16. Egress from Buildings Under Construction	
(1)	[F10-OS1.5]
8.2.6.20. Storage of Combustible Refuse	
(1)	[F01-OS1.2]

Notes to Table 8.3.1.1.:

(1) See Parts 2 and 3 of Division A.

Notes to Part 8
Safety Measures at Construction and Demolition Sites

A-8.1.2.1.(1) Application. The use of streets or public property and vehicular traffic during construction or demolition is normally controlled by regulations of authorities other than the building department (e.g., police department).

A-8.2.2.2. Protection of Adjacent Properties. The requirements of 8.2.2.2. apply to projects of all sizes where there exists the potential for unintended movement of bearing surfaces as a consequence of proposed or prior, soil disturbance or excavation. Designers should take care that appropriate assessments of the existing conditions have been carried out before relying upon shallow *foundation* design principles, as this may lead to concerns over soil movement, slope stability and the impact on adjacent properties and City infrastructure.

Owners considering deeper basements, or work in areas containing peat, liquefiable, or potentially unstable soils (such as adjacent to site where the amount of native untouched fill is unknown), should obtain assistance from qualified professionals before undertaking such this work. Guidance for geotechnical and *foundation* design work for one and two family homes are provided in the "Housing Foundations and Geotechnical Challenges – Best Practices for Residential Builders in BC" publication.

A-8.2.5.5.(1) Disposal of Waste Material. Certain waste materials are banned or prohibited from disposal at a garbage or landfill site. The Greater Vancouver Sewerage and Drainage District Act and its regulations, and the City of Vancouver Solid Waste By-law No. 8417 lists materials that are restricted or prohibited from disposal at a garbage or landfill sites. Sorted material means the separation of waste materials into like type materials at the construction site prior to disposal. Diverted material means the reuse, recycle or recovery of sorted waste material to avoid disposal at a garbage, landfill or incinerator facility.

A-8.2.6.1. Application. The degree of application should be determined in advance in conjunction with the *Chief Building Official*. Each operation should be determined in advance, as part of the fire safety plan for the operation, taking into consideration such issues as the size of the operation, exposure of adjacent buildings or facilities to hazards and the site conditions. Operations can range from large multi-storey buildings to small single-storey residences and may include additions or alterations to existing buildings. Where the work does not pose an exposure hazard to other buildings or to occupants, the application of Subsection 8.2.6. may be minimal.

A-8.2.6.2. Protection of Adjacent Buildings. Methods and materials used to protect adjacent buildings and facilities can range from active to passive systems such as spatial separation, installing water curtains, using construction methods and materials that include gypsum sheathing or erecting a temporary fire barrier such as a fire tarpaulin.

A-8.2.6.3.(2)(a) Fire Safety Plan. The control of fire hazards in and around buildings under construction, renovation or demolition includes fire protection for combustible material construction and combustible refuse on the site. The size of material and refuse piles and the location of these piles in relation to adjacent buildings are factors that should be taken into consideration in determining which fire protection measures to implement. The selection of fire protection measures for demolition operations will also depend on the demolition procedure being used, the specific conditions existing on the site and the firefighting capabilities of the responding fire department. It is the intent of this By-law that the Outdoor Storage requirements of the Fire By-law are in compliance on all construction and demolition sites.

A-8.2.6.6. Standpipe Systems. Not all aspects of Subsection 3.2.5. of Division B of the Building By-law are applicable to unoccupied areas of buildings, parts of buildings, facilities and associated areas undergoing construction, alteration or demolition operations. When the temperature causes freezing conditions, the standpipe should be drained to prevent damage to the equipment. It is not expected that hoses and nozzles be made available in the building undergoing construction, alteration or demolition operations, as they will be brought to the relevant floor by the responding fire department.

PART 9 – See Volume 2

Part 10
Energy and Water Efficiency

Section 10.1. General

10.1.1. Application

10.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

10.1.1.2. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

10.1.2. Definitions

10.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 10.2. Energy Efficiency

10.2.1. Energy Design Building Classification

10.2.1.1. Application

1) Except as permitted by Sentence (2), a *building* shall be designed and constructed in conformance with this Subsection for the purpose of energy efficiency.

2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of 10.2.1.2., or as deemed *acceptable* to the *Chief Building Official*.

3) To meet the energy efficiency requirements of Articles 10.2.1.2. to 10.2.1.4., the design requirements of Subsection 10.2.2. shall form an integral part of this Subsection.

4) For the purposes of Part 10 and the classification of applicable energy design requirements of a *building*, the application of these requirements are to be applied to a *building* or that portion of a *building*, which for the purposes of energy and emissions performance, is designed to function as an independent entity. (See Note A-10.2.1.1.(4).)

5) Except as permitted by Sentence (6), a balcony, including those that are enclosed, shall be designed and constructed as unconditioned ambient space, exterior to the *building* envelope, without the provision of heating, cooling, or gas connection. (See Note A-10.2.1.1.(5).)

6) A residential *building* with not more than 2 principal *dwelling units* may be provided with a gas connection serving an exterior space that is not enclosed. (See Note A-10.2.1.1.(6).)

10.2.1.2. Buildings Without Residential or Commercial Components

1) All *buildings* except those included in 10.2.1.3 and 10.2.1.4.,

a) shall be designed in compliance with Article (See Note A-10.2.1.2.(1)(a).)

i) 10.2.2.2. or 10.2.2.3., or

ii) 10.2.2.2. in a *building* required to be designed to Part 9 by Division A, 1.3.3.3.,

b) except where space heating and service water heating systems are powered only by electricity, shall be designed with a *greenhouse gas* intensity (GHGI) reduction in compliance with Table 10.2.2.5.A, or a reduction as *acceptable* to the *Chief Building Official*,

c) shall be provided with vestibules in compliance with Article 10.2.2.8.,

d) shall be provided with metering equipment in compliance with Article 10.2.2.9,

e) shall be provided with lighting in conformance with Article 10.2.2.10.,

f) shall comply with Article 10.2.2.15. where domestic gas-fired fireplaces are provided,

g) may provide exterior heated spaces in compliance with Article 10.2.2.19.

h) shall provide airtightness testing in compliance with Article 10.2.2.21., and

i) shall *commission* in compliance with Article 10.2.2.22.,

10.2.1.3. Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

1) All *buildings* containing Group C, D, or E *Major Occupancies*, except those included in Article 10.2.1.4.,

a) shall be designed in compliance with energy and emissions performance per Article 10.2.2.5,

b) shall be provided with vestibules in compliance with Article 10.2.2.8.,

c) shall be provided with metering equipment in compliance with Article 10.2.2.9,

d) shall be provided with lighting in compliance with Article 10.2.2.10.,

e) shall comply with Article 10.2.2.15., where domestic gas-fired fireplaces are provided,

f) may provide exterior heated spaces in compliance with Article 10.2.2.19..

g) shall provide airtightness testing in compliance with Article 10.2.2.21., and

h) shall *commission* in compliance with Article 10.2.2.22.,

10.2.1.4. Residential Buildings of 1 to 3 Storeys, and Houses (excluding Hotels/Motels)

1) A *building* shall comply with the requirements of either the Performance Path set out in Sentence (2) or the Prescriptive Path set out in Sentence (3), where it

a) contains entirely Group C *major occupancies* except subsidiary *occupancies,*

b) is either

i) less than 4 storeys in building height, or

ii) contains not more than 2 principal *dwelling units* and their subsidiary structures with conditioned space, and

c) does not include a Hotel or Motel use.

(See Note A-10.2.1.4.(1)(a))

2) A *building* conforming with the criteria of Sentence (1) and the “Performance Path”,

a) shall be designed in compliance with the energy and GHG emissions performances of Article 10.2.2.4.,

b) shall be designed in compliance with the *building* envelope thermal performance values of Article 10.2.2.6.,

c) shall be designed in compliance with the exterior closures and fenestration thermal performance values of Article 10.2.2.7.,

d) except for *residential buildings* with not more than 2 principal *dwelling units*, shall be provided with vestibules in compliance with Article 10.2.2.8.,

e) shall be provided with metering equipment in compliance with Article 10.2.2.9.,

f) shall be provided with lighting in compliance with Article 10.2.2.10.,

g) shall comply with Articles 10.2.2.11. through 10.2.2.13. where domestic boilers generate space heating or hot water,

h) shall comply with Article 10.2.2.14. where domestic heat pumps, furnaces, or make-up air units are provided,

i) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided,

j) shall comply with Article 10.2.2.16. where domestic wood fireplaces are provided,

k) shall be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,

l) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.19..

m) shall provide documentation in compliance with Article 10.2.2.20., and

n) shall provide airtightness testing in compliance with Article 10.2.2.21..

3) Except as permitted in Sentence (2), a *building* conforming with the criteria of Sentence (1) and the "Prescriptive Path",

a) shall be designed in compliance with a GHG emissions compliance option of Sentence 10.2.2.4.(5), and, where applicable, the large home emissions limit of Sentence 10.2.2.4.(6).,

b) shall be designed in compliance with the building envelope thermal performance values of Article 10.2.2.6.,

c) shall be designed in compliance with the exterior closures and fenestration with thermal performance values of Article 10.2.2.7.,

d) except for *residential buildings* with not more than 2 principal *dwelling units*, shall be provided with vestibules in compliance with Article 10.2.2.8.,

e) shall be provided with metering equipment in compliance with Article 10.2.2.9.,

f) shall be provided with lighting in compliance with Article 10.2.2.10.,

g) shall comply with Articles 10.2.2.11. through 10.2.2.13. where domestic boilers generate space heating or hot water,

h) shall comply with Sentence 10.2.2.14. where domestic heat pumps, furnaces, or make-up air units are provided,

i) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided

j) shall comply with Article 10.2.2.16. where domestic wood fireplaces are provided,

k) shall be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,

l) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.19.

m) shall provide documentation in compliance with Article 10.2.2.20., and

n) shall provide airtightness testing in compliance with Article 10.2.2.21..

10.2.2. Design Measures for Energy Efficiency

10.2.2.1. Application

1) This Subsection applies to all *buildings* and parts of the *buildings* that are required to be energy efficient under Subsection 10.2.1.

10.2.2.2. ANSI/ASHRAE/IESNA 90.1

1) A *building* designed in accordance with this Article shall, be designed and constructed in accordance with ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings, except Low-Rise Residential Buildings".

2) A *building* designed in accordance with Sentence (1), shall be designed, as applicable, with

a) ASHRAE 90.1, Exception to 4.2.1.3. (*alteration* for Historical buildings), being replaced by "In a *building* where components have been formally recognized by a federal, provincial, territorial, or municipal *authority having jurisdiction*, as having either Heritage or Character value, the alteration of these components need not comply with these requirements.",

b) a climate zone of 4,

c) no requirement for *commissioning* per ASHRAE 90.1, Section 4.2.5.2,

d) no requirement to comply with whole building air leakage testing of ASHRAE 90.1, Section 5.4.3.1.1.,

e) no requirement to comply with vestibules provision of ASHRAE 90.1, Section 5.4.3.3.,

f) no requirement to comply with the Fenestration Orientation provisions of ASHRAE 90.1, Section 5.5.4.5.,

g) ventilation in conformance with ASHRAE 62-2001 (except addendum n), or if applicable, 6.3.1.1.(3)(b) of the Building By-law,

h) no requirement to comply with Service Water-Heating System Controls, per ASHRAE 90.1, Article 7.4.4. (See Article 2.6.1.12. of Division B of Book II (Plumbing Systems) of this By-law.), (See Note A-10.2.2.2.(2)(h).)

i) no requirement to comply with Automatic Receptacle Control, per ASHRAE 90.1, Section 8.4.2,

j) no requirement to comply with Electrical Energy Monitoring provision of ASHRAE 90.1, Section 8.4.3.1.

k) ASHRAE 90.1, Section 9.1.2. (lighting alterations) and Exception 9.1.2. being replaced by:

"9.1.2 Lighting Alterations.

For the *alteration* of any *lighting system* in an interior *space* or exterior area, that *space* or area shall comply with the entirety of Chapter 9, as applicable to that *space* or area.

Exceptions to 9.1.2:

1. Interior lighting *alterations* where the total new wattage of all *replaced luminaires* on a project is 2,000 watts or less, the total wattage of *replaced luminaires* of a *lighting system* within a *space* shall be at least 50% below the total wattage of all *removed luminaires* of that *lighting system*, unless the *space* is at or below the LPD allowance of Table 9.6.1 or Section 9.6.2 as applicable.

Controls shall comply with the requirement of either Section 9.4.1.1(h) or Section 9.4.1.1(i).

2. Exterior lighting *alterations* where the total number of *replaced luminaires* on a project is 10 or less, the total wattage of *replaced luminaires* shall be at least 50% below the total wattage of all *removed luminaires*, unless each altered area is at or below the LPD allowances of Table 9.4.2-2.

Controls shall comply with the requirement of Section 9.4.1.4(a).

3. The replacement of a failed *lamp* or *ballast/driver* in an individual *luminaire* or the replacement of any failed lighting control.

4. The removal or relocation of interior or exterior *luminaires* as part of, or independent of, exceptions 1, 2, or 3.",

l) ASHRAE 90.1, Section 9.6.1.d. (lighting Space by Space Method application), being replaced by "The *interior lighting power allowance* is the sum of lighting power allowances of all *spaces* and subspaces. Trade-offs among *spaces* and subspaces are not permitted."

(See Note A-10.2.2.2.(2)(l).),

m) the 5% in Table 11.5.1, Item 5 Building Envelope, Exception a., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Section 11, and

n) the 5% in Table G3.1, Item.5.a. Building Envelope, Exception 1., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Appendix G.".

10.2.2.3. National Energy Code of Canada for Buildings

1) A *building*, other than a Part 9 *building*, designed in accordance with this Article shall be designed and constructed in accordance with the National Energy Code of Canada for Buildings (NECB), except that the provisions of this By-law shall apply where the NECB refers to the National Building Code of Canada (NBCC), and shall be designed, as applicable, with

a) a climate zone of 4,

b) ventilation in conformance with ASHRAE 62-2001 (except addendum n) or if applicable, 6.3.1.1.(3)(b) of the Building By-law,

c) no requirement to comply with vestibules provision of NECB Article 3.2.2.1.,

d) window-to-wall and skylight-to-roof area ratios of the reference *building* identical to area ratios of the proposed *building*, to a maximum of 40% for windows and to a maximum of 3% for skylights,

e) a vertical glazing Solar Heat Gain Coefficient which does not exceed an assembly maximum of 0.36, and

f) a skylight Solar Heat Gain Coefficient for all types, which does not exceed an assembly maximum of 0.40, where the ratio of the aggregate skylight area to roof area is less than or equal to 3.0%,

g) no requirement to comply with whole building air leakage testing of NECB, Article 3.2.4.2.,

h) lighting exclusions 4.2.1.4.(4)(a) and 4.2.1.4.(4)(b) applicable to exclude "display" lighting for retail merchandise,

i) NECB, Section 4.3. (lighting Trade-off Path application), shall be permitted using whole building application only. Trade-offs among *spaces* and subspaces are not permitted with the application of the Space by Space Method, (See Note A-10.2.2.2.(2)(l).),

j) no requirement to comply with Hot Service Water requirements, per NECB Subsection 6.2.6. (See Article 2.6.1.12. of Division B of Book II (Plumbing Systems) of this By-law.). (See Note A-10.2.2.2.(3)(j).), and

k) no requirement to comply with Monitoring provision of NECB, Article 7.2.1.1..

10.2.2.4. Energy and Emissions Performance (for Buildings subject to Article 10.2.1.4.)

1) *Buildings* and major occupancies designed and constructed to conform to the certification criteria for Passive House Standard are deemed to comply with this Article provided the design's energy model is:

a) version 9 or newer of the Passive House Planning Package, and

b) prepared by a Certified Passive House Designer, or Certified Passive House Consultant.

(See Note A-10.2.2.5.(1).)

2) Except as permitted by Sentence (1), for a *building* required to comply with this Article, any energy modelling shall conform to:

a) the EnerGuide Rating System (version 15 or newer) and the City of Vancouver 1 to 3 Storey Residential Energy Modelling Guidelines, or

b) the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines

3) Except as permitted by Sentence (1), a *building* required to comply with this Article shall demonstrate modelling compliance with the following performance metrics:

a) the applicable mechanical energy use intensity (MEUI) target in Table 10.2.2.4.A., and

b) except as permitted in Sentence (4), a thermal energy demand intensity (TEDI) ≤ 20 kWh/(m²•year)

Table 10.2.2.4.A
Mechanical Energy Use Intensity
Forming part of Clause 10.2.2.4.(3)(a)

Conditioned Floor Area	MEUI (kWh/m²a)
≤50 m²	125
≤75 m²	108
≤120 m²	78
≤165 m²	58
≤210 m²	48
>210 m²	45

4) The thermal energy demand intensity requirements may be calculated using the 'Adjusted TEDI' formula: (See Note A-10.2.2.4.(4).)

$$TEDI_{adjusted} = TEDI_{20} + (TEDI_{higher} - TEDI_{step})(HDD_{actual} - HDD_{lowest})/500$$

5) Except as permitted by Sentence (1), a *building* required to comply with this Article shall be designed and constructed to one of the following GHG emissions compliance options in Table 10.2.2.4.B:

Table 10.2.2.4.B
Greenhouse Gas Emissions Compliance Options
Forming part of Sentence 10.2.2.4.(5)

Maximum GHG Emissions ($kgCO_{2e}$ / a) (1)(2)	or	Maximum GHG Emissions (1)(2)(3)		or	Reduction of GHG Emissions by Energy Source of *Building* Systems
		Maximum GHGI Emissions ($kgCO_{2e}/m^2a$)	Maximum GHG Emissions ($kgCO_{2e}/a$)		
265		1.5	500		Energy sources supplying all *building* systems, including *equipment* and *appliances*, shall be electricity

Notes to Table 10.2.2.4.(B):
(1) GHG and GHGI values shall be calculated for each 'house' which consists of a principal dwelling unit, with or without ancillary dwelling units
(2) Refer to the City of Vancouver Energy Modelling Guidelines for 1 to 3 Storey Residential Buildings for guidance on modelling GHG and GHGI metrics
(3) Compliance with this option is demonstrated by meeting both the GHGI and the GHG emission requirements for each house.

6) A *building* required to comply with this Article that contains more than 325 m² of *conditioned space*, and does not consist of more than *one principal dwelling unit*, shall provide a calculation to demonstrate that the proposed home, including all exterior gas equipment, has a maximum greenhouse gas (GHG) limit of 2,000 $kgCO_{2e}$/year. (See Note A-10.2.2.4.(6).)

10.2.2.5. (ZEBP) Building Energy and Emissions Performance (for Buildings subject to Article 10.2.1.3.)

1) *Buildings* and major occupancies designed and constructed to conform to the certification criteria for Passive House Standard are deemed to comply with this Article provided the design's energy model is:

a) version 9 or newer of the Passive House Planning Package, and

b) prepared by a Certified Passive House Designer, or Certified Passive House Consultant,

(See Note A-10.2.2.5.(1).)

2) Except as permitted by Sentence (1), for a *building* required to comply with this Article, any energy modelling shall comply with the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines.

3) Compliance with the GHGI limits in Table 10.2.2.5.A is not required where a *building* can demonstrate the performance values of the proposed *building* comply with the TEUI and TEDI limits in Table 10.2.2.5.B.

4) Except as permitted in Sentences (1), (3), or (5), a *building* designed with this Article shall demonstrate the performance values of the proposed *building* comply with the limits in Table 10.2.2.5.A.

5) Compliance with the TEUI and TEDI limits in Table 10.2.2.5.A is not required where a building is connected to a *Low Carbon Energy System*, and can demonstrate the performance values of the proposed building comply with the limits in Table 10.2.2.5.C.

Table 10.2.2.5.A
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(4)

Occupancy Classification (1)	**Total Energy Use Intensity** (kWh/m^2-a)	**Thermal Energy Demand Intensity** (kWh/m^2a)	**Greenhouse Gas Intensity** ($kgCO_{2e}/m^2a$)
Group C *occupancies* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	3.0
Group C *occupancies* in *buildings* over 6 *Storeys*, except Hotel and Motel	120	30	3.0
Hotel and Motel *occupancies*	140	20	4.0
Group D and E *occupancies*, except Office	120	20	3.0
Office *occupancies*	100	20	3.0
All other *occupancies*	(1)		50% lower than GHGI of the reference building modelled using only fossil-fuel systems

Notes to Table 10.2.2.5.A:
(1) For *buildings* containing multiple *occupancies*, refer to the procedures on mixed-use *buildings* in Section 5 of the City of Vancouver Energy Modelling Guidelines.

Table 10.2.2.5.B
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(3)

Occupancy Classification	**Total Energy Use Intensity** (kWh/m^2a)	**Thermal Energy Demand Intensity** (kWh/m^2a)	**Greenhouse Gas Intensity** ($kgCO_{2e}/m^2a$)
Group C *occupancies*	100	15	NA

Table 10.2.2.5.C
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(5)

Occupancy Classification	**Total Energy Use Intensity** (kWh/m^2-a)	**Thermal Energy Demand Intensity** (kWh/m^2a)	**Greenhouse Gas Intensity** ($kgCO_{2e}/m^2a$)
Group C *occupancies* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	3.0
Group C *occupancies* in *buildings* over 6 *Storeys,* except Hotel and Motel	130	40	3.0

Hotel and Motel *occupancies*	170	30	4.0
Business and Personal Services or Mercantile *occupancies*, except Office	170	30	3.0
Office *occupancies*	130	30	3.0

10.2.2.6. Building Envelope Opaque Elements

1) Except as otherwise required in this Subsection, a *building* required to comply with this Article shall comply with the performance values in Table 10.2.2.6., between

a) heated space and unheated space,

b) heated space and exterior air,

c) heated space and exterior *soil*,

d) heating floor assemblies and heated space,

e) heating floor assemblies and unheated space,

f) heating floor assemblies and exterior air, and

g) heating floor assemblies and exterior *soil*.

Table 10.2.2.6.
Minimum Effective Thermal Resistance of Assemblies
Forming part of Sentence 10.2.2.6.(1)

Building Assembly	Assembly Minimum Thermal Resistance (RSI - m^2K/W)	
	Performance Path (per Sentence 10.2.1.4.(2))	**Prescriptive Path** (per Sentence 10.2.1.4.(3))
Roof Assemblies	4.30	7.04
Decks[1]		
Area > 10.0 m^2	4.30	7.04
Area ≤ 10.0 m^2	4.30	
Attic Space[2]	8.50	
Walls (including frame crawl space walls)[3]	3.85	
Foundation Walls	3.85	
Box and Rim Joists	3.85	
Concrete or Masonry Walls (other than foundation walls)	3.85	
Suspended Floors (framed)	4.22	
Suspended Floors (concrete slab)	4.22	
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.45	
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below)[4]	2.45	
Concrete Balconies, Eyebrows, and Exposed Slab Edge (wrapped or using manufacturer thermal break in structure)	0.42	

Notes to Table 10.2.2.6.:

[1] The term "Decks" shall represent flat roof assemblies, intended for pedestrian access, installed over living spaces.

[2] Refer to Notes for Part 10: Figure A-10.2.2.6.-B for permitted reduction in insulation value for attic insulation near an exterior wall

[3] Headers and lintels: cavities between structural members are to be fully insulated, except where a framing plan provided by the builder, architect, designer, or engineer indicates that full-depth solid headers are structurally required.

(4) Not applicable when heating elements or piping are located within a concrete topping on a suspended floor assembly or within an internally heated suspended slab.

2) The effective total "RSI" value of the opaque envelope area, the non-opaque envelope area, and the overall envelope area, calculated by a design professional, shall be submitted as part of an application for a *permit.*

(See Note A-10.2.2.6.)

3) In a residential *building* containing more than two principal *dwelling units*, low-sloped roofs (< 2:12) shall use light coloured and high albedo materials with a minimum initial solar reflectance index range (SRI) of 73 to 78, when tested in accordance with ASTM E908, and a minimum emissivity of 0.85 (in the 8-13 micron band), when tested in accordance with ASTM E408. (See Note A-10.2.2.6.(3).)

10.2.2.7. Building Envelope Windows, Skylights, Doors and Other Glazed Products

1) Except as otherwise required in this Subsection and as permitted by Sentence (2), a *building* required to comply with this Article shall comply with the performance values in Table 10.2.2.7.(1).

Table 10.2.2.7.(1)
Maximum Thermal Transmittance of Exterior Closures and Fenestration
Forming part of Sentence 10.2.2.7.(1)

Type of Closure	**Assembly Maximum Thermal Transmittance USI Value(2)** (W/(m²K))	
	Performance Path (per Sentence 10.2.1.4.(2))	**Prescriptive Path** (per Sentence 10.2.1.4.(3))
Windows, sliding, and folding doors with glazing		
Window-to-wall ratio ≥ 30%, and One Family Dwelling with conditioned space ≥ 325 m²	1.44	Average of 1.04 or lower and no individual window can be above U1.22
All Other	1.44	1.22
Curtainwall and Window Wall Assemblies		
Window-to-wall ratio ≥ 30%, and One Family Dwelling with conditioned space ≥ 325 m²	1.44	Average of 1.04 or lower and no individual window can be above U1.22
All Other	1.44	1.22
Other Types of Closures		
Storefront curtainwall, window, and door assemblies	2.27	
Doors with or without glazing(1)	1.80	
Doors with a required fire resistance rating	Exempt	
Roof access hatches	2.94	
Skylights (not larger than 1220 mm in both directions), roof windows and sloped glazing systems	2.44	
Skylights larger than 1220 mm in both directions	2.95	
Tubular daylight devices	2.64	

Notes to Table 10.2.2.7.(1):
(1) Includes doors swinging on a vertical axis with or without glazing, door transoms, and sidelites.
(2) See note A-10.2.2.7.(3)

2) A maximum of one entry door assembly consisting of one or two leafs installed in the principle entrance of a *building*, together with attached transoms and sidelites all within a single rough opening, need not comply with Table 10.2.2.7.(1), where constructed of thermally broken metal or wood with multiple panes of glass, which may be argon filled, or coated with a low-e coating.

3) The thermal transmittance of factory-assembled fenestration products within the scope of existing certification programs shall be indicated by labels applied to the products at the manufacturing location. The thermal transmittance of fenestration products that are site-assembled, imported, or otherwise outside the scope of existing certification programs shall be suitably documented. (See Note A-10.2.2.7.(3).)

10.2.2.8. Building Envelope Vestibules

(See Note A-10.2.2.8.)

1) Except as provided in Sentence (3), a door that separates conditioned space from the exterior shall be protected with an enclosed vestibule whose doors opening into and out of the vestibule are equipped with self-closing devices.

2) Except for doors equipped with power operators in barrier-free entrances, vestibules required in Sentence (1) shall be designed so that the interior and exterior doors of the vestibule shall be separated by no less than 2.1 m when closed and users passing through the vestibule are not required to open the interior and exterior doors at the same time.

3) A vestibule is not required for an exterior door that

a) is a revolving door,

b) is used primarily to facilitate vehicular movement or material handling,

c) is intended to be used as a service, emergency exit, or stairwell exit door only,

d) is intended to be used as a seasonal use door, such as a door leading to a patio,

e) opens directly from a dwelling unit,

f) opens directly from a building or space less than 278.7 m^2 in area.

10.2.2.9. Building Services Submetering

1) Every *building* shall be equipped with metering equipment capable of collecting and reporting *building* energy performance data for each energy source to the *building* and for every portion of the *building* which supports a separate use or *occupancy*.

(See Note A-10.2.2.9.(1).)

2) *Buildings* shall be designed to facilitate the installation of the means to monitor energy usage of:

(See Note A-10.2.2.9.(2).)

a) central HVAC systems, including boilers, chillers, pumps, heat pumps, fans and other equipment used to provide space heating, space cooling, dehumidification, and ventilation to the building, but not including energy that serves process loads or water heating; and

b) central service water heating systems, and water heating systems for amenity spaces, pools and spas.

10.2.2.10. Lighting in Residential Buildings

(See Note A-10.2.2.10.)

1) Where a portion of a residential *building* or a portion of a multi-use *building* located above a garage or on an adjacent grade contains more than 20 residential *suites*, the *building* shall be designed with

a) *occupancy* based lighting sensor controls, located in all *exit* stair shafts and parking garages, compatible with the requirements of Sentence 3.2.7.3.(1) of Division B, and

b) a switch near the principal entrance of each residential *suite* that controls all non high efficiency lighting fixtures within the *suite*, except lights serving corridors, stairs, washrooms, and rooms with no exterior window.

2) Except as permitted by Sentence (3), permanent ancillary exterior lighting of a *building* of *residential* occupancy or the *residential* portion of a multi-use *building,* or those parts of a *building* facing a *lane*, that is required to conform to this Article shall

a) be provided with fixtures that are appropriately shielded that

i) utilize full cut-off optics or are fully shielded fore luminaires that emit over 600 lumens, or any luminaire installed along the side or back yard, and

ii) are partially shielded and utilize a diffusing cover for luminaires that emit 600 lumens or less.

b) be mounted no higher than 4 m above grade or the balcony surface it illuminates along the side yard, back yard, and similar outward facing courtyards or setbacks of the *building*,

c) be provided with dimmer and timer controls,

d) minimize lighting of adjacent exterior properties and properties across a *street*, *lane*, or *public way.*

3) Where exterior lighting is required by this By-law or other regulator enactments to provide illumination along paths of pedestrian or vehicular travel, fire department access, or equipment signage or lighting, it need not comply with the requirements of Sentence (2).

10.2.2.11. Hot Water Tank Piping

1) In a *building* required to comply with this Article, the first 3 m of non-recirculating hot water piping leading from both electrically heated and gas heated hot water tanks, and the last 1 m of piping leading to the hot water tank connection, shall have insulation with a minimum RSI value of 0.35.

10.2.2.12. Domestic Hot Water Heaters

1) In a *building* required to comply with this Article, water heating appliances shall

a) be powered only by electricity, except as permitted by Sentence (2), and

b) comply with the following standards:

i) CSA C191, “Performance of electric storage tank water heaters for domestic hot water service”, or

ii) CAN/CSA-C745 “Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters, or

iii) CAN/CSA-P.9 Combined space- and water-heating systems

2) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide gas-fired appliances providing domestic hot water, and shall have a uniform energy factor of not less than 0.92 or alternatively a thermal efficiency of not less than 90% as determined by the following:

a) CSA P.3-04, “Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters”,

b) CSA P.7-10, “Testing Method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters”,

c) CAN/CSA-P.9 Combined space- and water-heating systems,

d) CSA C191, “Performance of electric storage tank water heaters for domestic hot water service”, or

e) CSA 4.3/ANSI Z21.10.3, “Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous”.

10.2.2.13. Domestic Boilers

1) Except as permitted by Sentence (2), in a *building* required to comply with this Article, domestic boilers providing heat, or heat and domestic hot water, shall be powered only by electricity and be tested using CAN/CSA-C22.2 No 165, “Testing Method for Electric Boilers”,

2) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide gas-fired appliances that have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, and must be tested using CSA P.2-07, “Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas Fired Furnaces and Boilers”.

10.2.2.14. Domestic Heat Pumps, Furnaces or Make-up Air Units

1) In a *building* required to comply with this Article, except as permitted by Sentence (5), domestic *heat pumps*, furnaces or make-up air units shall be powered only by electricity and be tested using CAN/CSA-C22.2 No. 236 "Heating and Cooling Equipment".

2) *Heat pumps* equipped with supplementary heaters shall incorporate controls to prevent supplementary heater operation when the heating load can be met by the *heat pump* alone, except during defrost cycles,

3) *Heat pumps* with a programmable thermostat shall be equipped with setback controls that will temporarily suppress electrical back-up or adaptive anticipation of the recovery point, in order to prevent the activation of supplementary heat during the *heat pump's* recovery.

4) *Heat pumps* shall conform to the performance requirements of Table 10.2.2.14..

Table 10.2.2.14
Heat Pump Equipment Performance Requirements
Forming part of Sentence 10.2.2.14.(4)

Component or Equipment	Heating or Cooling Capacity (kW)	Standard	Minimum Performance (no units)
Air Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Split Systems	≤ 19	CSA C656	SEER = 14.5 EER = 11.5 HSPF = 7.1
Single Package System	≤ 19	CSA C656 (Including General Instruction No 2)	SEER = 14 EER = 11 HSPF = 7.0
All Systems	> 19	CAN/CSA-C746	See Level 2 in standard
Water Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Ground Source Closed Loop			COP_h ≥3.91
Water loop *heat pumps*		CAN/CSA-C13256-1	COP_h ≥3.91
Direct Expansion Ground Source Heat Pumps – Electrically Operated			
Direct Expansion Ground Source *Heat Pumps*	≥ 21	CSA C748	COP_h ≥3.1

Notes to Table 10.2.2.14
The symbols and abbreviations that appear in this column have the following meanings:
COP = coefficient of performance, in W/W (COPc = in cooling mode and COPh = in heating mode)
EER = energy efficiency ratio, in (Btu/h)/W (no metric equivalent)
HSPF = heating season performance factor, in watt-hours
SEER = seasonal energy efficiency ratio, in (Btu/h)/W (no metric equivalent)

5) *Buildings* complying with the Performance Path option of Sentence 10.2.1.4.(2) may provide domestic gas-fired furnaces or make-up air units that shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, as tested using CSA 2.6/ANSI Z83.8, "Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces".

6) *Heat pumps* used to provide space heating shall be of the variable or multi stage compressor type.

7) *Heat pumps* providing space heating shall not provide for domestic hot water production, except where the heat pump only provides pre-heated water to a separate and independent electric domestic hot water system.

8) In a *building* containing not more than two principal *dwelling units*, *heat pumps* that provide space cooling must also be able to provide space heating.

9) *Heat pumps,* furnaces and make-up air units shall be readily accessible for maintenance, and capable of being reached quickly for operation, renewal or inspection, without requiring those to whom ready access is a requisite to climb over or remove obstacles.

10.2.2.15. Domestic Gas-Fired Fireplaces

(See Note A-10.2.2.15.)

1) In a *building* required to comply with this Article, domestic gas-fired fireplaces in conditioned spaces

a) shall be equipped with

i) intermittent pilot ignition (IPI) systems,

ii) on-demand ignition systems that automatically shut off within 7 days of appliance non-use in a single detached house or duplex *building*, or 6 hours of appliance non-use in a multifamily dwelling,

iii) match ignition, and

iv) a timer, and

b) shall be direct vented.

2) Where exterior gas fireplaces are provided as ancillary equipment to a *building* required to comply with this Article, then the exterior fireplaces shall be considered as part of the *building* for the purposes of this Part.

3) In a *building* required to comply with this Article, the total rated input of all gas-fired fireplaces installed shall not exceed 17.59 kW (60,000 Btu per hour).

4) In a *building* required to comply with this Article, gas-fired fireplaces are not permitted as the primary heating *appliance*.

10.2.2.16. Domestic Wood Burning Heating Appliances

1) In a *building* required to comply with this Article, and except for cooking stoves and ranges, a domestic wood burning heating appliance installed in a residential *dwelling unit* shall be tested in accordance with CAN/CSA B415.1-10 "Performance Testing of Solid-Fuel-Burning Heating Appliances" or EPA Title 40, Part 60, Subpart AAA - "Standards of Performance for New Residential Wood Heaters", and shall

a) produce not more than 2.5 grams per hour of particulate air contaminant emissions for catalytic appliances, or

b) produce not more than 4.5 grams per hour of particulate air contaminant emissions for non-catalytic appliances.

2) Open masonry fireplaces and factory-built fireplaces are not permitted.

10.2.2.17. Domestic Heat Recovery Ventilators

1) In a *building* required to comply with this Article, each dwelling unit shall be served by a heat recovery ventilator (HRV) or energy recovery ventilator (ERV) located in

a) each dwelling *unit*, including *ancillary dwelling units*, or

b) a commonly accessible location if serving multiple *dwelling units*.

2) In a *building* required to comply with this Article, an HRV or ERV shall

a) be sized to run at its rated speed for continuous operation while achieving the performance requirements of Table 10.2.2.17 as designed and tested in conformance with CAN/CSA-C439:

Table 10.2.2.17
Heat Recovery / Energy Recovery Ventilator Performance Requirements
Forming part of sentence 10.2.2.17.(2)

Compliance Path	Sensible Heat Recovery Efficiency (SRE) at 0° Celsius[1]
Performance Path (complying with Sentence 10.2.1.4.(2))	65%
Prescriptive Path (complying with Sentence 10.2.1.4.(3))	75%

Notes to Table 10.2.2.17
[1] See Note A-10.2.2.17 for guidance on determining efficiency ratings

b) be installed and commissioned by persons trained by the Thermal Environmental Comfort Association (TECA) or the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) or equivalent,

c) not be connected to kitchen and bathroom exhaust fans,

d) have balanced HRV or ERV supply and exhaust air flows within plus or minus 10% of the actual normal operating exhaust capacity, and

e) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM.

3) In a *building* required to comply with this Article, the HRV or ERV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the *Chief Building Official*.

10.2.2.18. [UTV Reserved]

10.2.2.19. System Requirements for Heating within Exterior Spaces

(See Note A-10.2.2.19.)

1) Any space heating or occupant heating within an exterior space associated with a *building* shall comply with the requirements of this Article.

2) The design and/or installation of space heating or occupant heating systems within exterior spaces shall be limited to spaces directly served by licensed beverage establishments or licensed food establishments.

3) Any exterior space designed with a heating system and directly served by a licensed beverage establishment or a licensed food establishment, shall prioritize the heating system design in the following order:

a) In-slab or in-floor radiant heat, using non fossil fuel or low-carbon system,

b) Electric fixed infrared radiant heat with metal-sheath element,

c) Heated seating, using non fossil fuel or low-carbon system,

d) Non-electric radiant heat using non fossil fuel system.

4) In spaces required to comply with Sentence (3), the design of exterior space heating or occupant heating systems shall comply with Table 10.2.2.19, as applicable,

Table 10.2.2.19.
Exterior Space or Occupant Heating System Design Requirements
Forming a part of 10.2.2.19.

System Type	Maximum output	Control type	Management Requirements
In-slab or in-floor radiant heat	15 W/ft^2	Zone-based controls interconnected with centralized automatic control system	Independent zone management
Electric radiant heat	18 W/ft^2	Unit-based or zone-based controls interconnected with centralized automatic control system	Independent unit or zone management

Heated seating	20 W per seat	Zone-based controls, interconnected with i) individual seat shutoff, or ii) a centralized automatic control system	Individual seat heater shutoff and independent zone management
Non-electric and non-fossil fuel radiant heat	18 W/ft^2	Unit-based controls interconnected with centralized automatic control system	Independent zone management

5) Heating systems designed to sentence (3) shall include

a) an automatic shut-off (ambient temperature sensor - lockout),

b) an automatic shut-off (space temperature sensors – integral/ zone), and

c) an automatic shut-off using programmable timeclock.

6) Heated zones within a zone-based design shall not exceed 4.8 kW per zone.

7) Heating systems designed with overhead radiant systems within a space containing a ceiling or roof of adequate height, shall be designed with circulation fans interconnected to heating mode operations, with an override for independent fan operation.

8) In a space required to comply with Sentence (2), any exterior space designed with a combination of systems contained in Sentence (3) shall

a) comply with the specific requirements pertaining to each system, without duplication of requirements, and

b) not contain an area where the combined heating exceeds the performance requirement of the least restrictive system.

10.2.2.20. Energy and Emissions Compliance Documentation Requirements

1) In a *building* required to comply with this Article, at the time of *permit* application, and at the time of final inspection, the owner shall provide compliance documentation, in the form of

a) a PHPP file from a Certified Passive House Consultant or Designer,

b) an EnerGuide Rating System Audit, or

c) equivalent documentation, *acceptable* to the Chief Building Official.

2) In a *building* subject to Sentence 10.2.1.4.(1), energy compliance reports shall provide:

a) a “Pre-construction Energy Checklist” at the time of permit application that demonstrates compliance with Article 10.2.1. 4. energy requirements,

b) a “Mid-construction Energy Checklist” to the *building official* at the time of mid-construction that:

i) demonstrates the energy components are consistent with the specified requirements at *permit* application, and

ii) includes a completed blower door test in which the airtightness meets or exceeds the specified value in Table 10.2.2.21.A, or is otherwise *acceptable* to the *Chief Building Official*, and

c) a final construction (as-built) report at project completion that:

i) demonstrates the energy components are consistent with the specified requirements at initial permit application, and

ii) includes a completed blower door test in which the airtightness meets or exceeds the specified value in Table 10.2.2.21.A, or is otherwise *acceptable* to the *Chief Building Official*.

10.2.2.21. Building and Dwelling Unit Airtightness Testing

(See Note A-10.2.2.21)

1) In a *building* required to comply with this Article, the *building* and *dwelling units* shall be tested for airtightness in accordance with

a) ASTM E 779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization,

b) USACE Version 3, Air Leakage Test Protocol for Building Envelopes,

c) airtightness protocol recognized by Natural Resources Canada for use in homes and buildings labeled under the EnerGuide for New Homes program, or

d) ASTM E3158, "Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building."

2) A *building* required to comply with this Article shall have, at time of final inspection, maximum tested air leakage rates in conformance with:

a) Table 10.2.2.21.A, for buildings subject to Article 10.2.1.4.,

b) Table 10.2.2.21.B, for buildings subject to Article 10.2.1.2. or Article 10.2.1.3., or

c) be sealed to the satisfaction of the *Chief Building Official.*

Table 10.2.2.21.A
Maximum Tested Air Leakage Rates for Buildings complying with Article 10.2.1.4.
Forming part of Clause 10.2.2.21.(2)(a)

#14688

Airtightness Levels	ACH_{50}	**NLA_{10}** (cm^2/m^2)	**NLR_{50}** ($L/s\text{-}m^2$)
All buildings	2.5	1.20	0.89

Table 10.2.2.21.B
Maximum Tested Air Leakage Rates for Buildings complying with Article 10.2.1.2 or 10.2.1.3
Forming part of Clause 10.2.2.21.(2)(b)

Building Classification	Maximum Tested Air Leakage Rate
Whole Building	1.5 L/s/m² at 75 pascals
Suites in *multi-family* buildings	1.23 L/s/m² at 50 pascals

10.2.2.22. Building Equipment and Systems Commissioning

1) In a *building* required to comply with this Article, *building* services (e.g. heating, ventilation, and air-conditioning, lighting, service water heating) and associated equipment, controls, meters, submeters shall be commissioned using a *commissioning* process carried out by a *Commissioning Provider* in accordance with: (See Note A-10.2.2.22.(1).)

a) ASHRAE Standard 202-2024, or

b) CSA Z320-11 (R2021) and CSA Z5000-18, with

i) no requirement to install metering or submetering equipment to monitor, record or display energy consumption, water consumption or end-use data,

ii) no requirement for post-occupancy monitoring-based commissioning, or continuous tracking and analysis for energy or water consumption data on an on-going basis, or user surveys, or post-occupancy energy model calibration. (See also Division C, Subsection 2.2.8.)

Section 10.3. Electric Vehicle Charging

10.3.1. Electric Vehicle Charging for Buildings

10.3.1.1. Electrical Service and Capacity

(See Note A-10.3.1.1.)

1) The electrical installations, including the service capacity of the installation, the number and distribution of circuits and receptacles, shall meet the requirements of the "Electrical Safety Regulation."

2) Where an *electric vehicle energy management system* is implemented, the *Chief Building Official* may specify a minimum performance standard to ensure a sufficient rate of electric vehicle charging.

Section 10.4. Low Carbon Materials and Construction

10.4.1. Low Carbon Materials and Construction

10.4.1.1. Application

1) This Section applies to new *buildings* and *additions* described in Sentence 1.3.3.2.(1) of Division A, except those (See Note A-10.2.2.22(1).)

a) subject to Article 10.2.1.5. and any *storage garage* attached to them, or

b) with gross *floor area* not exceeding 1,800 m^2.

10.4.1.2. Low Carbon Materials and Construction

1) A *building* shall be designed and constructed to achieve whole-building embodied carbon impacts of not more than double an *acceptable* benchmark as determined in compliance with the "National Whole-Building Life Cycle Assessment Practitioner's Guide" and the associated City of Vancouver Addendum, or as *acceptable* to the *Chief Building Official*.

Section 10.5. Objectives and Functional Statements

10.5.1. Objectives and Functional Statements

10.5.1.1. Attribution to Acceptable Solutions

1) For the purposes of compliance with this By-law as required in Clause 1.2.1.1.(1)(b) of Division A of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 10.5.1.1. (See Note A-1.1.1.2.(1) of Division A.)

Table 10.5.1.1.
Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10
Forming part of Sentence 10.5.1.1.(1)

Acceptable Solutions	Functional Statements and Objectives(1)
10.2.2.2. ANSI/ASHRAE/IESNA 90.1	
(1)	[F85, F86-OE1]
10.2.2.3. National Energy Code of Canada for Buildings	
(1)	[F85, F86-OE1]
10.2.2.5. Building Energy and Emissions Performance	

(1)	[F85, F86-OE1]
(2)	[F85, F86-OE1]
10.2.2.6. Building Envelope Opaque Elements	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.2.2.7. Windows, Glass Doors and Skylights	
(1)	[F85-OE1]
10.2.2.8. Building Envelope Vestibules	
(1)	[F85-OE1]
10.2.2.9. Sub-metering in Buildings	
(1)	[F86, OE1]
(2)	[F86, OE1]
10.2.2.10. Lighting Controls in Residential Buildings	
(1)	[F86, OE1]
10.2.2.11. Hot Water Tank Piping	
(1)	[F85-OE1]
(2)	[F85, F86-OE1]
(3)	[F100-OE1]
10.2.2.12. Domestic Gas-Heated Hot Water Heaters	
(1)	[F86-OE1]
10.2.2.13. Domestic Gas-Heated Boilers	
(1)	[F86-OE1]
10.2.2.14. Domestic Gas-Heated Furnaces	
(1)	[F86-OE1]
(6)	[F86-OE1]
(7)	[F95,F96-OE1]
(8)	[F95,F96-OE1]
10.2.2.15. Domestic Gas-Fired Fireplaces	
(1)	[F86-OE1] [F41, F44-OS3.4] [F44-OH1.1]
10.2.2.16. Domestic Wood Burning Heating Appliances	
(1)	[F86-OE1] [F44-OS3.4] [F44-OH1.1]
10.2.2.17. Domestic Heat Recovery Ventilators	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.2.2.20. Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation	
(1)	[F85-OE1]

10.2.2.21. Building and Dwelling Unit Airtightness Testing	
(1)	[F85-OE1]
(2)	[F85-OE1]
10.3.1.1. Electrical Service and Capacity	
(1)	[F02-OS1.2]
	[F02-OP1.2]
(2)	[F41-OE1]
10.4.1.2. Low Carbon Materials and Construction	
(1)	[F101-OE2.2]

Notes to Part 10
Energy and Water Efficiency

A-10.2.1.1.(4) Building or Independent Parts Thereof. The intention of sentence (4), for the purposes of Part 10, is to recognize that multiple independent structures atop a parkade, for example, can and should have their respective energy and emissions performances evaluated independently, both during design as well as operationally throughout their respective lifespans. The intention is to prevent the performance assessment of one independent structure from effecting the performance assessment of any other, thus eliminating the ability to trade-off energy and/or emissions performance(s) between independent structures.

A-10.2.1.1.(5) Balcony. The intention is to apply the requirements to exterior spaces regardless of designation such as balcony, patio, porch, veranda, or other name whether located on the side or the roof of a building.

A-10.2.1.1.(6) Gas Connection for Small Residential Buildings. In line with the original intention, this note is to clarify the total limit of one gas connection, and not one gas connection for each exterior space, where an exterior space can include, but is not limited to, a balcony, patio, deck or lawn.

A-10.2.1.2.(1)(a) Designing to Passive House. If designing to Passive House then contact the Office of the CBO for potential recognition as being compliant with Article 10.2.1.2., where buildings and major occupancies designed and constructed to conform to the certification criteria for the Passive House Standard, may, at the discretion of the CBO, be deemed to comply with Article 10.2.1.2. provided the design's energy model is

a) version 9 or newer of the Passive House Planning Package, and
b) prepared by a Certified Passive House Designer, or Certified Passive House Consultant.

A-10.2.1.4.(1)(b) Subsidiary Structures with Conditioned Space. The intention of this wording is to allow separate ancillary structures such as garages or workshops, with conditioned space(s), to be constructed to the same requirements of a residential *building* with not more than 2 principal *dwelling units* rather than another standard such as ASHRAE 90.1, NECB, or ZEPB (10.2.2.5.) requirements that may be triggered based on use. Conditioned space is considered to be the alteration of interior space temperature, through the provision of heating or cooling.

A-10.2.2.2.(2)(h) and A-10.2.2.3.(1)(j) SWH Temperature and Flow Rate Control Systems – Modelling. The intention is to prioritize health and safety over energy and emissions reductions, from the threat of Legionellae development and exposure, however, performance models can continue to account for energy and emissions savings through the incorporation of phantom low flow rates in the proposed model.

A-10.2.2.2.(2)(l) Lighting Trade-off Limited to Whole Building. The intention of this limitation is to prevent LPD results, through the application of trade-offs over numerous renovations, that could otherwise not be achieved as a regular new construction project. Allowing under-lit spaces to be renovated to their maximum allowance without considering the existing over-lit spaces (through previous trade-off applications) can result in total building/tenancy LPD limits being exceeded by excessive amounts.

A-10.2.2.4.(4) Adjusted Thermal Energy Demand Intensity (TEDI). Refer to the latest BC Energy Step Code documentation and guidance for calculating the Adjusted TEDI

A-10.2.2.4.(6) Modelling Guidelines for Large Homes. For a building required to comply with the greenhouse gas (GHG) limit, the total annual GHG footprint shall be calculated using approved modelling software and modelling criteria provided in the "Modelling Guidelines for Large Homes."

A-10.2.2.5.(1) Passive House (PER). Exceedances of the published Primary Energy Renewable (PER) criterion of the Passive House Standard may be accepted as complying with this Sentence where written approval has been provided by the Passive House Institute, or where additional energy efficiency measures have been included to the satisfaction of the Chief Building Official.

A-10.2.2.6. Calculating the Effective Thermal Resistance of Building Envelope Assemblies. The general theory of heat transfer is based on the concept of the thermal transmittance through an element over a given surface area under the temperature difference across the element.

To calculate effective thermal resistance, contributions from all portions of an assembly including heat flow through studs and insulation, must be taken into account because the same insulation product (nominal insulation value) can produce different effective thermal resistance values in different framing configurations. The resulting effective thermal resistance of an assembly also depends on the thermal properties and thickness of the building materials used and their respective location.

The following paragraphs provide the calculations to determine the effective thermal resistance values for certain assemblies and the thermal characteristics of common building materials.

Calculating the Effective Thermal Resistance of an Assembly with Continuous Insulation: Isothermal-Planes Method

To calculate the effective thermal resistance of a building envelope assembly containing only continuous materials – for example, a fully insulated floor slab – simply add up the RSI values for each material. This procedure is described as the "isothermal-planes method" in the "ASHRAE Handbook – Fundamentals."

Calculating the Effective Thermal Resistance of a Wood-frame Assembly: Isothermal-Planes and Parallel-Path Flow Methods

To calculate the effective thermal resistance of a building envelope assembly containing wood framing, RSI_{eff}, add up the results of the following calculations:

A. calculate the effective thermal resistance of all layers with continuous materials using the isothermal-planes method, and

B. calculate the effective thermal resistance of the framing portion, $RSI_{parallel}$, using the following equation, which is taken from the parallel-path flow method described in the "ASHRAE Handbook – Fundamentals":

$$RSI_{parallel} = \frac{100}{\frac{\%\ \text{area of framing}}{RSI_F} + \frac{\%\ \text{area of cavity}}{RSI_C}}$$

where

RSI_F = thermal resistance of the framing member,

RSI_C = thermal resistance of the cavity (usually filled with insulation),

% area of framing = value between 0 and 100, and

% area of cavity = value between 0 and 100.

Calculating the Effective Thermal Resistance of a Steel-frame Assembly

The parallel-path flow method described above for wood-frame assemblies involves simple one-dimensional heat flow calculations based on two assumptions:

- that the heat flow through the thermal bridge (the stud) is parallel to the heat flow through the insulation, and
- that the temperature at each plane is constant.

Tests performed on steel-frame walls have shown that neither of these assumptions properly represents the highly two-dimensional heat flow that actually occurs. The difference between what is assumed and what actually occurs is even more significant in steel-frame assemblies. Designers should consider the potential discrepancies in such assemblies and include them as part of their evaluation and energy models.

Calculating Gross Wall Area

Where the structure of the lowest floor and rim joist assembly is above the finished ground level or where the above-grade portion of foundation walls separates conditioned space from unconditioned space, they should be included in the calculation of gross wall area. Figure A-10.2.2.6.-A shows the intended measurements for the most common type of housing construction.

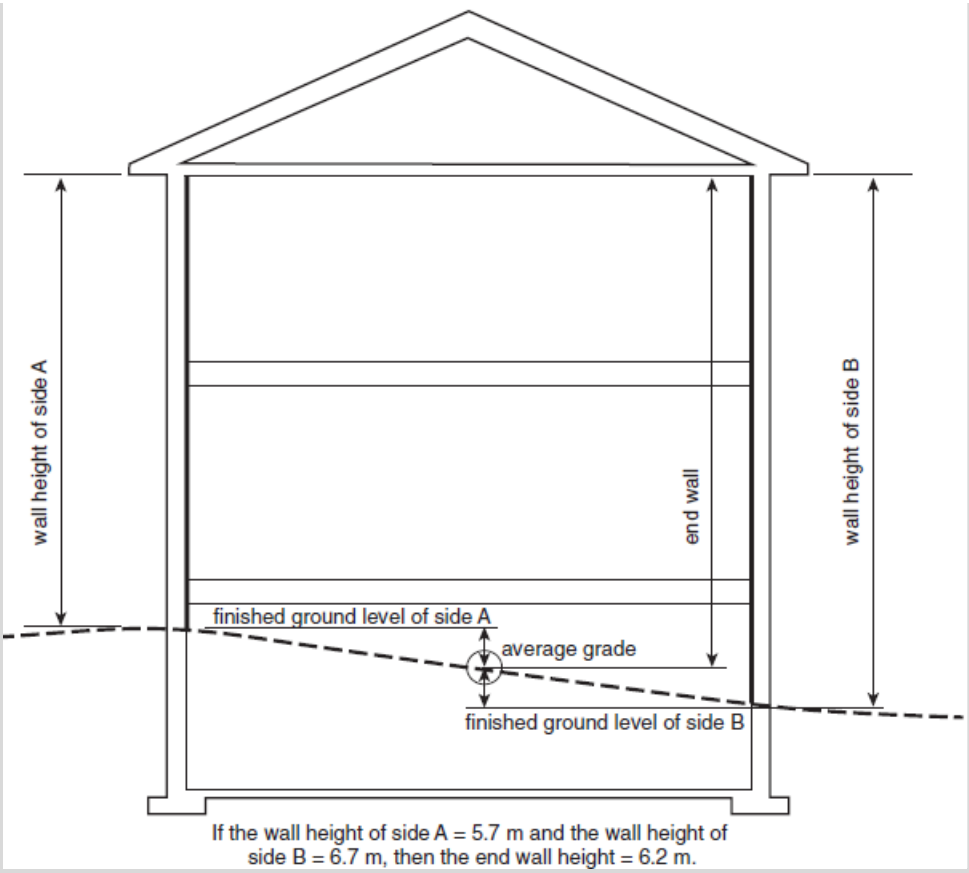


Figure A-10.2.2.6.-A

Example of interior wall height to be used in the calculation of gross wall area

Reduced Effective Thermal Resistance Near the Eaves of Sloped Roofs~~.~~

Minimum thermal resistance values for attic-type roofs are significantly higher than those for walls. The exemption in Note (1) of T-10.2.2.6. recognizes that the effective thermal resistance of a ceiling below an attic near its perimeter will be affected by roof slope, truss design and required ventilation of the attic space. It is assumed that the thickness of the insulation will be increased as the roof slope increases until there is enough space to allow for the installation of the full thickness of insulation required.

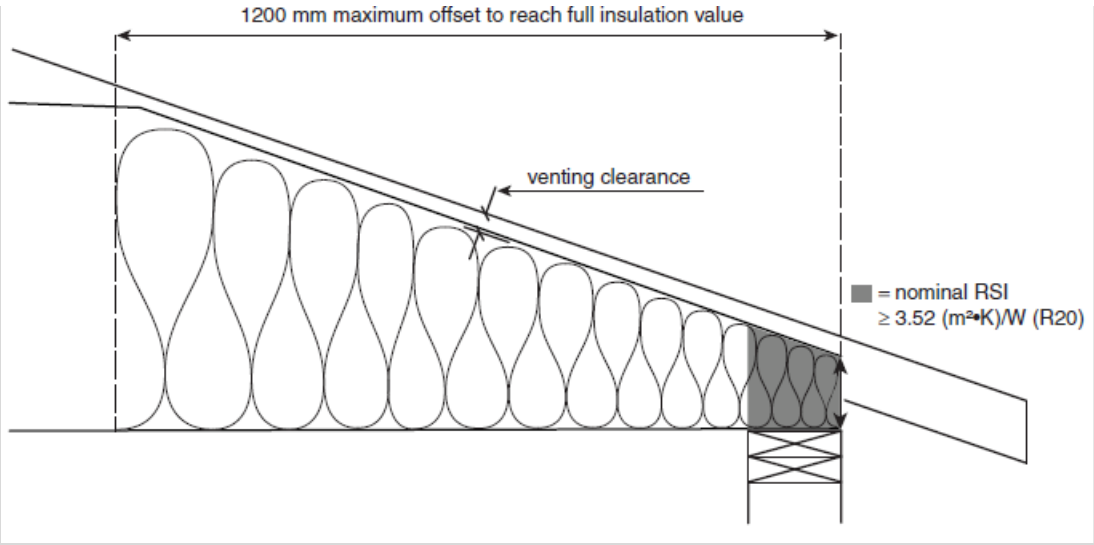


Figure A-10.2.2.6.-B
Area of ceiling assemblies in attics permitted to have reduced thermal resistance

A-10.2.2.6.(3) Roof Albedo and Emissivity. The intention is to reduce the radiative effect from solar heated roofs on top floor residence(s). The emissivity target is to incorporate the micron band to maximize the cooling effect. The overall emissivity value may be determined either directly or through a weighted average of the applicable roofs and their respective areas. Only exposed membraned areas apply, while calculations are to exclude skylights, parapets and equipment. The SRI range is meant to allow tan roofs (SRI 73) where reflection is more likely to be a nuisance to adjacent buildings.

A-10.2.2.7.(3) Building Envelope Windows, Skylights, Doors and Other Glazed Products. There are three compliance paths ('A' to 'C') available for fenestration products to comply with the energy performance requirements in Article 10.2.2.7. General guidelines are provided first, followed by the details of each compliance path.

General Requirements for Labels On Factory-Assembled Fenestration Products

The U-value (either IP or SI) labeling and verification requirements for windows, doors, and skylights in British Columbia are stipulated in the Energy Efficiency Standards Regulation of the BC Energy Efficiency Act.

Labels bear the mark of a third-party verifier and follow NFRC 100-2010 or CSA A440.2-14 standards. Each product shall bear two labels: a removable "temporary" label indicating the product U-value, and a non-removable "permanent" marking or label identifying the verification entity, the product line and the manufacturer.

The organizations that verify U-values according to these standards require these labels to be applied at the factory. They do not permit labels to be applied at the jobsite without prior authorization of the verifier.

The U-value on a label is reported to two decimal places. To demonstrate compliance, the U-value must meet or be below code stipulated values; for example: a USI-value of U 1.23 would not meet requirements where USI 1.22 is required.

General Requirements for Simulated U-value Reports

Products may comply with the By-law under a "flexibility provision" that demonstrates compliance by means of a simulated U-value report accompanied by supporting documentation. This provision provides a path by which a designer can provide "suitable documentation" of U-values for products that cannot be labeled because they are outside the scope of existing energy performance certification programs, and for imported products that do not yet have U-values determined using NFRC 100 or CSA A440.2 methods.

An electronic copy of the report and description of the chosen compliance path should be provided to the Building Official prior to sheathing inspection. A paper copy of the report must be present on-site for the Building Official at time of sheathing inspection.

Simulation reports must include the following:

1) A cover letter on the professional's letterhead that includes:

a) the professional's identity and contact information.
b) the street address(es) of the building.
c) the U-values (reported to two decimal places) for each product type, at its standard size as identified in NFRC 100 or CSA A440.2, at the actual project size, or at an average size product, depending on the compliance option.
d) verification by the registered professional that the information provided in the energy performance certification and accompanying documentation supports the U-value of the fenestration assembly or assemblies identified in the report.
e) the name, address and contact information of the fenestration product supplier(s).
f) the name, address and contact information of the glass supplier(s), if different from the fenestration product supplier(s).
g) the name, address and contact information of any individuals or firms that carried out energy performance simulations, if different from the registered professional.
h) a complete list of the supporting documentation attached to the letter.
i) the registered professional's seal and signature.

2) An attached documentation package that includes:

a) a list of each fenestration product type, quantity, size, area, description and U-value.
b) the sizes and configurations of the simulated products as shown by frame elevations and/or shop drawings, keyed to the list.
c) a table of the area-weighting calculations performed to determine the overall average U-value of all products using Method 1 or Method 2, of Option 2 of Compliance Path C, when applicable.
d) a description of each framing system used, including manufacturer name, series, and model numbers, as well as frame material and any internal reinforcing used.
e) a complete description of the glazing, including overall glass thickness, number of panes, pane thicknesses, gap widths, low-E coating manufacturer and type, low-E coating emissivity, and surfaces to which coatings are applied, type of gap fill with percentages of inert gas, complete description of spacer by make, series, and model, and its constituent materials, and insulating glass edge sealant materials.
f) NFRC or CSA A440.2 certified test data for each system, or isotherms for each unique framing member used in each system covered by the letter, (heads, sills, jambs, mullions) as well as all reinforcing metal in mullions and perimeter frames.

Compliance Path 'A' (Prescriptive U-value compliance)

Compliance is demonstrated by means of verifier labels, affixed to factory-assembled fenestration products at the manufacturing location in which each individual fenestration product has a compliant U-value. Compliance is achieved if each product meets the USI-value requirements required by Article 10.2.2.7., at its standard size as identified in NFRC 100 or CSA A440.2.

When one or more products exceed the applicable USI-value in Table 10.2.2.7.(1), compliance Paths B or C may be employed.

Compliance Path 'B' (Labeled / Tested U-value area-weighted average compliance)

Compliance Path 'B' is intended for projects in which all products have U-values simulated at NFRC standard sizes.

Compliance path B requires area-weighting calculations but does not require actual size or project-specific simulation. When one or more products within Table 10.2.2.7.(1) exceed the applicable USI-value , compliance may be demonstrated by calculating the overall average USI-value by means of a tabulated USI x A reporting format. In such a table, the USI-values for the standard size of each product are to be multiplied by the area of the product to determine the average area weighted USI-value of all the products.

Under this option, standard size U-values from test and simulation reports from accredited laboratories may be used for unlabeled products. The U-value report with area-weighting calculations shall be submitted under the seal of a registered professional and may be subject to independent review at the discretion of city staff.

The area-weighting report shall include documentation of verified U-values by means of label reproductions or attached laboratory simulation reports. In the case of NFRC certified products, CPD numbers may be used in place of label reproductions.

Compliance Path 'C' (Simulated U-value compliance)

Compliance path 'C' is intended for projects that use products that cannot demonstrate compliance at standard size by means of labels or accredited laboratory test/simulation reports. Such products include:

- site-assembled windows, doors,
- imported windows and doors not previously tested in Canada,
- curtainwalls and sloped glazing assemblies, and
- factory-assembled curtainwalls and window wall assemblies.
-

Under this compliance path qualified professionals perform simulations for each Individual Product simulated in accordance with NFRC 100 procedures at the size and configuration defined in NFRC 100 Table 4-3, including the normative table footnotes. Individual Products are defined in NFRC 100 and may be grouped according to NFRC 100 Grouping Rules. Products that require metal reinforcing at project sizes shall be simulated with metal reinforcing. U-values may be reported using one of the following options:

Option 1 - All products conform to Table 10.2.2.7.(1) at standard sizes.
If all products are found to have USI-values that conform to Table 10.2.2.7.(1) at sizes in NFRC 100 Table 4-3, the standard size USI-values may be reported to demonstrate compliance with Article 10.2.2.7.

Option 2 - One or more products do not conform to Table 10.2.2.7.(1) at standard sizes.
Area-weighting the USI-values of products within a U-value group at actual project sizes may be employed to demonstrate compliance for that U-value group.

To comply with Option 2, area-weighted average USI-values may be computed using one of two methods:

Method 1 USI x A table of all products within a U-value group, tabulating frame size, frame area and USI-value for each individual product to compute an overall area-weighted average for all products within the U-value group.

Method 2 USI x A table of USI-values for each individual product at its average project frame size.

Average project frame sizes shall be determined as follows:

1) Average frame sizes shall be determined for each individual product.
2) For fixed windows, the average frame size shall be based on averaging the width and height of all fixed daylight opening sizes for the fixed product type.
3) For curtain wall framing at single storey height, the average frame size shall be based on averaging the width and height of all fixed daylight opening sizes for the Window Wall product type.
4) For single panel operable windows and swinging doors, the average frame size shall be the average of all single panel operable product frame sizes of the same operator type.
5) For multiple panel side hinged products (swinging doors, folding doors), the average frame size shall be based on averaging the width and height of all panel sizes for the Swinging Door with Frame product type.
6) For sliding doors, the average frame size and number of panels will depend on the number of sliding door tracks. (The fixed lite of a sliding door shall be considered a panel.)

a) For two-track sliding doors, a two-panel door configuration shall be simulated having a frame size shall be based on two average size panels.
b) For three-track sliding doors, a three-track, three-panel door configuration shall be simulated having a frame size based on three average size panels.
c) For four-track sliding doors, a four-track, four-panel door configuration shall be simulated having a frame size based on four average size panels. (Etc.)
d) Simulations shall include two jambs, head and sill simulations with the glass in each panel position, and one interlock for each panel-panel joint of the configuration.

7) For individual unit (single lite) skylights, the average frame size shall be the average of all frame sizes of the same product type.
8) For skylights with more than one lite, the average frame size shall be based on averaging the width and height of all daylight opening sizes for the Sloped Glazing product type at the solarium-sunroom configuration in NFRC 100 Table 4-3 Note 3.

A-10.2.2.8. Vestibules. The intention of the vestibule requirements within 10.2.2.8. are to recognize that vestibules are breeches within a building's envelope and are the last line of defense against the interaction between a building's interior conditioned space and the ambient conditions. The vestibule design requirements are intended to minimize the transference of air and associated energy properties through the opening of these breeches, with or without the assistance of pressure differentials from internal sources such as stack effect or elevator operation, or external pressures such as wind load. Vestibules are therefore to be enclosed spaces without direct access by stairwells and elevators.

Specified distances between interior and exterior vestibule doors support typical daily operation. These specified minimum separation distances are to be deemed the vestibule's maximum separation distances as well, however, under circumstances deemed problematic by the CBO, these maximum distances may be extended by 1 foot increments until the design issue is resolved. For example, a 7 foot minimum spacing may not be possible due to interference from a structural column, in which case an application may be requested for an 8 foot separation. No request for a 9 foot separation will be considered without review of the 7 foot and 8 foot separation scenarios.

The use of "space" within Clause 10.2.2.8.(3)(f) is intended to refer to an entire tenancy space, such as a commercial retail unit for example, and not simply a reception area or lobby.

A-10.2.2.9.(1) Building Services Submetering. Meters provided by the utility service provider that collect and report energy usage typically already meet this requirement. Energy sources include electricity, gas, liquid fuel, and district system-provided steam, hot or chilled water. Note that for buildings with certain occupancies and gross floor areas, energy and carbon reporting requirements may apply after building occupancy. Refer to the City of Vancouver Annual Greenhouse Gas and Energy Limits By-law No. 13472 for applicability and details.

A-10.2.2.9.(2) Building Services Submetering. Monitoring energy consumption is considered essential to energy management. However, this Article does not require the installation of monitoring equipment, but requires the provision of the necessary access and hardware to permit the eventual installation and use of monitoring equipment, if desired. For electrical energy, this might include, for example, the installation of a meter socket or the provision of access to the load side of the service box or main distribution panel to allow for the measurement of energy consumption for electrical energy. For other sources of energy such as gas or district system supplied steam, hot or chilled water, etc., this might include installation of measurement ports or shut-off valves that allow future installation of meters.

Where design loads from Clauses 10.2.2.9.(2)(a) to 10.2.2.9.(2)(b) are less than 10% of the whole-building load, these categories may be combined with other categories.

A-10.2.2.10. Exterior Lighting in Residential Buildings.
10.2.2.10.(1)(b) Master Switch Except for residences containing only high efficiency light fixtures (LED etc) excluding pot lights, the objective is to require a master switch that will permit non-essential lighting to be turned off when an occupant leaves the premises. As this was only intended to consider residential portions of a building, it is acceptable to consider each portion of the building structure located above the parkade slab constructed to Article 3.2.1.2. on an individual basis given that the cost-effectiveness of such energy saving features would not be as significant for smaller structures with proportionally larger exterior wall and roof surface areas relative to their volume.

10.2.2.10.(2) Exterior Lighting A growing body of evidence exists that identifies that excessive amounts of nighttime lighting (frequently referred to as light pollution) may be potentially harmful to the environment and to human wellbeing. Poorly controlled night time lighting in urbanized areas has been widely documented to have significant effects on the environment, such as increased skyglow, and physiological and behavioral changes to individual organisms. Research suggests that excessive nighttime lighting may be detrimental to human health.

Consequently, Sentences 10.2.2.10.(2) attempts to limit the quantity and quality of exterior lighting of buildings to reduce the impact and consequences of external lighting. Interior lighting emitted through glazed openings is also a concern, but this is

largely dependent upon human activity, and it is not presently considered as part of these requirements. Nonetheless, it can be seen that conceptually this would also have similar effect as exterior lighting, so an effort should be made to minimize the potential for lighting trespass where possible.

The key components of Sentence 10.2.2.10.(2) requirements are the requirements for appropriate lighting fixtures that eliminate the upwards emission of light, and cast more of the illumination produced across the intended surfaces. Horizontal emission of lighting across the property line is more challenging due to the varying heights of a given building, but measures should be taken to reduce the potential and extent of lighting trespass to the limits specified. Additionally, the reflectance of adjacent surfaces that may be illuminated must also be considered as these also contribute to the total lighting emitted into adjacent properties. The orientation, reflectance, and illumination of the adjacent surfaces should be evaluated to limit backscatter or unintended reflectance.

To increase the likelihood of meeting the requirements, designers opt to

- Choose light fixtures that minimize backlight, uplight, and glare (BUG). Light fixtures with a BUG rating of UO are optimal.
- Choose luminaires with the lowest possible intensity for the task needed
- Consider warmer tones of 2500-3000K to reduce impact. A practical maximum temperature is 4000K.

10.2.2.10.(3) External Illumination Understanding that there may be periodic needs to provide external illumination, the requirements of 10.2.2.10.(3) serve to exempt lighting specifically intended to enhance security, safety and improve visibility for limited periods of time.

A-10.2.2.15. Gas Fireplaces
Interior and exterior fireplaces connected to building services are to be included as part of the building for the purposes of meeting the energy targets of Part 10 of the Building By-law. The building performance model is to incorporate such features per the requirements of the City of Vancouver Modelling Guidelines.

10.2.2.15.(1)(b) Direct Venting. Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted.

A-10.2.2.17. Heat Recovery in Dwelling Units. Whereas Section 9.32. addresses the effectiveness of mechanical ventilation systems in dwelling units from a health and safety perspective, Article 10.2.2.17. is concerned with their functioning from an energy efficiency perspective.

The requirements of Subsection 9.32.3. can be met using one of several types of ventilation equipment, among them heat-recovery ventilators (HRVs), which are typically the system of choice in cases where heat recovery from the exhaust component of the ventilation system is required. As such, Article 10.2.2.17. should be read in conjunction with the provisions in Subsection 9.32.3. that deal with HRVs.

Efficiency of Heat-Recovery Ventilators (HRVs).
HRVs are required to be tested in conformance with CAN/CSA-C439, “Rating the Performance of Heat/Energy-Recovery Ventilators,” under different conditions to obtain a rating.

The performance of an HRV product and its compliance with Article 10.2.2.17. can be verified using the sensible heat recovery at the 0°C test station (i.e. location where the temperature is measured) published in the manufacturer’s literature or in product directories, such as HVI’s Certified Home Ventilating Products Directory. Any energy model output must also demonstrate an SRE (%) that meets or exceeds the requirement of this By-law.

The SRE (%) rating at continuous rated speed typically corresponds to the rating at the middle speed of three standard test fan speeds. For systems with a different number of tested speeds, linear interpolation is permitted to obtain the efficiency rating.

The rating of HRVs also depends on the flow rate used during testing. Therefore, the minimum flow rate required in Section 9.32. needs to be taken into consideration when selecting an HRV product.

Servicability of Heat Recovery Ventilators

Heat recovery ventilators and similar devices form an integral part of the building ventilation and requires inspection,maintenance, repair, and cleaning from time to time so that the building air quality remains within the original design parameters. In order to perform such regular maintenance or more extensive maintenance in the event of the failure of an HRV or similar device, the mechanical components of an Heat Recovery Ventilator are to be located and installed so as to provide a worker with adequate space and access to unit to conduct maintenance on the unite or replace it. Unusually tight, distant, or convoluted access may lead to regular maintenance being skipped, or lead to other significant challenges or costs for services and replacement.

A-10.2.2.19. System Requirements for Heating within Exterior Spaces. The use of the terms "licensed beverage establishment" and "licensed food establishment" are meant to clarify how the allowance of Article 10.2.2.19 is limited to business-licensed establishments where the primary use is the consumption of food or beverages while seated.

The intention of Article 10.2.2.19 is not to require exterior heating, rather it is meant to minimize energy use and emissions when choosing the option of providing some level of occupant heating within an exterior space. The City of Vancouver recognizes a number of options however the prioritization of these options must also take into account their viability with existing and potential site conditions. Sentence 10.2.2.19.(2) is intended to be understood as "first consider the viability of option (a), either in whole or in part, then consider the viability of option (b) in whole or in part, then consider option (c)", and so on. If the most viable solution is a mixed system then this would be encouraged, but if the best, most viable solution is a single option then proceed with that option. Designers wishing to consider a unique system, such as using waste heat, are encouraged to do so and should contact the CBO's office if any customized system design does not easily fall into the options provided.

The control items within Sentence 10.2.2.19.(4) are meant to assist with the efficient operation of the heating system. It is important to note that exterior spaces are not intended to operate as if they are interior conditioned spaces. The maximum recommended temperature for exterior spaces with heating systems is 18C, and so the ambient and space temperature sensors should be set accordingly. The ambient sensor is intended to prevent the heating system from operating during warm weather while the space temperature sensors are meant to accommodate naturally occurring temperature variations across adjacent zones (direct sun vs shade), and thus allowing independent zone control operation. The space temperature sensors may override the ambient sensor to prevent zones from either overheating or over cooling. The timeclock will satisfy the mandatory requirement of not operating exterior heating systems after the establishment's hours of operation. At no point should the controls system automatically activate exterior space heating.

Zoned systems are most likely to be electric radiant and so are limited to 4,800 W (240V @ 20 amp). At the maximum allowable intensity of 18 W/ft^2 this would equate to 266 ft^2 per zone, however less energy intensive systems would be allowed to cover a larger area, for example, a 15 W/ft^2 system would allow 320 ft^2 per zone.

For multi-system design scenarios, Sentence 10.2.2.19.(6) is intended to clarify the options and opportunities this may provide. The total energy intensity of a combined system shall not exceed the highest allowable intensity of the system types involved. Example: where an overhead electric radiant system is allowed to operate at 18 W/ft^2, a combined system of in-slab heating with an overhead radiant system cannot be designed to exceed a combined total operation of 18 W/ft^2. This scenario allows in-slab heating at 8 W/ft^2 while limiting the overhead heating to 10 W/ft^2, or the possibility of 5 W/ft^2 and 13 W/ft^2 respectively. This concept allows one system to be used during warmer weather with the option for a secondary system as a top-up during colder weather.

A-10.2.2.21. Building Airtightness Testing Requirements. The intent of this testing is to quantify the airtightness level of the air barrier system, not airtightness of the building at in-service operating conditions.

Air Barrier Assembly Testing

Air barrier assemblies are subjected to structural loading due to mechanical systems, wind pressure and stack effect. In addition, they may be affected by physical degradation resulting from thermal and structural movement. Where local climatic data and building conditions exceed these limits, the maximum building height and sustained 1-in-50 hourly wind pressure values are permitted to be extrapolated beyond the listed ranges to apply to any building height, in any location, provided the air barrier assembly in question has been tested to the specific building site and design parameters.

Air Barrier System Approaches

For an air barrier system to be effective, all critical junctions and penetrations addressed in must be sealed using either an interior or exterior air barrier approach or a combination of both.

Where the air barrier and vapour barrier functions are provided by the same layer, it must be installed toward the warm (in winter) side of the assembly or, in the case of mass walls such as those made of cast-in place concrete, provide resistance to air leakage through much of the thickness of the assembly. Where these functions are provided by separate elements, the vapour barrier is required to be installed toward the interior of the assembly while the airtight element can be installed toward the interior or exterior depending on its vapour permeance.

A-10.2.2.22.(1) Building Systems Commissioning. Projects that are required to follow the commissioning requirements of the BC Housing Building Commissioning Guidelines are deemed equivalent to 10.2.2.22 requirements.

The Commissioning Provider (also known as a Commissioning Authority or CxP) is an individual with the following qualifications and is independent of the design and construction teams:A minimum of 10 years of demonstratable experience in commissioning with a minimum of 5 projects of a similar scale or scope, or

- A minimum of 4 years of demonstratable experience in commissioning with a commissioning designation provided by an organization with an accredited commissioning training program (e.g. ASHRAE, Association of Energy Engineers, Building Commissioning Certification Board), or
- A member or licensee of the Association of Professional Engineers and Geoscientists of British Columbia qualified by virtue of training or experience to provide commissioning services across building systems.

The Commissioning Authority may be supported by a Commissioning Provider Team (CxP Team) which consists of a team of specialists and related support staff who are responsible for the management of actions and the generation of deliverables by the Commissioning Authority. The Commissioning Provider Team may consist of several companies, including subcontractors to the Commissioning Authority who act as the contact to the Owner.

A-10.3.1.1. Electric Vehicle Charging for Buildings. The Canadian Electrical Code, Part I contains the requirements of electric vehicle charging systems, the requirements of Rule 86-300(2) and (3) recognize the use of load management technologies via the manual transfer or automated control in a branch circuit that supplies the electric vehicle supply equipment load and other loads. This Rule requires that, where the electric vehicle supply equipment load and other loads are installed, only one load can be operated at any one time and the branch circuit must be based on the calculated demand in accordance with Section 8.

All references to the electrical installation including receptacle, supply equipment and rating of voltage and ampere in Article 10.3.1.1. are intended to align with the requirements of SAE AC Level 2 charging requirements, whether in applying load managed solutions or separate branch circuits for each charging point. In addition to the requirements of Article 10.3.1.1., the installation of electric vehicle charging systems and electric vehicle supply equipment must meet the requirements of the Canadian Electrical Code, Part I and the manufacturer's instructions.

A-10.4.1.1.(1)(a) Embodied Carbon. The intention of this wording is to exempt smaller buildings, including stacked townhomes and their shared underground parkades, from Low Carbon Materials and Construction requirements. Where uncertainty exists, applicants should consult with building officials to confirm the applicability of embodied carbon requirements.

Part 11
Existing Buildings

Section 11.1. General

11.1.1. Application

11.1.1.1. Scope

1) The scope of this Part shall be as described in Subsection 1.3.3. of Division A.

11.1.1.2. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

2) Where *construction* of an *existing building* occurred before the effective date of this By-law, reconstruction or *alteration* of an *existing building* is not a requirement of this By-law, except as required by Subsection 11.1.4.

11.1.2. Definitions

11.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A

2) The following additional words and terms shall have the following meanings for this Part.

(see Note A-11.1.2.1.(2))

Change of *Major occupancy* means a change of *major occupancy* within a *building*, a *suite*, or its constituent *floor areas*.

Restricted Change of *Major occupancy* means a change of *major occupancy* restricted to a specific set of uses as set out in Sentence 11.5.4.1.(2) that are limited both in hazard and scope such that it does not increase the overall level of risk.

Small *Suite* Change of *Major occupancy* means a change of *major occupancy* within a *suite* with an *occupant load* not exceeding 60 persons and limited to Group A2, Group D, Group E, Group F2 (limited to wholesale showroom use), or Group F3 *major occupancies*.

Horizontal Addition means any new *floor area* beyond the extents of the existing *floor area.*

Major Horizontal Addition means a horizontal *addition* which exceeds the limits permitted by a *Minor Horizontal Addition*.

Minor Horizontal Addition means a horizontal *addition* to the existing *floor area* in which it is located, and which ~~that~~ does not exceed 25 per cent of the *existing building area*, 500 m^2 in aggregate *floor area, or both*.

Renovation means a *project* whose scope of work includes *construction* limited to the improvement, renovation, reconfiguration, or refurbishment.

Major Renovation means a renovation whose scope of work includes multiple *suites* in a *building*, or work not falling into other subcategories of renovation.

Minor Renovation means a renovation of a single *suite* contained within a single tenant space and those demising walls shared with the adjoining *suites*, but which does not include the public or common *floor areas* of the *building*.

Small *Suite* Renovation means a renovation whose scope of work includes a *suite* that is limited to Group A2, Group D, Group E, Group F2 (limited to wholesale showroom use), or Group F3 major occupancies, and has an *occupant load* of

• up to 60 persons as determined by Division B, or

• up to 100 persons if egress is directly to the adjoining ground level.

Reconstruction means the extensive removal of the majority of *construction* to expose the *building's* primary structure on interior and exterior walls, floors and roof with only the primary structural elements remaining in place.

Repair means work pertaining to a limited scope of interior or exterior renovation work to replace *existing building* components with functionally equivalent components.

Vertical Addition means the addition of any new *floor area* that in-fills existing unoccupied roof or deck area or is superimposed over *existing building* structure or *floor area.*

Major Vertical Addition means a Vertical Addition which exceeds the limits permitted by a *Minor Vertical Addition*.

Minor Vertical Addition means a Vertical Addition with an aggregate *floor area* increase that does not exceed 25 per cent of the *building area*, 500 m^2 in aggregate *floor area, or both*.

Voluntary Building By-Law Upgrades means upgrades limited to *alterations* that directly contribute to the improvement of *building* systems for fire and life safety, accessibility, health, seismic force resistance, *building* envelope, and energy or water efficiency systems in an *existing building*, and which do not arise as a consequence of other new work or improvements.

11.1.3. Objectives

11.1.3.1. Upgrade Objectives

1) An *alteration* to an *existing building* shall trigger upgrading of the *existing building* to meet the following objectives:

a) all *unsafe conditions* shall be corrected to an *acceptable* level,

b) all new materials and *construction* work shall comply with this By-law,

c) the *building* shall be upgraded to an *acceptable* level of

i) fire, life and health safety,

ii) structural safety,

iii) non-structural safety,

iv) accessibility for persons with disabilities, and

v) water efficiency,

d) any significant extension of the design life of an *existing building* beyond its original design life shall require upgrading to an *acceptable* level,

e) an *alteration* to an individual *suite* within an *existing building* will not trigger upgrades within any other *suites* except where the *alteration* creates non-conformity with the By-law within such other *suites (see Note 11.1.3.1.(1)(e))*, and

f) the level of life safety and *building* performance shall not be decreased below the existing level.

2) An *alteration* to an *existing building* shall not trigger upgrading of the *existing building* to meet the rainwater management requirements described in Article 2.4.2.5. of Division B of Book II (Plumbing Systems) of this By-law.

11.1.4. Compliance

11.1.4.1. Upgrading of Existing buildings

1) Except as otherwise permitted in this Subsection, where an *alteration* is made to an *existing building*, the *alteration* shall comply with the upgrade objectives of this By-law and the *existing building* shall be

a) provided with *acceptable* upgrades satisfying the upgrade levels required by the *existing building* Upgrade Mechanism in Section 11.5.,

b) upgraded to the satisfaction of the *Chief Building Official* through Alternative Compliance Measures that demonstrate equivalent improvement where specific characteristics of the *building* are intended to be retained, or

c) upgraded to the satisfaction of the *Chief Building Official* where the *owner* demonstrates that the design levels, as determined by the Upgrade Mechanism, present a hardship for the *owner*.

(See Note 11.1.4.1.(1))

2) Where an order issued under the Fire By-law requires upgrading of a *building*, the *Chief Building Official* may allow deviations from this By-law.

11.1.4.2. Exceptions to Upgrade Requirements

1) Where an *alteration* does not involve an *addition* or a change in *major occupancy*, further upgrading to an *existing building* is not a requirement of this By-law provided

a) construction or a full upgrade of the *building* occurred by means of a *building* permit issued on or after May 1, 2007,

b) all new work is in compliance with this By-law, and

c) all unsafe conditions are corrected to the satisfaction of the *Chief Building Official*.

2) Where a voluntary Building By-law upgrade is carried out, no further upgrade of the *building* is required except that, where other work is included in the application the upgrade requirement will only be based on the non-voluntary work proposed.

3) Existing construction complying with Alternative Compliance Measures in accordance with Sections 11.2. to 11.4. need not be further upgraded (see Note A-11.1.4.2.(3)).

4) Where the scope of a renovation is limited to minor or major renovation, and no *alteration*s are proposed to existing *fire separation*s, the applicable structural and non-structural upgrades may be limited to the renovated *suite*s provided that measures are taken to limit the risk that a failure of connected elements outside the renovated *suite*s will cause a failure of structural or non-structural elements within the subject *suite*.

5) Where the scope of a renovation project is limited to a minor or major renovation and the value of project is less than $255,000, structural or non-structural upgrading need not be provided (see Note A-11.1.4.3.(6**)**, 11.2.3.1.,11.5.3.1.(2)&(4), and 11.5.4.2.(4) **).**

6) Where an *alteration* to a *building* is a self-contained volumetric space that is separated from the remainder of the *building* by a *noncombustible* vertical *fire separation* with a 2 h fire resistance rating, the upgrade requirements of this Part do not apply to the remainder of the *building* provided

a) the self-contained volumetric space is upgraded in conformance with this By-law,

b) the self-contained volumetric space does not *exit* through the remainder of the *building*,

c) the *floor area* of the self-contained volumetric space is not larger than 10% of the *existing building area*,

d) a *noncombustible* vertical *fire separation* with a 2 h *fire-resistance rating* is constructed as a continuous vertical *fire separation* from the *building* foundation to the underside of the roof sheathing, and

e) the self-contained volumetric space does not reduce the existing structural capacity of the *building*.

11.1.4.3. Additional Upgrade Requirements

1) Where *building* envelope repair involves more than 60% of an opaque portion of a *building* face, the *building* envelope on the entire vertical section of that *building* face shall be replaced and upgraded to the thermal resistance and air-tightness requirements of Part 10, except where

a) the scope of work is limited to the replacement of windows

b) the *building* is two *storeys* in *building height* or less and is required to comply with Part 9 per Division A, Article 1.3.3.3., or

c) the *building* face has heritage merit and is required to be retained as part of an approved retention plan.

2) Where property lines are relocated closer to a *building*, the *building* shall be upgraded to conform to the spatial separation requirements, fire department access requirements and *means of egress* requirements of this By-law or the applicant shall demonstrate that the relocated property lines and the *existing building* configuration comply with this By-law.

3) Where a *building* has been damaged, all work necessary to reconstruct the damaged portions of the *building* shall conform to this By-law and the Fire By-law, and the remainder of the *building* shall be upgraded in conformance with Article 11.1.4.1.

4) Where a *building* is being demolished in whole or in part, the *demolition* work shall conform to the requirements of Part 8 and any part of the *building* that remains after *demolition* shall be upgraded in conformance with the upgrade triggers of Article 11.1.4.1

5) Existing lighting exceeding the Lighting Power Density of ASHRAE 90.1-2016 shall be removed within existing spaces of a *suite* within the scope of a *project*.

6) Where the total construction value of an *alteration* to a *marina* exceeds 50% of the replacement value of the *marina* as determined at the application stage for *alteration*, then the *marina* shall comply with Subsection 12.2.1.

11.1.5. Alternative Compliance Measures

11.1.5.1. Conditions for Using Alternative Compliance Measures

1) Where a *building* or a portion of a *building* is required to be upgraded, the Alternative Compliance Measures provided in Section 11.2. or 11.4. may be applied as alternatives to those requirements contained elsewhere in this By-law, under the conditions specified in this Article, and Sections 11.2. through 11.4.

2) Except for *additions*, and new construction, where Subsection 3.2.2. requires that the construction of a *building* be *noncombustible*, the applicable Article in Subsection 11.3.3. may be applied as an alternative provided all of the requirements of that Article have been met.

3) Except for *additions* and new *construction*, where the spatial separation and exposure protection requirements of Subsection 3.2.3. or 9.10.14. require that the exterior wall construction of a *building* to be *noncombustible*, Subsection 11.3.4. may be applied.

Section 11.2. Alternative Compliance Measures for the Conversion of Existing Buildings

11.2.1. Application

11.2.1.1. Alternative Compliance Measures for Existing Conditions

1) The alternative compliance measures for conversions in this Section apply to existing conditions only and do not apply to new work, which must conform to the requirements for new *construction* in this By-law.

2) The requirements of this section may be applied in lieu of the upgrades required by 11.5 Upgrade Mechanism. Except as required by this Section, the alternative compliance measures in Section 11.3. may be applied to existing conditions for conversions.

3) Except as required by this Section, where a *building* is a *heritage building*, the measures in Section 11.4 may be applied to existing conditions for conversions.

11.2.2. Conversion of an Existing Residential Building Containing Not More Than Two Principal Dwelling units into a Community Care Facility, Group Residence or Daycare Facility for Children

11.2.2.1. General Requirements

1) An existing residential *building* containing not more than two principal *dwelling units* may be converted or partially converted into a *community care facility*, *group residence* or daycare facility for *children* provided

a) the *occupant load* does not exceed

i) 10 residents in a *community care facility*,

ii) 6 residents in a *group residence*, or

iii) 8 *children* in a daycare facility for *children*,

b) the *community care facility* or *group residence* is

i) separated from the residential portions of the *building* containing not more than one principal *dwelling unit* by a *fire separation* with a *fire-resistance rating* of 1 h,

ii) separated from the residential portions of the *building* containing not more than two principal *dwelling units* by a *fire separation* with a *fire-resistance rating* of 2 h,

iii) completely *sprinklered*, and

iv) equipped with a fire alarm system, emergency lights and smoke and heat detectors installed throughout the *building*.

c) the daycare facility for *children* conforms with Article 3.1.2.8.,

d) firefighter access conforms with this By-law,

e) the *building area* is no more than 300 m^2,

f) all *unsafe conditions* are corrected to the satisfaction of the *Chief Building Official*, and

g) the *building* shall be upgraded to conform to upgrade design levels F2, S2, N2, A2.

11.2.2.2. Alternative Compliance Measures

1) The alternative compliance measures contained in Sentences (2) to (11) inclusive may be applied to the conversion or partial conversion of an existing residential *building* containing not more than two principal *dwelling units* into a *community care facility*, *group residence* or daycare facility for *children*.

2) For the purposes of determining *building height*, a residential *building* containing not more than one principal *dwelling unit* constructed pursuant to a *building permit* issued prior to July 01, 1994 which is four *storeys* or less in height may be considered as 3 *storeys* in *building height*.

3) Existing exterior wood-frame walls may be retained instead of required *noncombustible* construction, provided

a) a minimum 45 min *fire-resistance rating* is provided, and

b) all voids are filled with mineral wool or fibreglass batts.

4) *Combustible* exterior cladding materials may be used instead of required *noncombustible* cladding provided the cladding

a) has a *flame-spread rating* of no more than 25,

b) is underlaid with a minimum layer of 12.7 mm exterior gypsum board sheathing, and

c) is composed of

i) aluminum panels,

ii) *fire-retardant treated wood* panels,

iii) fire-retardant treated cedar shakes or shingles, or

iv) vinyl siding.

5) Where exterior walls and openings are required by Subsections 3.2.3., 9.10.14. or 9.10.15. to have exposure protection, existing openings need only conform to Article 11.3.4.

6) If one interior *exit* stair is no less than 900 mm wide, a second interior *exit* stair which is no less than 750 mm wide may be permitted.

7) The *flame-spread rating* of the existing interior finish of a *means of egress* shall not exceed 150.

8) Ducts passing through *fire separations* need not be equipped with *fire dampers* if

a) the duct opening is less than 150 cm^2 in cross-sectional area, or

b) the duct work is constructed entirely of sheet steel and the duct opening is no more than 1 000 cm^2 in cross-sectional area.

9) Manual stations are not required if the fire alarm system and the *sprinkler* water flow alarm are designed in accordance with Article 3.2.4.7.

10) An existing exterior wall opening adjacent to an exterior *exit* stair or fire escape need not conform to Article 3.2.3.13. if the opening is glazed with wired or tempered glass in an aluminum or wood frame.

11) A single *exit* from a *dwelling unit* need not conform to Sentence 3.3.4.3.(3) if

a) the *exit* serves only one *dwelling unit*, and

b) the vertical floor elevation from the uppermost floor level to the adjacent ground level does not exceed 6 m.

11.2.3. Conversion of a Portion of a Suite into an Ancillary Residential Unit

11.2.3.1. Alternative Compliance Measures

1) Except as required in Sentences (2) and (3), where an *existing building* containing not more than two principal *dwelling units* is altered to create an *ancillary residential unit*, the *existing building* shall conform to the requirements of Part 9, except as permitted by Table 11.2.3.1., provided the *building* was constructed under a *building permit* issued prior to June 22, 2004. (See Note A-11.2.3.1.(1).)

2) Where an *existing building* was constructed with a *building permit* issued on or after June 22, 2004, the *existing building* and the *alteration* shall conform to Part 9 of Division B.

3) Where the *alteration* in Sentence (1) includes an *addition*, the *addition* shall conform to the requirements of this By-law.

4) Notwithstanding the requirements of Sentence 9.34.1.1.(1), circuits and receptacles in the *ancillary residential unit* shall have a minimum of

a) two kitchen counter duplex receptacles

   i) supplied by two appliance circuits, and

   ii) wired on single circuits or a split circuit,

b) two duplex receptacles located on different walls in each bedroom, and

c) three duplex receptacles located on different walls in the living area.

5) Notwithstanding the requirements of Sentence 9.34.1.1.(1)

a) where a single existing panel board is located in a common area within the *building accessible* to all occupants of the *building*, the panel board may supply electrical loads for both the principal dwelling and the *ancillary residential unit*,

b) any electrical range and equipment loads provided for the *ancillary residential unit* shall be calculated with demand factors in conformance with Sentence 9.34.1.1.(2), and

c) general circuit branch wiring may be interconnected between outlets located in the principal dwelling and the *ancillary residential unit*.

Table 11.2.3.1.
Fire Safety Requirements for *Ancillary residential unit* Conversions
Forming Part of Article 11.2.3.1.

Item	Item Details	Alternative Compliance Measure(s)
Spatial Separation	Existing windows and doors	Original unaltered windows, doors, or other openings may remain.
	New windows in existing openings	Where windows are provided in existing openings to be protected by Subsections 3.2.3. or 9.10.14. Existing openings may be protected in conformance with Article 11.3.4.4.
Fire Containment within a Principal *Dwelling unit*	Separation between a principal *dwelling unit* and its contained *ancillary residential units*	Existing lath and plaster in good condition or 12.7 mm gypsum wall board on wood studs at maximum 450 mm on centre may be used where the interior wall finish is in place prior to the *construction* of an *ancillary residential unit*. Except where existing conditions create unreasonable hardship, new walls are to be constructed with • 15.9 mm (5/8") type 'X' GWB or 12.7 mm (½") Type 'C' GWB on wood or steel studs at maximum 600 mm on centre. The stud cavity is to be filled with minimum 89 mm (3 ½") mineral wool insulation. • Caulked joints where floor and ceiling assemblies intersect. • Resilient acoustic channels on at least one side of the wall assembly.

	Ducts common to both units through *suite* separations	*Fire dampers* not required if sheet metal ducting extends a minimum of 1 800 mm (6'-0") beyond the *suite* separation and the opening is firecaulked. Acoustic insulation is to be used inside the common duct extending a minimum of 1 500 mm (60") from either side of the *suite* separation.
	Plumbing and sprinkler plastic piping that penetrate *fire separations*	Shall be tightly fitted, cast in place, or caulked as per product listing.
	Suite entry doors between the principal *dwelling unit* and its contained *ancillary residential unit*	Existing solid core doors and frames with or without wired glass in good condition. Doors to be provided with positive latching hardware and self-closing devices.
Resistance to Forced Entry	Solid Blocking	Solid blocking may be omitted for doors described in Sentence 9.7.5.2.(9) where the interior wall finish adjacent the door is in place prior to the construction of an *ancillary residential unit*.
Exits	Egress from each *dwelling unit*	In combination with the egress window requirements of Sentence 9.9.10.1., at least one conforming *exit* is required from the principal *dwelling unit* and one from the *ancillary residential unit*.
	Windows and doors adjacent to *exits*	No requirements where the *suite* is *sprinklered*, provided with a closure or provided with intervening construction extending out by at least 600 mm.
Fire Department Access	Access Path	Existing path designated for fire department is permitted to be minimum 860 mm.
Flame Spread Rating	*Exits*	Not more than 150
	Remainder of *building*	No requirement
Sprinklers		Sprinklers are not required where the construction value of the *alteration* does not exceed $255,000 or 50% of the replacement(1) value of the *existing building*.
Heating Systems	Furnace room enclosure	No separation required but provide proper combustion air and required clearances from all equipment.(2)
Smoke Alarms	Entire *building*	Interconnected *smoke alarms* to be installed on each *storey* including basements, in each sleeping room and in a location between the sleeping room and the remainder of the *storey* and if the sleeping room is served by a hallway, the *smoke alarm* to be located in the hallway. Installed by permanent connections to an electrical circuit in conformance with Subsection 9.10.19. Division B. Provided with battery backup and manual silencing devices which will silence the alarm in conformance with Article 9.10.19.6. of Division B. Carbon Monoxide detectors to be provided in accordance with the 9.32.4.2.(3)
Stairs and Handrails	Entire *building*	Existing stairs to comply with Section 9.8, excepting the following dimensions: tread depth 235 - 355 mm, rise 125 - 200 mm and run 210 - 355 mm, unless considered to present an *unsafe condition* as determined by the *Chief Building Official*.

		All existing stairs to have at least one handrail in conformance with Subsection 9.8.7.
Guardrail Protection	Entire *building*	Existing guards may be retained provided they are structurally sound, non-climbable and are at least 900 mm high.
Existing Headroom	Entire *building*	May be reduced to 1950 mm over 80% of the *suite* area and all egress routes. The minimum clear height under the remaining *suite floor area* shall be not less than 1 850 mm, except *public corridors* and *exits* which shall be not less than 2 000 mm.
	Doorway opening sizes	Doorway openings within an ancillary residential unit may be reduced to not less than 1 890 mm high. Except for *exit* doors, and doors serving *public corridors* and *exit* corridors that serve principle *dwelling units* in a *building* containing an *ancillary residential unit*, doorway openings shall be designed to accommodate swing-type and folding doors not less than 1 980 mm high.
Sound Separation	Between the principal *dwelling unit* and its contained *ancillary residential units*	Not required where the interior wall finish is in place prior to the construction of an *ancillary residential unit*. Fill cavity spaces of *suite* separation with mineral wool in walls and floor assemblies of new construction.
Unsafe Conditions	Entire *building*	Any condition within or around the *building* which could cause undue hazard or risk to persons to be corrected as directed by the *Chief Building Official*.

Notes to Table 11.2.3.1.:

(1) See Note A-11.2.3.1.

(2) The Gas Code places restrictions on locating gas furnaces adjacent to sleeping rooms or bathrooms.

(3) See Note A-11.2.3.1.(1) Interconnected *Smoke Alarms* and Carbon Monoxide Detectors

6) For the purposes of determining *building height*, an *existing building* containing not more than two principal *dwelling units* constructed pursuant to a *building permit* issued on or prior to June 22, 2004 which is four *storeys* or less in *building height* may be considered as 3 *storeys* in *building height* where the *project* is limited to the creation of a new *ancillary residential unit*.

11.2.4. Enclosure of an Exterior Open Balcony in an Existing Residential Building

11.2.4.1. Alternative Compliance Measures

1) An existing open balcony may be converted to an enclosed balcony if

a) required *suite fire separations* are provided,

b) spatial separations conform to this By-law,

c) travel distances conform to this By-law,

d) guards conform to this By-law,

e) exhaust ducts conform to this By-law,

f) light and natural ventilation are maintained and conform to this By-law,

g) all new structural work conforms to this By-law,

h) high *building* measures (smoke-free refuge areas) are maintained,

i) the existing door assembly separating the *suite* from the existing open balcony is maintained, and

j) the *suite* is upgraded to an *acceptable* level as defined in the Upgrade Mechanism in Section 11.5.

11.2.5. Conversion of Space in an Existing Group F Division 2 Building into Artist Live/Work Studios

11.2.5.1. Alternative Compliance Measures

1) *Artist live/work studios* are permitted in an *existing building* classified as a Group F, Division 2 *major occupancy* if

a) the *building* is *sprinklered* with fast-response heads,

b) all *suites* are separated from the remainder of the *building* by a *fire separation* with a 1 h *fire-resistance rating* and all floors are separated from each other by a *fire separation* with a 1 h *fire-resistance rating*, except that a 45 min *fire-resistance rating* or existing lath and plaster in good repair is *acceptable* in a *building* not more than 3 *storeys* in *building height*,

c) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.6. and 11.3.7.,

d) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.5. and 11.3.7.,

e) the emergency lighting conforms to Subsection 3.2.7.,

f) a fire alarm and detection system conforming to Subsection 3.2.4. is installed in the entire *building*,

g) if dust or fumes are produced in a studio

i) the *building* complies with the Fire By-law, and

ii) the *building* is heated by hot water, electrical equipment, or elevated gas-fired forced-air heaters,

h) if flammable or *combustible* liquids or gases are stored or used in a studio, the *building* complies with the Fire By-law and the British Columbia Gas Safety Act,

i) service rooms and storage rooms located outside of a studio conform to Section 3.6.,

j) the floor assembly is designed for a minimum live load of 3.6 kPa and the *building* conforms to the structural upgrade level S3 as defined in the upgrade mechanism in Section 11.5,

k) a studio complies with the sound transmission requirements of Section 5.8.,

l) light and ventilation for the studio sleeping area complies with Parts 5 and 6,

m) shared washroom facilities comply with the requirements of the Standards of Maintenance By-law for lodging houses, and

n) the *building* is upgraded to an *acceptable* level as defined in the upgrade mechanism in Section 11.5.

2) For the purpose of determining *major occupancy* classification, *artist live/work studios* shall be considered to have a *major occupancy* classification as defined in Articles 3.1.3.3. and 3.1.3.4.

11.2.6. Conversion of an Existing Hotel to Single Room Accommodation

11.3.6.1. Alternative Compliance Measures

1) Single room accommodation is permitted in an *existing building* classified as a Group C *major occupancy* (hotel) if

a) all *suites* are separated from the remainder of the *building* by a *fire separation* with a 1 h *fire-resistance rating* and all floors are separated from each other by *a fire separation* with a 1 h *fire-resistance rating*, except that a *45 min fire-resistance rating* or existing lath and plaster in good repair is *acceptable* if the *building* is not more than 3 *storeys* in *building height*,

b) the *exit* systems conform to Section 3.4., except as permitted in Subsections 11.3.6. and 11.3.7.,

c) all *public corridors* conform to Article 3.3.1.4., except as permitted in Subsections 11.3.5. and 11.3.7.,

d) the emergency lighting conforms to Subsection 3.2.7.,

e) a fire alarm and detection system conforming to Subsection 3.2.4. is installed throughout the *building*,

f) the floor assembly is designed for a minimum live load of 2.4 kPa,

g) notwithstanding Clause (j), the *building* conforms to the structural upgrade level S3 as defined in the upgrade mechanism in Section 11.5.,

h) shared washroom facilities comply with the requirements of the Standards of Maintenance By-law for lodging houses,

i) the *suite*s comply with the sound transmission requirements of Section 5.8, and

j) the *building* is upgraded to an *acceptable* level as defined in the upgrade mechanism in Section 11.5.

11.2.7. Conversion of an Existing Non-Strata Building to a Strata Property

11.2.7.1. Alternative Compliance Measures

1) Except as permitted by Sentence (2), an *existing building* or parcel may be converted into 2 or more strata lots, if the entire *building* is

a) upgraded to design upgrade levels F4, S4, N4, and A4 as detailed in the upgrade mechanism in Section 11.5., and

b) fully *sprinklered*.

2) An existing parcel containing one or more *buildings*, may be converted into 2 or more strata lots, if the *existing buildings* are not otherwise *altered*, and

a) upgraded to comply with the exposure requirements of Subsection 3.2.3., 9.10.14. or 9.10.15. as applicable,

b) upgraded to comply with the fire department access path of travel in accordance with Articles 3.2.5.5. and 3.2.5.6.,

c) upgraded to design upgrade levels S4 and N4, as detailed in the upgrade mechanism in Section 11.5., and

d) fully *sprinklered*.

(See Note A-11.2.7.1.(2).)

11.2.7.2. Alternative Compliance Measures for Energy Upgrades

1) An existing residential *building* containing not more than two principal *dwelling units* may be converted into 2 or more strata lots, if the entire *building* is

a) upgrade to comply with the domestic hot water heating requirements in Sentence 10.2.2.12.(1), and

b) upgrade to comply with electric heating requirements in Sentence 10.2.2.13.(1) and 10.2.2.14.(1).

#14688

Section 11.3. Alternative Compliance Measures for Existing Conditions to Assist Renovation

11.3.1. Application

11.3.1.1. Application of Alternative Compliance Measures for Existing Conditions

(See Note A-11.3.1.1.)

1) Except as permitted in Sentence (3), the alternative compliance measures provided in Subsection 11.3.3. shall not apply to newly *constructed buildings* or portions of a *building*, which shall conform to the requirements for new *construction* in this By-law.

2) Where the *building* is a *heritage building*, the alternative compliance measures in Section 11.4 may be applied to existing *construction*.

3) The alternative compliance measures provided in Subsection 11.3.2. may be applied to existing conditions or existing *construction* required to be modified to support new *construction*.

11.3.2. Energy Retrofit Design Building Classification

11.3.2.1. Application to Existing buildings

1) Except as permitted by Sentences (2) and (8), *alterations* to a *building* shall be in conformance with this Subsection for the purposes of energy and emissions performance.

2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of Article 11.3.2.2., or as deemed *acceptable* to the *Chief Building Official*.

3) Except as permitted in Sentence (5) and Articles 11.3.2.2. through 11.3.2.4., *alteration*s to a *building* shall comply with

a) *alteration*s clauses within ANSI/ASHRAE/IES 90.1, "Energy Standard for *Building*s Except Low-Rise Residential *Building*s," and Sentence 10.2.2.2.(2), or

b) the "*Alteration* Language Supporting NECB 2020" (See Note A-11.3.2.1.(3)(b).).

4) Where a *building* contains one or more major occupancies that conform to Article 10.2.2.5., the remaining major occupancies shall comply with Clause (3)(a) or (b).

5) Spaces never previously occupied, shall be designed and constructed to new *building* requirements, in compliance with

a) Article 10.2.2.3., if the *building* was designed or upgraded to NECB, or

b) Article 10.2.2.2.

(See Note A-11.3.2.1.(5).)

6) The design requirements of Subsection 10.2.2. shall form an integral part of this Subsection, except where otherwise indicated.

7) Compliance with the requirements of this Subsection does not exempt upgrades that are otherwise required by this Part.

8) In a *building* where components have been formally recognized by a federal, provincial, territorial, or municipal *authority having jurisdiction,* as having either Heritage or Character value, the alteration of these components need not comply with this subsection.

11.3.2.2. Buildings without Residential or Commercial Components

1) *Alteration*s to energy systems or components of a *building*, except those included in Articles 11.3.2.3. and 11.3.2.4., shall comply with

a) the *alteration* requirements of

i) Clause 11.3.2.1.(3)(a) except as required by Clause (ii), or

ii) Clause 11.3.2.1.(3)(b) where the *building* was designed or upgraded to NECB, and

b) Articles 10.2.2.8. through 10.2.2.20. as applicable,

c) the airtightness performance requirements of Article 10.2.2.21. for reconstruction projects, and

d) the *commissioning* requirements of Article 10.2.2.22 for new equipment and new systems including controls, meters, submeters. (See Note A-11.3.2.2.(1)(d).

11.3.2.3. (ZEBP) Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

1) *Alteration*s to energy systems or components of a *building* containing Group C, D, or E Major Occupancies, except those included in Articles 11.3.2.4. shall comply with

a) the *alteration* requirements of Clause 11.3.2.1.(3)(b),

b) Articles 10.2.2.8. through 10.2.2.20. as applicable,

c) the airtightness performance of Article 10.2.2.21. for reconstruction projects, and

d) the *commissioning* requirements of Article 10.2.2.22 for new equipment and new systems including controls, meters, submeters. (See Note A-11.3.2.2.(1)(d).)

11.3.2.4. Residential Buildings of 1 to 3 Storeys

1) Except as otherwise required by Sentence 11.3.2.1.(7), Table 11.5.3.1.(2), or in this Subsection, *alteration*s to energy systems or components of a *building*, described in Sentence 10.2.1.4.(1), shall comply with

a) the *building* envelope opaque elements with thermal performance requirements of Article 10.2.2.6., except:

i) for albedo (SRI) and emissivity requirements of Sentence 10.2.2.6.(3), and

ii) as permitted by Sentence (2),

b) the exterior closures and fenestration performance requirements of Article 10.2.2.7., except as permitted by Sentence (2),

c) Articles 10.2.2.8 through 10.2.2.11. as applicable,

d) domestic hot water requirements of Article 10.2.2.12. except the system may be gas-fired with a uniform energy factor of not less than 0.78 or a thermal efficiency of not less than 90%;

e) space-heating appliance performance requirements of Articles 10.2.2.13. and 10.2.2.14, except a system may be gas-fired with an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92% as tested using CSA 2.6/ANSI Z83.8, "Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces"

f) the domestic fireplace performance requirements of Articles 10.2.2.15. and 10.2.2.16.,

g) the heat recovery ventilator requirements of Article 10.2.2.17., except that *projects* may provide continuous exhaust ventilation in accordance with Section 9.32.,

h) Article 10.2.2.19. as applicable, and

i) documentation *acceptable* to the *Chief Building Official*.

2) Where it is deemed prohibitive by the *Chief Building Official*, an *alteration* or upgrade to a *building* may

a) achieve the applicable standard of performance in Table 11.3.2.4. or as otherwise permitted by the *Chief Building Official*, and

b) trade-off the remaining emissions-reduction outcomes with other *building* systems or components, *acceptable* to the *Chief Building Official*.

Table 11.3.2.4.
Permitted minimum standards (with equivalent emissions reduction trade-offs selected and approved)
Forming part of 11.3.2.4.(2)(a)

10.2.2.6. Wall Assemblies	Shall achieve a minimum nominal RSI of 2.5 m^2K/W in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25.
10.2.2.6. Roof Assemblies	Shall achieve a minimum nominal RSI of 3.8 m^2K/W in the affected assemblies with heat transfer, air leakage and condensation control per Section 9.25.
10.2.2.7. Windows, Curtain wall, Sliding or folding doors with glazing	Shall achieve a maximum USI of 1.44 W/m^2K

3) *Alterations* designated as reconstruction (see Note A-11.5.1.), shall comply with

a) the energy and emissions requirements in either the Performance Path in Sentence 10.2.1.4.(2) or the Prescriptive Path in Sentence 10.2.1.4.(3), and

b) the applicable airtightness requirements of Article 10.2.2.21. except an airtightness performance of 3.5 ACH may be achieved.

11.3.3. Construction and Building Safety Alternatives

11.3.3.1. General

1) Except for additions and new construction, where the *building* is required to be of *noncombustible* construction, the provisions of this Subsection may be applied as an alternative to the Construction requirements of Subsection 3.2.2.

2) A *building* applying the provision of Articles 11.3.3.2. to 11.3.3.10 shall

a) be structurally upgraded to the design upgrade level S3 as defined in Article 11.5.1.2.,

b) except as permitted in Subsections 11.3.5. and 11.3.7., be upgraded to comply with the fire containment requirements within a *floor area* conforming to this By-law, and

c) except as permitted in Subsections 11.3.6. and 11.3.7. and as required by Clause (d), be upgraded to provide *exit* systems conforming to Section 3.4.

11.3.3.2. Group A1 up to 600 Auditorium Occupants

1) A Group A, Division 1 occupancy having an occupant load of no more than 600 may be permitted within the first *storey* and second *storey* of a *building* provided the *building* conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of heavy timber construction or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s

i) with a fire resistance rating not less than 1 h, or

ii) of heavy timber construction with a fire resistance rating not less than 1 h, and

b) loadbearing walls, columns and arches shall

i) have a fire resistance rating not less than that required for the supported assembly, or

ii) be of heavy timber construction with a fire resistance rating not less than 1 h.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) be upgraded to provide all *exit* locations with a maximum travel distance of 22.5 m for *sprinklered building*s and 15 m for un*sprinklered building*s, and

d) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.3. Group A1 up to 300 Auditorium Occupants

1) A Group A, Division 1 occupancy having an auditorium occupant load of no more than 300, may be permitted within the first *storey* and second *storey* of a *building*, provided the *building* conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible* construction or *noncombustible* construction used singly, or in combination, and

a) floor assemblies shall be *fire separation*s with a fire resistance rating not less than 1 h,

b) mezzanines shall have, if of *combustible* construction, a fire resistance rating not less than 45 min,

c) loadbearing walls, columns and arches supporting an assembly shall have a fire resistance rating not less than that required for the supported assembly.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7.,

c) be upgraded to provide all *exit* locations with a maximum travel distance of 22.5 m for *sprinklered building*s and 15 m for un*sprinklered building*s, and

d) except as permitted in Subsection 11.3.4. and Table 11.3.1.1., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.4. Group A2 in Building More Than 3 Storeys

1) A Group A, Division 2 occupancy may be permitted within the first 3 *storeys* of a *building* which is more than three *storeys* in *building height*, provided the *building* conforms to Sentence (2), and provided

a) where the occupancy is located on the third *storey* or where the *building area* exceeds 400 m^2, the entire *building* shall be *sprinklered* or

b) where the occupancy is located on the first *storey* or second *storey* or the *building area* does not exceed 400 m^2 the *building* shall be *sprinklered* up to and including the *storey* containing the Group A2 occupancy.

2) A *building* referred to in Sentence (1) shall conform to Sentences 11.3.3.4.(2) and (3).

11.3.3.5. Group A2 Up to 3 *Storeys*

1) A Group A, Division 2 occupancy may be permitted in a *building* no more than three *storeys* in *building height*, provided

a) the *building* conforms to the construction requirements of Sentences (2) and (3), and

b) the entire *building* is *sprinklered*, where

i) the *building area* exceeds 400 m^2, or

ii) the occupancy is located on the third *storey*.

2) A *building* referred to in Sentence (1) may be of *combustible* or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s and, if of *combustible* construction, shall have a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is constructed as a fire-retardant-treated wood roof system conforming to Article 3.1.14.1., and the *building area* is not more than

i) 800 m^2 if facing one street,

ii) 1 000 m^2 if facing 2 streets, or

iii) 1 200 m^2 if facing 3 streets, and

d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible* construction.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.6. Group B2 Ambulatory Occupants

1) A Group B, Division 2 occupancy containing only occupants that are capable of walking up or down stairs unaided may be permitted within the first 3 *storeys* of a *building*, provided the entire *building* is *sprinklered* and conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible* construction or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4. where the *building* contains more than 2 *storeys* including *storeys* below *grade* or where the *building area* exceeds 250 m^2 regardless of the occupant load,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.7. Group B2 Non-ambulatory Occupants

1) A Group B, Division 2, non-ambulatory occupancy may be permitted only within a *storey* of a *building* which has direct or ramped access to ground level, provided the entire *building* is *sprinklered* and conforms to Sentences (2) and (3).

2) A *building* referred to in Sentence (1) may be of *combustible* construction or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.8. Group C More Than 3 *Storeys*

1) A Group C occupancy may be permitted in a *building* more than 3 *storeys* in *building height* provided the entire *building* is *sprinklered* and conforms to Sentences (2) to (4).

2) A *building* referred to in Sentence (1) shall have a maximum height of less than 18 m measured between *grade* and the uppermost floor level of the top *storey*,

3) A *building* referred to in Sentence (1) may be of *combustible* construction or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

4) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.9. Group D Occupancies

1) A Group D occupancy may be permitted in a *building* that exceeds 3 *storeys* in *building height* provided that the entire *building* is *sprinklered* and conforms to Sentence (2) to (4).

2) A *building* referred to in Sentence (1) may be of *combustible* construction or *noncombustible* construction used singly or in combination, and

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 1 h,

c) roof assemblies shall have, if of *combustible* construction, a fire resistance rating not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the fire resistance rating is permitted to be waived provided the roof assembly is constructed as a fire-retardant-treated wood roof system conforming to Article 3.1.14.1. and the *building area* is not more than

i) 2 400 m^2 if facing one street,

ii) 3 000 m^2 if facing 2 streets, or

iii) 3 600 m^2 if facing 3 streets, and

d) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

3) Notwithstanding the requirements of Sentence (2), the floor, mezzanine, and roof assemblies, are permitted to have a *fire-resistance rating* of 45 min provided

a) it is not more than 6 *storeys* in *building height*, and

b) it has a *building area* not more than the value in Table 11.3.3.8.(3)

Table 11.3.3.8.(3)
Maximum *Building area*, Group D, up to 6 *Storeys*
Forming part of Sentence 11.3.3.8.(3)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 Street	**Facing 2 Streets**	**Facing 3 Streets**
1	not limited	not limited	not limited
2	7 200	not limited	not limited
3	4 800	6 000	7 200
4	3 600	4 500	5 400
5	2 880	3 600	4 320
6	2 400	3 000	3 600

4) A *building* referred to in Sentence (1) shall

a) be provided with a fire alarm and detection system conforming to Subsection 3.2.4., notwithstanding any exemptions permitted by Article 3.2.4.1.,

b) Be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.10. Group E Occupancies

1) A Group E occupancy may be permitted in a *building* conforming to Sentences (2) to (5) except that where the *building* exceeds 1000 m^2 in *building area* or 3 *storeys* in *building height* the entire *building* shall be *sprinklered*.

2) A *building* referred to in Sentence (1), that is not more than 4 *storeys* in *building height* and the *building area* is no more than 1800 m^2 is permitted to be of *combustible* construction or *noncombustible* construction used singly or in combination, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall have a *fire-resistance rating* not less than 45 min, except that in a *building* not more than 1 *storey* in *building height*, the *fire-resistance rating* is permitted to be waived provided the roof assembly is of *noncombustible* construction or is constructed as a fire-retardant-treated wood roof system conforming to Article 3.1.14.1.,

d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

   i) have a *fire-resistance rating* not less than 45 min, or

   ii) be of *noncombustible* construction, and

e) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

3) A *building* referred to in Sentence (1), that is not more than 6 *storeys* in *building height* and the *building area* conforms to Table 11.3.3.9.(3), is permitted to be of *noncombustible* construction, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

Table 11.3.3.9.(3)
Maximum *Building area*, Group E, Existing Building
Forming part of Sentence 11.3.3.9.(3)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 Street	**Facing 2 Streets**	**Facing 3 Streets**
1	Unlimited	Unlimited	Unlimited
2	7 500	Unlimited	Unlimited
3	5 000	6 250	7 500
4	3 750	4 688	5 625
5	3 000	3 750	4 500
6	2 500	3 125	3 750

4) A *building* referred to in Sentence (1), is permitted to retain existing *combustible* construction, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1.5 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

5) A *building* referred to in Sentence (1) shall be upgraded as follows

a) where required to have a sprinkler system, the *building* shall be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) except as permitted in Subsection 11.3.4., be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3.

11.3.3.11. Group F2 or F3 Occupancies

1) A Group F, Division 2 or 3 occupancy may be permitted in a *building*, provided that the *building* conforms to Sentences (2) to (5) except that where the *building* exceeds 1000 m^2 in *building area*, or 2 *storeys* in *building height*, the entire *building* shall be *sprinklered*.

2) A *building* referred to in Sentence (1) and in conformance with Table 11.3.3.10.(2) is permitted to be of *combustible* construction or *noncombustible* construction used singly or in combination, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 45 min,

b) mezzanines shall have, if of *combustible* construction, a *fire-resistance rating* not less than 45 min,

c) roof assemblies shall be

i) *noncombustible* construction,

ii) *combustible* construction with a *fire-resistance rating* of no less than 45 min in *building*s with a *building area* no greater than 4800 m^2, or

iii) *combustible* construction constructed as a fire-retardant-treated wood roof system conforming to Article 3.1.14.1. in a *building* of not more than 1 *storey* in *building height*,

d) loadbearing walls, columns and arches supporting an assembly required to have a *fire-resistance rating* shall

i) have a *fire-resistance rating* not less than 45 min, or

ii) be of *noncombustible* construction, and

e) loadbearing walls, columns and arches supporting a *fire separation* shall have a *fire-resistance rating* not less than that required for the *fire separation*.

Table 11.3.3.10.(2)
Maximum *Building area*, Group F, Division 2 or 3, Existing Building

Forming part of Sentence 11.3.3.10.(2)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 Street	**Facing 2 Streets**	**Facing 3 Streets**
1	9 000	11 250	13 500
2	4 500	5 625	6 750
3	3 000	3 750	4 500
4	2 250	2 812	3 375
5	1 800	2 250	2 700
6	1 500	1 875	2 250

3) A *building* referred to in Sentence (1) is permitted to be of *noncombustible* construction, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

4) A *building* referred to in Sentence (1), is permitted to retain existing *combustible* construction, provided

a) floor assemblies shall be *fire separation*s with a *fire-resistance rating* not less than 1.5 h,

b) mezzanines shall have a *fire-resistance rating* not less than 1 h, and

c) loadbearing walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

5) A *building* referred to in Sentence (1) shall be upgraded as follows

a) Where required to have a sprinkler system, the *building* shall be provided with a fire alarm and detection system conforming to Subsection 3.2.4.,

b) Be provided with lighting and emergency power systems conforming to Subsection 3.2.7., and

c) be upgraded to provide exterior wall and opening protection conforming to Subsection 3.2.3., except as permitted in Subsection 11.3.4.

11.3.3.12. Combustible Construction for Minor Repairs

(See Article 1.5.2.9. of Division C.)

11.3.3.13. Open Air Repair and Storage Garages

1) Open-air *storeys* of a storage garage or repair garage located below *grade* need not be *sprinklered*.

11.3.3.14. Daycare Facilities for Children

1) Sprinklers required by Table 3.1.2.8. need not be provided for an *existing building* containing a daycare facility for children where

a) in a Group A, Division 2 or a Group C major occupancy, at least two *means of egress* are provided by means of doors located so that at least one *means of egress* could provide egress from the daycare facility for children if the other *means of egress* becomes inaccessible to the occupants due to a fire, that

i) discharge directly to exterior at the adjacent ground level, or

ii) discharge into an *exit* stair enclosure with a *fire-resistance rating* at least equal to that required by the fire separation in Table 3.1.2.8., where it is not required to travel up or down more than 1 storey to reach the adjacent ground level, and

b) in a Group A, Division 2 major occupancy, the occupant load of the daycare facility for children shall not exceed Table 3.1.2.8.(3)

Table 11.3.3.14.
Fire Safety Requirements for Omission of Sprinkler in Daycare Facilities for Children
Forming part of Sentence 11.3.3.14.

	Maximum number of Children
Total number of Children	30(1)
Children under 30 months	8

Notes to Table 11.3.3.14.:

(1) Maximum number of children, inclusive of children of age 30 months and under.

11.3.4. Spatial Separation Alternatives

11.3.4.1. General

1) Except for additions and new construction, where the exterior wall of a *building* is required by Parts 3 and 9 to be of *noncombustible* construction, the provisions of this Subsection may be used as an alternative compliance measure to the spatial separation requirements of Parts 3 and 9.

11.3.4.2. Exterior Wall Construction

1) In a *building* of Group B or C occupancy, existing *combustible* construction may be retained in an existing exterior wall provided

a) the wall has at least a 1 h *fire-resistance rating*,

b) the *building* is *sprinklered*, and

c) all voids in the wall are completely filled with *noncombustible* insulation and fire stopped.

2) In a *building* of other than Group B or C occupancy, existing *combustible* construction may be retained in an existing exterior wall provided the wall has at least a 1 h *fire-resistance rating*, and

a) the *building* is *sprinklered*, or

b) all voids in the wall are completely filled with *noncombustible* insulation and fire stopped.

3) When an existing exterior wall requires a 2 h *fire-resistance rating*, existing *combustible* construction may be retained provided

a) the wall has at least a 1 h *fire-resistance rating*,

b) the *building* is *sprinklered*, and

c) all voids in the wall are completely filled with *noncombustible* insulation and fire stopped.

11.3.4.3. Exterior Cladding

1) Existing *combustible* cladding may be retained provided

a) the *building* is *sprinklered* using fast-response heads,

b) the exterior cladding is treated with *acceptable* exterior quality fire retardant intumescent paint,

(See Note A-11.3.4.3.(1)(b).) and

c) all exterior windows contain wired or safety glass in steel frames.

11.3.4.4. Existing Unprotected and Relocated Openings

1) Where the *limiting distance* is less than 900 mm, existing *unprotected openings* may be retained, provided

a) the openings are constructed with non-operable closures of glass block, wired glass, tempered glass or laminated safety glass, and the *building* is *sprinklered* using fast-response heads,

b) the openings are constructed of glass block, wired glass, tempered glass or laminated safety glass in operable frames, the *building* is *sprinklered* using fast-response and openings are protected with close spaced sprinkler in accordance with Sentence 3.2.3.13.(5)., or

c) *acceptable* self-closing fire protection shutters are installed at the existing opening locations, where the fire shutter operation is not obstructed by the openable window, and where the opening is not required for an escape function as outlined in Article 9.9.10.1.

2) Where a *limiting distance* is 900 mm or more, existing *unprotected openings* which have a total area exceeding the values listed in or extrapolated from Tables 3.2.3.1.B, 3.2.3.1.C, 3.2.3.1.D, 3.2.3.1.E or 9.10.14.4.A, may be retained, provided

a) the openings are constructed of glass blocks or wired glass in fixed frames, or

b) the *building* is to be *sprinklered* using fast-response heads.

3) Where construction on an *existing building* consists of renovation where the *exposing building face* is not being altered, the existing *unprotected openings* of that *building* face may be retained and no additional protection shall be required provided

a) the *project* consists of interior work only,

b) no additional principal *dwelling units* are being added,

c) the openings on the vertical *building* face are less than 10% of the entire *exposing building face*, and

d) the *limiting distance* is greater than 600 mm.

4) Notwithstanding the requirements of this Article, the replacement of existing windows that do not substantially alter the existing spatial separation configuration by more than 2% shall not require additional protection provided that the openings are constructed of glass block, wired glass, tempered glass or laminated safety glass. (See Note A-11.3.4.4.(4).)

5) A new *unprotected opening* in an existing exterior wall need not comply with the requirements of Article 9.10.15.4.(1) provided

a) an equivalent area of existing *unprotected openings* within the same *fire compartment* or *storey* are removed, and

b) the *limiting distance* of the new *unprotected opening* is greater than 2 m.

11.3.5. Alternatives for Fire Containment and Separation

11.3.5.1. Public corridors

1) Existing *public corridor* walls, serving Group A Division 2, D, E, F Division 2 and F Division 3 occupancies, required to have a *fire-resistance rating* exceeding 45 min may be terminated at the underside of a 30 min ceiling membrane, where the *public corridor*s are equipped with *acceptable* smoke detectors connected to the *building* fire alarm system.

11.3.5.2. Occupancy and Suite Separations

1) Existing vertical occupancy *fire separation*s and *suite fire separation*s in Group A Division 2, D, E, F Division 2 and F Division 3 occupancies, need not exceed a 1 h *fire-resistance rating* provided *acceptable* smoke detectors are installed on each side of such separations and are connected to the *building* fire alarm system.

2) Existing floor assemblies required by Sentence 3.3.1.1.(5) to be *fire separation*s, need not exceed a 1 h *fire-resistance rating* provided the *suite* is *sprinklered*.

11.3.5.3. Alternative to 20 Minute Doors

1) An existing door assembly may be retained in place of a required door assembly with a 20 min fire-protection rating provided

a) a solid core wood door has a minimum thickness of no less than 45 mm, or

b) a hollow core or panel type *suite* door has a layer of gypsum wallboard on the *suite* side covered by a minimum 0.9 mm thick sheet steel which extends over the edges of the door.

11.3.6. Alternatives for Exits and Means of Egress

11.3.6.1. General

1) Except as permitted in Articles 11.3.6.2. through 11.3.6.4. and in Subsection 11.3.7., every *floor area* or other space shall be served with *exits* in conformance with Section 3.4.

11.3.6.2. Openings in an Exit Enclosure

1) A maximum of 2 *suite* doors or 2 room doors per *storey* may be located within an *exit* enclosure provided

a) the *exit* enclosure is not required to have a *fire-resistance rating* of more than 1 h,

b) the *suite*s or rooms have a second and separate *means of egress*, and

c) the *suite* or room doors have a fire-protection rating of 45 min, are self-closing and self-latching and do not lock automatically.

2) *Exit* stairs shall be enclosed as required in Subsection 3.4.4. except that existing *exit* enclosures may have

a) wired glass set in steel frames conforming to Article 3.1.8.14. only in the portion of the enclosure which faces a *public corridor*, and

b) in *sprinklered building*s, *acceptable* hold-open devices actuated by smoke detectors and the *building* fire alarm system.

11.3.6.3. Group C Single Exit

1) A single *exit* is permitted from an existing non-*sprinklered dwelling unit* provided

a) the *exit* is an exterior doorway located no more than 1.5 m above adjacent ground level,

b) the total area served by the *exit* door does not exceed 100 m^2,

c) the maximum travel distance within the *dwelling unit* does not exceed 15 m, and

d) it is not necessary to travel up or down more than one *storey* to reach the *exit* door, or the uppermost floor level opens from a common area to an unenclosed balcony or deck no more than 6 m above adjacent ground level.

11.3.6.4. Existing Stairs in a Means of Egress

1) Existing stairs with rectangular treads in straight flights in an *exit* or a *means of egress*, other than those serving seating areas, may be retained provided that

a) existing tread and riser dimensions within a flight comply with Table 11.3.6.4.(1),

Table 11.3.6.4.(1)
Dimensions of Existing Stairs
Forming Part of Sentence 11.3.6.4.(1)

	Maximum (mm)	Minimum (mm)
Rise	205	125
Run	355	200

b) existing treads and landings shall

i) be dimensionally uniform,

ii) have a finish that is slip resistant,

iii) have nosings with distinct colour contrast for the full width of the leading edge of each tread visible in both direction of travel, and

iv) have no projecting stair nosing, rakeback, or combination thereof, exceeding 38 mm or angle of more than 30 degrees from the vertical,

c) lighting is provided to

i) an average level of not less than 100 lx at floor or tread level, and

ii) the minimum illumination required by (i) shall be not less than 20 lx,

d) emergency lighting is provided to

i) an average level of illumination of not less than 20 lx at floor or tread level,

ii) a minimum illumination required by (i) shall be not less than 2 lx, and

iii) provided with emergency power in accordance with Article 3.2.7.4.,

e) handrails are provided conforming to the requirements of Article 3.4.6.5., and

f) tread and landings of exterior egress stairs are designed to be free of ice and snow accumulations.

11.3.7. Alternatives for Sprinklered Buildings

11.3.7.1. General

1) The alternative compliance measures in Articles 11.3.7.2. to 11.3.7.9. may be used in a *building* where

a) the *building* is *sprinklered* in conformance with Subsection 3.2.5., and

b) the *building* has a fire alarm system in conformance with Subsection 3.2.4.

11.3.7.2. Group C and D Fire Containment

1) The *fire separation* between a Group C or D occupancy and the remainder of a *building* which is no more than 3 *storeys* in *building height* need not exceed a *fire-resistance rating* of 45 min.

2) Existing lath and plaster, properly restored to its original condition, may be accepted by the *Chief Building Official* as meeting the *fire separation* requirements in Sentence (1).

11.3.7.3. Occupancy Separations

1) The existing *fire-resistance rating* for an occupancy separation in a *building* need not exceed 1 h when the By-law requires 2 h for new construction and 45 min when the By-law requires 1 h for new construction.

11.3.7.4. Flame Spread Rating

1) The *flame-spread rating* for an existing wall or ceiling finish may be increased to 300 for no more than 25% of the wall or ceiling area, provided the wall or ceiling has no exposed foamed plastic.

11.3.7.5. Fire Dampers

1) Where a *fire separation* is permitted to have a 45 min *fire-resistance rating*, a fire damper is not required for existing *noncombustible* ducts less than 0.065 m^2 in cross-sectional area.

11.3.7.6. Plastic Sprinkler Piping

1) Plastic sprinkler piping may penetrate a vertical *fire separation* provided

a) the piping and its installation are listed by an *acceptable* testing agency, and

b) the piping is tightly fitted or fire stopped to maintain the integrity of the separation.

11.3.7.7. Smoke-Venting in High Buildings

1) Existing means of venting which are capable of removing smoke to aid firefighting may penetrate exterior openings and existing service shafts in adjacent *fire compartments*.

11.3.7.8. Alternatives for Dead-end Public corridors

1) In a *building* provided with a sprinkler system with fast-response heads, existing *public corridor*s which have smoke detectors installed and connected to the fire alarm system may contain existing dead-end *public corridor*s of lengths not exceeding

10 m to the nearest *exit* in Group C occupancies and 15 m to the nearest *exit* in Group D, Group E, Group F Divisions 2 and Group F Division 3 occupancies.

2) In a *building* containing *exits* conforming to Article 11.3.7.9., one existing dead-end *public corridor* per floor may be permitted provided

a) the existing dead-end *public corridor* does not exceed the lengths specified in Sentence (1),

b) each *exit* stair serving the existing dead-end *public corridor* contains a smoke barrier between each *storey* or mezzanine, which prevents smoke from entering stairways and allows access to other stairways, and which may have a door equipped with an *acceptable* hold-open device actuated by a local smoke detector circuit, and

c) the entire *building* is *sprinklered* with fast-response heads.

11.3.7.9. Alternatives for Exits

1) Existing open *exit* stairways located at the ends of *public corridor*s need not be enclosed provided

a) the *building* does not exceed 3 *storeys* in *building height*,

b) there is a smoke barrier located within each *public corridor* approximately midway between the *exit* stairways, which

i) has a door provided with an *acceptable* hold-open device actuated by the fire alarm system and smoke detectors on that floor,

ii) is constructed of tempered or wired glass, or has a fire-protection rating of no less than 20 min, and

iii) is designed to retard the passage of smoke,

c) the *public corridor* contains no dead-ends,

d) the *public corridor* on both sides of the smoke barrier is continuously pressurized, and

e) the entire *building* is *sprinklered* with fast-response heads.

2) Wired glass in steel frame exposure protection for exterior fire escapes need not be provided in an *existing building* provided

a) there is at least one *exit* enclosure which conforms to this By-law and which leads directly to the exterior of the *building*,

b) access to the fire escape is by means of a full-size door at each floor level,

c) the fire escape leads directly to ground level by means of an interior stair enclosure no less than 750 mm in width,

d) a sprinkler head is located on the ceiling adjacent to and within 1 500 mm of each opening requiring protection, and

e) the entire *building* is *sprinklered* with fast-response heads.

3) Where a *building* is provided with a sprinkler system with fast-response heads, existing *exit* doors may be retained provided they do not swing over stairs or significantly impede safe egress and the *Chief Building Official* is satisfied that the existing *exit* door swing and existing *exit* and corridor widths substantially comply with the requirements of Section 3.4.

11.3.8. Alternatives for Accessibility

11.3.8.1. Protection on Accessible Floor areas

1) Every *floor area* that is not *sprinklered* throughout and that has an *accessible* path of travel shall

a) be served by an elevator

i) conforming to Sentences 3.2.6.5.(4) to (6),

ii) protected against fire in conformance with Clauses 3.2.6.5.(3)(b) or (c), and

iii) in a *building* over 3 *storeys* in *building height*, protected against smoke movement so that the hoistway will not contain more than 1% per cent by volume of contaminated air from a fire floor during a period of 2 h after the start of a fire, assuming an outdoor temperature equal to the January design temperature on a 2.5% per cent basis determined in conformance with Subsection 1.1.3.,

b) be divided into at least 2 zones by *fire separation*s conforming to Sentences (2), (3) and 3.1.8.5.(6) so that (See Note A-3.3.1.7.(1)(b))

i) persons with disabilities can be accommodated in each zone, and

ii) the travel distance from any point in one zone to a doorway leading to another zone shall be not more than the travel distance permitted by Sentence 3.4.2.5.(1) for the occupancy classification of the zone, (See also Sentence 3.1.8.5.(6) for requirements regarding the passage of smoke.

c) in the case of residential occupancies, be provided with balconies conforming to Sentence (4),

d) have an *accessible* exterior *exit* at ground level, or

e) have a ramp conforming to Subsection 3.8.3. leading to ground level.

(See Note A-11.2.8.1.(1).)

2) Except as permitted by Sentence (3), the *fire separation*s referred to in Clause (1)(b) shall have a *fire-resistance rating* not less than 1 h.

3) The *fire-resistance rating* of the *fire separation*s referred to in Clause (1)(b) is permitted to be less than 1 h but not less than 45 min provided the *fire-resistance rating* required by Subsection 3.2.2. is permitted to be less than 1 h for

a) the floor assembly above the *floor area*, or

b) the floor assembly below the *floor area*, if there is no floor assembly above.

4) A balcony required by Clause (1)(c) shall

a) have direct access from the *suite* or *floor area*,

b) be not less than 1.5 m deep from the outside face of the exterior wall to the inside edge of the balcony, and

c) provide not less than 2 m^2 of balcony space for each *accessible* sleeping room or bed space.

5) The *floor area* on either side of a horizontal *exit* conforming to Article 3.4.6.10. is permitted to be considered as a zone in applying the requirements of Clause (1)(b).

11.3.9. Alternatives for Building Systems

11.3.9.1. Location of Exhaust Vents in a Building Containing not more than 2 Principal Dwelling Units

1) In a *building* containing not more than 2 principal *dwelling units*, exhaust vents serving heating and air conditioning equipment and similar appliances, other than direct vented fireplaces, shall

a) not terminate within

i) 1.2 m horizontally of an adjacent property line,

ii) 1.8 m vertically of the underside of a soffit above, or

iii) 1.2 m horizontally of any soffit vent above,

b) be located as high as possible, and

c) be directed upwards and away from the source *building* with

i) a vertical discharge through the roof, or

ii) a side discharge configuration that terminates vertically only in a manner that minimizes condensation on adjacent surfaces.

Section 11.4. Alternative Compliance Measures for Heritage Buildings

11.4.1. Application

11.4.1.1. Alternative Compliance Measures

1) This Subsection provides alternative compliance measures for the restoration and renovation of heritage *building*s.

2) The alternative compliance measures provided in Table 11.4.1.1. apply to existing conditions only and do not apply to new work which must conform to the requirements for new construction in other Parts of this By-law.

3) Notwithstanding Article 11.1.4.3.(2), relocation of a heritage *building* may conform to the upgrade requirements for spatial separation outlined in Table 11.4.1.1.

4) Site-built and custom-built replica wood doors, wood framed windows and wood framed skylights, intended to preserve the heritage look of a *building* that separated conditioned space and unconditioned space from the exterior, are exempt from the provisions of Subsection 9.7.4. and Article 5.9.2.2. provided the replica

a) complies with Clause 9.7.5.1.(3)(a) or (b) as applicable,

b) does not create an unsafe condition, and

c) is *acceptable* to the *Chief Building Official*.

Table 11.4.1.1.
Alternative Compliance Measures for Heritage Buildings
Forming part of Sentence 11.4.1.1.(2)

No.	By-law Requirement	Alternative Compliance Measures
1	***Fire separations*** Sentence 3.1.3.1.(1) and Table 3.1.3.1.; Subsection 9.10.9. 2 h *fire separation* required between some major occupancies	Except for F1 occupancies, 1 h *fire separation* is *acceptable*, if the *building* is *sprinklered*.
2	***Fire separations*** **Sentence 3.1.3.1.(1) and 3.1.3.1.; Subsection 9.10.9.** **1 h fire separation required between some major occupancies**	1/2 h *fire separation* is *acceptable*, if the *building* is *sprinklered*.
3	***Noncombustible* Construction** Subsection 3.1.5. and Article 9.10.6.1. All materials used in *noncombustible* construction must be *noncombustible* unless otherwise permitted.	1. Roofs may be of *combustible* construction provided the *building* is *sprinklered*. 2. Up to 10% gross *floor area* to a maximum of 10% of any one *floor area* may be of *combustible* construction provided the *building* is *sprinklered*.
4	***Fire-resistance rating*** Sentence 3.1.7.1.(1); Article 9.10.3.1. Where a material, assembly of materials or structural member is required to have a *fire-resistance rating* it shall be tested in accordance with CAN/ULC-S101.	A *fire-resistance rating* may also be used based on: 1. HUD No. 8 Guideline on Fire Ratings of Archaic Materials and Assemblies. 2. Fire Endurance of Protected Steel Columns and Beams, DBR Technical Paper No. 194. 3. Fire Endurance of Unit Masonry Walls, DBR Technical Paper No. 207. 4. Fire Endurance of Light-Framed and Miscellaneous Assemblies, DBR Technical Paper No. 222.
5	**Rating of Supporting Construction** Article 3.1.7.5.; Article 9.10.8.3. Supporting assemblies to have fire resistance rating at least equivalent to that of the supported floor.	Heavy timber construction is permitted to have a fire resistance rating less than would be required by the By-law provided the *building*: (a) is *sprinklered*, and (b) does not exceed 6 *storeys* in *building height*.

No.	By-law Requirement	Alternative Compliance Measures
6	**Continuity of *Fire separation*s** Sentence 3.1.8.3.(1) and 3.1.8.3.(2); Article 9.10.9.2. *Fire separation*s are required to be continuous above the ceiling space.	*Fire separation*s are not required to be continuous above the ceiling space where: (a) the ceiling space is non*combustible* construction, (b) both *fire compartments* are *sprinklered*, or (c) the ceiling has a minimum rating of 30 minutes.
7	**Wired Glass** Sentences 3.1.8.5.(1) and 3.1.8.16; Articles 9.10.13.1. and 9.10.13.5. 6 mm wired glass in steel frame required in *fire separation*s.	For fixed transoms or sidelights, 6 mm wired glass fixed to a wood frame of at least 50 mm thickness with steel stops is permitted in a required *fire separation*.
8	**Mezzanines** Sentences 3.2.1.1.(3) to 3.2.1.1.(6); Article 9.10.4.1. Mezzanines enclosing more than 10% above the horizontal plane are considered as *storey* in *building height*.	Enclosed mezzanines may be up to 40% of the *storey* in which they occur and not be considered a *storey* in *building height* if the *building* is *sprinklered*.
9	***Building height*** Articles 3.2.2.20. to 3.2.2.90. *Noncombustible* construction required for *building*s over 3 *storeys* in *building height*.	*Building*s may be of *combustible* construction up to 6 *storeys* provided: (a) the *building* is *sprinklered* (b) the *building* contains Group C, D, E, F2 or F3 occupancies, and (c) floor assemblies not required to exceed 1 h *fire separation* requirements may be of heavy timber construction.
10	**Spatial Separation** Subsection 3.2.3. The area of *unprotected opening* shall not exceed the limits in Tables 3.2.3.1.A to 3.2.3.1.E	The area of existing *unprotected opening* is not limited provided: (a) the *limiting distance* is a minimum 1 m, (b) the *building* has a supervised sprinkler system in conformance with Article 3.2.4.9., and (c) the sprinkler system is designed to notify the fire department in conformance with Article 3.2.4.7.
	Spatial Separation Subsection 9.10.14.; Subsection 9.10.15. The area of *unprotected opening* in an un*sprinklered building* shall not exceed the limits in Tables 9.10.14.4.-A or 9.10.15.4.	The area of existing *unprotected opening* on a *building* face is not limited provided the existing *unprotected openings* on that face are protected with close spaced sprinklers per Clause 3.2.3.13.(5)
11	**Construction of *Exposing building face*** Article 3.2.3.7.; Article 9.10.14.5. The *exposing building face* is required to have a *fire-resistance rating* and/or be of *noncombustible* construction.	*Exposing building face* is not required to have a fire resistance rating if the *building* is *sprinklered*. Also, the *exposing building face* is not required to be of *noncombustible* construction if it is protected by an exterior sprinkler system conforming to NFPA 13.
12	**Roof Covering Rating** Sentence 3.1.15.2.(1)	For existing roofs not covered by a Class A, B or C roofing, a manually operated deluge system in accordance with NFPA 13 is permitted.

No.	By-law Requirement	Alternative Compliance Measures
	Class A, B or C roof covering in conformance with CAN/ULC-S107 required.	
13	**Smoke Alarms** Sentences 3.2.4.20.(7) and 3.2.4.20.(9); Sentence 9.10.19.1.(2) Smoke alarms are required to be connected to an electric circuit.	Smoke alarms may be battery operated in a residential *building* containing not more than one principal *dwelling unit*.
14	**Interconnected Floor Space** Subsection 3.2.8.; Sentence 9.10.1.3.(6)	1. Open stairs in *building*s of not more than 4 *storeys* in *building height* need not comply with Subsection 3.2.8. provided: (a) the *building* contains a Group C or D occupancy, (b) the *building* is *sprinklered* with fast-response sprinklers, (c) corridors opening into the interconnected floor space are separated from the interconnected floor space by a *fire separation* with the rating required for the corridor, and (d) smoke detectors are installed in the rooms opening into the interconnected floor space and the smoke detectors are connected to the fire alarm system. 2. Open stairs in *building*s of maximum 3 *storeys* in *building height*, or the first 2 *storeys* and basement, need not comply with Subsection 3.2.8. provided: (a) the *building* contains a Group C or D occupancy, (b) the *building* is *sprinklered* with fast-response sprinklers, (c) smoke detectors are installed in the rooms opening into the interconnected floor space and the smoke detectors are connected to the fire alarm system, and (d) at least one *means of egress* is not through the interconnected floor space.
15	**Separation of *Suite*s** Article 3.3.1.1.; Article 9.10.9.13., Article 9.10.9.14. *Suite*s are required to be separated from adjoining *suite*s by 3/4 h or 1 h rated *fire separation*s.	Existing *fire separation*s of 30 min, such as wood lath and plaster in good condition, are *acceptable* in *sprinklered building*s not exceeding 6 *storeys* in *building height*.
16	**Corridor *Fire separation*** Article 3.3.1.4.; Article 9.10.9.15. *Public corridor*s are required to be separated from the remainder of the *building* by a *fire separation* having a fire resistance rating of at least 3/4 h.	Existing corridors with 30 min *fire-resistance rating*s, such as wood lath and plaster in good condition, are *acceptable* in residential occupancies provided the *building*: (a) does not exceed 6 *storeys* in *building height*, and (b) is fully *sprinklered* with fast-response sprinklers.
17	**Corridor Width** Articles 3.3.1.9. and Subsection 3.4.3.; Article 9.9.3.3. *Public corridor*s and *exit* corridors are required to have a minimum width of 1 100 mm.	*Public corridor*s and *exit* corridors are required with a minimum width of 800 mm provided: (a) the occupant load of the *building* is maximum 20 people, and (b) the *building* does not exceed 3 *storeys* in *building height*.

No.	By-law Requirement	Alternative Compliance Measures
18	**Door Swing** Articles 3.3.1.11. and 3.4.6.12. Doors required to swing in the direction of *exit* travel.	Second egress door from a room is not required to swing in the direction of *exit* travel provided: (a) the *building* is *sprinklered* and the system is supervised in conformance with Sentence 3.2.4.9.(3), and (b) the occupant load of the *building* is a maximum of 100 people.
19	**Stairs, Ramps, Handrails and Guards** Article 3.3.1.14., Article 3.3.1.16., Article 3.3.1.18., Article 3.4.6.4., Article 3.4.6.6., Article 3.4.6.2. through Article 3.4.6.9.; Section 9.8.	Existing conditions that do not comply fully with the requirements are permitted if they are *acceptable* to the *Chief Building Official*.
20	**Transparent Doors and Panels** Article 3.3.1.20.; Article 9.6.1.4. Glass in doors and sidelights are required to be protected by guards and to be safety glass.	Existing glass or transparent panels that do not comply fully with the requirements are permitted if sufficiently discernible or guards are provided in unsafe conditions.
21	**Dead-end Corridors** Sentence 3.3.1.9.(7); Article 9.9.7.3. Dead-end corridors are permitted to a maximum length of 6 m.	1. Dead-end corridors are permitted to a maximum length of 10 m in Group C occupancies provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) smoke detectors are installed in the corridor system. 2. Dead-end corridors are permitted to a maximum of 15 m in length in Group D, E, F2 and F3 occupancies provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) smoke detectors are installed in the corridor system.
22	***Exits*** Article 3.4.2.1.; Article 9.9.8.2. *Floor areas* shall be served by not fewer than 2 *exits* except as permitted by Sentence 3.4.2.1.(2)	*Floor areas* may be served by a single *exit* within the limits of Sentence 3.4.2.1.(2).(b) provided: (a) the *building* does not exceed 3 *storeys* in *building height*, (b) the *building* is *sprinklered* with fast-response sprinklers, and (c) all *floor areas* are protected by a system of smoke detectors connected to a fire alarm system.
23	**Reduction of *Exit* Width** Sentence 3.4.3.3.(2); Article 9.9.6.1. Swinging doors in their swing shall not reduce the effective width of *exit* stairs and landings to less than 750 mm.	Existing swinging doors in their swing are permitted to reduce the effective width of *exit* stairs and landings to a minimum of 550 mm provided: (a) they serve Group C or D occupancies, (b) the *building* does not exceed 4 *storeys* in *building height*, and (c) the *building* is *sprinklered*.
24	***Fire separation* of *Exits*** Article 3.4.4.1.; Subsection 9.9.4. Article 3.4.4.1.; Subsection 9.9.4. *Exits* are required to be separated from the remainder of the *floor area* by a *fire separation* having a *fire-resistance rating* of not less than 3/4 h.	1. *Building*s of 3 *storeys* or less may have *exits* that are separated by a *fire separation* that does not have a *fire-resistance rating* provided: (a) the *building* is *sprinklered* with fast-response sprinklers, and (b) the sprinkler system is supervised in accordance with Sentence 3.2.4.9.(2). 2. *Building*s not exceeding 6 *storeys* in *building height* may have *exits* that are separated by a 45 min *fire separation* provided the *building* is *sprinklered*.

No.	By-law Requirement	Alternative Compliance Measures
25	***Exits* Through Lobbies** Article 3.4.4.2.; Article 9.9.8.5. Rooms adjacent to the lobby are required to be separated by a *fire separation*.	Rooms adjacent to the lobby are not required to be separated by a *fire separation* provided: (a) the *floor area* is *sprinklered* with fast-response sprinklers, and (b) smoke detectors are installed in the adjacent rooms.
26	**Rooms Opening into an *Exit*** Sentence 3.4.4.4.(7); Article 9.9.5.9. Service rooms and ancillary rooms are not permitted to open directly into an *exit*.	Service rooms and ancillary rooms may open directly into an *exit* provided: (a) the rooms are *sprinklered* with fast-response sprinklers, and (b) weather stripping is installed on the doors to prevent the passage of smoke.
27	**Illumination of *Exit* Signs** Sentences 3.4.5.1.(2) and 3.4.5.1.(4); Sentences 9.9.11.3.(3) to 9.9.11.3.(4) *Exit* signs are required to be illuminated continuously while the *building* is occupied.	Where *exit* signage may compromise historic appearances, or authenticity of displays, *exit* signs may be installed to light only on an emergency condition, such as by the fire alarm system or due to power failure.
28	**Clearance from *Exit* Doors** Sentence 3.4.6.11.(1); Article 9.9.6.6. Stair risers shall not be closer than 300 mm from an *exit* door.	Except as permitted in Sentences 3.4.6.11.(3) or 9.9.6.6.(2), existing *exit* doors shall not extend beyond the first riser.
29	**Fire Escapes** Subsection 3.4.7.; Sentence 9.9.2.1.(2) Fire escapes are required to conform to Subsection 3.4.7.	Existing fire escapes that do not completely conform to Subsection 3.4.7. are *acceptable* provided: (a) the fire escapes are *acceptable*, and (b) the *building* is *sprinklered*.
30	**Fire Escape Construction** 3.4.7.2.; Sentence 9.9.2.1.(2)	Existing *combustible* fire escapes are permitted if the *building* is permitted to be of *combustible* construction by Part 3, Part 9 or by this table.
31	**Protection of Fire Escapes** Article 3.4.7.4.; Sentence 9.9.2.1.(2) Openings in the exterior wall adjacent to the fire escape are required to be protected by closures.	Existing openings in the exterior wall adjacent to the fire escape are not required to be protected by closures provided: (a) the *building* is *sprinklered*, and (b) a sprinkler head is located within 1.5 m of the opening required to be protected by Article 3.4.7.4.
32	**Vertical Service Space** Article 3.6.3.1. Vertical service spaces are required to be separated from the adjacent *floor area* by a rated *fire separation*.	Existing vertical service spaces that do not completely conform to the rated *fire separation* requirements are *acceptable* provided the vertical service spaces are *sprinklered*.
33	**Height and Area of Rooms** Subsection 3.7.1.; Section 9.5. The height and area of rooms are required to comply to minimum dimension requirements.	Existing rooms are not required to comply to the minimum dimension requirements of Subsection 3.7.1. or Subsection 9.5.3. provided it is *acceptable* to the *Chief Building Official*.
34	**Washroom Requirements** Subsection 3.7.2.; Section 9.31.	Existing facilities are not required to completely comply to the requirements of Subsection 3.7.2. or Section 9.31. provided it is *acceptable* to the *Chief Building Official*.

No.	By-law Requirement	Alternative Compliance Measures
	*Building*s are required to be provided with a minimum number of washroom fixtures.	
35	**Seismic Anchorage of Exterior Decoration** Subsection 4.1.8.	Existing exterior decorations are not required to fully comply to the anchorage requirements of Subsection 4.1.8. provided: (a) *acceptable* means of protection is provided, or (b) there is no exposure to the public.
36	**Mechanical Systems** Part 6 and Part 7	Existing mechanical systems in *building*s are not required to fully comply to the requirements of Parts 6 or 7 provided: (a) it is not an unsafe condition, and (b) it is *acceptable* to the *Chief Building Official*.
37	**Mechanical and Plumbing Systems** Parts 9, 10 and 11	Existing mechanical systems in *building*s are not required to fully comply to the requirements of Parts 6 or 7 provided: (a) it is not an unsafe condition, and (b) it is *acceptable* to the *Chief Building Official*.
38	**Energy and Water Efficiency** Parts 9, 10 and 11.	The existing level of energy and water efficiency in a *building* is not required to comply with the requirements of Parts 9, 10 or 11 provided the level of energy efficiency is *acceptable* to the *Chief Building Official*.

Section 11.5. Upgrade Mechanism

11.5.1. General

(See Note A-11.5.1.)

11.5.1.1. Application

1) The *acceptable* level of upgrade required for a *building* shall be determined on the basis of the Upgrade Triggers Mechanism of Subsection 11.5.2., except as otherwise required or permitted by this Part.

2) For a single detached house or duplex, the *acceptable* level of upgrade required shall be determined on the basis of Subsection 11.5.3.

3) The Hazard Index may be determined by the Hazard Index Table or other methodology as deemed *acceptable* to the *Chief Building Official* (see Note A-11.5.1.1.(3)).

11.5.1.2. Required Upgrade Levels

1) The required Upgrade Levels determined by this Part are as follows (see Note A-11.5.1.2.(1)):

Fire

F1 - *Exit*ing to be reviewed to ensure that the *exits* do not present an unsafe condition.

F2 - *Existing building* to meet the fire & life safety requirements of this By-law within the project area and have conforming *exits* leading from the project area to an *acceptable* open space.

F3 - *Existing building* to meet fire, life and health safety requirements within the *project* area. *Existing building* to meet fire, life and health safety requirements within the public areas.

F4 - Entire *building* to substantially meet the intent of health, fire and life safety requirements of this By-law as well as provide protection to adjacent property.

Structural

S1 - Proposed work must not have an adverse effect on the structural capacity of the existing structure.

S2 - Limited structural upgrade required in order to provide minimum protection to *building* occupants during a seismic event within the *project* area.

S3 - The *building* structure shall be upgraded to an *acceptable* level in order to provide a minimum level of property and life safety to unreinforced masonry or other *buildings* having less than 30 percent of the current required seismic resistance. Falling hazards that may impact adjacent properties and over public ways must be addressed.

S4 - The entire *building* structure shall be brought up to an *acceptable* level in order to meet seismic requirements of this By-law.

Nonstructural

N1 - *Project* area to be reviewed to ensure safety from overhead falling hazards.

N2 - *Project* area and *means of egress* to be reviewed to ensure safety from overhead falling hazards.

N3 - *Building exits* and to *acceptable* open space to be reviewed to ensure safety from overhead falling hazards.

N4 - Entire *building* and to *acceptable* open space to be reviewed to ensure safety from overhead falling hazards.

Accessibility

A1 - The proposed work must not adversely affect the existing *accessibility* level of the *building*.

A2 - A limited level of upgrade shall be provided within the *project* area to ensure *access* for persons with disabilities.

A3 - The *existing building* shall be upgraded to an *acceptable* level in order to ensure complete *access* within the *project* area as well as *access* to the remainder of the *building*.

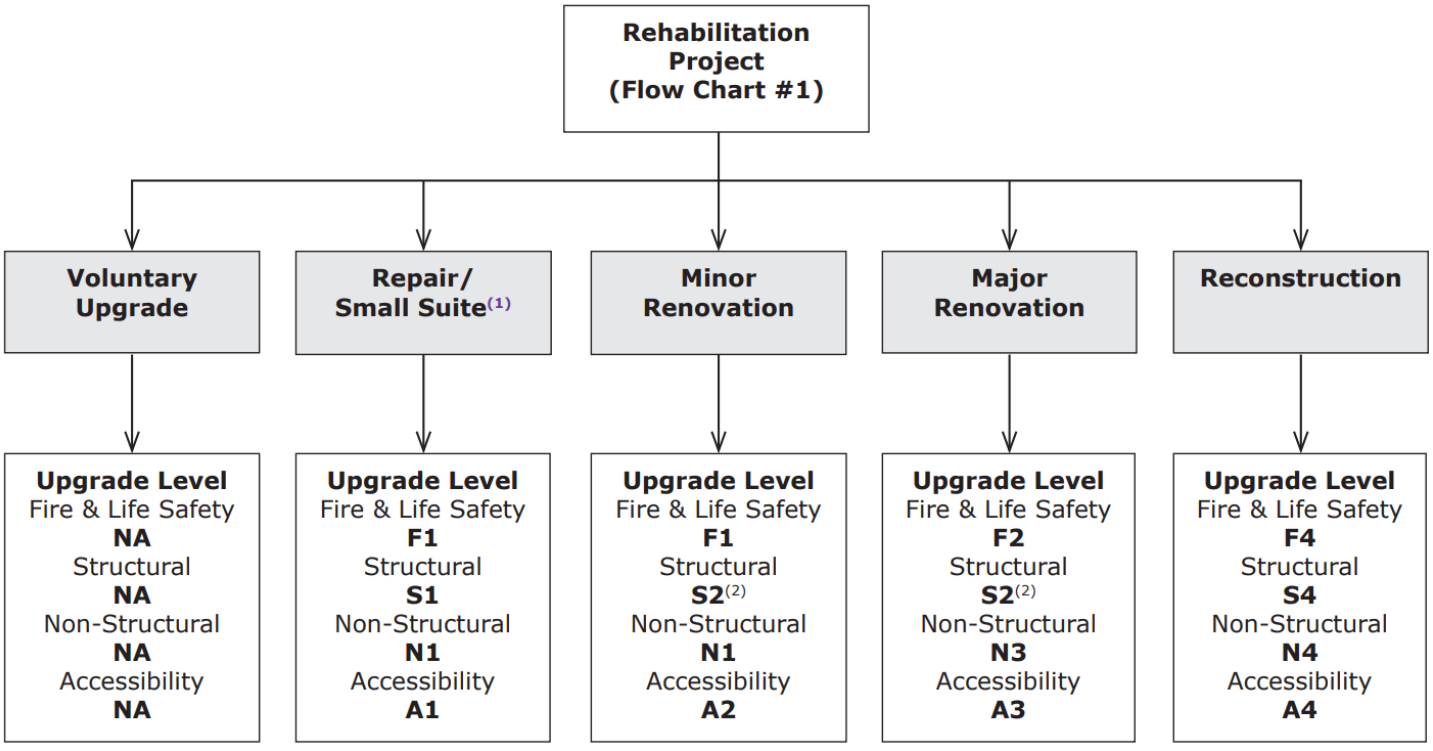
A4 - The *existing building* shall be upgraded in order to provide the minimum *accessibility* requirements of this By-law.

11.5.2. General Upgrade Requirements

11.5.2.1. Upgrade Trigger Mechanism

1) Except as otherwise required or permitted by this Part, the *acceptable* level of upgrade for an *existing building* shall be determined in accordance with Flow Chart No. 1, 2, and 3 for each type of project. #14688

RENOVATION PROJECT TYPE (Flow Chart No. 1)

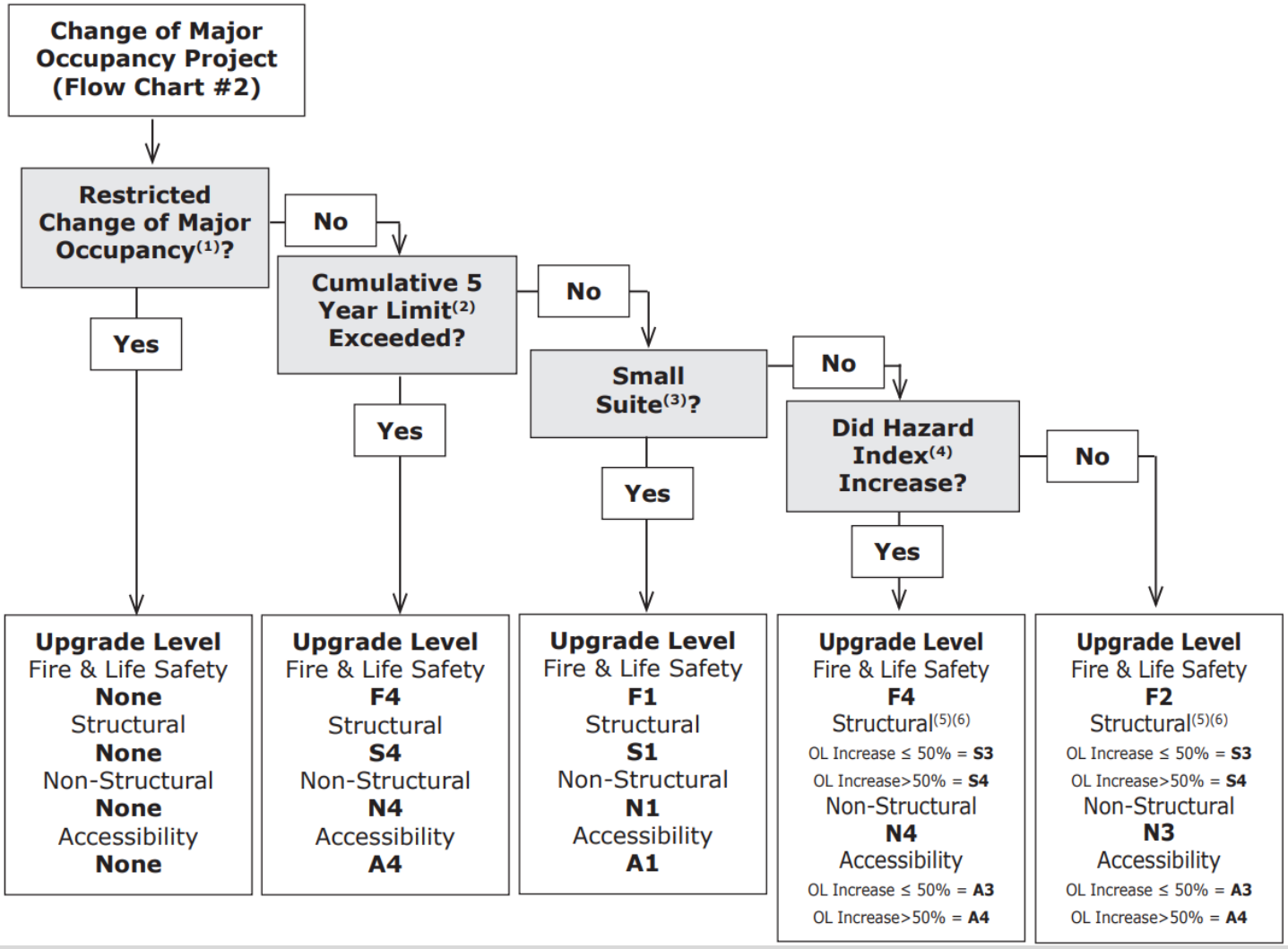


Notes to Flow Chart No. 1:

(1) For small *suite*s, the small *suite* must be separated on the *suite* side of the *suite* separation with at least two layers of gypsum wall board (GWB) as required by Sentence 11.5.1.1.(3). #14688

(2) Notwithstanding the upgrade levels in Flow Chart #1, where a minor or major renovation involves an entire *building* and the renovation includes the removal of the majority interior wall cladding then the structural seismic upgrade level shall be S3.

CHANGE OF *MAJOR OCCUPANCY* CLASSIFICATION PROJECTS (Flow Chart No. 2)



Notes to Flow Chart No. 2:

(1) Restricted Change of *Major occupancy* (see Article 11.5.4.1.(2))

(2) The cumulative 5 year limit is triggered when there is a change of *major occupancy* in an *existing building* and the aggregate area of the change in *major occupancy* including the current work within any 5 year period is greater than 50% of the *building area* (as defined in Article 1.4.1.2. of Division A) in a *building* of not more than one *storey*, or the aggregate area of the change in *major occupancy* within any 5 year period is greater than 100% of the *building area* (as defined in Article 1.4.1.2. of Division A) in a *building* of more than one *storey*.

(3) For small *suite*s, the small *suite* must be separated on the *suite* side of the *suite* separation with at least two layers of gypsum wall board (GWB) as required by Sentence 11.5.1.1.(3).

(4) Where there is a change of *major occupancy* and the structural load paths or structural design criteria are altered then it must be demonstrated that the *existing building* has the structural capacity to carry the increase in load or the *building* shall be structurally upgraded to carry the increase in live load.

(5) Occupant load (OL) increase is based on the proposed occupant load for the entire *building* versus the current occupant load for the entire *building*. The OL change may be assessed in a comparative manner by considering only those areas undergoing a change of *major occupancy*, where the occupant load of the remainder of the *building* cannot otherwise reasonably be assessed. Occupant loads are to be determined by the *acceptable* solutions in Subsection 3.1.17. of Division B.

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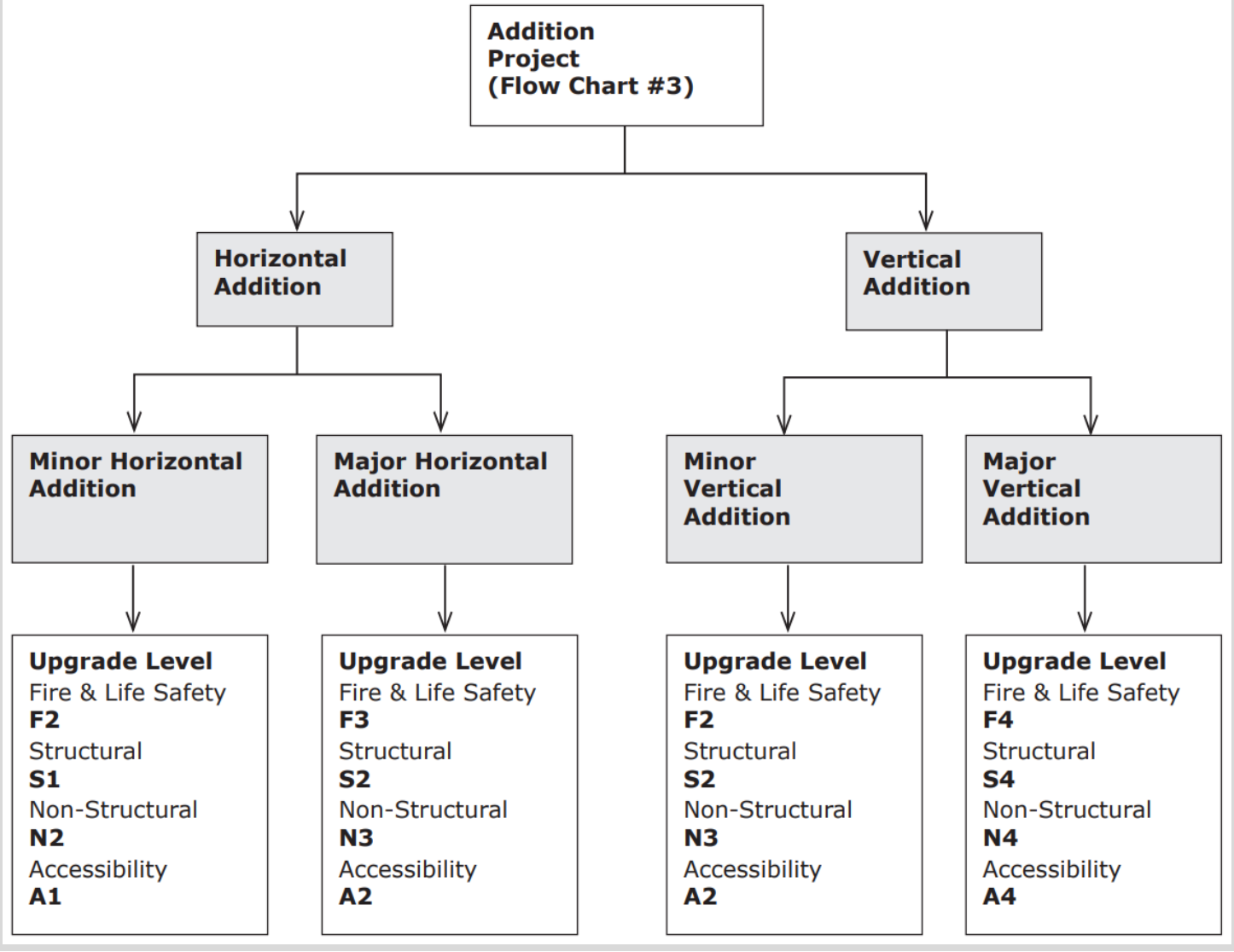
ADDITION PROJECTS (Flow Chart No. 3)



2) Where a project scope includes multiple categories of work the highest upgrade level in each category shall apply and include the requirements of all lower upgrade levels.

3) Where a *suite* is altered as a small *suite* renovation or small *suite* change of *major occupancy*, and the existing framed ceiling/floor and wall assemblies separating the *suite* from adjacent spaces in the *building* are not constructed with at least 2 layer of 13 mm thick gypsum board on the interior side, the *suite* separation shall be upgraded to include at least 2 layers of 13 mm thick gypsum wall board.

11.5.3. Upgrade Requirements for Single Detached House and Duplex Building

11.5.3.1. Upgrade Requirement

1) An *alteration* or addition to a single detached house or duplex *building* containing not more than two principal *dwelling units* shall comply with this By-law, and the existing portions of *building* shall be upgraded to an *acceptable* level as determined by Tables 11.5.3.1.(1)-A, 11.5.3.1.(1)-B, and 11.5.3.1.(1)-C.

Table 11.5.3.1.(1)-A
Fire and Life Safety Upgrade requirements for Residential Buildings containing not more than Two Principal *Dwelling units*
Forming part of Sentence 11.5.3.1.(1)

Scope of Work	Smoke Alarms(1)	CO Alarms(2)	Guards(3)	Spatial Separation(4)	Structural(5)
Renovation	Y	Y	Y	N	N
Relocation or Reconstruction	Y	Y	Y	Y	Y
Horizontal Addition *Floor area*					
up to 25%(6)	Y	Y	Y	N	N
over 25%(7)	Y	Y	Y	Y	Y
Vertical Addition *Floor area*					
up to 25%(6)	Y	Y	Y	N	Y
over 25%(7)	Y	Y	Y	Y	Y

Notes to Table 11.5.3.1.(1)-A:
(1) Smoke Alarms: to be installed in conformance with Subsections 3.2.4. and 9.10.19. as applicable.
(2) CO Alarms: to be installed in conformance with Subsections 6.9.3. and 9.32.4. as applicable.
(3) Guards: all unsafe guards to be upgraded to the satisfaction of the *Chief Building Official*.
(4) Spatial Separation: Spatial separation of the *building* shall comply with Subsections 3.2.3., 9.10.14. or 9.10.15. as applicable; or as permitted by Section 11.3.
(5) All existing wood frame walls to be anchored to existing concrete foundation walls for seismic resistance.
(6) Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.2.1.2).
(7) Aggregate increase in *floor area* greater than 25% of the *building area*.

Table 11.5.3.1.(1)-B
Egress and *Exit* Upgrade requirements for Residential Buildings containing not more than Two Principal *Dwelling units*
Forming part of Sentence 11.5.3.1.(1)

Scope of Work	*Means of egress*(1)	Handrails(2)	*Exit* Exposure(3)	Stair Dimensions(4)	Building Services(5)	Falling Hazards(6)
Renovation	**N**	**Y**	**N**	**N**	**N**	**N**
Relocation or Reconstruction	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Horizontal Addition *Floor area*						
up to 25%(7)	**Y**	**N**	**N**	**N**	**N**	**Y**
over 25%(8)	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Vertical Addition *Floor area*						
up to 25%(7)	**Y**	**Y**	**N**	**N**	**N**	**Y**
over 25%(8)	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

Notes to Table 11.5.3.1.(1)-B:
(1) *Means of egress*: confirm that access to *exit* (9.9.9.) and means of escape (9.9.10.) from all *floor areas* is compliant with regards to travel distance and *fire separation* (where applicable).

(2) Handrails: all unsafe handrails to be upgraded to the satisfaction of the *Chief Building Official*.
(3) *Exit* Exposure: *Exits* to be confirmed to be compliant with regards to *exit* exposure where applicable.
(4) Stair Dimensions: Existing stairs in *means of egress* to comply with the dimensional requirements of Subsection 9.8.2.
(5) *Building* Services: Restrain *building* service piping, conduit, and appliances to resist lateral movement due to earthquake.
(6) Falling hazards: Restrain falling hazards within 3 m of the egress path to resist lateral movement due to earthquake.
(7) Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.5.2.1).
(8) Aggregate increase in *floor area* greater than 25% of the *building area*.

Table 11.5.3.1.(1)-C
Floor area* Upgrade Requirements for Residential Buildings containing not more than Two Principal *Dwelling units
Forming part of Sentence 11.5.3.1.(1)

Scope of Work	Flame Spread[1]	Floor *Fire separations*[2]	*Suite Fire separations*[3]	Lighting & Emergency Lights[4]	Door Hardware[5]
Renovation	N	N	N	N	N
Relocation or Reconstruction	Y	Y	Y	Y	Y
Horizontal Addition *Floor area*					
up to 25% [6]	N	N	N	N	N
over 25% [7]	Y	Y	Y	Y	Y
Vertical Addition *Floor area*					
up to 25% [6]	N	N	N	Y	N
over 25% [7]	Y	Y	Y	Y	Y

Notes to Table 11.5.3.1.(1)-C:
[1] Flame Spread Rating: Exposed wall and ceiling finishes of egress routes to meet the requirements of Subsection 9.10.17. in *exits*
[2] Floor *Fire separation*s: Floor and occupied roof assemblies to be fire rated per Article 9.10.8.1.
[3] *Suite Fire separation*s (where applicable): Residential *suite*s to be provided with a *fire separation* in accordance with Article 9.10.9.16.
[4] Lighting & Emergency Lights (where applicable): Lighting and emergency lighting to be provided in *means of egress* in accordance with Subsection 9.9.12.
[5] Door Hardware: Door hardware within existing *floor areas* to be made adaptable as per Subsection 3.8.5.
[6] Aggregate increase in *floor area* less than 25% of the *building area* (see flow chart #3 of Note A-11.5.2.1).
[7] Aggregate increase in *floor area* greater than 25% of the *building area*.

2) Where an *alteration* or addition is made to an existing residential *building* containing not more than two principal *dwelling units*, the energy efficiency of the *building* shall be upgraded to an *acceptable* level in conformance with Table 11.5.3.1.(2).

Table 11.5.3.1.(2)
Energy Efficiency Upgrade Requirements for Residential Buildings containing not more than Two Principal *Dwelling units*
Forming part of Sentence 11.5.3.1.(2)

Alteration construction value[1]	EnerGuide Assessment[2]	Air tightness upgrades[3]	Attic and Sloped Roof Insulation[4]	Hot Water Heating	Electric Space Heating
$0.00 to $152,999	N	N	N	N	N
$153,000 to $254,999	N	N	N	Y[5]	N
≥$255,000	Y	Y	Y	Y	Y

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Notes to Table 11.5.2.1.(2):
[1] "Construction Value" - see note **A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2)&(4), and 11.5.4.2.(4)**.
[2] An EnerGuide Assessment completed within the last 4 years must be submitted, a post-construction assessment must also be completed.
[3] Where EGH>5 air changes per hour, air sealing is required.
[4] Where attic insulation <R12 (2.11RSI), increase to R28 (4.93RSI); where attic insulation ≥R12 (2.11RSI), increase to R40 (7.04RSI);

Insulation in existing attics shall not exceed R43.7 (7.7RSI). All flat roof and cathedral ceiling insulation shall be upgraded to ≥R14 (2.47RSI).

(5) Domestic hot water equipment must be replaced in compliance with the domestic hot water requirements of Article 10.2.2.12. or a uniform energy factor of not less than 1.0, except the system may be gas-fired with a uniform energy factor of not less than 0.78 or a thermal efficiency of not less than 90% where

- the *building* mechanical room, storage or service spaces have insufficient space to accommodate the footprint, height, or manufacturer-specified space requirements of the new equipment;
- the existing electrical panel has insufficient circuit or amperage capacity to accommodate the new equipment;
- the existing domestic hot water system is part of a combined system that also provides space-heating;
- the existing domestic hot water equipment was installed with a valid permit within the previous five years; or
- equivalent emissions reduction measures are completed as *acceptable* to the *Chief Building Official*.".

3) Where an *alteration* is made to an existing residential *building* containing not more than two principal residential *dwelling units*, a sprinkler system shall be installed

a) throughout the *building*, where more than one *dwelling unit* is created, reconstructed, or both,

b) throughout any *storey* on which a new principal *dwelling unit* is created and all *storeys* below, or

c) throughout any *storey* on which an *alteration* increases the existing *building floor area* by more than 50%.

4) A *building* need not be *sprinklered* in accordance with Sentence (3), if the construction value of the *alteration* does not exceed $255,000 (see Note **A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2)&(4), and 11.5.4.2.(4))**.

11.5.4. Special Cases

11.5.4.1. General

1) Where there is a change of *major occupancy* in a *building*, and the aggregate area of the change in *major occupancy* within any 5 year period is greater than 50% of the *building area* in a one *storey building* or greater than 100% of the *building area* in a *building* of more than one *storey*, the entire *building* shall be upgraded to design upgrade levels F4, S4, N4 and A4 as detailed in the Upgrade Trigger Mechanism except where

a) the change in *major occupancy* is to a single *suite* of not more than 100 m^2, and the work does not exceed 5% of the *building area*, or

b) such upgrades are in conflict with an approved heritage retention plan.

2) Where there is a change of *major occupancy* in a *building*, the upgrade requirements of Flow Chart #2 of the Upgrade Trigger Mechanism need not be provided where

a) the change in *major occupancy* is to a single *suite*,

b) the aggregate *suite* area does not exceed the lesser of 50% of the *building area* or 300 m^2,

c) the *major occupancy* of the *suite* is Group D or Group E, and

d) the use and aggregate *suite* area complies with Table 11.5.4.1.(2)

Table 11.5.4.1.(2)
Maximum Aggregate *Suite* Area
Forming part of Sentence 11.5.4.1.(2)

Major occupancy	***Suite* Use**	**Aggregate *Suite* Area**	
		≤200 m^2	**201 to 300 m^2**
Group D	Administrative & Business Offices	Y	Y
	Barber and Hairdressing Shop	Y	Y
	Beauty Salon	Y	Y
	Health Care Offices (non-surgical, non-sedation)	Y	Y(1)

Group E	General Retail (Non-hazardous materials)	Y(1)	N(2)

Notes to Table 11.5.4.1.(2).:
(1) Provided the Hazard Index of the space is not increased (see Table A-11.5.4.1.C)
(2) Except as *acceptable* to the *Chief Building Official*

3) Where a *building* is altered and is a *post-disaster building* as defined in Table 4.1.2.1., or where there is a major addition to a *post-disaster building*, the entire *building* shall be upgraded to design upgrade levels F4, S4, N4 and A4 as detailed in the Upgrade Trigger Mechanism.

4) Except as permitted by Article 11.5.3.1., where a *building* is relocated from another municipality to the City, from another lot within the City or within its existing lot, the *building* shall be upgraded to Design Upgrade Levels F4, S4, N4 and A4, as determined by the Upgrade Trigger Mechanism.

11.5.4.2. Sprinkler Installation Requirements for the Addition of One or More *Dwelling units*

(See Note A-11.5.4.2.)

1) Where an *alteration* to an *existing building* creates or adds one or more *dwelling units*, the *building* shall be *sprinklered* in conformance with Table 11.5.4.2.(1), except as permitted by Sentence (4) and Sentence 11.5.3.1.(3).

Table 11.5.4.2.(1)
Sprinkler Installation Determination Where *Dwelling units* are Added
Forming part of Sentence 11.5.4.2.(1)

Existing *Dwelling units*	New DUs(1) Added Over Any 5 year Period(2)				
	1	**2-3**	**4-5**	**6**	**>6**
0-1	Spr R(3)	Spr R	Spr R	Spr R	Spr R
2-4	-	Spr R	Spr R	Spr R	Spr R
5-10	-	-	Spr R	Spr R	Spr R
11-20	-	-	-	Spr R	Spr R
>20	-	-	-	-	Spr R

Notes to Table 11.5.4.2.(1)
(1) *Dwelling units*
(2) The creation of *dwelling units* over the previous 5 years from the date of the proposed *building* permit application.
(3) Sprinklers Required.

2) Where the *alteration* in Sentence (1) involves the addition of existing *floor area* to an existing *dwelling unit*, and that converted space is greater than 50% of the *floor area* of the original *dwelling unit*, the altered *dwelling unit* shall be considered as a new *dwelling unit* and the *building* shall be *sprinklered* in conformance with Table 11.5.4.2.(1)

3) Sprinklers required by Table 11.5.4.2.(1) shall be installed throughout the *storey* on which the new *dwelling unit* is to be located and all *storeys* below the new *dwelling unit*.

4) A *building* need not be *sprinklered* in accordance with Sentence (1) if the construction value of the *alteration* does not exceed $255,000 (see Note **A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2) & (4), and 11.5.4.2.(4))**.

Notes to Part 11

Existing buildings

A-11.1.2.1.(2) Project Scopes in Part 11

For the purposes of Part 11, and establishing acceptable upgrade requirements, Sentence 11.1.2.1.(2) establishes several project scopes used to classify work involving existing construction. A project may fall under one or more project categories, and as a result, it will be subject to the most restrictive set of requirements applicable to all of the project categories that it falls under.

Change of Major occupancy refers to a project scope that includes a change of use or introduces a new use within a suite, storey, or its constituent floor areas, that exceeds the last permitted major occupancy (as last legally authorized) of that suite, storey, or constituent floor areas.

More limited scopes of Change of Major occupancy include:

Restricted Change of Major Occupancy which refers to changes of major occupancy within a limited set of uses as set out in Clause 11.5.1.3.(9)(c) that are limited by both hazard and scope such that it does not increase the overall risk.

Small Suite Change of Major Occupancy which means a change of major occupancy within a suite of limited occupant load and lower hazard use. This categorization is contingent upon the provision of a separation incorporating additional gypsum board on the suite side from adjacent spaces in the building (including vertically).

Horizontal Additions are construction that creates new floor area beyond the extents of the existing floor area but which does not impose new vertical loads on existing construction. This could include the construction of a new addition to a building supported on *grade*.

Minor Horizontal Additions are horizontal additions, of limited size, the extents of which may not exceed the lesser of 25 per cent of the existing total building area, or 500 m^2 of floor area increase aggregated over all of a building's storeys.

Renovation projects include alterations to existing construction for the purpose of improvement, renovation, reconfiguration, or refurbishment of existing floor spaces.

There are several subcategories of Renovations including the following:

Major Renovation is the broadest category of renovation work, and includes all renovations to existing construction which do not fall into other subcategories

Minor Renovation is renovation work within a single suite (or a space occupied by a single tenant space) and those demising walls shared with the adjoining suites, but which does not include the public or common floor areas of the building. Minor renovation may also include the subdivision of a single suite of not more than one storey into smaller constituent suites.

Minor Renovation may include the following:

- Reconfiguration of the interior space of the suite which may occupy multiple levels in a building,
- Retention of existing interconnected floor spaces that do not create new connections to previously unconnected floor areas,
- Retention of existing mezzanines that do not add floor area,
- Subdivision of an existing suite of not more than one storey into one or more suites which do not include floor area outside of the subdivided suite
- Renovation in adjacent suites to the extent necessary to support the relocation of shared demising walls, or
- Exterior renovations pertaining to the subject suite

Where the renovation includes a new interconnected floor space, this work would not be considered to be a minor renovation. New mezzanines are considered to be additions.

Small Suite Renovation means renovations pertaining to a suite of limited occupant load and lower hazard use. This is contingent upon the provision of a separation incorporating additional gypsum board on the suite side from adjacent spaces in the building (including vertically),

Small Suite renovations may include reconfiguration of the interior space of the suite, but may not include work on more than level (storey or mezzanine), interconnected floor spaces, exterior renovations, or the consolidation of more than one existing suite into a single new tenant space.

Reconstruction means the extensive removal of the major of construction to expose the building's primary structure on interior and exterior walls, floors and roof with only the primary structural elements remaining in place (building skeleton). Reconstruction also includes substantial reconfiguration of the interior floor space. Where work, which might otherwise be considered as reconstruction, is undertaken solely to facilitate the repair or the abatement of a health hazard of a building, then such work need not to be considered a reconstruction and would be considered a repair, minor renovation or a major renovation as defined in this By-law.

Repair focuses on interior or exterior renovations where existing building components are being replaced with components that do not change the essential characteristics of the original building components. This is not the same as a restoration, but a repair may not include work that increases the usable floor area of a building, creates an interconnected floor space, supports an addition or change of use, or the consolidation of more than one existing suite into a single tenant space.

Vertical Additions are the addition of any new floor area superimposed over an existing building structure or floor area which imparts an additional structural load. Structural loads include not only gravity loads, but could include implications from uplift, wind, or changes in rain or snow loads.

In addition to storeys, vertical additions may also include mezzanines, decks, or other roof areas intended for occupancy which in-fill existing unoccupied spaces, but which do not necessarily add to the floor or building areas.Major Vertical Addition are those vertical additions which exceeds the limits permitted by a Minor Vertical Addition.

Minor Vertical Addition is an addition of new floor area that does not result in an increase to the aggregate floor area by more than 25 per cent of the building area, 500 m^2 in aggregate floor area, or both.

Voluntary Building By-Law Upgrades are alterations to the building that directly contribute to the improvement of existing building systems and that are aligned with the fundamental objectives of the Building By-law, and exceed the minimum expectations for the code compliance of other planned improvements. These improvements may include improvements in the fire alarm system, sprinkler system, *exit*, accessibility, seismic, building envelope, and energy or water efficiency systems in an existing building. However, this does not generally apply to improvements to these systems where this is already a requirement needed to achieve code compliance for other planned new construction or renovation (e.g. one would not typically consider the addition of sprinklers to be a voluntary improvement, where an existing major occupancy was changed to a different major occupancy that would be required to be sprinklered).

A-11.1.3.1.(1)(e) Limitation of Upgrades to Suites. The objective described in Clause 11.1.3.1.(1)(e) is to limit the potential scope of upgrades to suite areas outside a renovated suite (i.e. to other suites, but not common areas) unless the effects of the renovation also have direct or significant impacts to another suite.

For example an increase to occupant loads to a suite, has direct impacts on the subject suite and the commonly accessed *means of egress* from the subject suite, which may lead to upgrades of those spaces, but the egress within another suite would likely not be affected until you left that other suite, and therefore upgrade would not be required.

However, judgement needs to be applied in this regards, as it may not be immediately obvious to what extent building systems shared by more than one suite might be affected. In the above example, a significant enough increase in the occupant load in a suite could have structural implications that affect all suites on a floor, in which case additional upgrades within suites not directly affected may be required.

A-11.1.4.1.(1) Upgrading of Existing buildings. Article 11.1.3.1. of the Building By-law identifies that existing buildings are required to be upgraded, and identifies three mechanism by which an appropriate level of upgrade may be determined. In most cases, this is achieved by use of the upgrade triggers mechanism described in Section 11.5.

However, the scope of projects vary considerably as do the state of existing building construction, and therefore upgrades in accordance with Clauses 11.1.4.1.(b) and (c) provide alternative means to establish acceptable upgrades to retained existing construction.

Clause (b) address upgrades via Alternative Compliance Measures, which include:

- Construction to achieve modified code requirements, to facilitate conversions of existing buildings, in Section 11.2.;
- Alternative acceptable construction providing an alternative set of improvement for specific existing components or systems of a building which are deemed to comply with the upgrades that would otherwise be required by the upgrade triggers mechanisms, in Section 11.3; and
- Measures intended to facilitate the alteration of existing heritage construction, in Section 11.4.

The figure below provides a general flowchart illustrating how the acceptable upgrade to an existing building is determined.

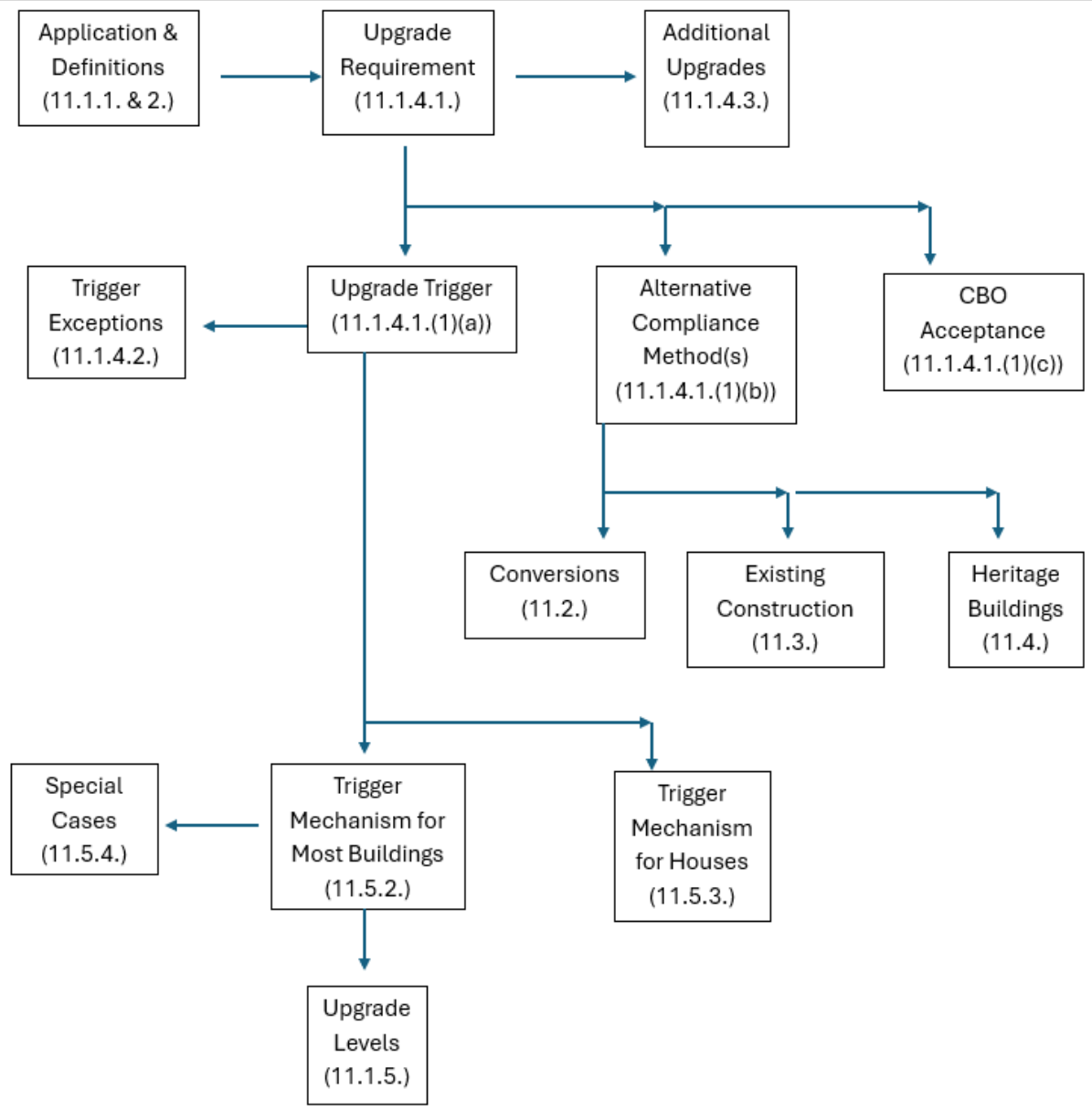

Figure 11.1.4.1.(1): Building Upgrade Overview

A-11.1.4.2.(2) Voluntary Building By-law Upgrades. Where a voluntary upgrade for fire alarm systems, sprinkler systems, *exits*, accessibility, seismic work, building envelope repair, energy efficiency, or water efficiency is performed, it is not the intent of this By-law to require the owner to further upgrade the building provided no other work is included in the project. If other work is included in the project, the upgrade requirement will only be based on the non-voluntary work proposed.

A-11.1.4.2.(3) Alternative Compliance Measure. Where Alternative Compliance Measures are implemented to address specific retained characteristics of a building, the retained construction is deemed to be compliant for the purposes of establishing the building upgrades as determined by the Upgrade Trigger Mechanism.

A-11.1.4.2.(6) Self-contained Separated Spaces. The self-contained space provisions of Article 11.1.4.2. are intended to be applied to modest upgrades or minor additions to existing buildings where the normal application of the upgrade requirements Part 11 would constitute a hardship. It is not intended that these provisions be utilized for the construction of additions of substantial size relative to the original building construction, or the conversion or substantial reconstruction of a heritage structure. Such structures should be upgraded in conformance with the general provisions of Part 11 as applicable to the intended scope of work.

A-11.1.4.3.(6), 11.2.3.1.,11.5.3.1.(2) & (4), and 11.5.4.2.(4) Project Value. The term "construction value" refers to the value of the proposed work stated on the application for the permit established by Division C, Article 1.6.2.3. This includes the current monetary worth of all labour and all fees and costs incurred for design, investigative testing, consulting services, construction, construction management, contractor's profit and overhead, sales taxes, and construction insurance related to the building, including all components of the building, and the market value of all labour, including unpaid labour provided by an owner or volunteer, and the market value of all materials, including donated, recycled or used materials.

A-11.2.3.1. and 11.1.4.3.(6) Replacement Value. The term "replacement value" is used as a baseline for determining the applicability of specific upgrade requirements. The term refers to the cost to replace the structure in its current state or serve the function of a previous structure. This is similar to the insurable value – the cost to replace the destructible improvements of a property (as applied to a building or part thereof). This is not intended to be an assessment of the construction, planning, and ancillary costs that could be incurred if the structure in question was built as a reproduction of the original or redeveloped as new construction.

A-11.2.3.1.(1) Interconnected Smoke Alarms and Carbon Monoxide Detectors. Concern has been expressed regarding the interconnection requirements of smoke alarms served by different electrical panels if the panels do not share a common ground as a current could be generated through the interconnecting wires and resulting in potential false alarms. Interconnected smoke alarms must be powered off the same (main) electrical panel so that a common ground and reliable operation is achieved.

A-11.2.7.1.(2) Bare Lands Strata Conversions. It is the general intent of the strata conversions requirements of this By-law to require upgrades to existing buildings where they undergo subdivision under the provincial Strata Act. In cases where the land is being subdivided, and existing buildings are not being internally subdivided into separate strata lots, then the extent of the upgrades may be limited to upgrades addressing the external where there is no other intent to alter the buildings. These upgrades could include, but are not limited to, risks associated with the partial or total collapse of the existing buildings, overhead fall hazards, and fire exposure to or from adjacent buildings and the egress and access routes. 'S4'and 'N4' and sprinklering are the appropriate upgrade categories, but as with all existing buildings, there may be a need to consider the impacts of site specific features which could constitute a hardship. Such cases should be evaluated by appropriately trained professionals, and alternative measures discussed with the Chief Building Official.

A-11.3.1.1. Application of Alternative Measures for Existing Conditions. This Article is not intended to be applied to new construction. In general, it is the purpose of Sections 11.2 to 11.4 to facilitate retention of existing conditions where the existing construction is not being substantially modified and the conditions of construction of the building do not otherwise affect their compliance. If there is new construction, this is subject to the general requirements pertaining to new construction in this By-law. Furthermore, "new work" (as opposed to existing construction) may include not only new construction, but could also consist of converted floor areas that feature newly occupied areas or spaces, areas of increased occupant load or net new floor area, or the altering of existing floor space beyond its original configuration to support new uses or occupancy.

A-11.3.2.1.(3)(b) Alteration Language Supporting NECB 2020. The term "alteration language" is used in Subsection 11.2.2. to describe the design upgrade requirements pertaining to the energy efficiency performance of buildings that are being altered from their existing condition. These requirements are fully described in the living document available on the City of Vancouver website and which is updated from time to time.

This document contains an introduction that clarifies Intent, Implementation, Scope, and Application and is reproduced here for convenience. By-law users are reminded of the need to keep up to date with the current requirements.

Alteration Language to Support the Application of the NECB 2020 Version: 2025

ACKNOWLEDGEMENT

The City of Vancouver would like to acknowledge the permission granted by ASHRAE for use of their alteration language, from the ASHRAE 90.1-2019 standard, as the foundation for this document. ASHRAE's willingness to support consistency within a jurisdiction with multiple energy standards is very much appreciated.

INTENT

The intention of this document is to provide building rehabilitation requirements to support the NECB in a manner consistent with the existing requirements pertaining to the ASHRAE 90.1-2019 standard.

With the implementation of NECB 2020 within Vancouver's Building Bylaw in 2025, this document provides the minimum requirements for alterations to existing buildings designed and constructed to NECB 2011/2015 and those buildings subject to this document through Subsection 11.3.2. (formerly 11.7) of Division B.

SCOPE

This document pertains to the application of existing buildings, specifically buildings:

- designed to NECB 2011,
- designed to NECB 2015,
- designed to ZEBP (10.2.2.5), or
- subject to 11.3.2.1.(3)(b) requirements (formerly 11.7.1.1.(3)(b) requirements).

APPLICATION

This document applies to the alteration of all building components with prescriptive requirements listed within NECB 2020, with the exception of Solar Heat Gain Coefficient requirements being applicable to the City of Vancouver only.

DEFINITIONS

Alteration means a replacement or *addition* to a *building* or its *systems* and *equipment*; routine maintenance, *repair*, and service or a change in a building's use classification or category shall not constitute an *alteration*.

Equipment means devices for space heating, space cooling, ventilation, humidification, dehumidification, electric power, lighting, transportation, refrigeration, cooking, or *service water heating*, including but not limited to, furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators, or other devices or installations.

Existing building means a *building* or portion thereof that was previously occupied or approved for *occupancy* by the *authority having jurisdiction*.

Existing system means a *system* or *systems* previously installed in an *existing building*.

Fenestration area means the total area of the *fenestration* measured using the rough opening and including the glazing, *sash*, and *frame*. For doors where the glazed vision is less than 50% of the door area, the *fenestration area* is the glazed vision area. For all other doors, the *fenestration area* is the door area.

Solar Heat Gain Coefficient (SHGC*) means the ratio of the solar heat gain entering the *space* through the *fenestration area* to the incident radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the *space*.

*All SHGC references within this document apply to the City of Vancouver only

Space means an enclosed *space* within a *building*.

System means a combination of *equipment* and auxiliary devices (e.g., controls, accessories, interconnecting means, and terminal elements) by which energy is transformed so it performs a specific function such as HVAC, *service water heating*, or lighting.

1.1 General

1.1.1 Instructions

This document shall be read in conjunction with NECB 2020. Words that appear in italics are defined in this document unless already defined within NECB 2020. All references to Parts are referring to the Parts within NECB 2020.

1.1.1.1 Additions to Existing Buildings. *Additions* to *existing buildings* shall comply with 1.2 of this document.

1.1.1.2 Alterations of Existing Buildings. *Alterations* of *existing buildings* shall comply with 1.2 of this document.

1.1.1.3 Replacement of Portions of Existing Buildings. Portions of a *building envelope*, heating, ventilating, air-conditioning, *service water heating*, power, lighting, and other *systems* and *equipment* that are being replaced shall be considered as *alterations* of *existing buildings* and shall comply with 1.2 of this document.

1.2 Compliance

1.2.1 Compliance Paths

1.2.1.1 Additions to Existing Buildings. Additions to *existing buildings* shall comply with either the provisions of Parts 3, 4, 5, 6, and 7, or Part 8.

Exception: When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Modelling of the modified components of the *existing building* and *addition* shall employ the procedures of NECB's Part 8; the *addition* shall not increase the energy consumption of the *existing building* plus the *addition* beyond the energy that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

1.2.1.2 Alterations of Existing Buildings. *Alterations* of *existing buildings* shall comply with the provisions of Parts 3, 4, 5, 6, and 7, or Part 8.

Exception: In a building where components have been formally recognized by a federal, provincial, territorial, or municipal authority having jurisdiction, as having either Heritage or Character value, the alteration of these components need not comply with these requirements.

2.1 Building Components and Systems

2.1.1 Building Envelope (supports Part 3 of the NECB 2020)

2.1.1.1 Envelope Alterations. *Alterations* to the *building envelope* shall comply with the requirements of Part 3 for insulation, air leakage, and *fenestration* applicable to those specific portions of the building that are being altered. Fenestration must also comply with the SHGC values of Article 10.2.2.3 of the Vancouver Building Bylaw.

Exceptions: The following *alterations* need not comply with these requirements, provided such *alterations* will not increase the energy usage of the building:

a. Installation of storm windows or glazing panels over existing glazing, provided the storm window or glazing panel contains a low-emissivity coating. However, a low-emissivity coating is not required where the existing glazing already has a low-emissivity coating. Installation is permitted to be either on the inside or outside of the existing glazing.

b. Replacement of glazing in existing sash and frame provided the U-factor and *SHGC* (Vancouver only) will be equal to or lower than before the glass replacement.

c. *Alterations* to roof, wall, or floor cavities that are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.

d. *Alterations* to walls and floors, where the existing structure is without framing cavities and no new framing cavities are created.

e. Roof recovering

f. Removal and replacement of a roof membrane where there is existing roof insulation integral to or below the roof deck.

g. Replacement of existing doors that separate a conditioned *space* from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned *space* from the exterior shall not be removed.

h. Replacement of existing fenestration, provided that the area of the replacement fenestration does not exceed 25% of the total *fenestration area* of an *existing building* and that the U-factor and *SHGC* (Vancouver only) will be equal to, or lower than before the fenestration replacement.

2.1.2 Lighting (supports Part 4 of the NECB 2020)

2.1.2.1 Lighting Alterations. For the *alteration* of any lighting *system* in an interior *space*, that *space* shall comply with the entirety of Part 4 as applicable to that *space* or area.

For the *alteration* of any lighting *system* for the exterior of a building application, that lighting *system* shall comply with the lighting power density (LPD) allowances of Part 4 applicable to the area illuminated by that lighting *system* and the applicable control requirements of 4.2.4.

Exceptions:

a. Interior lighting *alterations* where the total new wattage of all *replaced luminaires* on a project is 2,000 watts or less, the total wattage of *replaced luminaires* of a *lighting system* within a *space* shall be at least 50% below the total wattage of all *removed luminaires* of that *lighting system*, unless the *space* is at or below the LPD allowances of Part 4. Controls shall comply with the requirement of 4.2.2.1.(20).

b. Exterior lighting *alterations* where the total number of *replaced luminaires* on a project is 10 or less, the total wattage of *replaced luminaires* shall be at least 50% below the total wattage of all *removed luminaires*, unless each altered area is at or below the *LPD* allowances of Part 4. Controls shall comply with the requirement of 4.2.4.

c. The replacement of a failed lamp or *ballast/driver* in an individual *luminaire* or the replacement of any failed lighting control.

d. The removal or relocation of interior or exterior *luminaires* as part of, or independent of, exceptions 1, 2, or 3.

2.1.3 HVAC (supports Part 5 of the NECB 2020)

2.1.3.1 Additions to Existing Buildings. Mechanical *equipment* and *systems* serving the heating, cooling, ventilating or refrigeration needs of additions to *existing buildings* shall comply with the requirements of Part 5.

Exception: When HVACR to an addition is provided by existing HVACR *systems* and *equipment*, such *existing systems* and *equipment* shall not be required to comply with Part 5. However, any new *systems* or *equipment* installed must comply with specific requirements applicable to those *systems* and *equipment*.

2.1.3.2 Alterations to Heating, Ventilating, and Air Conditioning in Existing Buildings

2.1.3.2.1 New HVACR *equipment* as a direct replacement of existing HVACR *equipment* shall comply with the specific minimum efficiency requirements of Part 5, applicable to that *equipment*.

2.1.3.2.2 New cooling systems installed to serve previously uncooled spaces shall comply with 5.1.1.3.

2.1.3.2.3 *Alterations* to existing cooling systems shall not decrease economizer capability unless the system complies with 5.2.2.8 and 5.2.2.9,

2.1.3.2.4 New and replacement ductwork shall comply with 5.2.2 and,

2.1.3.2.5 New and replacement piping shall comply with 5.2.5.

Exceptions: Compliance shall not be required:

a. for *equipment* that is being modified or repaired but not replaced, provided that such modifications and/or repairs will not result in an increase in the annual energy consumption of the *equipment* using the same energy type;

b. where a replacement or *alteration* of *equipment* requires extensive revisions to other *systems*, *equipment*, or elements of a building, and such replaced or altered *equipment* is a like-for-like replacement;

c. for a refrigerant change of existing *equipment*;

d. for the relocation of existing *equipment*; or

e. for ducts and piping where there is insufficient *space* or access to meet these requirements.

2.1.4 Service Water Heating Systems (supports Part 6 of the NECB 2020)

2.1.4.1 Additions to Existing Buildings. Service water heating *systems* and *equipment* shall comply with the requirements of Part 6.

Exception: When the service water heating *system* to an addition is provided by existing service water heating *systems* and *equipment*, such *systems* and *equipment* shall not be required to comply with Part 6. However, any new *systems* or *equipment* installed must comply with specific requirements applicable to those *systems* and *equipment*.

2.1.4.2 Alterations to Existing Buildings. Building service water heating *systems equipment* installed as a direct replacement for *existing building* service water heating *system equipment* shall comply with the requirements of Part 6 applicable to the *equipment* being replaced. New and replacement piping shall comply with 6.2.3.

Exception: Compliance shall not be required where there is insufficient *space* or access to meet these requirements.

2.1.5 Power (supports Part 7 of the NECB 2020)

2.1.5.1 Addition to Existing Buildings. *Equipment* installed in addition to *existing buildings* shall comply with the requirements of Part 7.

2.1.5.2 Alterations to Existing Buildings.

Exception: Compliance shall not be required for the relocation or reuse of existing *equipment* at the same site.

2.1.5.3 *Alterations* to building service *equipment* or *systems* shall comply with the requirements of this section applicable to those specific portions of the building and its *systems* that are being altered.

2.1.5.4 Any new *equipment* subject to the requirements of this section that is installed in conjunction with the *alterations*, as a direct replacement of existing *equipment* shall comply with the specific requirements applicable to that *equipment*.

A-11.3.2.1.(5) Spaces Never Previously Occupied. Spaces “never previously occupied” shall be designed and constructed to “new building” requirements, and must comply with all applicable new construction requirements within the applicable standard/code (ASHRAE 90.1, NECB, ZEBP), rather than the alteration language supporting the applicable standard/code. No length of unoccupied period can downgrade the design requirements, for a space’s first occupancy, from full code to alteration requirements.

A-11.3.2.2.(1)(d) Commissioning (Cx) Requirements and Scope. These new commissioning requirements are not meant to include the Re-commissioning or Retro-commissioning of existing equipment or existing systems unless they are part of a new system, or dependent upon or interlocked with, the operation of new equipment.

A-11.3.4.3.(1)(b) Intumescent Paint. Experience has shown that maintenance considerations of fire retardant intumescent paint are not well understood by applicants. To be effective, multiple coats are required at installation time for complete and proper application. Proper surface preparation is also a significant portion of the work and imperative to prevent pre-mature delamination. This preparation and application period could span several days based on existing surfaces and re-coat durations. Then there is the curing time needed prior to the application of any exterior finish coat. Exterior finish coat(s) will

likely be necessary as most intumescent coatings are not suitable for prolonged exterior exposure. As well, there could be a detailed installation and inspection process to confirm the installation. Experienced labour is a major factor in the process.

Another consideration is exposure to weather effects; particularly water can lead to cracking and delamination of the coating systems. As well, product information has stated that fire-resistive coatings are not intended for exterior exposures or interior environments exposed to freeze/thaw conditions. This exposure can lead to severe cracking and delamination. This could lead to expensive re-application.

Ongoing maintenance and re-application due to weather degradation or mechanical damage is another significant consideration. Product and care information must be provided to new owners or tenants when there is a change of use or ownership. This must be provided in the strata information, maintenance manuals and guaranteed by restrictive covenant against the property's deed.

A-11.3.4.4.(4) Window Replacement. The provisions of Sentence 11.2.4.4.(4) are intended to facilitate voluntary window replacements to higher energy efficient products as part of a renovation project. As modern windows may have slightly different dimensional requirements, this Sentence allows for minor variations that do not substantially affect the existing spatial condition of the existing building. This means that the location, orientation, and size of the windows may not change, excepting minor dimensional variations to the extent necessary to accommodate the new window.

A-11.3.8.1.(1) Temporary Refuge for Persons with Disabilities. These measures are intended to provide temporary refuge for persons with disabilities. It is acknowledged, however, that the measures cannot provide absolute safety for all occupants in the fire area. It may, therefore, be necessary to develop special arrangements in the fire safety plan to evacuate persons with disabilities from these areas. Details for a suitable plan are contained in the Fire By-law.

The protected elevator referred to in Clause 11.2.8.1.(1)(a) is intended to be used by firefighters as a means for evacuating persons with disabilities. It is not intended that this elevator be used by persons with disabilities as a *means of egress* without the assistance of firefighters.

If an estimate is to be made of the number of persons with disabilities in a floor area who can be accommodated in each zone in Clause 11.2.8.1.(1)(b), this estimate may be based on Table 3.8.2.3., which is used to determine the minimum number of spaces to be provided for wheelchair occupants in fixed seating areas. If more precise information is available, it should be used for sizing the zones.

For residential occupancies, the choices of protection include the option to provide an *accessible* balcony, but it is not required that balconies be the chosen means of protection.

A-11.5.1. Existing Building Upgrade Mechanism.

BACKGROUND AND INTENT. When work is carried out to an existing building, the Building By-law requires that the building be upgraded to an "acceptable" level. On April 20, 2004 Council approved a new model for determining the "acceptable" level of Building By-law upgrade for existing buildings undergoing alterations under the City's building permit process.

Prior to April 20, 2004, the required upgrades to an existing building were based primarily on construction values. The Upgrade Mechanism determines the required "acceptable" level of upgrade for an existing building using the concept of defined "Categories of Work" falling with the broad project types of Rehabilitation, Additions, and Change of Major occupancy.

The intent of the Upgrade Mechanism is to provide a road map for building owners and designers to determine the required level of Building By-law upgrade for the existing portion of a building as a function of the project types and the related categories of work.

The Upgrade Mechanism is not generally intended for existing residential buildings containing not more than two principal dwelling units. The general upgrade requirement for these types of buildings is defined in Article 11.5.2.1.of Division B.

A-11.5.1.1.(3) Hazard Index. Hazard Index ratings are intended to reflect the level of fire and life safety risk to occupants for various building uses. Hazard index ratings range from 1 to 6, such that a hazard index of rating of 6 represents the highest risk to occupants. The Hazard Index for various building uses are indicated in Table A-11.5.1.1.(4), and are used to determine the required level of Building By-law upgrade for a Change of Major Occupancy Type projects is dependent on whether or not the Hazard Index has increased for the proposed alteration.

For the purposes of a Restricted Change of Occupancy, the Hazard Index may be established based on the aggregate area of the suite, to provided indices that can be compared to establish a relative level of risk between the proposed and current

uses of different sizes. Where a suite is subdivided as part of change in major occupancy, the relative risk is established based on the index number of the final aggregate size of the suite as compared to the original size of the suite (see Note A-11.5.3.1.(1)).

Table A-11.5.1.1.(3)
Hazard Index Table

Group A, Division 1		
Building Use	**Hazard Index(1)**	
	≤200 m²	>200 m²
Dinner Theatres	4	5
Live Theatres	4	5
Motion Picture Theatres	4	5
Opera Houses	4	5
Television Studios (With Audience)	4	5
Group A, Division 2		
Building Use	**Hazard Index**	
	≤200 m²	>200 m²
Art Galleries	3	4
Auditoria	3	4
Billiard Halls, Amusement Arcades	3	4
Bowling Alleys	3	4
Churches	3	4
Clubs, Lodges (Non-Residential)	3	4
Community Halls	3	4
Concert Halls	3	4
Court Rooms	3	4
Dance Halls	3	4
Daycare Centres	3	4
Exhibition Halls (Without Sales)	3	4
Exhibition Halls (With Sales)	See Group E	
Gymnasia (Multi-Purpose)	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Gymnasia (Athletic)	3	4
Lecture Halls	3	4
Libraries	3	4
Licensed Beverage Establishments	3	4
Licensed Clubs, Lodges	3	4
Museums	3	4
Passenger Stations/Depots	3	4
Recreational Piers	3	4
Restaurants (Seating Over 17)	3	4
Schools, Colleges	3	4
Undertaking Premises	3	4
Group A Division 3		
Building Use	**Hazard Index(1)**	
	≤200 m^2	>200 m^2
Arenas (No Occupancy On Activity Surface)	3	4
Armouries (No Occupancy On Activity Surface)	3	4
Enclosed Stadia or Grandstand	3	4
Ice Rinks (No Occupancy On Activity Surface)	3	4
Indoor Swimming Pools	3	4
Group A Division 4		
Building Use	**Hazard Index(1)**	
	≤200 m^2	>200 m^2
Amusement Park Structures	2	3
Bleachers	1	3
Grandstands (Open)	1	3
Reviewing Stands	1	3
Stadia (Open)	1	3
Group B, Division 1		
Building Use	**Hazard Index**	

Table A-11.5.1.1.(3) Hazard Index Table		
	≤200 m²	>200 m²
Detention Facilities (Minimum Security)	4	5
Detention Facilities (All other types of security)	6	6
Police Station with Detention (not meeting Article 3.1.2.4.)	3	4
Group B, Division 2		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Hospital, Nursing Home, Geriatric, Sanitarium (Immobile)	4	5
Hospital, Nursing Home, Geriatric, Sanitarium (Non-Ambulatory)	4	5
Psychiatric Hospitals (Maximum Confinement)	4	5
Psychiatric Hospitals (Minimum Confinement)	3	4
Police Station with Detention (Meeting Article 3.1.2.4.)	3	3
Group B, Division 3		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Residential Care Facilities (Ambulatory)	3	4
Residential Care Facilities (Non-Ambulatory)	4	5
Children Custodial Homes	3	4
Convalescent Homes (Ambulatory)	3	4
Convalescent Homes (Non-Ambulatory)	4	5
Group Homes for Adult Residents with Developmental Disabilities (Minimum Confinement)	3	4
Group Homes for Adult Residents with Developmental Disabilities (Maximum Confinement)	4	5
Group C		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Apartments	3	4
Clubs, Residential	3	4
Colleges Residential	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Congregate Care Housing for Seniors	3	5
Convents	3	4
Dormitories/Hotels	3	4
Hotels	3	5
Detached Houses (1 or 2 Family)	2	2
Live/work units	3	5
Monasteries	3	4
Retirement Homes	3	4
Schools, Residential	3	4
Group D		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Advertising and Sales Offices	3	3
Automatic Bank Deposit	3	4
Barber/Hairdresser Shops	3	4
Beauty Parlours	3	4
Branch Banks	3	4
Car Rental Premises	3	3
Chiropractic Offices	3	4
Communications Offices (Telephone Exchange)	3	4
Communications Offices (Telex)	3	4
Communications Offices (Courier)	3	3
Computer Centres	3	4
Construction Offices	3	3
Costume Rental Premises	3	4
Dental Offices (Denture Clinic)	3	4
Dental Offices (General)	3	4
Dental Offices (Surgical/Anaesthesia)	4	5
Dry Cleaning Depots	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Dry Cleaning Premises (Self-Serve)	4	4
Health/Fitness Clubs	3	4
Laundries (Self-Serve)	4	4
Massage Parlours	3	4
Medical Offices (Examination)	3	4
Medical Offices (Surgical Anaesthesia)	4	5
Offices (Business)	3	3
Offices (Charitable)	3	3
Offices (Legal/Accounting)	3	3
Offices (Design)	3	4
Pharmacy Offices	3	4
Photographic Studios	3	4
Physiotherapy Offices	3	4
Police Stations (No Detention)	3	4
Printing and Duplicating	4	5
Public Saunas	3	4
Radio Stations (No Audience)	3	4
Small Tool Rental Premises	3	4
Suntan Parlours	3	4
Veterinary Offices	3	4
Group E		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Automotive/Hardware Department Store	4	5
China Shops	3	4
Department Stores	4	5
Electrical Stores (Fixtures)	3	3
Exhibition Halls (With Sales)	4	5
"Fast Food" Outlets	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Feed and Seed Stores	4	5
Flea Markets	3	5
Flower Shops	3	4
"Food" and Vegetable Markets	3	4
Garden Shops	3	4
"Gas" Bars	4	5
Gift Shops	3	4
Home Improvement Stores	4	5
Kitchen/Bathroom Cupboards Stores	3	4
Plumbing Stores (Fixtures/Accessories)	3	3
"Pop" Shops	3	4
Restaurants (Not More Than 30 Persons)	3	4
Shopping Malls	4	5
Stationery/Office Supply Stores	3	4
Stores (Art)	3	4
Stores (Baked Goods)	3	4
Stores (Beer)	3	4
Stores (Book)	3	4
Stores (Camera)	3	4
Stores (Candy)	3	4
Stores (Clothing)	3	4
Stores (Drugs)	4	4
Stores (Electronic)	3	4
Stores (Floor Coverings)	4	5
Stores (Food)	3	3
Stores (Furniture/Appliances)	3	4
Stores (Hardware)	4	5
Stores (Health)	4	4
Stores (Hobby)	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Stores (Jewellery)	3	3
Stores (Paint/Wallpaper)	4	5
Stores (Pet)	3	4
Stores (Records/Tapes)	3	4
Stores (Spirits)	4	5
Stores (Toys)	4	5
Stores (Variety)	4	4
Stores (Video Sales/Rental)	3	4
Supermarket	3	4
Group F, Division 1		
Building Use	**Hazard Index**	
	≤200 m2	**>200 m^2**
All Uses	6	6
Group F, Division 2		
Building Use	**Hazard Index**	
	≤200 m^2	**>200 m^2**
Aircraft Hangars	3	5
Abattoirs	3	4
Bakeries	3	5
Body Shop	3	5
Candy Plants	3	4
Cold Storage Plants with Flammable Refrigerant	3	5
Cold Storage Plants with Non-flammable Refrigerant and	3	4
Dry Cleaning Establishments (non-flammable or non-explosive)	3	4
Electrical Substations	3	4
Factories (High Fire Load)	3	5
Freight Depots (High Fire Load)	3	5
Laboratories (High Fire Load)	3	5
Laundries (not self-serve)	3	4

Table A-11.5.1.1.(3) Hazard Index Table		
Manufacturer Sales (High Fire Load)	3	5
Mattress Factories	3	4
Meat Packing Plants	3	4
Packaging Manufacturers (Cellulose)	3	4
Packaging Manufacturers (Noncombustible)	3	3
Packaging Manufacturers (Plastics)	3	5
Paper Processing Plants (Wet)	3	5
Plaining Mills	3	5
Printing Plants	3	4
Public Heritage Buildings	3	3
Repair Garages	3	5
Sample Display Rooms (High Fire Load)	3	5
Self Service Storage Buildings	3	4
Service Stations (no spray painting)	3	5
Storage Rooms (High Fire Load)	3	5
Television Studios (no audience)	3	4
Tire Storage	3	5
Warehouse (High Fire Load)	3	5
Welding Shops	3	5
Wholesale Rooms (High Fire Load)	3	5
Wood Working Factories	3	5
Workshops (High Fire Load)	3	5
Group F, Division 3		
Building Use	**Hazard Index**	
	≤200 m²	**>200 m²**
Creameries	2	2
Factories (Low Fire Load)	2	3
Freight Depots (Low Fire Load)	2	3
Laboratories (Low Fire Load)	2	3

Table A-11.5.1.1.(3) Hazard Index Table		
Manufacturers Sales (Low Fire Load)	2	3
Power Plants	3	4
Public Heritage Buildings	3	3
Sample Display Rooms (Low Fire Load)	2	3
Storage Garages	2	3
Storage Rooms (Low Fire Load)	2	3
Warehouse (Low Fire Load)	2	3
Wholesale Rooms (Low Fire Load)	2	3
Workshops (Low Fire Load)	2	3

Notes to Table A-11.5.1.1.(3).:

(1) For the purposes of a Restricted Change of Occupancy, the Hazard Index may be established based on the aggregate area of the suite provided the suite changing occupancy is fully contained in the original suite area.

A-11.5.1.2.(1) Upgrade Levels. The required upgrading of an existing building are assigned Levels 1 through 4, where 4 represents the highest level of upgrade in each of the areas associated with the upgrade objectives of the Building By-law.

If an alteration includes more than one category of work or project type, then the most restrictive upgrade levels from each category of work will be applied. The individual upgrade levels are cumulative, so the higher level upgrade levels include all of the preceding lower upgrade level requirements. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

The acceptable solutions indicated in these notes and associated with upgrade levels are examples of possible upgrade plans that are deemed to satisfy the prescribed upgrade levels. Code users are not necessarily required to provided upgrades that are comply exactly with the acceptable solutions.

It is expected that owner may choose to adopt specific upgrades that better align with the planned work. Analysis by the building designer may be required to demonstrate that the proposed set of upgrades will achieve the performance of the required upgrade level.

Acceptable Solutions for Upgrade Levels

Fire

F1 Project Area – *Exits* to be upgraded with respect to number, capacity, and fire separations only.

F2 Project Area – Alarms and detectors (only where existing devices are provided), emergency lights, access to *exit*, *exits*, *exit* signs, and *exit* lights.

Public Area (leading from project area to an acceptable open space) – emergency lights, *exit* signs, access to *exit*, *exits*, and flame spread ratings.

F3 Project Area – Alarms & detectors (only where existing devices are provided), emergency lighting, access to *exit*, *exits*, *exit* signs, *exit* lights, flame spread ratings, floor assemblies & supports, occupancy separation, standpipes and sprinklers, washrooms.

Public Area – Alarms & detectors (only where existing devices are provided), emergency lighting, access to *exit*, *exits*, *exit* signs, *exit* lights.

Entire Building – Fire fighter's access.

F4 Entire Building – Alarms & detectors, emergency lighting, access to *exit*, *exits*, *exit* signs, *exit* lights, flame spread ratings, firefighting access & water supply, floor assemblies & support, spatial separation, occupancy separation, standpipes

& sprinklers, washrooms, high building requirements, lighting levels, sound transmission classifications, ventilation, building envelope review, and radio antenna systems.

Structural

S1 Entire Building – Proposed work must not reduce the structural integrity of the existing building.

S2 Project Area – Non-structural elements and falling hazards must be restrained to resist lateral loads due to earthquakes within the project area.

S3 Entire Building – Building to be upgraded to resist 50 per cent of the current By-law specified lateral force levels, where the building is evaluated as having less than 30 percent of the current required seismic resistance. Restrain falling hazards from major building components such as cantilevered walls, parapets, exterior ornaments, towers, chimneys, or other appendages, which could impact adjacent properties and public ways to resist forces due to a seismic event.

S4 Entire Building – Building to be upgraded to resist 75 percent of the current By-law specified lateral force levels, where the building is evaluated as having less than 60 percent of the current required seismic resistance.

Nonstructural

N1 Project Area – Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, all overhead mechanical ducts, sprinklers, equipment, sprinkler system, overhead electrical conduits and lights.

N2 Project Area *Means of egress* – Restrain interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, all overhead mechanical ducts, sprinklers, equipment, sprinkler system, overhead electrical conduits and lights. Restrain cladding veneer, parapets, canopies and ornaments over *exit* and extended to 5 m on either side of *exit.*

N3 Entire Building *Exits* – Restrain interior partition walls. Restrain ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, sprinklers, sprinkler system, overhead electrical equipment and services. Restrain falling hazards to resist forces due to a seismic event from non-structural elements including cladding, veneer, cornices, canopies, awnings, and ornaments over *exit* and extended to 5 m on either side of *exit*.

N4 Entire Building – Restrain all interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, sprinklers, sprinkler systems, overhead electrical equipment and services. Restrain exterior falling hazards to resist forces due to a seismic event from cladding, veneer, cornices, parapets, canopies, awnings, and ornaments attached to the exterior of the building.

Accessibility

A1 Project Area – Existing level of accessibility must be maintained throughout the project area. No additional accessibility enhancements are required.

A2 Project Area – door clearances, door hardware, and areas of refuge.

A3 Project Area – Door clearances, door hardware, *accessible* washrooms, and areas of refuge.

Public Area – Door clearances, door hardware, areas of refuge, washrooms, ramps, and elevators.

A4 Entire Building – Building to meet accessibility provisions of the current VBBL.

Note: that where there is one or more upgrade level(s) within the same category preceding the design upgrade level in Article 11.5.1.2., then the design upgrade level shall also include all of the preceding upgrade levels. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply. (see also 11.5.2.1.(2).)

A-11.5.2.1.(1) Procedure for Using the Upgrade Trigger Mechanism. The following steps outline a recommended procedure for using the Upgrade Trigger Mechanism.

STEP 1 – Determine Any Other Requirements that may be Applicable. Other Building By-law requirements may be applicable to the existing building project. Review the Overall Conditions for the Upgrade Trigger Mechanism to determine if other requirements are applicable.

STEP 2 – Determine the appropriate Project Type(s) and Related Category or Categories of Work as a function of the scope of work for the alteration.

STEP 3 – Determine the Required Design Upgrade Level Based on the Category of Work for the Project

The required upgrade levels for fire, life & health safety; structural safety; non-structural safety; and accessibility for persons with disabilities are to be determined using each of the applicable project type flow charts and the related category of work

For Renovation Type Projects use Flow Chart No. 1 in Article 11.5.2.1.

For Change of Major occupancy Type Projects use Flow Chart No. 2 in Article 11.5.2.1.

For Addition Type Projects use Flow Chart No. 3 in Article 11.5.2.1.

NOTE: Where a project involves more than one category of work, the most restrictive upgrade level, as determined from each category of work, shall determine the upgrade design level.

STEP 4 – Determine the objective and acceptable solution for the most restrictive upgrade level for fire, life and health safety; structural safety; non-structural safety; and accessibility for persons with disabilities. The most restrictive upgrade levels are the design upgrade levels that are to be applied to the existing building.

A-11.5.2.1.(2) Incremental Upgrade.
The model is based on incremental upgrade levels for each of the fire, life and health safety (F), structural safety (S); non-structural safety (N); and accessibility (A). For each of the upgrade levels, these is a corresponding acceptable solution that is deemed to meet the intended upgrade objectives of the applicable upgrade level. The upgrade objectives and acceptable solution for each F, S, N and A upgrade level provided in A 11.5.1.2 and its associated notes.

If an alteration includes more than one category of work or project type, then the most restrictive upgrade levels from each category fo work will be applied. The individual upgrade levels are cumulative, so the higher level upgrade levels include all of the preceding lower upgrade level requirements. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

A-11.5.3.1.(1) Upgrade Requirements for Detached Houses and Duplexes. The upgrades applicable to Detached house and Duplexes are detemined by Article 11.5.3.1. through a simplified and more prescriptive process. This is intended to reflect the simpler nature of these projects, and the absence of many of the usual design features of such projects.

A-11.5.4.1.(1) Restricted Change of Major Occupancy. The term “restricted change of major occupancy” refers to a change in major occupancy restricted to a specific set of uses that are limited both in scope and risk such that it does not increase the overall hazard.

While it is intended that designers and owners seeking to apply this requirement refer to the hazard index Table A-11.5.1.1.(3), for the purposes of the uses specified in Sentence 11.5.3.1.(2) – they may substitute the aggregate suite area of the suite in lieu of the building area where the change of major occupancy is wholly contained within the original suite.

For example: a suite of 300 m^2 is being repartitioned and converted from a “business office” use (Group D) to a suite of “retail toystore” use (Group E) of 150 m^2 and second suite of “health care office” use which are fully contained within the original 300 m^2 suite area. The aggregate suite area is therefore permitted to be used for the purposes of determining the appropriate hazard index which is then established as follows:

- Business Office (300 m^2) – 4 (original)
- Retail Toystore (150 m^2) – 4 (new)
- Health Care Office (150 m^2) – 3 (new)

By comparison, a larger toystore, such as the conversion of the original 300 m^2 suite area into a toystore, would result in a hazard index of ‘5’ which would not meet the requirements of Article 11.5.1.3. for a “restricted change of major occupancy” as it represents an increase in hazard.

While the hazard index table is a useful tool for assessment, it is also important to understand that no table can address all possible combinations of uses. Designers and owners should exercise caution when making judgments of relative hazards in this regard.

A-11.5.4.1.(2) Sprinkler Installation Determination Where Dwelling units Are Added. Table 11.5.4.1.(2) provides a matrix that determines sprinkler upgrades for existing unsprinklered or partially sprinklered buildings. The location of the newly created dwelling unit will determine the extent of the sprinkler coverage for the subject building.

Part 12
Float Homes and Marinas

Section 12.1. General

12.1.1. Application

12.1.1.1. Application

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

12.1.2. Definitions

12.1.2.1. Defined Terms

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

Section 12.2. Design and Construction

12.2.1. Float Homes and Marinas

12.2.1.1. Construction Requirements

1) A *marina walkway* shall be protected against fire spread and collapse in accordance with NFPA 303, "Fire Protection Standard for Marinas and Boatyards". (See Note A-12.2.1.1.(1).)

2) A *float home* shall be designed and constructed in accordance with the British Columbia Float Home Standard. (See Note A-12.2.1.1.(2).)

3) In addition to this Part, the requirements of Parts 3 to 9 shall apply to the design and *construction* of any structure or installation forming part of a *marina*.

4) Except as required by Sentence (5), a *marina* shall have an *occupancy* classification of *Group F Division 3*.

5) Despite the provisions of Sentence (4), a *marina* equipped with a fueling station shall have an *occupancy* classification of *Group F Division 2*.

12.2.1.2. Potable Water Supply for Marinas

1) The *potable* water connection at a *marina* shall be located not more than 300 m from any *water craft*.

2) Each moorage space for a *liveaboard vessel* or *float home* shall be provided with a *potable* water connection.

3) Where *potable* water is supplied to a dockside, watering point, or *water craft* connection, the *potable* water supply and each berth connection shall be protected with a *backflow preventer*.

4) A *marina* shall meet the requirements of Book II Plumbing Systems, regarding potable water supply.

12.2.1.3. Sewer Discharge for Float Homes and Marinas

1) Each moorage space for a *liveaboard vessel* or *float home* shall be provided with a *sanitary sewer* connection.

2) *Sewage* shall be discharged into an *acceptable sanitary sewer*.

3) Every *owner* or operator of a *marina* shall provide an easily accessible pump-out connection for visiting vessels and non *liveaboard vessels*.

4) *Pump-out facilities* shall be discharged into the *sanitary sewer*, and shall be designed, operated, and maintained to prevent any discharge of *sewage* onto docks or into the adjacent water.

5) A *sewer* pipe shall be located beside or underneath the surface of any *marina walkway* and shall not be submerged below water.

6) A marina shall meet the requirements of Book II Plumbing Systems, regarding sewage discharge.

12.2.1.4. Lighting for Marinas

1) All areas throughout a *marina* shall be illuminated to a minimum average level of 50 lx at the level of all *marina walkways*, at angles and intersections, and at changes of level where there are stairs or ramps.

2) The minimum value of the illumination required by Sentence (1) shall be not less than 10 lx.

12.2.1.5. Marina Walkways and Ramps Serving Float Homes and Marinas

1) A floating *marina walkway* which provides access to the shore shall be at least 2 m wide.

2) A floating *marina walkway* which provides access to *water craft* shall be at least 750 mm wide.

3) An inclined *marina walkway* shall have a non-skid surface and handrails on both sides conforming to Article 9.8.7.4.

4) Life rings, assist poles, and ladders from docks into the water shall be provided at intervals not exceeding 30 m along the length of all *marina walkways*.

12.2.1.6. Washroom Facilities for Marinas

1) Separate washroom facilities shall be

a) provided for each sex, and

b) located within a 300 m walking distance from any *watercraft* moored at the *marina*.

2) The washroom facilities in Sentence (1) shall consist of a minimum of one water closet and one hand basin for males and one water closet and one hand basin for females for each 100 moorage spaces or part thereof, except that

a) up to one half of the total number of water closets required for males may be substituted with urinals, and

b) a marina with less than 10 moorage spaces shall be provided with one universal washroom having one water closet and one wash basin.

12.2.1.7. Shower Facilities for Marinas

1) A *marina* providing moorage space to *water craft* which are not *liveaboard vessels* or *float homes* shall provide separate shower facilities for each sex in accordance with Sentence (2).

2) A minimum of one shower for males and one shower for females shall be provided for each 100 moorage spaces or part thereof.

12.2.1.8. Laundry Facilities for Marinas

1) Every *owner* or operator of a *marina* providing moorage space to *water craft* which are not *liveaboard vessels* or *float homes* shall provide a laundry room in accordance with Sentences (2) and (3).

2) Laundry facilities in a *marina* shall include a washing and drying machine.

3) Laundry facilities in a *marina* shall not be located in a washroom.

Notes to Part 12
Float Homes and Marinas

A-12.2.1.1.(1). Reference Standards. This By-law makes reference to the NFPA 303 standard for the purposes of identifying appropriate design requirements to protect a marina or float home against the spread of fire and collapse. Under the design criteria outlined in the NFPA 303 standard, it is identified that fixed fire suppression equipment shall be provided in accordance with various standards including:

- NFPA 13, "*Standard for the Installation of Sprinkler Systems"*;
- NFPA 14, "S*tandard for the Installation of Standpipe and Hose Systems"*;
- NFPA 24, "*Standard for the Installation of Private Fire Service Mains and Their Appurtenances"*; and
- NFPA 25, "*Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems"*.

Designs in accordance with NFPA 303 must therefore also consider the requirements these referenced standards as part of their design in order to be deemed compliant with the provisions of this By-law.

A-12.2.1.1.(2). Float Home Standard. The BC Float Home Standard referenced by this By-law, has references to both the NFPA 303 and NFPA 307 design standards as they pertain to marina fire protection. These standards in turn include references in their appendix material to NFPA 80A – "Recommended Practice for Protection of Buildings from Exterior Fire Exposures". Designers may consider design solutions that satisfy NFPA 80A, which may be sufficient to address some aspects of the protection of marinas or float homes from fire exposure. Nonetheless, both marinas and float homes must still be designed to the appropriate spatial separation requirements of Part 3 or Part 9 of this By-law, as the requirements of the BC Float Homes standard require that float homes be designed to Part 9, and the permitted exceptions do not waive the spatial separation requirements of this By-law.

Part 13
Temporary Buildings and Temporary Uses

Section 13.1. General

13.1.1. General

13.1.1.1. Scope

1) The application of this Part shall be as described in Subsection 1.3.3. of Division A.

13.1.1.2. Application

1) This Section applies to

a) temporary *buildings*, including special event facilities and emergency shelters in temporary buildings,

b) tents, and

c) temporary uses in *existing buildings* designed to support a different *major occupancy*, including arts and culture events, temporary special events, emergency shelters, retail, and day care for children.

13.1.1.3. Alternative Compliance Measures

1) The alternative compliance measures provided in this Part apply to temporary *buildings* and *existing buildings* temporarily used for other uses and occupancies and do not apply to new work, which must conform to the requirements for new *construction* in other Parts of this By-law.

2) The alternative compliance measures in Section 11.3. may be applied to existing conditions, except as otherwise required by this Part.

3) The alternative compliance measures in Section 11.5. may be applied to existing conditions in a *heritage building*, except as otherwise required by this Part.

13.1.1.4. Definitions

1) Words that appear in italics are defined in Article 1.4.1.2. of Division A.

2) The following additional words and terms shall have the following meanings for this Part:

Arts and culture event means an event of an artistic or cultural nature, including but not limited to visual, performing, media, literary, craft or interdisciplinary arts, for a maximum of 250 persons, with or without liquor service, which occurs no more than three days per month in a *building* or portion of a *building* not approved for *assembly occupancy*.

Temporary special event means a presentation of an artistic or cultural nature, including but not limited to visual, performing, media, literary, craft or interdisciplinary arts, for a maximum of 250 people, with or without liquor service, which occurs not more than two days per month in a *building* not approved for *assembly occupancy*.

13.1.1.5. Use of Term Temporary

1) For the purposes of this Part, the term “temporary building” refers to a *building* that is neither intended for nor constructed to a standard that would support continuous ongoing *occupancy* on a permanent basis, and is used for a time period that does not exceed

a) 12 consecutive months, or

b) a fixed term of *occupancy* no longer than 3 years, that is acceptable to the *Chief Building Official*.

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2) For the purposes of this Part, the term "temporary use" shall refer to the interim or provisional occupancy of a portion of an *existing building* designed to support a different *major occupancy* over a fixed time period, as permitted by this Part or as *acceptable* to the *Chief Building Official*.

Section 13.2. Temporary Buildings

13.2.1. Temporary Buildings

13.2.1.1. Alternative Compliance Measures

1) The alternative compliance measures of Table 13.3.1.1. may be applied to temporary *buildings*.

Table 13.2.1.1.
Alternative Compliance Measures for Temporary Buildings, including Temporary Special Events and Emergency Shelters
Forming part of Sentence 13.2.1.1.(1)

No.	By-law Requirement Division B	Alternative Compliance Measures
1	Handrails 3.4.6.5.	Handrail extensions for temporary *buildings* may extend vertically downward not less than 300 mm beyond the top and bottom of the stairway.
2	Guards 3.4.6.6.	Openings greater than 100 mm may be permitted in *guards* where a) the guard serves stairs that are used only by staff or work force volunteers, and b) a triangular space created by the stair tread, stair rise, and the underside of the *guard*, provided the opening will not permit the passage of a sphere greater than 200 mm, in egress stairs that serve bleacher seating. Member, attachment or openings located between 140 mm and 900 mm above the level being protected by the *guard* may be permitted where a) the *guard* serves stairs that are used only by staff or work force volunteers, and b) rosettes in the vertical posts of scaffolding type bleachers have been installed.
3	Treads and Risers 3.4.6.8.	In locations where it is not practical for persons with disabilities to work, stairs with no public access, may have a) runs of not less than 250 mm between successive steps, b) risers between successive treads not less than 125 mm and not more than 190 mm, and c) open risers.
4	Direction of Door Swing 3.4.6.12. Door Release Hardware 3.4.6.16.	Temporary sliding gates may be used as *exit* doors provided a) gates are left open during normal operating hours and always manned by *supervisory staff*, b) gates are closed during non-operating hours, and locked c) operational procedures are in place to ensure that the gates are unlocked during operating hours, and d) *supervisory staff* are trained for emergency evacuation procedures.
5	Environment Separation Part 5	Part 5 does not apply.

Table 13.2.1.1.
Alternative Compliance Measures for Temporary Buildings, including Temporary Special Events and Emergency Shelters
Forming part of Sentence 13.2.1.1.(1)

No.	By-law Requirement Division B	Alternative Compliance Measures
68	Commercial Cooking Equipment 6.2.2.7.	26 gauge galvanized sheet metal kitchen exhaust ducts with seams are permitted provided clean-out access panels are provided at all elbow locations and at 6 m spacing for straight runs.
79	Faucets and Shower Head Efficiency Book II, Division B, 2.2.10.6.	No restriction required.
8	Water Closet Efficiency Book II, Division B, 2.6.1.6.	No restriction required.
9	Urinal Efficiency Book II, Division B, 2.6.1.6.	All urinals shall conform to CSA B45 “Plumbing Fixtures” and shall have an average water consumption not exceeding 3.8 litres per flush cycle.
10	Sanitary Connection 2.4.2.1. Book II	Portable water closets that form part of a temporary facility need not be connected to the *sanitary drainage system.*
11	Storm Drainage Connection Book II, Division B, 2.4.2.1.	Roofs and paved areas need not be connected to the storm drainage system

2) An emergency shelter in a temporary building shall also comply with the requirements of Subsection 13.4.4.

Section 13.3. Tents

13.3.1. Tents

13.3.1.1. General

1) Except as permitted by this Subsection, a tent shall comply with the requirements of 3.1.18., and Sections 3.3. and 3.4.

2) Tents use for temporary purpose may also apply the alternative compliance measures of Section 13.2.

13.3.1.2. Clusters of Tents

1) A cluster of tents, may be considered a single tent for the purposes of spatial separation under Article 3.1.18.3., where

a) the cluster of tents have an aggregate area of not more than 60 m^2, and

b) each tent in the cluster is located no more than 3 m away that any other tent in that cluster.

2) Fabric tent material may conform to

a) NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films", 2004 edition, or

b) Certification of Registered Flame Resistant Product certified by the California Department of Forestry and Fire Protection, Office of the State Fire Marshall.

3) *Exit* doors for a tent, may be equipped with fabric flaps, tie straps, zippers, or VELCRO brand or equivalent hook and loop fasteners in lieu of doors that swing on a vertical axis provided

a) a minimum of two *exit* doors are be provided for each tent,

b) the *occupant load* of the tent does not exceed 60, and

c) *supervisory staff* are trained for emergency evacuation procedures, and remain in the vicinity of the *exit* at all times.

Section 13.4. Temporary Uses in Existing Buildings

13.4.1. Temporary Uses

13.4.1.1. Alternative Compliance Measures for Temporary Uses

1) The alternative compliance measures of this Section, may be applied to the

a) temporary use of a *building* or part of a *building* designed to support a different *major occupancy*, and

b) temporary use of a tent designed to support a different *major occupancy*.

2) A *building* supporting a temporary use through the application of alternative compliance measures in this Part, shall have a valid *occupancy permit*.

13.4.2. Temporary Special Event

13.4.2.1. Alternative Compliance Measures for Temporary Special Event

1) A *fire separation* between adjacent *occupancies* and the seats is not required provided

a) the only occupied space beneath the bleacher seating is used as a pedestrian walkway for access to the bleacher seating,

b) the occupied space is not used for storage, signage must be posted in the space beneath the bleacher seating that reads "No Storage Permitted in This Area", and

c) cleanup crews must clean up debris from the space beneath the bleacher seating at the end of each day.

13.4.3. Art and Culture Event

13.4.3.1. Alternative Compliance Measures for Temporary Art and Culture Event

1) Where the occupancy of an existing building or portion of an existing building is classified as Group D offices, Group E retail, Group F Division 2 production or rehearsal studio, wholesale, warehouse, or factory, or

Group F Division 2 artist studio without living accommodations, the major occupancy may be classified as a temporary Group A Division 2 major occupancy for an arts and culture event where

a) the *arts and culture event* is located in the *first storey* or the *storey* below the *first storey,*

b) the *floor area* containing the *arts and culture event* complies with the fire and life safety requirements of Sentences (2) and (3), and

c) an *Occupant Load* plan acceptable to the *Fire Chief* is obtained where an *arts and culture event* has an *occupant load* of more than 60 persons or where alcohol is served in connection with a Special Occasion Liquor License issued by the Province, or

d) an approved Security Assessment by the Vancouver Police Department is obtained where an *Arts and culture event* is a public event with an *occupant load* of more than 60 persons or where alcohol is served in connection with a Special Occasion Liquor License issued by the Province

2) *Floor area* used for an *arts and culture event* shall

a) be constructed of concrete supported by solid ground without suspended slab, or certified by a *registered professional*, to be suitable for *assembly occupancy* and designed to a minimum specified uniformly distributed *live load* of 4.8 kPa,

b) include at least one *accessible* entrance conforming with Subsection 11.3.7.1.(1)(d) or (e),

c) be sprinklered in a basement used for an *arts and culture event*,

d) except as required by Clause 11.6.2.1(4)(b), be provided with a fire alarm or at least one designated *supervisory staff* posted at each required egress door, but in no case shall there be fewer than two *supervisory staff* for an *arts and culture event*, and

e) include emergency lighting

i) inside washrooms or, in the case of a single toilet room, immediately outside the entrance door and visible under the closed toilet room door, and

ii) in locations leading from the *arts and culture event* to the *street* as described in Sentence 3.2.7.3.(1).

3) *Means of egress* from *floor areas* used for an *arts and culture event* shall include

a) *exits* in compliance with the requirements of Section 3.4. with respect to size, travel distance, and number, as applicable to a Group A, Division 2 *major occupancy,* except that not less than

i) one *exit* is permitted where the *occupant load* does not exceed 60 persons, or

ii) two *exits* are permitted where the *occupant load* does not exceed 250 persons, and

b) *exit* signs installed over or adjacent to exits and in common paths of travel where the *occupant load* exceeds 60 persons.

4) *Floor area* used for an *arts and culture event* which occurs more than 3 days per month or occurs with any other arts and culture event more than 3 days per month, shall

a) include a fire separation to adjacent occupancies or uses

b) be served by a permanent or temporary fire alarm system, and

c) except where the floor area is *sprinklered*, draperies, fabrics or combustible hangings shall be flame retardant and other combustible finishes shall be of *fire-retardant-treated wood* or have a Flame-spread rating of not more than 150 (see Note A-11.6.2.1.(4)).

5) An *arts and culture event* shall include portable fire extinguishers installed in accordance with the Fire By-law, with

a) at least one extinguisher at the main entrance and at each egress door leading from the *arts and culture event floor area*, and

b) the approved fire emergency procedures and security plan with approved maximum occupant load posted beside each portable extinguisher at the main entrance and at each egress door leading from the *arts and culture event*.

6) Cooking which generates grease-laden vapour is not permitted at an *arts and culture event*, unless commercial cooking and ventilation equipment, installed under *permit* and conforming with Article 6.3.1.7., is used.

13.4.4. Emergency Shelter

13.4.4.1. Alternative Compliance Measures for Temporary Emergency Shelter

1) Notwithstanding the provisions of this By-law, a temporary emergency shelter is permitted in an *existing building*, except that there shall be

a) no cooking in the *building*, other than food re-heated by microwave,

b) no less than one staff for each 20 shelter spaces on duty at all times,

c) no more than one shelter bed for every 3.7 m^2 of *floor area* or, if bunk beds are provided, no more than two shelter beds for every 3.7 m^2 of *floor area*,

d) aisles no less than 900 mm wide on both sides of every shelter bed,

e) at least 2 *means of egress*,

f) *exit* signs on all *exit* doors,

g) additional directional *exit* signs, in any circumstance where *exit* signs over *exit* doors are not visible from any location in the shelter,

h) *exit* signs which comply with Subsection 3.4.5.,

i) *smoke alarms* conforming to Article 3.2.4.20. installed throughout the entire *building*,

j) at least one water closet for every 20 shelter spaces,

k) at least one lavatory for every 5 water closets, and

l) all staff shall have training in first aid and emergency evacuations.

2) A fixed term transitional housing or emergency shelter complying with the requirements of this Sentence is permitted to remain for not more than 3 years provided

a) the *building* is constructed as a

   i) temporary emergency shelter complying with the requirements of Sentence (1), or

   ii) factory constructed *building* complying with CSA Z240 MH except as required by 1.1.1.1.(2)(g) of Division A,

b) the *building* is *sprinklered* with quick response or residential sprinklers,

c) the *building* is provided with a single stage fire alarm system, and

d) the owner provides an operating agreement stating the intended fixed term of occupancy, maximum occupant load, and minimum operating staff level, as acceptable to the *Chief Building Official*.

13.4.5. Temporary Retail Use

13.4.5.1. Alternative Compliance Measures for Temporary Retail Use

1) Notwithstanding the provisions of this By-law, a temporary use for retail is permitted in an *existing building floor area* of Group A Division 2, Group D, Group F, Division 2 or Group F Division 3 major occupancy, where

a) the *temporary use* for retail is located on the *first storey* or the adjacent grade level, but not both,

b) the *building* is provided with a *fire alarm system*, and the

c) *floor area* containing the temporary retail use complies with the fire and life safety requirements of Sentence (2), (3) and (4).

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2) *Floor area* used for *t*emporary use for retail shall

a) be constructed of concrete supported by solid ground without suspended slab, or certified by a *registered professional*, to be suitable for *assembly occupancy* and designed to a minimum specified uniformly distributed *live load* of 4.8 kPa,

b) be separated from other all other *major occupancies* by a *fire separation* with a *fire resistance rating* of at least 2 h,

c) be sprinklered in accordance with NFPA 13,

d) have washroom facilities complying with Subsection 3.7.2.,

e) have emergency lighting

i) inside washrooms or, in the case of a single toilet room, immediately outside the entrance door and visible under the closed toilet room door, and

ii) in common paths of egress travel to the exits as described in Sentence 3.2.7.3.(1), and

f) include at least one *accessible* entrance conforming with Subsection 11.3.7.1.(1)(d) or (e).

3) *Means of egress* from *a* temporary use for retail shall include

a) *exits* in compliance with the requirements of Section 3.4. with respect to size, travel distance, and number, as applicable to a Group A, Division 2 *major occupancy,* except that not less than

i) one *exit* is permitted where the *occupant load* does not exceed 60 persons, or

ii) two *exits* are permitted where the *occupant load* does not exceed 250 persons, and

b) *exit* signs installed over or adjacent to exits and in common paths of travel where the *occupant load* exceeds 60 persons.

4) The *temporary use* shall be provided with

a) portable fire extinguishers installed in accordance with the Fire By-law, with at least one extinguisher at the main entrance and at each egress door,

b) a safety plan, outlining procedures for supervisory personnel with no less than one staff member for each interval of up to 50 occupants, and training in first aid and emergency evacuations, and

c) *smoke detectors* installed in accordance to Article 3.2.4.20. are installed throughout the *temporary use*,

5) *Floor area* use for the *temporary use* of retail may not include cooking.

13.4.6. Temporary Day Care for Children

13.4.6.1. Alternative Compliance Measures for Temporary Day Care for Children

1) Notwithstanding the provisions of this By-law, a temporary daycare facility for children is permitted in an *existing building*, where it

a) has a fixed term of occupancy of not more than 3 years, or otherwise acceptable to the *Chief Building Official*, and

b) complies with the requirements of this Article.

2) The temporary daycare facility for children shall be located in a *floor area* of Group A, Division 2 major occupancy, where

a) the temporary daycare facility for children does not exceed 30 *children*,

b) the temporary daycare facility for children is separated from other all other major occupancies by a *fire separation* with a *fire resistance rating* of at least 1 h,

c) the *storey* containing the temporary daycare facility for children and all *storeys* below are fully *sprinklered*, except where

   i) *means of egress* are provided directly to the exterior,

   ii) it is not required to travel up or down more than 1 *storey*, and

   iii) at least two *means of egress* are located so that one *means of egress* could provide egress, if any other *means of egress* becomes inaccessible due to fire,

d) the temporary daycare facility for children is equipped with emergency lights in accordance with articles 3.2.7.3. and 3.2.7.4.,

e) firefighter access conforms with Part 3 of this By-law,

f) A fire alarm system with heat and smoke detection in accordance with Articles 3.2.4.10. and 3.2.4.11.,

g) nonstructural elements and other falling hazards in the temporary daycare facility for children are restrained to resist lateral loads due to earthquakes,

h) interior partition walls and ceiling, and their support frames and overhead lights and services are restrained, and

i) all *unsafe conditions* are corrected to the satisfaction of the *Chief Building Official*.

Notes to Part 13

Temporary Buildings and Temporary Uses

A-13.4.3.1.(4) Combustible Finishes. Combustible finishes have been associated with the rapid propagation of fire within assembly occupancies. Such materials will often be affixed to wall and ceiling surface, or loose hanging materials will be provided so as to improve the appearance of a space or reduce hard surface that reflect sound.

Sentence 11.6.2.1.(4) is intended to limit the type of built-in combustible wall and ceiling finishes and hanging materials (such as draperies or fabrics) to reduce the risk to occupants where the space is not protected by fire sprinklers, which can respond to a fire before rapid fire propagation occurs.

Loose fabric materials should be flame retardant, which is commonly demonstrable through a product listing identifying that it meets the requirements of CAN/ULC-S109. Built-in combustible finishes must demonstrate a flame-spread rating of not more than 150 which is readily demonstrable by listings confirming the product meets the requirement of CAN/ULC-S102, or they may be constructed with fire retardant-treated wood.

A-13.4.4.1.(2) Fixed Term Transitional Housing or Emergency Shelter. The requirements for fixed term transitional housing or emergency shelters described in Sentence 11.6.3.2.(2) are intended to accommodate temporary, but longer term housing that may be deployed for a fixed duration to address ongoing housing concerns.

Fixed term housing or shelters may consist of temporarily repurposed buildings, or may be constructed as modular factory built structures in accordance with CSA Z240 MH to the extent permitted by Division A (See also Note A-1.1.1.1.(3) of Division A) or other regulatory requirements.

The requirements of Sentence 11.6.3.2.(2) and Division C Sentence 1.6.8.1.(1) require that the term of occupancy be limited. This reflects the potential risk that the form of construction may not be appropriate for permanent use, either as a consequence of the inability to maintain the building due to ongoing use, or due to reduced durability. However, this term may be extended once by the Chief Building Official in accordance with Article 1.6.8.8., provided that it can be shown that the building will be able to support extended use.

Appendix C
Climatic and Seismic Information for Building Design in Canada

This Appendix is included for explanatory purposes only and does not form part of the requirements of this By-law except as referenced from Division A, Sentence 1.1.3.1.(1).

Introduction

The great diversity of climate in British Columbia has a considerable effect on the performance of buildings; consequently, building design must reflect this diversity. This Appendix briefly describes how climatic design values are computed and provides recommended design data for a number of cities, towns, and lesser populated locations. Through the use of such data, appropriate allowances can be made for climate variations in different localities of British Columbia Building Code can be applied regionally.

The climatic design data presented in Table C-2 are based on weather observations collected by the Meteorological Service of Canada, Environment and Climate Change Canada. The data were researched and analyzed for the Canadian Commission on Building and Fire Codes by Environment and Climate Change Canada.

As it is not practical to list values for all locations, recommended climatic design values for locations not listed can be obtained by e-mail from the Engineering Climate Services Unit of Environment and Climate Change Canada at scg-ecs@ec.gc.ca. It should be noted, however, that these recommended values may differ from the legal requirements set by the City of Vancouver.

The information on seismic hazard given in this Appendix has been provided by Natural Resources Canada.

General

The choice of climatic elements tabulated in this Appendix and the form in which they are expressed have been dictated largely by the requirements for specific values in several sections of this By-law. These elements include ground snow loads, wind pressures, design temperatures, heating degree-days, one-day and 15-minute rainfalls, and annual total precipitation values. The following notes briefly explain the significance of these particular elements in building design, and indicate which weather observations were used and how they were analyzed to yield the required design values.

Table C-2 lists design weather recommendations and elevations for locations around the City of Vancouver. The named locations refer to the specific latitude and longitude defined by the Gazetteer of Canada (Natural Resources Canada), available from Publishing and Depository Services Canada, Public Works and Government Services Canada, Ottawa, Ontario K1A 0S5. The elevations are given in metres and refer to heights above sea level.

Almost all of the weather observations used in preparing Table C-2 were, of necessity, observed at inhabited locations. To estimate design values for arbitrary locations, the observed or computed values for the weather stations were mapped and interpolated appropriately. Where possible, adjustments have been applied for the influence of elevation and known topographical effects. Such influences include the tendency of cold air to collect in depressions, for precipitation to increase with elevation, and for generally stronger winds near large bodies of water. Elevations have been added to Table C-2 because of their potential to significantly influence climatic design values.

Since interpolation from the values in Table C-2 to other locations may not be valid due to local and other effects, Environment and Climate Change Canada will provide climatic design element recommendations for locations not listed in Table C-2. Local effects are particularly significant in mountainous areas, where the values apply only to populated valleys and not to the mountain slopes and high passes, where very different conditions are known to exist.

Changing and Variable Climates

Climate is not static. At any location, weather and climatic conditions vary from season to season, year to year, and over longer time periods (climate cycles). This has always been the case. In fact, evidence is mounting that the

climates of Canada are changing and will continue to change significantly into future. When estimating climatic design loads, this variability can be considered using appropriate statistical analysis, data records spanning sufficient periods, and meteorological judgement. The analysis generally assumes that the past climate will be representative of the future climate.

Past and ongoing modifications to atmospheric chemistry (from greenhouse gas emissions and land use changes) are expected to alter most climatic regimes in the future despite the success of the most ambitious greenhouse gas mitigation plans.(1) Some regions could see an increase in the frequency and intensity of many weather extremes, which will accelerate weathering processes. Consequently, many buildings will need to be designed, maintained and operated to adequately withstand ever changing climatic loads.

Similar to global trends, the last decade in Canada was noted as the warmest in instrumented record. Canada has warmed, on average, at almost twice the rate of the global average increase, while the western Arctic is warming at a rate that is unprecedented over the past 400 years.(1) Mounting evidence from Arctic communities indicates that rapid changes to climate in the North have resulted in melting permafrost and impacts from other climate changes have affected nearly every type of built structure. Furthermore, analyses of Canadian precipitation data shows that many regions of the country have, on average, also been tending towards wetter conditions.(1) In the United States, where the density of climate monitoring stations is greater, a number of studies have found an unambiguous upward trend in the frequency of heavy to extreme precipitation events, with these increases coincident with a general upward trend in the total amount of precipitation. Climate change model results, based on an ensemble of global climate models worldwide, project that future climate warming rates will be greatest in higher latitude countries such as Canada.(2)

In this By-law, future climatic design data projections have been provided based upon climate modelling by the Pacific Climate Impacts Consortium. Given the inherent uncertainty of making future prediction, the provided values can not necessarily be seen to be a wholly accurate prediction of future occurrences. Rather, these projections are intended to be a baseline guide for designers to wishing to consider how their building systems designs will perform in the near future. It is cautioned that complete data is not presently available for all variables, and those values related to snow and wind pressures are derived from fewer data points and are therefore less reliable.

January Design Temperatures

A building and its heating system should be designed to maintain the inside temperature at some pre-determined level. To achieve this, it is necessary to know the most severe weather conditions under which the system will be expected to function satisfactorily. Failure to maintain the inside temperature at the pre-determined level will not usually be serious if the temperature drop is not great and if the duration is not long. The outside conditions used for design should, therefore, not be the most severe in many years, but should be the somewhat less severe conditions that are occasionally but not greatly exceeded.

The January design temperatures are based on an analysis of January air temperatures only. Wind and solar radiation also affect the inside temperature of most buildings and may need to be considered for energy-efficient design.

The January design temperature is defined as the lowest temperature at or below which only a certain small percentage of the hourly outside air temperatures in January occur. In the past, a total of 158 stations with records from all or part of the period 1951-66 formed the basis for calculation of the 2.5 and 1% January temperatures. Where necessary, the data were adjusted for consistency. Since most of the temperatures were observed at airports, design values for the core areas of large cities could be 1 or 2°C milder, although the values for the outlying areas are probably about the same as for the airports. No adjustments were made for this urban island heat effect. The design values for the next 20 to 30 years will probably differ from these tabulated values due to year-to-year climate variability and global climate change resulting from the impact of human activities on atmospheric chemistry.

The design temperatures were reviewed and updated using hourly temperature observations from 480 stations for a 25-year period up to 2006 with at least 8 years of complete data. These data are consistent with data shown for Canadian locations in the 2009 Handbook of Fundamentals(3) published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). The most recent 25 years of record were used to provide a balance between accounting for trends in the climate and the sampling variation owing to year-to-year variation. The 1% and 2.5% values used for the design conditions represent percentiles of the cumulative frequency distribution of hourly temperatures and correspond to January temperatures that are colder for 8 and 19 hours, respectively, on average over the long term.

The 2.5% January design temperature is the value ordinarily used in the design of heating systems. In special cases, when the control of inside temperature is more critical, the 1% value may be used. Other temperature-dependent climatic design parameters may be considered for future issues of this document.

July Design Temperatures

A building and its cooling and dehumidifying system should be designed to maintain the inside temperature and humidity at certain pre-determined levels. To achieve this, it is necessary to know the most severe weather conditions under which the system is expected to function satisfactorily. Failure to maintain the inside temperature and humidity at the pre-determined levels will usually not be serious if the increases in temperature and humidity are not great and the duration is not long. The outside conditions used for design should, therefore, not be the most severe in many years, but should be the somewhat less severe conditions that are occasionally but not greatly exceeded.

The summer design temperatures in this Appendix are based on an analysis of July air temperatures and humidities. Wind and solar radiation also affect the inside temperature of most buildings and may, in some cases, be more important than the outside air temperature. More complete summer and winter design information can be obtained from Environment and Climate Change Canada.

The July design dry-bulb and wet-bulb temperatures were reviewed and updated using hourly temperature observations from 480 stations for a 25-year period up to 2006. These data are consistent with data shown for Canadian locations in the 2009 Handbook of Fundamentals[3] published by ASHRAE. As with January design temperatures, data from the most recent 25-year period were analyzed to reflect any recent climatic changes or variations. The 2.5% values used for the dry- and wet-bulb design conditions represent percentiles of the cumulative frequency distribution of hourly dry- and wet-bulb temperatures and correspond to July temperatures that are higher for 19 hours on average over the long term.

Heating Degree-Days

The rate of consumption of fuel or energy required to keep the interior of a small building at 21°C when the outside air temperature is below 18°C is roughly proportional to the difference between 18°C and the outside temperature. Wind speed, solar radiation, the extent to which the building is exposed to these elements and the internal heat sources also affect the heat required and may have to be considered for energy-efficient design. For average conditions of wind, radiation, exposure, and internal sources, however, the proportionality with the temperature difference generally still holds.

Since the fuel required is also proportional to the duration of the cold weather, a convenient method of combining these elements of temperature and time is to add the differences between 18°C and the mean temperature for every day in the year when the mean temperature is below 18°C. It is assumed that no heat is required when the mean outside air temperature for the day is 18°C or higher.

Although more sophisticated computer simulations using other forms of weather data have now almost completely replaced degree-day-based calculation methods for estimating annual heating energy consumption, degree-days remain a useful indicator of relative severity of climate and can form the basis for certain climate-related By-law requirements.

The degree-days below 18°C were compiled for 1300 stations for the 25-year period ending in 2006. This analysis period is consistent with the one used to derive the design temperatures described above and with the approach used by ASHRAE.[3]

A difference of only one Celsius degree in the mean annual temperature will cause a difference of 250 to 350 in the Celsius degree-days. Since differences of 0.5 of a Celsius degree in the mean annual temperature are quite likely to occur between two stations in the same town, heating degree-days cannot be relied on to an accuracy of less than about 100 degree-days.

Heating degree-day values for the core areas of larger cities can be 200 to 400 degree-days less (warmer) than for the surrounding fringe areas. The observed degree-days, which are based on daily temperature observations, are often most representative of rural settings or the fringe areas of cities.

Climatic Data for Energy Consumption Calculations

The climatic elements tabulated in this Appendix represent commonly used design values but do not include detailed climatic profiles, such as hourly weather data. Where hourly values of weather data are needed for the purpose of

simulating the annual energy consumption of a building, they can be obtained from multiple sources, such as Environment and Climate Change Canada, Natural Resources Canada, the Regional Conservation Authority and other such public agencies that record this information. Hourly weather data are also available from public and private agencies that format this information for use with annual energy consumption simulation software; in some cases, these data have been incorporated into the software.

Snow Loads

The roof of a building should be able to support the greatest weight of snow that is likely to accumulate on it in many years. Some observations of snow on roofs have been made in Canada, but not enough to form the basis for estimating roof snow loads throughout the country. Similarly, observations of the weight, or water equivalent, of the snow on the ground have not been available in digital form in the past. The observations of roof loads and water equivalents are very useful, as noted below, but the measured depth of snow on the ground is used to provide the basic information for a consistent set of snow loads.

The estimation of the design snow load on a roof from snow depth observations involves the following steps:

1. The depth of snow on the ground, which has an annual probability of exceedance of 1-in-50, is computed.

2. The appropriate specific weight is selected and used to convert snow depth to loads, Ss.

3. The load, Sr, which is due to rain falling on the snow, is computed.

4. Because the accumulation of snow on roofs is often different from that on the ground, adjustments are applied to the ground snow load to provide a design snow load on a roof.

The annual maximum depth of snow on the ground has been assembled for 1618 stations for which data has been recorded by the Meteorological Service of Canada (MSC). The period of record used varied from station to station, ranging from 7 to 38 years. These data were analyzed using a Gumbel extreme value distribution fitted using the method of moments[4] as reported by Newark et al.[5] The resulting values are the snow depths, which have a probability of 1-in-50 of being exceeded in any one year.

The specific weight of old snow generally ranges from 2 to 5 kN/m^3, and it is usually assumed in Canada that 1 kN/m^3 is the average for new snow. Average specific weights of the seasonal snow pack have been derived for different regions across the country[6] and an appropriate value has been assigned to each weather station. Typically, the values average 2.01 kN/m^3 east of the continental divide (except for 2.94 kN/m^3 north of the treeline), and range from 2.55 to 4.21 kN/m^3 west of the divide. The product of the 1-in-50 snow depth and the average specific weight of the seasonal snow pack at a station is converted to the snow load (SL) in units of kilopascals (kPa).

Except for the mountainous areas of western Canada, the values of the ground snow load at MSC stations were normalized assuming a linear variation of the load above sea level in order to account for the effects of topography. They were then smoothed using an uncertainty-weighted moving-area average in order to minimize the uncertainty due to snow depth sampling errors and site-specific variations. Interpolation from analyzed maps of the smooth normalized values yielded a value for each location in Table C-2, which could then be converted to the listed By-law values (Ss) by means of an equation in the form:

Ss = smooth normalized SL + bZ

where b is the assumed rate of change of SL with elevation at the location and Z is the location's elevation above mean sea level (MSL). Although they are listed in Table C-2 to the nearest tenth of a kilopascal, values of Ss typically have an uncertainty of about 20%. Areas of sparse data in northern Canada were an exception to this procedure. In these regions, an analysis was made of the basic SL values. The effects of topography, variations due to local climates, and smoothing were all subjectively assessed. The values derived in this fashion were used to modify those derived objectively.

For the mountainous areas of British Columbia, Yukon, and the foothills area of Alberta, a more complex procedure was required to account for the variation of loads with terrain and elevation. Since the MSC observational network often does not have sufficient coverage to detail this variability in mountainous areas, additional snow course observations were obtained from the provincial and territorial governments of British Columbia, Yukon, and Alberta. The additional data allowed detailed local analysis of ground snow loads on a valley-by-valley basis. Similar to other studies, the data indicated that snow loads above a critical or reference level increased according to either a linear or quadratic relation with elevation. The determination of whether the increase with elevation was linear or quadratic, the

rate of the increase and the critical or reference elevation were found to be specific to the valley and mountain ranges considered. At valley levels below the critical elevation, the loads generally varied less significantly with elevation. Calculated valley- and range-specific regression relations were then used to describe the increase of load with elevation and to normalize the MSC snow observations to a critical or reference level. These normalized values were smoothed using a weighted moving-average.

Tabulated values cannot be expected to indicate all the local differences in Ss. For this reason, especially in complex terrain areas, values should not be interpolated from Table C-2 for unlisted locations. The values of Ss in the Table apply for the elevation and the latitude and longitude of the location, as defined by the Gazetteer of Canada. Values at other locations can be obtained from Environment and Climate Change Canada.

The heaviest loads frequently occur when the snow is wetted by rain, thus the rain load, Sr, was estimated to the nearest 0.1 kPa and is provided in Table C-2. When values of Sr are added to Ss, this provides a 1-in-50-year estimate of the combined ground snow and rain load. The values of Sr are based on an analysis of about 2100 weather station values of the 1-in-50-year one-day maximum rain amount. This return period is appropriate because the rain amounts correspond approximately to the joint frequency of occurrence of the one-day rain on maximum snow packs. For the purpose of estimating rain on snow, the individual observed one-day rain amounts were constrained to be less than or equal to the snow pack water equivalent, which was estimated by a snow pack accumulation model reported by Bruce and Clark.(7)

The results from surveys of snow loads on roofs indicate that average roof loads are generally less than loads on the ground. The conditions under which the design snow load on the roof may be taken as a percentage of the ground snow load are given in Subsection 4.1.6. The By-law also permits further decreases in design snow loads for steeply sloping roofs, but requires substantial increases for roofs where snow accumulation may be more rapid due to such factors as drifting. Recommended adjustments are given in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

The ground snow load values, Ss, were updated for the 2012 edition of the BC Building Code using a similar approach to the one used for the ground snow load update in the 1990 edition of the NBCC, which was the basis for the 1992 British Columbia Building Code. The Gumbel extreme value distribution was fitted to the annual maxima of daily snow depth observations made at over 1400 weather stations, which were compiled from 1990 onward—to as recently as 2012 for some stations—to calculate the 50-year return period snow depth. The 50-year ground snow load was then calculated for each weather station by combining the 50-year snow pack depth with the assigned snow pack density. The Ss values for each location in Table C-2 were compared with the updated weather station values and revised accordingly.

Annual Total Precipitation

Total precipitation is the sum in millimetres of the measured depth of rainwater and the estimated or measured water equivalent of the snow (typically estimated as 0.1 of the measured depth of snow, since the average density of fresh snow is about 0.1 that of water).

The average annual total precipitation amounts in Table C-2 have been interpolated from an analysis of precipitation observations from 1379 stations for the 30-year period from 1961 to 1990.

Annual Rainfall

The total amount of rain that normally falls in one year is frequently used as a general indication of the wetness of a climate, and is therefore included in this Appendix. See also Moisture Index below.

Rainfall Intensity

Roof drainage systems are designed to carry off rainwater from the most intense rainfall that is likely to occur. A certain amount of time is required for the rainwater to flow across and down the roof before it enters the gutter or drainage system. This results in the smoothing out of the most rapid changes in rainfall intensity. The drainage system, therefore, need only cope with the flow of rainwater produced by the average rainfall intensity over a period of a few minutes, which can be called the concentration time.

In Canada, it has been customary to use the 15-minute rainfall that will probably be exceeded on an average of once in 10 years. The concentration time for small roofs is much less than 15 minutes and hence the design intensity will be exceeded more frequently than once in 10 years. The safety factors in Book II (Plumbing Systems) of this By-law will

probably reduce the frequency to a reasonable value and, in addition, the occasional failure of a roof drainage system will not be particularly serious in most cases.

The rainfall intensity values were updated for the 2014 edition of the By-law using observations of annual maximum 15-minute rainfall amounts from 485 stations with 10 or more years of record, including data up to 2007 for some stations. Ten-year return period values—the 15-minute rainfall having a probability of 1-in-10 of being exceeded in any year—were calculated by fitting the annual maximum values to the Gumbel extreme value distribution(4) using the method of moments. The updated values are compiled from the most recent short-duration rainfall intensity-duration-frequency (IDF) graphs and tables available from Environment and Climate Change Canada.

It is very difficult to estimate the pattern of rainfall intensity in mountainous areas, where precipitation is extremely variable and rainfall intensity can be much greater than in other types of areas. Many of the observations for these areas were taken at locations in valley bottoms or in extensive, fairly level areas.

One-Day Rainfall

If for any reason a roof drainage system becomes ineffective, the accumulation of rainwater may be great enough in some cases to cause a significant increase in the load on the roof. In previous editions of this information, it had been common practice to use the maximum one-day rainfall ever observed for estimating the additional load. Since the length of record for weather stations in Canada is quite variable, the maximum one-day rainfall amounts in previous editions often reflected the variable length of record at nearby stations as much as the climatology. As a result, the maximum values often differed greatly within relatively small areas where little difference should be expected. The current values have been standardized to represent the one-day rainfall amounts that have 1 chance in 50 of being exceeded in any one year or the 1-in-50-year return value one-day rainfalls.

The one-day rainfall values were updated using daily rainfall observations from more than 3500 stations with 10 years or more of record, including data up to 2008 for some stations. The 50-year return period values were calculated by fitting the annual maximum one-day rainfall observations to the Gumbel extreme value distribution using the method of moments.(4)

Rainfall frequency observations can vary considerably over time and space. This is especially true for mountainous areas, where elevation effects can be significant. In other areas, small-scale intense storms or local influences can produce significant spatial variability in the data. As a result, the analysis incorporates some spatial smoothing.

Moisture Index (MI)

Moisture index (MI) values were developed through the work of a consortium that included representatives from industry and researchers from NRC.(1) The MI is an indicator of the moisture load imposed on a building by the climate and is used in Part 9 to define the minimum levels of protection from precipitation to be provided by cladding assemblies on exterior walls.

It must be noted, in using MI values to determine the appropriate levels of protection from precipitation, that weather conditions can vary markedly within a relatively small geographical area. Although the values provided in the Table give a good indication of the average conditions within a particular region, some caution must be exercised when applying them to a locality that is outside the region where the weather station is located.

MI is calculated from a wetting index (WI) and a drying index (DI).

Wetting Index (WI)

To define, quantitatively, the rainwater load on a wall, wind speed and wind direction have to be taken into consideration in addition to rainfall, along with factors that can affect exposure, such as nearby buildings, vegetation and topography. Quantitative determination of load, including wind speed and wind direction, can be done. However, due to limited weather data, it is not currently possible to provide this information for most of the locations identified in the Table.

This lack of information, however, has been shown to be non-critical for the purpose of classifying locations in terms of severity of rain load. The results of the research indicated that simple annual rainfall is as good an indicator as any for describing rainwater load. That is to say, for Canadian locations, and especially once drying is accounted for, the additional sensitivity provided by hourly directional rainfall values does not have a significant effect on the order in which locations appear when listed from wet to dry.

Consequently, the wetting index (WI) is based on annual rainfall and is normalized based on 1000 mm.

Drying Index (DI)

Temperature and relative humidity together define the drying capacity of ambient air. Based on simple psychrometrics, values were derived for the locations listed in the Table using annual average drying capacity normalized based on the drying capacity at Lytton, B.C. The resultant values are referred to as drying indices (DI).

Determination of Moisture Index (MI)

The relationship between WI and DI to correctly define moisture loading on a wall is not known. The MI values provided in the Table are based on the root mean square values of WI and 1-DI, with those values equally weighted. This is illustrated in Figure C-1. The resultant MI values are sufficiently consistent with industry's understanding of climate severity with respect to moisture loading as to allow limits to be identified for the purpose of specifying where additional protection from precipitation is required.

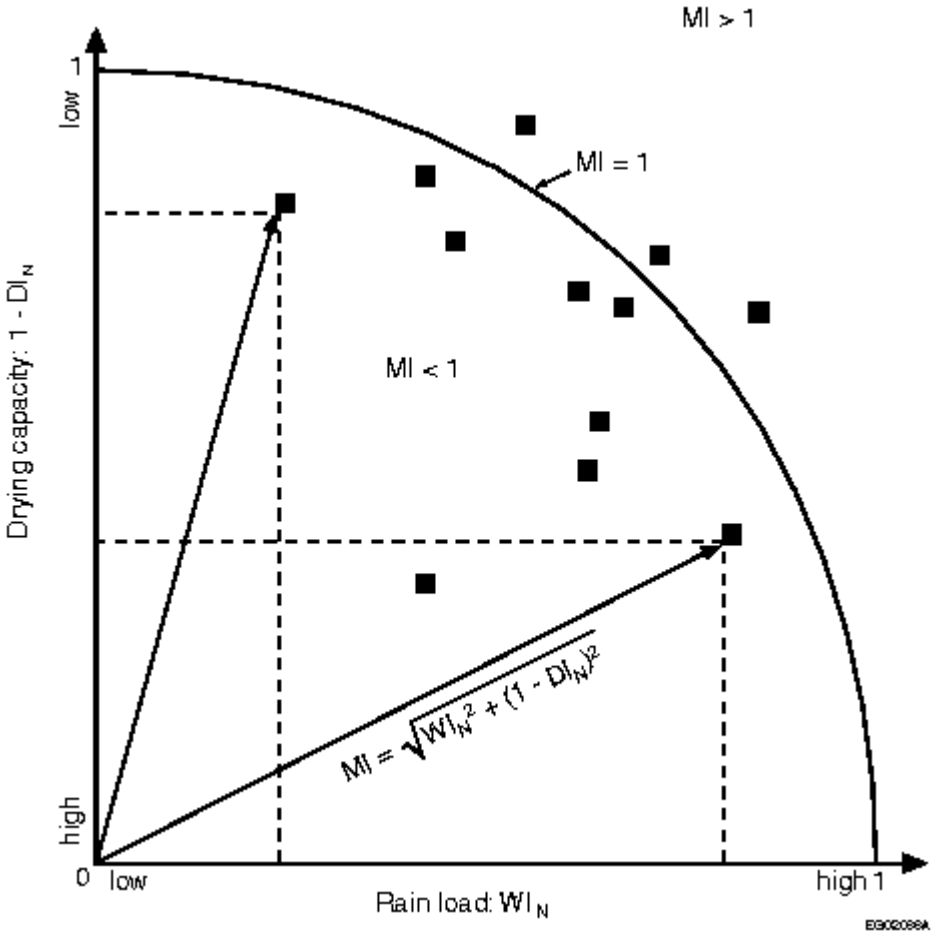

Figure C-1

Derivation of moisture index (MI) based on normalized values for wetting index (WI) and drying index (DI)

Note to Figure C-1:
(1) MI equals the hypotenuse of the triangle defined by WIN and 1-DIN

Driving Rain Wind Pressure (DRWP)

The presence of rainwater on the face of a building, with or without wind, must be addressed in the design and construction of the building envelope so as to minimize the entry of water into the assembly. Wind pressure on the windward faces of a building will promote the flow of water through any open joints or cracks in the facade.

Driving rain wind pressure (DRWP) is the wind load that is coincident with rain, measured or calculated at a height of 10 m. The values provided in the Table represent the loads for which there is 1 chance in 5 of being reached or exceeded in any one year, or a probability of 20% within any one year. Approximate adjustments for height can be made using the values for C_e given in Sentence 4.1.7.3.(5) as a multiplier.

Because of inaccuracies in developing the DRWP values related to the averaging of extreme wind pressures, the actual heights of recording anemometers, and the use of estimated rather than measured rainfall values, the values are considered to be higher than actual loads.[8][9] Thus the actual probability of reaching or exceeding the DRWP in a particular location is less than 20% per year and these values can be considered to be conservative.

DRWP can be used to determine the height to which wind will drive rainwater up enclosed vertical conduits. This provides a conservative estimate of the height needed for fins in window extrusions and end dams on flashings to control water ingress. This height can be calculated as:

height of water, mm = DRWP/10, Pa

Note that the pressure difference across the building envelope may be augmented by internal pressures induced in the building interior by the wind. These additional pressures can be estimated using the information provided in the Commentary entitled Wind Load and Effects of the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

Wind Effects

All structures need to be designed to ensure that the main structural system and all secondary components, such as cladding and appurtenances, will withstand the pressures and suctions caused by the strongest wind likely to blow at that location in many years. Some flexible structures, such as tall buildings, slender towers and bridges, also need to be designed to minimize excessive wind-induced oscillations or vibrations.

At any time, the wind acting upon a structure can be treated as a mean or time-averaged component and as a gust or unsteady component. For a small structure, which is completely enveloped by wind gusts, it is only the peak gust velocity that needs to be considered. For a large structure, the wind gusts are not well correlated over its different parts and the effects of individual gusts become less significant. The "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)" evaluates the mean pressure acting on a structure, provides appropriate adjustments for building height and exposure and for the influence of the surrounding terrain and topography (including wind speed-up for hills), and then incorporates the effects of wind gusts by means of the gust factor, which varies according to the type of structure and the size of the area over which the pressure acts.

The wind speeds and corresponding velocity pressures used in the By-law are regionally representative or reference values. The reference wind speeds are nominal one-hour averages of wind speeds representative of the 10 m height in flat open terrain corresponding to Exposure A or open terrain in the terminology of the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)." The reference wind speeds and wind velocity pressures are based on long-term wind records observed at a large number of weather stations across Canada.

Reference wind velocity pressures in the 1961 to 2005 editions of the Code since 1961 were based mostly on records of hourly averaged wind speeds (i.e. the number of miles of wind passing an anemometer in an hour) from over 100 stations with 10 to 22 years of observations ending in the 1950s. The wind pressure values derived from these measurements represented true hourly wind pressures.

The reference wind velocity pressures were reviewed and updated for the 2014 edition of the Building By-law. The primary data set used for the analysis comprised wind records compiled from about 135 stations with hourly averaged wind speeds and from 465 stations with aviation (one- or two-minute average) speeds or surface weather (ten-minute average) speeds observed once per hour at the top of the hour; the periods of record used ranged from 10 to 54 years. In addition, peak wind gust records from 400 stations with periods of record ranging from 10 to 43 years were used. Peak wind gusts (gust durations of approximately 3 to 7 seconds) were used to supplement the primary once-per-hour observations in the analysis.

Several steps were involved in updating the reference wind values. Where needed, speeds were adjusted to represent the standard anemometer height above ground of 10 m. The data from years when the anemometer at a station was installed on the top of a lighthouse or building were eliminated from the analysis since it is impractical to adjust for the effects of wind flow over the structure. (Most anemometers were moved to 10 m towers by the 1960s.) Wind speeds of the various observation types—hourly averaged, aviation, surface weather and peak wind gust—were adjusted to

account for different measure durations to represent a one-hour averaging period and to account for differences in the surface roughness of flat open terrain at observing stations.

The annual maximum wind speed data was fitted to the Gumbel distribution using the method of moments[4] to calculate hourly wind speeds having the annual probability of occurrence of 1-in-10 and 1-in-50 (10-year and 50-year return periods). The values were plotted on maps, then analyzed and abstracted for the locations in Table C-2.

The wind velocity pressures, q, were calculated in Pascals using the following equation:

$$q = \frac{1}{2}\rho V^2$$

where ρ is an average air density for the windy months of the year and V is wind speed in metres per second. While air density depends on both air temperature and atmospheric pressure, the density of dry air at 0°C and standard atmospheric pressure of 1.2929 kg/m^3 was used as an average value for the wind pressure calculations. As explained by Boyd[10], this value is within 10% of the monthly average air densities for most of Canada in the windy part of the year.

As a result of the updating procedure, the 1-in-50 reference wind velocity pressures remained unchanged for most of the locations listed in Table C-2; both increases and decreases were noted for the remaining locations. Many of the decreases resulted from the fact that anemometers at most of the stations used in the previous analysis were installed on lighthouses, airport hangers and other structures. Wind speeds on the tops of buildings are often much higher compared to those registered by a standard 10 m tower. Eliminating anemometer data recorded on the tops of buildings from the analysis resulted in lower values at several locations.

For the 2025 edition of the By-law, the reference wind velocity pressures were updated to reflect the new data collected in the approximately 10 years since the previous update for the 2012 edition. Only data collected at stations with a period of record of at least 20 years were used in the analysis. As a result, the data set comprised wind records from 368 hourly and 222 daily peak wind gust stations with periods of record ranging from 20 to 65 years. The annual maximum wind speed data were fitted to the Gumbel distribution.

The 1-in-50 hourly wind speeds, after adjusting for roughness to represent open exposure, were mapped and compared to the BCBC 2018 values for the locations in Table C-2. This updating procedure resulted in small changes to the 1-in-50 reference wind velocity pressures for some locations.

The 1-in-10 reference wind velocity pressures were updated using the same procedure, except that regional values of the coefficient of variation were used in the calculations instead of the national value used previously. This procedure resulted in small changes to the 1-in-10 reference wind velocity pressures for some locations, including many for which there was no change to the 1-in-50 reference wind velocity pressure.

Wind speeds that have a 1-in-"n" chance of being exceeded in any year can be calculated from the wind speeds corresponding to the 1-in-10 and 1-in-50 return period values in Table C-2 using the following equation:

$$V_{1/n} = \frac{1}{1.4565}\left\{ V_{1/50} + 0.4565\, V_{1/10} + \frac{V_{1/50} - V_{1/10}}{1.1339} \times \ln\frac{-0.0339}{\ln(1 - 1/n)} \right\}$$

Table C-1 has been arranged to give pressures to the nearest one-hundredth of a kPa and their corresponding wind speeds. The value of "q" in kPa is assumed to be equal to 0.00064645 V^2, where V is given in m/s.

Table C-1
Wind Speeds

q kPa	V m/s	q kPa	V m/s	q kPa	V m/s	q kPa	V m/s
0.15	15.2	0.53	28.6	0.91	37.5	1.29	44.7
0.16	15.7	0.54	28.9	0.92	37.7	1.30	44.8
0.17	16.2	0.55	29.2	0.93	37.9	1.31	45.0
0.18	16.7	0.56	29.4	0.94	38.1	1.32	45.2

0.19	17.1	0.57	29.7	0.95	38.3	1.33	45.4
0.20	17.6	0.58	30.0	0.96	38.5	1.34	45.5
0.21	18.0	0.59	30.2	0.97	38.7	1.35	45.7
0.22	18.4	0.60	30.5	0.98	38.9	1.36	45.9
0.23	18.9	0.61	30.7	0.99	39.1	1.37	46.0
0.24	19.3	0.62	31.0	1.00	39.3	1.38	46.2
0.25	19.7	0.63	31.2	1.01	39.5	1.39	46.4
0.26	20.1	0.64	31.5	1.02	39.7	1.40	46.5
0.27	20.4	0.65	31.7	1.03	39.9	1.41	46.7
0.28	20.8	0.66	32.0	1.04	40.1	1.42	46.9
0.29	21.2	0.67	32.2	1.05	40.3	1.43	47.0
0.30	21.5	0.68	32.4	1.06	40.5	1.44	47.2
0.31	21.9	0.69	32.7	1.07	40.7	1.45	47.4
0.32	22.2	0.70	32.9	1.08	40.9	1.46	47.5
0.33	22.6	0.71	33.1	1.09	41.1	1.47	47.7
0.34	22.9	0.72	33.4	1.10	41.3	1.48	47.8
0.35	23.3	0.73	33.6	1.11	41.4	1.49	48.0
0.36	23.6	0.74	33.8	1.12	41.6	1.50	48.2
0.37	23.9	0.75	34.1	1.13	41.8	1.51	48.3
0.38	24.2	0.76	34.3	1.14	42.0	1.52	48.5
0.39	24.6	0.77	34.5	1.15	42.2	1.53	48.6
0.40	24.9	0.78	34.7	1.16	42.4	1.54	48.8
0.41	25.2	0.79	35.0	1.17	42.5	1.55	49.0
0.42	25.5	0.80	35.2	1.18	42.7	1.56	49.1
0.43	25.8	0.81	35.4	1.19	42.9	1.57	49.3
0.44	26.1	0.82	35.6	1.20	43.1	1.58	49.4
0.45	26.4	0.83	35.8	1.21	43.3	1.59	49.6
0.46	26.7	0.84	36.0	1.22	43.4	1.60	49.7
0.47	27.0	0.85	36.3	1.23	43.6	1.61	49.9
0.48	27.2	0.86	36.5	1.24	43.8	1.62	50.1
0.49	27.5	0.87	36.7	1.25	44.0	1.63	50.2
0.50	27.8	0.88	36.9	1.26	44.1	1.64	50.4

0.51	28.1	0.89	37.1	1.27	44.3	1.65	50.5
0.52	28.4	0.90	37.3	1.28	44.5	1.66	50.7

Application of Tables C-2 and C-3

Structural engineers and building designers should be aware that there are two Climatic and Seismic Data tables, Tables C-2 and C-3 included in the Building By-law.

All buildings submitted for building permit shall be designed according to the appropriate table based on the location of the building within the City limit.

The adjacent street map identifies the intended application of Table C-2 and C-3 for the area around 41st Avenue and Granville Street.

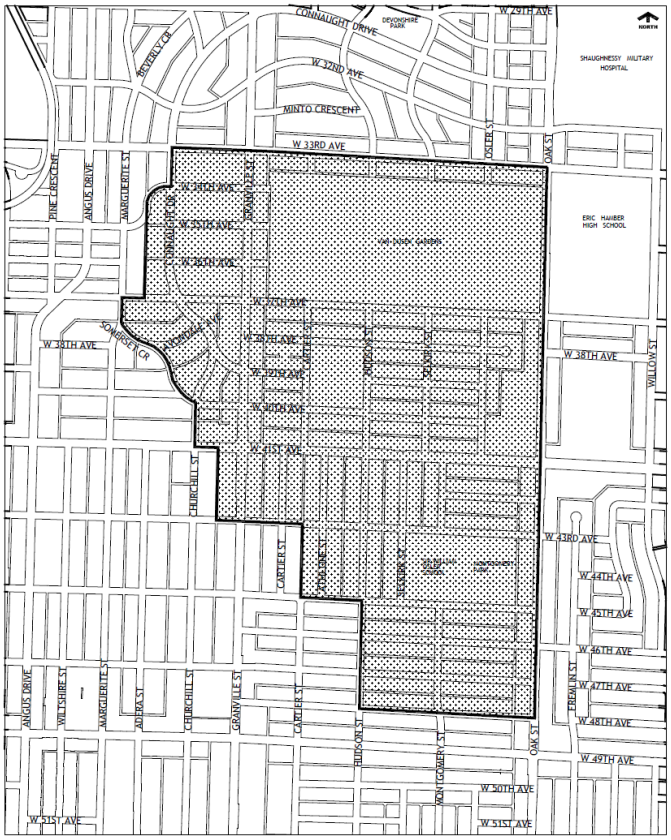

Table C-2
Climatic Design Data for Selected Locations in Vancouver

Location	Elev., m	Design Temperature				Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa	
		January		July 2.5%												
		2.5% °C	1% °C	Dry °C	Wet °C								Ss	Sr	1/10	1/50
Vancouver (City Hall)	40	-7	-9	28	20	2825	10	112	1325	1.4	1400	160	1.8	0.2	0.34	0.45
Vancouver (Granville St. & 41st Ave)	120	-6	-8	28	20	2925	10	107	1325	1.4	1400	160	1.9	0.3	0.36	0.45
Vancouver (General) (2020s)	120	-4	-6	30	22	2471	n/a	117	1350	n/a	n/a	n/a	1.8	n/a	0.36	0.43
Vancouver (General) (2050s)	120	-2	-4	32	24	2102	n/a	127	1371	n/a	n/a	n/a	1.7	n/a	0.36	0.43

Seismic Hazard for Part 4

The seismic hazard values to be used for the design of buildings under Part 4 can be obtained from the 2020 National Building Code of Canada Seismic Hazard Tool (https://doi.org/10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b), which provides seismic hazard values for any site in Canada defined by latitude, longitude and site designation. The seismic hazard values used for the design of buildings under Part 4 must correspond to the applicable probability of exceedance stated in Subsection 4.1.8. The tool also provides seismic hazard values at additional probabilities and periods.

Seismic hazard values can be appreciably different for localities across a large locale. Therefore, applying the same seismic hazard value to a large geographic area could result in buildings being over-designed or under-designed. Given the large number of data points in Canada, listing every locality in a table is not practical. For archival purposes, the seismic hazard values for 679 specific latitudes and longitudes are reproduced from the 2020 National Building Code of Canada Seismic Hazard Tool on NPARC at https://doi.org/10.4224/nqzr-dz38. The digital properties of the NPARC website are more suited for a static, archival data set. As such, Figure A-1.1.3.1.(4) identifies the NPARC website as the primary data set for the specified latitude and longitudes.

The parameters used to represent seismic hazard for specific geographical locations are the 5%-damped horizontal spectral acceleration for periods of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s, the horizontal peak ground acceleration (PGA) and the horizontal peak ground velocity (PGV) corresponding to a 2% probability of being exceeded in 50 years. The six spectral acceleration parameters are deemed sufficient to define spectra closely matching the shape of the uniform hazard spectra (UHS) for design purposes. Spectral acceleration values for additional periods are provided for use in the selection of ground motion time histories. Spectral acceleration values for additional probabilities of exceedance are also provided.

The seismic hazard values are mean values based on a statistical analysis of the earthquakes that have been experienced in Canada and adjacent regions.[11] They were updated for the 2020 edition of the Code by slightly revising the seismic source zones, adding the Leech River and Devil's Mountain fault sources near Victoria, B.C.,[12] increasing the rate of occurrence of great earthquakes on the Cascadia subduction zone to match new information, revising the ground motion models (GMMs),[13] and using a probabilistic model to combine all inputs.

In addition, the method of determining seismic hazard values for different site designations has changed. For the NBC 2015, the seismic hazard values were calculated for reference Site Class C, and the values for other site designations were determined by applying a site coefficient to the calculated values. For the NBC 2020, the seismic hazard values for each site designation were calculated directly.

For almost all locations, the revised GMMs are the most significant reason for changes in the seismic hazard values from the NBC 2015. In general, the estimated seismic hazard has increased across Canada.

Further details regarding the representation of seismic hazard can be found in the Commentary entitled Design for Seismic Effects in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

Seismic Hazard for Part 9

Table C-3 lists the seismic hazard values to be used in the application of the prescriptive requirements in Part 9 relating to lateral loads due to earthquake. For locations not listed in Table C-3, the seismic hazard values to be used can be determined using the 2020 National Building Code of Canada Seismic Hazard Tool (https://doi.org/10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b).

The Tool provides seismic hazard values for any site in Canada based on the following information:

- Latitude and longitude of the site’s location: Seismic hazard values can be appreciably different for localities across a large locale. Therefore, applying the same seismic hazard value to a large geographic area could result in buildings being over-designed or under-designed.
- Site designation in terms of Site Class, X_S, where S is the Site Class (see Sentence 4.1.8.4.(3)).

The procedure to determine the seismic design parameter, S_{max}, for a site is as follows:

1. Go to the 2020 National Building Code of Canada Seismic Hazard Tool (https://doi.org/10.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b).
2. Select “Site Class (X_S)” as the site designation.
3. Select the appropriate Site Class (A, B, C, D or E).

4. Enter the latitude and longitude of the site's location manually, or determine the latitude and longitude from an address or current location.
5. Click "Obtain Seismic Hazard Values." The following values are needed to determine S_{max}: $S_a(0.2,X_S)$ and $S_a(0.5,X_S)$.
6. Determine $S(0.2,X_S)$ in accordance with Sentence 4.1.8.4.(6):
   $S(0.2,X_S) = S_a(0.2,X_S)$ or $S_a(0.5,X_S)$, whichever is greater
7. Determine $S(0.5,X_S)$ in accordance with Sentence 4.1.8.4.(6):
   $S(0.5,X_S) = Sa(0.5,X_S)$
8. Determine Smax:
   $S_{max} = (2/3)S(0.2,X_S)$ or $S(0.5,X_S)$, whichever is greater
9. Round S_{max} to three significant digits.

In cases where the Site Class is determined in accordance with Sentence 4.1.8.4.(3), S_{max} is calculated for the determined Site Class. In cases where the Site Class is unknown, S_{max} must be calculated for each of Site Classes A, B, C, D and E, by repeating Steps 1 to 9, and the highest value of S_{max} among all the Site Classes used for design.

Example

Consider a site in Strathmore, Alberta, a location not listed in Table C-3. The latitude and longitude of Strathmore are 51.04040 and −113.40205, respectively. In this example, the Site Class is determined by a geotechnical investigation to be Site Class C.

Using the 2020 National Building Code of Canada Seismic Hazard Tool (Step 1), select "Site Class (X_S)" as the site designation (Step 2). Select "C" as the Site Class (Step 3).

Under "Location," enter the latitude, 51.04040, and longitude, −113.40205, and then click "Set coordinates" (Step 4). Click "Obtain Seismic Hazard Values" to obtain the values for $S_a(0.2,X_C)$ and $S_a(0.5,X_C)$, which are 0.191 and 0.125, respectively (Step 5).

Next, determine $S(0.2,X_C)$ as follows (Step 6):

$S(0.2,X_C) = S_a(0.2,X_C)$ or $S_a(0.5,X_C)$, whichever is greater

$S(0.2,X_C) = 0.191$ or 0.125, whichever is greater

$S(0.2,X_C) = 0.191$

Now, determine $S(0.5,X_C)$ as follows (Step 7):

$S(0.5,X_C) = Sa(0.5,X_C)$

$S(0.5,X_C) = 0.125$

Finally, determine S_{max} for Site Class C as follows (Step 8):

$S_{max} = (2/3)S(0.2,X_C)$ or $S(0.5,X_C)$, whichever is greater

$S_{max} = 0.127333$ or 0.125, whichever is greater

$S_{max} = 0.127$ (rounded to three significant digits according to Step 9)

If the Site Class is unknown, this procedure is repeated to determine S_{max} for each of Site Classes A, B, C, D and E. For Strathmore, the resulting values of S_{max} are as follows: 0.071 for Site Class A, 0.097 for Site Class B, 0.127 for Site Class C, 0.213 for

Site Class D, and 0.254 for Site Class E. The highest value is selected as S_{max} for unknown Site Class: 0.254.

Table C-3
Seismic Design Parameter, S_{max}, for Selected Locations in Vancouver

Province and Location	S_{max} for Unknown Site Class	S_{max} According to Site Class				
		A	B	C	D	E
Vancouver (City Hall)	1.24	0.458	0.563	0.884	1.18	1.24

Vancouver (Granville St. & 41st Ave)	1.26	0.466	0.573	0.899	1.2	1.26

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Appendix D
Fire-Performance Ratings

Section D-1 General

The content of this Appendix was prepared on the recommendations of the Standing Committee on Fire Protection, which was established by the Canadian Commission on Building and Fire Codes (CCBFC) for this purpose.

D-1.1. Introduction

D-1.1.1. Scope

1) This fire-performance information is presented in a form closely linked to the performance requirements and the minimum materials specifications of this By-law.

2) The ratings have been assigned only after careful consideration of all available literature on assemblies of common building materials, where they are adequately identified by description. The assigned values based on this information will, in most instances, be conservative when compared to the ratings determined on the basis of actual tests on individual assemblies.

3) The fire-performance information set out in this Appendix applies to materials and assemblies of materials that comply in all essential details with the minimum structural design standards described in Part 4. Additional requirements, where appropriate, are described in other Sections of this Appendix.

4) Section D-2 assigns fire-resistance ratings for walls, floors, roofs, columns and beams related to CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," and describes methods for determining these ratings.

5) Section D-3 assigns flame-spread ratings and smoke developed classifications for surface materials related to CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies," and CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies."

6) Section D-4 describes noncombustibility in building materials when tested in accordance with CAN/ULC-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials."

7) Section D-5 contains requirements for the installation of fire doors and fire dampers in fire-rated stud wall assemblies.

8) Section D-6 contains construction specifications for exterior wall assemblies that are deemed to satisfy the criteria of Clause 3.1.5.5.(1)(b) when tested in accordance with CAN/ULC-S134, "Standard Method of Fire Test of Exterior Wall Assemblies."

9) Section D-7 contains background information regarding fire test reports, obsolete materials and assemblies, assessment of archaic assemblies and the development of the component additive method.

D-1.1.2. Referenced Documents

1) Where documents are referenced in this Appendix, they shall be the editions designated in Table D-1.1.2.

Table D-1.1.2.
Documents Referenced in Appendix D(1)

Issuing Agency	Document Number(2)	Title of Document	By-law Reference
ANSI	A208.1-2009	Particleboard	D-3.1.1.

ASTM	C330/C330M-17	Standard Specification for Lightweight Aggregates for Structural Concrete	D-1.4.3.
ASTM	C840-18b	Standard Specification for Application and Finishing of Gypsum Board	D-2.3.9.
ASTM	C1396/C1396M-17	Standard Specification for Gypsum Board	D-1.5.1. D-3.1.1.
ASTM	D2898-10	Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	D-6.1.1.
CCBFC	NRCC 30629	Supplement to the National Building Code of Canada 1990	D-7.2. D-7.3.
CGSB	4-GP-36M-1978	Carpet Underlay, Fiber Type	D-3.1.1.
CGSB	CAN/CGSB-4.129-93	Carpet for Commercial Use	D-3.1.1.
CGSB	CAN/CGSB-92.2-M90	Trowel or Spray Applied Acoustical Material	D-2.3.4.
CSA	A23.1:19/A23.2:19	Concrete materials and methods of concrete construction/Test methods and standard practices for concrete	D-1.4.3.
CSA	A23.3:19	Design of concrete structures	D-2.1.5. D-2.6.6. D-2.8.2.
CSA	CAN/CSA-A82:14	Fired masonry brick made from clay or shale	D-2.6.1.
CSA	A82.22-M1977	Gypsum Plasters	D-3.1.1.
CSA	CAN/CSA A82.27-M91	Gypsum Board	D-1.5.1. D-3.1.1.
CSA	A82.30-M1980	Interior Furring, Lathing and Gypsum Plastering	D-1.7.2. D-2.3.9. D-2.5.1.
CSA	A165.1-14	Concrete block masonry units	D-2.1.1.
CSA	O86:19	Engineering design in wood	D-2.11.3. D-2.11.4.
CSA	O112.10-08	Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)	D-2.3.6.
CSA	O121-17	Douglas fir plywood	D-3.1.1.
CSA	O141:05	Softwood Lumber	D-2.3.6. D-2.4.1.
CSA	O151-17	Canadian softwood plywood	D-3.1.1.
CSA	O153-13	Poplar plywood	D-3.1.1.
CSA	O325-16	Construction sheathing	D-3.1.1.
CSA	O437.0-93	OSB and Waferboard	D-3.1.1.
CSA	S16:19	Design of steel structures	D-2.6.6.
NFPA	80-2013	Standard for Fire Doors and Other Opening Protectives	D-5.2.1.

ULC	CAN/ULC-S101-14	Standard Method of Fire Endurance Tests of Building Construction and Materials	D-1.1.1. D-1.12.1. D-2.3.2. D-2.11.1.
ULC	CAN/ULC-S102-10	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies	D-1.1.1. D-6.1.1.
ULC	CAN/ULC-S102.2:2018	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies	D-1.1.1. D-3.1.1.
ULC	CAN/ULC-S112.2-07	Standard Method of Fire Test of Ceiling Firestop Flap Assemblies	D-2.3.10. D-2.3.11.
ULC	CAN/ULC-S114:2018	Standard Method of Test for Determination of Non-Combustibility in Building Materials	D-1.1.1. D-4.1.1. D-4.2.1.
ULC	CAN/ULC-S134-13	Standard Method of Fire Test of Exterior Wall Assemblies	D-1.1.1. D-6.1.1.
ULC	CAN/ULC-S702.1-14	Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification	D-2.3.4. D-2.3.5. D-2.6.1. D-6.1.1. D-7.4.
ULC	CAN/ULC-S703-09	Standard for Cellulose Fibre Insulation (CFI) for Buildings	D-2.3.4.
ULC	CAN/ULC-S706.1:2016	Standard for Wood Fibre Insulating Boards for Buildings	D-3.1.1.

Notes to Table D-1.1.2.:

(1) While every effort was made to ensure the accuracy of the information in this Table, the NRC is not responsible for the accuracy, timeliness or reliability of the content presented therein. For all purposes of interpreting and applying the referenced standards, By-law users should refer to the most recent official versions of the referenced editions.

(2) Some documents may have been reaffirmed or reapproved. Check with the applicable issuing agency for up-to-date information.

D-1.1.3. Applicability of Ratings

The ratings shown in this document apply if more specific test values are not available. The construction of an assembly that is the subject of an individual test report must be followed in all essential details if the fire-resistance rating reported is to be applied for use with this By-law.

D-1.1.4. Higher Ratings

The authority having jurisdiction may allow higher fire-resistance ratings than those derived from this Appendix, where supporting evidence justifies a higher rating. Additional information is provided in summaries of published test information and the reports of fire tests carried out by NRC, which are included in Section D-7, Background Information.

D-1.1.5. Additional Information on Fire Rated Assemblies

Assemblies containing materials for which there is no nationally recognized standard are not included in this Appendix. Many such assemblies have been rated by Underwriters' Laboratories Inc. (UL), ULC Standards (ULC), or Intertek Testing Services NA Ltd. (ITS).

D-1.2. Interpretation of Test Results

D-1.2.1. Limitations

1) The fire-performance ratings set out in this Appendix are based on those that would be obtained from the standard methods of test described in the By-law. The test methods are essentially a means of comparing the performance of one building component or assembly with another in relation to its performance in fire.

2) Since it is not practicable to measure the fire resistance of constructions in situ, they must be evaluated under some agreed test conditions. A specified fire-resistance rating is not necessarily the actual time that the assembly would endure in situ in a building fire, but is that which the particular construction must meet under the specified methods of test.

3) Considerations arising from departures in use from the conditions established in the standard test methods may, in some circumstances, have to be taken into account by the designer and the authority having jurisdiction. Some of these conditions are covered at present by the provisions of the By-law.

4) For walls and partitions, the stud spacings previously specified as 16 or 24 inch have been converted to 400 and 600 mm, respectively, for consistency with other metric values; however, the use of equivalent imperial dimensions for stud spacing is permitted.

D-1.3. Concrete

D-1.3.1. Aggregates in Concrete

Low density aggregate concretes generally exhibit better fire performance than natural stone aggregate concretes. A series of tests on concrete masonry walls, combined with mathematical analysis of the test results, has allowed further distinctions between certain low density aggregates to be made.

D-1.4. Types of Concrete

D-1.4.1. Description

1) For purposes of this Appendix, concretes are described as Types S, N, L, L_1, L_2, L40S, $L_1$20S or $L_2$20S as described in Sentences (2) to (8).

2) Type S concrete is the type in which the coarse aggregate is granite, quartzite, siliceous gravel or other dense materials containing at least 30% quartz, chert or flint.

3) Type N concrete is the type in which the coarse aggregate is cinders, broken brick, blast furnace slag, limestone, calcareous gravel, trap rock, sandstone or similar dense material containing not more than 30% of quartz, chert or flint.

4) Type L concrete is the type in which all the aggregate is expanded slag, expanded clay, expanded shale or pumice.

5) Type L_1 concrete is the type in which all the aggregate is expanded shale.

6) Type L_2 concrete is the type in which all the aggregate is expanded slag, expanded clay or pumice.

7) Type L40S concrete is the type in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 40% of the total volume of all aggregates in the concrete.

8) Type $L_1$20S and Type $L_2$20S concretes are the types in which the fine portion of the aggregate is sand and low density aggregate in which the sand does not exceed 20% of the total volume of all aggregates in the concrete.

D-1.4.2. Determination of Ratings

Where concretes are described as being of Type S, N, L, L_1 or L_2, the rating applies to the concrete containing the aggregate in the group that provides the least fire resistance. If the nature of an aggregate cannot be determined accurately enough to place it in one of the groups, the aggregate shall be considered as being in the group that requires a greater thickness of concrete for the required fire resistance.

D-1.4.3. Description of Aggregates

1) The descriptions of the aggregates in Type S and Type N concretes apply to the coarse aggregates only. Coarse aggregate for this purpose means that retained on a 5 mm sieve using the method of grading aggregates described in CSA A23.1/A23.2, “Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.”

2) Increasing the proportion of sand as fine aggregate in low density concretes requires increased thicknesses of material to produce equivalent fire-resistance ratings. Low density aggregates for Type L and Types L-S concretes used in loadbearing components shall conform to ASTM C330/C330M, “Standard Specification for Lightweight Aggregates for Structural Concrete.”

3) Non-loadbearing low density components of vermiculite and perlite concrete, in the absence of other test evidence, shall be rated on the basis of the values shown for Type L concrete.

D-1.5. Gypsum Board

D-1.5.1. Types of Gypsum Board

1) Where the term “gypsum board” is used in this Appendix, it is intended to include—in addition to gypsum board—gypsum backing board and gypsum base for veneer plaster as described in

a) CAN/CSA A82.27-M, “Gypsum Board,” or

b) ASTM C1396/C1396M, “Standard Specification for Gypsum Board.”

2) Where the term “Type X gypsum board” is used in this Appendix, it applies to special fire-resistant board as described in

a) CAN/CSA A82.27-M, “Gypsum Board,” or

b) ASTM C1396/C1396M, “Standard Specification for Gypsum Board.”

D-1.6. Equivalent Thickness

D-1.6.1. Method of Calculating

1) The thickness of solid-unit masonry and concrete described in this Appendix shall be the thickness of solid material in the unit or component thickness. For units that contain cores or voids, the Tables refer to the equivalent thickness determined in conformance with Sentences (2) to (10).

2) Where a plaster finish is used, the equivalent thickness of a wall, floor, column or beam protection shall be equal to the sum of the equivalent thicknesses of the concrete or masonry units and the plaster finish measured at the point that will give the least value of equivalent thickness.

3) Except as provided in Sentence (5), the equivalent thickness of a hollow masonry unit shall be calculated as equal to the actual overall thickness of a unit in millimetres multiplied by a factor equal to the net volume of the unit and divided by its gross volume.

4) Net volume shall be determined using a volume displacement method that is not influenced by the porous nature of the units.

5) Gross volume of a masonry unit shall be equal to the actual length of the unit multiplied by the actual height of the unit multiplied by the actual thickness of the unit.

6) Where all the core spaces in a wall of hollow concrete masonry or hollow-core precast concrete units are filled with grout, mortar, or loose fill materials such as expanded slag, burned clay or shale (rotary kiln process), vermiculite or perlite, the equivalent thickness rating of the wall shall be considered to be the same as that of a wall of solid units, or a solid wall of the same concrete type and the same overall thickness.

7) The equivalent thickness of hollow-core concrete slabs and panels having a uniform thickness and cores of constant cross section throughout their length shall be obtained by dividing the net cross-sectional area of the slab or panel by its width.

8) The equivalent thickness of concrete panels with tapered cross sections shall be the cross section determined at a distance of 2 t or 150 mm, whichever is less, from the point of minimum thickness, where t is the minimum thickness.

9) Except as permitted in Sentence (10), the equivalent thickness of concrete panels with ribbed or undulating surfaces shall be

a) t_a for s less than or equal to 2 t,

b) $t + (4\,t/s - 1)(t_a - t)$ for s less than 4 t and greater than 2 t, and

c) t for s greater than or equal to 4 t

where

t = minimum thickness of panel,

t_a = average thickness of panel (unit cross-sectional area divided by unit width), and

s = centre to centre spacing of ribs or undulations.

10) Where the total thickness of a panel described in Sentence (9), exceeds 2 t, only that portion of the panel which is less than 2 t from the non-ribbed surface shall be considered for the purpose of the calculations in Sentence (9).

D-1.7. Contribution of Plaster or Gypsum Board Finish to Fire Resistance of Masonry or Concrete

D-1.7.1. Determination of Contribution

1) Except as provided in Sentences (2) to (5), the contribution of a plaster or gypsum board finish to the fire resistance of a masonry or concrete wall, floor or roof assembly shall be determined by multiplying the actual thickness of the finish by the factor shown in Table D-1.7.1., depending on the type of masonry or concrete to which it is applied. This corrected thickness shall then be included in the equivalent thickness as described in Subsection D-1.6.

Table D-1.7.1.
Multiplying Factors for Masonry or Concrete Construction

Type of Surface Protection	Type of Masonry or Concrete			
	Solid Clay Brick, Unit Masonry and Monolithic Concrete, Type N or S	**Cored Clay Brick, Clay Tile, Monolithic Concrete, Type L40S and Unit Masonry, Type L120S**	**Concrete Unit Masonry, Type L1 or L220S and Monolithic Concrete, Type L**	**Concrete Unit Masonry, Type L2**
Portland cement-sand plaster or lime sand plaster	1	0.75	0.75	0.50
Gypsum-sand plaster, wood fibred gypsum plaster or gypsum board	1.25	1	1	1
Vermiculite or perlite aggregate plaster	1.75	1.5	1.25	1.25

2) Where a plaster or gypsum board finish is applied to a concrete or masonry wall, the calculated fire-resistance rating of the assembly shall not exceed twice the fire-resistance rating provided by the masonry or concrete because structural collapse may occur before the limiting temperature is reached on the surface of the non-fire-exposed side of the assembly.

3) Where a plaster or gypsum board finish is applied only on the non-fire-exposed side of a hollow clay tile wall, no increase in fire resistance is permitted because structural collapse may occur before the limiting temperature is reached on the surface of the non-fire-exposed side of the assembly.

4) The contribution to fire resistance of a plaster or gypsum board finish applied to the non-fire-exposed side of a monolithic concrete or unit masonry wall shall be determined in conformance with Sentence (1), but shall not exceed 0.5 times the contribution of the concrete or masonry wall.

5) When applied to the fire-exposed side, the contribution of a gypsum lath and plaster or gypsum board finish to the fire resistance of masonry or concrete wall, floor or roof assemblies shall be determined from Table D-2.3.4.-A or D-2.3.4.-D.

D-1.7.2. Plaster

1) Gypsum plastering shall conform to CSA A82.30-M, “Interior Furring, Lathing and Gypsum Plastering.”

2) Portland cement-sand plaster shall be applied in 2 coats: the first coat containing 1 part Portland cement to 2 parts sand by volume, and the second coat containing 1 part Portland cement to 3 parts sand by volume.

3) Plaster finish shall be securely bonded to the wall or ceiling.

4) The thickness of plaster finish applied directly to monolithic concrete without metal lath shall not exceed 10 mm on ceilings and 16 mm on walls.

5) Where the thickness of plaster finish on masonry or concrete exceeds 38 mm, wire mesh with 1.57 mm diam wire and openings not exceeding 50 mm by 50 mm shall be embedded midway in the plaster.

D-1.7.3. Attachment of Gypsum Board and Lath

Gypsum board and gypsum lath finishes applied to masonry or concrete walls shall be secured to wood or steel furring members in conformance with Article D-2.3.9.

D-1.7.4. Sample Calculations

The following examples are included as a guide to the method of calculating the fire resistance of concrete or hollow masonry walls with plaster or gypsum board protection:

Example (1)

A 3 h fire-resistance rating is required for a monolithic concrete wall of Type S aggregate with a 20 mm gypsum-sand plaster finish on metal lath on each face.

(a) The minimum equivalent thickness of Type S monolithic concrete needed to give a 3 h fire-resistance rating = 158 mm (Table D-2.1.1.).

(b) Since the gypsum-sand plaster finish is applied on metal lath, Sentence D-1.7.1.(5) does not apply. Therefore, the contribution to the equivalent thickness of the wall of 20 mm gypsum-sand plaster on each face of the concrete is 20 × 1.25 = 25 mm (see Sentences D-1.7.1.(1) to (4)).

(c) The total contribution of the plaster finishes is 2 × 25 = 50 mm.

(d) The minimum equivalent thickness of concrete required is 158 mm - 50 mm = 108 mm.

(e) From Table D-2.1.1., the 108 mm equivalent thickness of monolithic concrete gives a contribution of less than 1.5 h. This is less than half the rating of the assembly so that the conditions in Sentence D-1.7.1.(2) are not met. Thus the equivalent thickness of monolithic concrete must be increased to 112 mm to give 1.5 h contribution.

(f) The total equivalent thickness of the plaster finishes can then be reduced to 158 mm - 112 mm = 46 mm.

(g) The total actual thickness of the plaster finishes required is therefore 46 mm ÷ 1.25 = 37 mm (Sentences D-1.7.1.(1) to (4)) or 18.5 mm on each face.

(h) Since the thickness of the plaster finish on each face exceeds 16 mm, metal lath is still required (Sentence D-1.7.2.(4)).

(i) Since this wall is symmetrical with plaster on both faces, the contribution to fire resistance of the plaster finish on either face is limited to one-quarter of the wall rating by virtue of Sentence D-1.7.1.(2). Under these circumstances, the conditions in Sentence D-1.7.1.(4) are automatically met.

Example (2)

A 2 h fire-resistance rating is required for a hollow masonry wall of Type N concrete with a 12.7 mm Type X gypsum board finish on each face.

(a) Since gypsum board is used, Sentence D-1.7.1.(5) applies. The 12.7 mm gypsum board finish on the fire-exposed side is, therefore, assigned 25 min by using Table D-2.3.4.-A.

(b) The fire resistance required of the balance of the assembly is 120 min - 25 min = 95 min.

(c) Interpolating between 1.5 h and 2 h in Table D-2.1.1. for 95 min fire resistance, the equivalent thickness for hollow masonry units required is 95 mm + (18 mm × 5/30) = 95 mm + 3 mm = 98 mm.

(d) The contribution to the equivalent thickness of the wall of the 12.7 mm gypsum board finish on the non-fire-exposed side using Table D-1.7.1. = 12.7 × 1.25 = 16 mm.

(e) Equivalent thickness required of concrete masonry unit = 98 - 16 = 82 mm.

(f) The fire-resistance rating of a concrete masonry wall having an equivalent thickness of 82 mm = 1 h for 73 mm + (9 mm × 30/22) = 1 h 12 min.

As this is more than 1 h, the conditions of Sentence D-1.7.1.(2) are met and the rating of 2 h is justified.

Example (3)

A 2 h fire-resistance rating is required for a hollow masonry exterior wall of Type L$_2$20S concrete with a 15.9 mm Type X gypsum board finish on the non-fire-exposed side only.

(a) According to Table D-2.1.1., the minimum equivalent thickness for Type L$_2$20S concrete masonry units needed to achieve a 2 h rating is 94 mm.

(b) Since gypsum board is not used on the fire-exposed side, Sentence D-1.7.1.(5) does not apply. The contribution to the equivalent thickness of the wall by the 15.9 mm Type X gypsum board finish applied on the non-fire-exposed side is 15.9 × 1 ≈ 16 mm (see Sentence D-1.7.1.(1) and Table D-1.7.1.).

(c) Therefore, the equivalent thickness required of the concrete masonry unit is 94 - 16 = 78 mm.

(d) The contribution to fire resistance of a 78 mm L $_2$20S concrete hollow masonry unit is 85 min. The contribution of the Type X gypsum board finish is 120 - 85 = 35 min, which does not exceed half the 85 min contribution of the masonry unit or 42.5 min, so that the conditions in Sentence D-1.7.1.(4) are met.

(e) The rating of the wall (120 min) is less than twice the contribution of the masonry unit (170 min) so that the conditions in Sentence D-1.7.1.(2) are also met.

D-1.8. Tests on Floors and Roofs

D-1.8.1. Exposure to Fire

All tests relate to the performance of a floor assembly or floor-ceiling or roof-ceiling assembly above a fire. It has been assumed on the basis of experience that fire on top will take a longer time to penetrate the floor than one below, and that the fire resistance in such a situation will be at least equal to that obtained from below in the standard test.

D-1.9. Moisture Content

D-1.9.1. Effect of Moisture

1) The moisture content of building materials at the time of fire test may have a significant influence on the measured fire resistance. In general, an increase in the moisture content should result in an increase in the fire resistance, though in some materials the presence of moisture may produce disruptive effects and early collapse of the assembly.

2) Moisture content is now controlled in standard fire test methods and is generally recorded in the test reports. In earlier tests, moisture content was not always properly determined.

D-1.10. Permanence and Durability

D-1.10.1. Test Conditions

The ratings in this Appendix relate to tested assemblies and do not take into account possible changes or deterioration in use of the materials. The standard fire test measures the fire resistance of a sample building assembly erected for the test. No judgment as to the permanence or durability of the assembly is made in the test.

D-1.11. Steel Structural Members

D-1.11.1. Thermal Protection

Since the ability of a steel structural member to sustain the loading for which it was designed may be impaired because of elevated temperatures, measures shall be taken to provide thermal protection. The fire-resistance ratings, as established by the provisions of this Appendix, indicate the time periods during which the effects of heat on protected steel structural members are considered to be within acceptable limits.

D-1.12. Restraint Effects

D-1.12.1. Effect on Fire-Resistance Ratings

In fire tests of floors, roofs and beams, it is necessary to state whether the rating applies to a thermally restrained or thermally unrestrained assembly. Edge restraint of a floor or roof, structural continuity, or end restraint of a beam can significantly extend the time before collapse in a standard test. A restrained condition is one in which expansion or rotation at the supports of a load-carrying element resulting from the effects of fire is resisted by forces or moments external to the element. An unrestrained condition is one in which the load-carrying element is free to thermally expand and rotate at its supports.

Whether an assembly or structural member can be considered thermally restrained or thermally unrestrained depends on the type of construction and location in a building. Guidance on this subject can be found in Appendix A of CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials." Different acceptance criteria also apply to thermally unrestrained and thermally restrained assemblies. These are described in CAN/ULC-S101.

The ratings for floors, roofs, and beams in this Appendix meet the conditions of CAN/ULC-S101, "Standard Method of Fire Endurance Tests of Building Construction and Materials," for thermally unrestrained specimens. In a thermally restrained condition, the structural element or assembly would probably have greater fire resistance, but the extent of this increase can be determined only by reference to behavior in a standard test.

Section D-2 Fire-Resistance Ratings

D-2.1. Masonry and Concrete Walls

D-2.1.1. Minimum Equivalent Thickness for Fire-Resistance Rating

The minimum thicknesses of unit masonry and monolithic concrete walls are shown in Table D-2.1.1. Hollow masonry units and hollow-core concrete panels shall be rated on the basis of equivalent thickness as described in Subsection D-1.6.

Table D-2.1.1.
Minimum Equivalent Thicknesses(1) of Unit Masonry and Monolithic Concrete Walls Loadbearing and Non-Loadbearing, mm

Type of Wall	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Solid brick units (80% solid and over), actual overall thickness	63	76	90	108	128	152	178
Cored brick units and hollow tile units (less than 80% solid), equivalent thickness	50	60	72	86	102	122	142
Solid and hollow concrete masonry units, equivalent thickness							
Type S or N concrete(2)	44	59	73	95	113	142	167
Type L120S concrete	42	54	66	87	102	129	152
Type L1 concrete	42	54	64	82	97	122	143
Type L220S concrete	42	54	64	81	94	116	134
Type L2 concrete	42	54	63	79	91	111	127
Monolithic concrete and concrete panels, equivalent thickness							
Type S concrete	60	77	90	112	130	158	180

Type N concrete	59	74	87	108	124	150	171
Type L40S or Type L concrete	49	62	72	89	103	124	140

Notes to Table D-2.1.1.:

(1) See definition of equivalent thickness in Subsection D-1.6.

(2) Hollow concrete masonry units made with Type S or N concrete shall have a minimum compressive strength of 15 MPa based on net area, as defined in CSA A165.1, "Concrete block masonry units."

D-2.1.2. Applicability of Ratings

1) Ratings obtained as described in Article D-2.1.1. apply to either loadbearing or non-loadbearing walls, except for walls described in Sentences (2) to (6).

2) Ratings for walls with a thickness less than the minimum thickness prescribed for loadbearing walls in this By-law apply to non-loadbearing walls only.

3) Masonry cavity walls (consisting of 2 wythes of masonry with an air space between) that are loaded to a maximum allowable compressive stress of 380 kPa have a fire resistance at least as great as that of a solid wall of a thickness equal to the sum of the equivalent thicknesses of the 2 wythes.

4) Masonry cavity walls that are loaded to a compressive stress exceeding 380 kPa are not considered to be within the scope of this Appendix.

5) A masonry wall consisting of 2 types of masonry units, either bonded together or in the form of a cavity wall, shall be considered to have a fire-resistance rating equal to that which would apply if the whole of the wall were of the material that gives the lesser rating.

6) A non-loadbearing cavity wall made up of 2 precast concrete panels with an air space or insulation in the cavity between them shall be considered to have a fire-resistance rating as great as that of a solid wall of a thickness equal to the sum of the thicknesses of the 2 panels.

D-2.1.3. Framed Beams and Joists

Beams and joists that are framed into a masonry or concrete fire separation shall not reduce the thickness of the fire separation to less than the equivalent thickness required for the fire separation.

D-2.1.4. Credit for Plaster Thickness

On monolithic walls and walls of unit masonry, the full plaster finish on one or both faces multiplied by the factor shown in Table D-1.7.1. shall be included in the wall thickness shown in Table D-2.1.1., under the conditions and using the methods described in Subsection D-1.7.

D-2.1.5. Walls Exposed to Fire on Both Sides

1) Except as permitted in Sentence (2), portions of loadbearing reinforced concrete walls, which do not form a complete fire separation and thus may be exposed to fire on both sides simultaneously, shall have minimum dimensions and minimum cover to steel reinforcement in conformance with Articles D-2.8.2. to D-2.8.5.

2) A concrete wall exposed to fire from both sides as described in Sentence (1) has a fire-resistance rating of 2 h if the following conditions are met:

a) its equivalent thickness is not less than 200 mm,

b) its aspect ratio (width/thickness) is not less than 4.0,

c) the minimum thickness of concrete cover over the steel reinforcement specified in Clause (d) is not less than 50 mm,

d) each face of the wall is reinforced with both vertical and horizontal steel reinforcement in conformance with either Clause 10 or Clause 14 of CSA A23.3, "Design of concrete structures,"

e) the structural design of the wall is governed by the minimum eccentricity (15 + 0.03h) specified in Clause 10.15.3.1 of CSA A23.3, "Design of concrete structures," and

f) the effective length of the wall, kl_u, is not more than 3.7 m

where

k = effective length factor obtained from CSA A23.3, “Design of concrete structures,”

l_u = unsupported length of the wall in metres.

D-2.2. Reinforced and Prestressed Concrete Floor and Roof Slabs

D-2.2.1. Assignment of Rating

1) Floors and roofs in a fire test are assigned a fire-resistance rating which relates to the time that an average temperature rise of 140°C or a maximum temperature rise of 180 °C at any location is recorded on the unexposed side, or the time required for collapse to occur, whichever is the lesser. The thickness of concrete shown in Table D-2.2.1.-A shall be required to resist the transfer of heat during the fire resistance period shown.

Table D-2.2.1.-A
Minimum Thickness of Reinforced and Prestressed Concrete Floor or Roof Slabs, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S concrete	60	77	90	112	130	158	180
Type N concrete	59	74	87	108	124	150	171
Type L40S or Type L concrete	49	62	72	89	103	124	140

2) The concrete cover over the reinforcement and steel tendons shown in Table D-2.2.1.-B shall be required to maintain the integrity of the structure and prevent collapse during the same period.

Table D-2.2.1.-B
Minimum Concrete Cover over Reinforcement in Concrete Slabs, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S, N, L40S or L concrete	20	20	20	20	25	32	39
Prestressed concrete slabs Type S, N, L40S or L concrete	20	25	25	32	39	50	64

D-2.2.2. Floors with Hollow Units

The fire resistance of floors containing hollow units may be determined on the basis of equivalent thickness as described in Subsection D-1.6.

D-2.2.3. Composite Slabs

1) For composite concrete floor and roof slabs consisting of one layer of Type S or N concrete and another layer of Type L40S or L concrete in which the minimum thickness of both the top and bottom layers is not less than 25 mm, the combined fire-resistance rating may be determined using the following expressions:

a) when the base layer consists of Type S or N concrete,

$$R = 0.00018t^2 - 0.00009dt + \frac{8.7}{t}$$

b) when the base layer consists of Type L40S or L concrete,

$$R = 0.0001t^2 + 0.0002dt - 0.0001d^2 + \frac{6.4}{t}$$

where

R = fire resistance of slab, h,

t = total thickness of slab, mm, and

d = thickness of base layer, mm.

2) If the base course described in Sentence (1) is covered by a top layer of material other than Type S, N, L40S or L concrete, the top course thickness may be converted to an equivalent concrete thickness by multiplying the actual thickness by the appropriate factor listed in Table D-2.2.3.-A This equivalent concrete thickness may be added to the thickness of the base course and the fire-resistance rating calculated using Table D-2.2.1.-A.

3) The minimum concrete cover under the main reinforcement for composite concrete floor and roof slabs with base slabs less than 100 mm thick shall conform to Table D-2.2.3.-B For base slabs 100 mm or more thick, the minimum cover thickness requirements of Table D-2.2.1.-B shall apply.

4) Where the top layer of a 2-layer slab is less than 25 mm thick, the fire-resistance rating for the slab shall be calculated as though the entire slab were made up of the type of concrete with the lesser fire resistance.

Table D-2.2.3.-A
Multiplying Factors for Equivalent Thickness

Top Course Material	Base Slab Normal Density Concrete (Type S or N)	Base Slab Low Density Concrete (Type L40S or L)
Gypsum board	3	2.25
Cellular concrete (mass density 400 – 560 kg/m^3)	2	1.50
Vermiculite and perlite concrete (mass density 560 kg/m^3 or less)	1.75	1.50
Portland cement with sand aggregate	1	0.75
Terrazzo	1	0.75

Table D-2.2.3.-B
Minimum Concrete Cover under Bottom Reinforcement in Composite Concrete Slabs, mm

Base Slab Concrete Type	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Reinforced concrete							
Type S, N, L40S or L	15	15	20	25	30	40	55
Prestressed concrete							
Type S	20	25	30	40	50	65	75
Type N	20	20	25	35	45	60	70
Type L40S or L	20	20	25	30	40	50	60

D-2.2.4. Contribution of Plaster Finish

1) The contribution of plaster finish securely fastened to the underside of concrete may be taken into account in floor or roof slabs under the conditions and using the methods described in Subsection D-1.7.

2) Plaster finish on the underside of concrete floors or roofs may be used in lieu of concrete cover referred to in Sentence D-2.2.1.(2) under the conditions and using the methods described in Subsection D-1.7.

D-2.2.5. Concrete Cover

1) In prestressed concrete slab construction, the concrete cover over an individual tendon shall be the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the slab, except that for ungrouted ducts the assumed cover thickness shall be the minimum thickness of concrete between the surface of the duct and the bottom of the slab. For slabs in which several tendons are used, the cover is assumed to be the average of those of

individual tendons, except that the cover for any individual tendon shall be not less than half of the value given in Table D-2.2.1.-B nor less than 20 mm.

2) Except as provided in Sentence (3), in post-tensioned prestressed concrete slabs, the concrete cover to the tendon at the anchor shall be not less than 15 mm greater than the minimum cover required by Sentence (1). The minimum concrete cover to the anchorage bearing plate and to the end of the tendon, if it projects beyond the bearing plate, shall be 20 mm.

3) The requirements of Sentence (2) do not apply to those portions of slabs not likely to be exposed to fire, such as the ends and tops.

D-2.2.6. Minimum Dimensions for Cover

Minimum dimensions and cover to steel tendons of prestressed concrete beams shall conform to Subsection D-2.10.

D-2.3. Wood and Steel Framed Walls, Floors and Roofs

D-2.3.1. Maximum Fire-Resistance Rating

The fire-resistance rating of walls constructed of wood studs or cold-formed-steel studs, of floors constructed of wood joists, wood I-joists, pre-manufactured wood trusses, cold-formed steel joists or open web steel joists, and of roofs constructed of wood joists, pre-manufactured metal-plate-connected wood trusses or open web steel joists can be determined for ratings of not more than 90 min from the information in this Subsection.

D-2.3.2. Loadbearing Conditions

1) The fire-resistance ratings derived from the information in this Subsection apply to loadbearing and non-loadbearing wood-framed and cold-formed-steel-framed walls, and to loadbearing floors and roofs, as specifically described in this Subsection.

2) Loadbearing conditions shall be as defined in CAN/ULC-S101, “Standard Method of Fire Endurance Tests of Building Construction and Materials.”

D-2.3.3. Limitations of Component Additive Method

(See Section D-7, Background Information.)

1) The fire-resistance rating of a framed assembly depends primarily on the time during which the membrane on the fire-exposed side remains in place.

2) The assigned times in Sentences D-2.3.4.(2) to (4) are not intended to be construed as the fire-resistance ratings of the individual components of an assembly, nor are they intended to be construed as times that are applicable or acceptable for use beyond the method and systems described in this Subsection. These assigned times are the individual contributions of each component to the overall fire-resistance rating of an assembly, which is permitted to be derived using the component additive method described in this Subsection.

3) The fire-resistance rating calculated by the component additive method cannot be increased by installing membranes in multiple layers, other than as specified in Tables D-2.3.4.-A, D-2.3.4.-B and D-2.3.4.-C.

D-2.3.4. Method of Calculation

1) In the component additive method, the fire-resistance rating of a framed assembly is calculated by adding the time assigned in Sentence (2) for the membrane on the fire-exposed side to the time assigned in Sentence (3) for the framing members and then adding any time assigned in Sentence (4) for additional protective measures, such as the inclusion of insulation or of reinforcement for a membrane. For loadbearing walls where resilient metal channels are installed with a single layer of gypsum board membrane in accordance with Table D-2.3.4.-A, the fire-resistance rating determined using this method of calculation must be reduced by 10 min.

2) The times to be used in the component additive method that have been assigned to membranes on the fire-exposed side of the assembly, which are partly based on their ability to remain in place during fire tests, are listed in Tables D-2.3.4.-A to D-2.3.4.-D. (This is not to be confused with the fire-resistance rating of the membrane, which also takes into account the rise in temperature on the unexposed side of the membrane. [See Sentence D-2.3.3.(2).])

Table D-2.3.4.-A
Time Assigned to Protective Membranes on Fire-Exposed Side of Wood-Framed and Cold-Formed-Steel-Framed Walls

Description of Finish	Time, min	
	Loadbearing Walls	Non-Loadbearing Walls
11.0 mm Douglas Fir plywood phenolic bonded	–	10(1)
14.0 mm Douglas Fir plywood phenolic bonded	–	15(1)
12.7 mm Type X gypsum board	25(2)	25
15.9 mm Type X gypsum board	40(2)	40(3)
Double 12.7 mm Type X gypsum board(4)	50	80

Notes to Table D-2.3.4.-A:
(1) Applies to stud cavities filled with mineral wool conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a mass per unit area of not less than 2 kg/m^2, with no additional credit for insulation according to Table D-2.3.4.-G.
(2) Applies only to wood-framed walls.
(3) Applies only to steel-framed walls.
(4) Resilient metal channels are permitted to be installed at a spacing of 400 mm o.c. with no effect on the rating of the wall assembly.

Table D-2.3.4.-B
Time Assigned to Gypsum Board Membranes on Fire-Exposed Side of Floors

Description of Finish	Resilient Metal Channels(1)	Time, min	
		Floors with Wood or Steel Joists	Floors with Open-Web Steel Joists
12.7 mm Type X gypsum board	Spaced ≤ 400 mm o.c.(2)	25(3)	—
15.9 mm Type X gypsum board		40	—
12.7 mm Type X gypsum board	—	25(4)	25
15.9 mm Type X gypsum board		40(4)	40
Double 12.7 mm Type X gypsum board	Spaced ≤ 400 mm o.c.(5)	50(3)	—
Double 12.7 mm Type X gypsum board	Spaced at 600 mm o.c.(6)	45(3)	—
Double 15.9 mm Type X gypsum board	Spaced ≤ 600 mm o.c.(6)	60(3)	—

Notes to Table D-2.3.4.-B:
(1) See Figures A-9.10.3.1.-A, A-9.10.3.1.-B and A-9.10.3.1.-D in Note A-9.10.3.1. for the attachment of single and double layers of gypsum board to resilient metal channels.
(2) Resilient metal channels must be installed to achieve the stated rating.
(3) Applies to wood joists, wood trusses, wood I-joists and cold-formed steel joists (C-shaped joists).
(4) Applies to wood joists and pre-fabricated metal-plate-connected wood trusses.
(5) Resilient metal channels must be installed or gypsum board must be applied directly to the structural members, which must be spaced not more than 400 mm o.c.
(6) Resilient metal channels are permitted to be installed with no effect on the rating of the floor assembly. Gypsum board is also permitted to be directly applied to the structural members.

Table D-2.3.4.-C
Time Assigned to Gypsum Board Membranes on Fire-Exposed Side of Roofs

Description of Finish	Time, min[1]
12.7 mm Type X gypsum board	25
15.9 mm Type X gypsum board	40

Notes to Table D-2.3.4.-C:
[1] Applies to wood joists, pre-fabricated metal-plate-connected wood trusses, and open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.

Table D-2.3.4.-D
Time Assigned for Contribution of Lath and Plaster Protection on Fire-Exposed Side

Type of Lath	Plaster Thickness, mm	Type of Plaster Finish		
		Portland Cement and Sand[1] or Lime and Sand	Gypsum and Sand or Gypsum Wood Fibre	Gypsum and Perlite or Gypsum and Vermiculite
		Time, min[2]		
9.5 mm gypsum	13	—	35	55
	16	—	40	65
	19	—	50	80[3]
Metal	19	20	50	80[3]
	23	25	65	80[3]
	26	30	80	80[3]

Notes to Table D-2.3.4.-D:
[1] For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).
[2] Applies to loadbearing and non-loadbearing wood studs or non-loadbearing cold-formed-steel studs, to floors constructed of wood joists or open-web steel joists, and to roofs constructed of wood joists, pre-manufactured metal-plate-connected wood trusses, or open-web steel joists.
[3] Values shown for these membranes have been limited to 80 min because the fire-resistance ratings of framed assemblies derived from these Tables must not exceed 1.5 h.

3) The times to be used in the component additive method that have been assigned to wall framing members and to floor and roof framing members are listed in Tables D-2.3.4.-E and D-2.3.4.-F respectively.

Table D-2.3.4.-E
Time Assigned for Contribution of Wood-Framed or Cold-Formed-Steel-Framed Walls

Description of Frame	Time, min	
	Loadbearing Walls	Non-Loadbearing Walls
Wood studs spaced ≤ 400 mm o.c.	20	
Wood studs spaced ≤ 600 mm o.c.	15	
Cold-formed-steel studs spaced ≤ 400 mm o.c.	10	
Cold-formed-steel studs spaced ≤ 600 mm o.c.	10	–

Table D-2.3.4.-F
Time Assigned for Contribution of Wood or Steel Frame of Floors and Roofs

Description of Frame		Time, min
Type of Assembly	**Structural Members**	
Floor(1)	Wood joists, wood I-joists, wood trusses and cold-formed-steel joists spaced ≤ 600 mm o.c.	10(2)
	Open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.	
Roof	Wood joists spaced ≤ 400 mm o.c.	10
	Open-web steel joists with ceiling supports spaced ≤ 400 mm o.c.	10
	Wood truss assemblies [metal-plate-connected] spaced ≤ 600 mm o.c.	5

Notes to Table D-2.3.4.-F:
(1) Resilient metal channels are permitted to be installed with no effect on the rating of the floor assembly.
(2) Applies only to floor structural members that are protected by a membrane.

4) Preformed insulation of glass, rock or slag fibre and cellulose fibre insulation provide additional protection to wood studs by shielding the studs from exposure to the fire and thus delaying the time of collapse. The use of preformed glass fibre, preformed rock or slag fibre and dry-blown cellulose insulation material does not decrease the rating of wall assemblies with the membranes identified in Table D-2.3.4.-A. Similarly, the use of preformed glass fibre, preformed rock or slag fibre and cellulose insulation material does not decrease the rating of floor assemblies constructed with wood joists, wood trusses, wood I-joists and cold-formed-steel floor joists (C-shaped joists), provided the insulation is not in direct contact with the membranes identified in Table D-2.3.4.-B. The use of reinforcement in the membrane exposed to fire also adds to the fire resistance by extending the time to failure. Table D-2.3.4.-G shows the time increments that may be added to the fire resistance if these features are incorporated in the assembly.

Table D-2.3.4.-G
Time Assigned for Additional Protection

Description of Additional Protection	Time, min
Add to the fire-resistance rating of wood stud walls, sheathed with gypsum board or lath and plaster, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” and with a mass per unit area of not less than 1.22 kg/m^2 of wall surface	15(1)
Add to the fire-resistance rating of non-loadbearing wood stud walls, sheathed with gypsum board or lath and plaster, if the spaces between the studs are filled with preformed insulation of glass fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” and having a mass per unit area of not less than 0.6 kg/m^2 of wall surface	5(2)
Add to the fire-resistance rating of loadbearing wood stud walls sheathed with gypsum board if the spaces between the studs are filled with insulation of cellulose fibres conforming to CAN/ULC-S703, “Standard for Cellulose Fibre Insulation (CFI) for Buildings,” and having a density of not less than 50 kg/m^3	10
Add to the fire-resistance rating of plaster on gypsum lath ceilings if 0.76 mm diam wire mesh with 25 mm by 25 mm openings or 1.57 mm diam diagonal wire reinforcing at 250 mm o.c. is placed between lath and plaster	30
Add to the fire-resistance rating of plaster on gypsum lath ceilings if 76 mm wide metal lath strips are placed over joints between lath and plaster	10
Add to the fire-resistance rating of plaster on 9.5 mm thick gypsum lath ceilings (Table D-2.3.4.-D) if supports for lath are 300 mm o.c.	10
Add to the fire-resistance rating of floor assemblies if the spaces between the structural members are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” and having a mass per unit area of not less than 1.22 kg/m^2 of floor surface	5(2)

Add to the fire-resistance rating of floor assemblies if the spaces between the structural members are filled with wet-blown cellulose fibres conforming to CAN/ULC-S703, "Standard for Cellulose Fibre Insulation (CFI) for Buildings," and having a density of not less than 50 kg/m^3	5(2)(3)
Add to the fire-resistance rating of floor assemblies where the floor topping on the unexposed side of the floor assemblies consists of concrete not less than 38 mm thick	5(2)

Notes to Table D-2.3.4.-G:

(1) Applies to wood-framed walls only.

(2) Applies to wood joists, wood trusses, wood I-joists and cold-formed-steel joists (C-shaped joists).

(3) Applies to cellulose fibre:

(i) for wood joists, wood I-joist and wood trusses–that is spray-applied with a minimum density of 50 kg/m^3, a minimum depth of 90 mm on the underside of the subfloor, and of 90 mm on the sides of the structural members;

(ii) for cold-formed-steel joists–that is spray-applied with a minimum density of 50 kg/m^3 and a minimum thickness of 90 mm on the underside of the subfloor, of 90 mm on the sides of the structural members, and of 13 mm on the underside of the bottom flange other than at resilient metal channel locations.

5) Cellulose fibre insulation conforming to CAN/ULC-S703, "Standard for Cellulose Fibre Insulation (CFI) for Buildings," applied in conformance with CAN/CGSB-92.2-M, "Trowel or Spray Applied Acoustical Material," does not affect the fire-resistance rating of a non-loadbearing cold-formed-steel stud wall assembly, provided that it is sprayed to either face of the wall cavity.

D-2.3.5. Considerations for Various Types of Assemblies

1) Interior vertical fire separations are to be rated for exposure to fire on each side (see Sentence 3.1.7.3.(2)). The method described in this Subsection applies when a membrane is provided on both sides of the assembly. However, in the calculation of the fire-resistance rating of such an assembly using this method, no additional contribution to fire resistance is to be assigned for a membrane on the non-fire-exposed side, since its contribution is already accounted for in the values assigned to the other components of the assembly.

2) Exterior wall assemblies required to have a fire-resistance rating are required to be rated for exposure to fire from the interior side only (see Sentence 3.1.7.3.(3)). When deriving a fire-resistance rating for such wall assemblies using the method described in this Subsection, only wood studs with a single layer of gypsum board or non-loadbearing cold-formed-steel studs conforming to Table D-2.3.4.-E may be used. Such walls must have a membrane on the exterior side of the stud consisting of plywood, oriented strandboard or gypsum sheathing, and exterior cladding. Additional materials are also permitted between the required sheathing and cladding. The spaces between the studs are to be filled with insulation conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a mass per unit area of not less than 1.22 kg/m^2 of wall surface. However, in the calculation of the fire-resistance rating of such an assembly, no additional contribution to fire resistance is to be assigned for a membrane on the non-fire-exposed side, since its contribution is already accounted for in the values assigned to the other components of the assembly.

3) In the case of a floor or roof assembly, the By-law only requires testing for fire exposure from below. Floors or roofs must have an upper flooring or roofing membrane in accordance with Table D-2.3.5.

Table D-2.3.5.
Flooring or Roofing Membranes

Type of Assembly	Structural Members	Subfloor or Roof Deck	Finished Flooring or Roofing
Floor	Wood or open-web steel joists(1) and metal-plate-connected wood trusses(1)	12.5 mm plywood or 15.5 mm oriented strandboard or 17 mm T & G softwood or 14 mm phenolic-bonded Douglas Fir plywood (no finished flooring required)	Hardwood or softwood flooring on building paper Resilient flooring, parquet floor, felted synthetic fibre floor coverings, carpeting, or ceramic tile on 8 mm thick panel-type underlay Ceramic tile on 30 mm mortar bed
	Open-web steel joists(1)	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet or	Finish flooring

		40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum board	
	Wood joists, wood I-joists, wood trusses and cold-formed-steel joists	minimum 15.5 mm T & G plywood or minimum 15.5 mm oriented strandboard	No requirement
Roof	Wood or open-web steel joists(1) and wood trusses(1)	12.5 mm plywood or 15.5 mm oriented strandboard or 17 mm T & G softwood or 14 mm phenolic-bonded Douglas Fir plywood (no finished flooring required)	Finish roofing material with or without insulation
	Open-web steel joists(1)	50 mm reinforced concrete or 50 mm concrete on metal lath or formed steel sheet or 40 mm reinforced gypsum-fibre concrete on 12.7 mm gypsum board	Finish roofing material with or without insulation

Notes to Table D-2.3.5.:
(1) Applies to single layer of gypsum board membrane, and lath and plaster.

4) Insulation used in the cavities of a wood joist or metal-plate-connected wood truss floor assembly with a single layer of gypsum board will not reduce the assigned fire-resistance rating of the assembly, provided:

a) the insulation is preformed of rock, slag or glass fibre conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," and having a mass per unit area of not more than 1.1 kg/m^2 and is installed adjacent to the bottom edge of the framing member, directly above steel furring channels,

b) the gypsum board ceiling membrane is attached to

i) wood trusses in conformance with Sentence D-2.3.9.(2) by way of steel furring channels spaced not more than 400 mm o.c., and the channels are secured to each bottom truss member with a double strand of 1.2 mm galvanized steel wire, or

ii) wood joists by way of resilient metal or steel furring channels spaced not more than 400 mm o.c. in conformance with Sentences D-2.3.9.(2) and (3), and

c) a steel furring channel is installed midway between each furring channel mentioned in Clause (b) to provide additional support for the insulation.

5) Except as required in Sentence D-2.3.5.(4), resilient metal or steel furring channels may be used to attach a gypsum board ceiling membrane to a floor assembly using wood joists, metal-plate-connected wood trusses and open-web steel joists, or to a roof assembly. The channels must be made of galvanized steel not less than 0.5 mm thick spaced not more than 600 mm o.c. perpendicular to the framing members, with an overlap of not less than 100 mm at splices and a minimum end clearance between the channels and walls of 15 mm.

D-2.3.6. Framing Members

1) The values shown in Tables D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-D and D-2.3.12. apply to membranes supported on framing members installed in their conventional orientation and spaced in conformance with Tables D-2.3.4.-E and D-2.3.4.-F.

2) Wood studs and wood roof framing members are to be not less than 38 mm by 89 mm. Wood floor joists are to be not less than 38 mm by 184 mm, except where they are used in an assembly from Table D-2.3.4.-D or from Table D-2.3.5. that uses a single layer of gypsum board as the lower (ceiling) membrane, in which case, wood floor joists are to be not less than 38 mm by 89 mm.

3) Wood roof trusses are to consist of wood chord and web framing members not less than 38 mm by 89 mm and metal connector plates fabricated from galvanized steel not less than 1 mm in nominal thickness with projecting teeth not less than 8 mm long.

4) Wood floor trusses are to consist of:

a) metal-plate-connected wood trusses that are not less than 305 mm deep with wood chord and web framing members not less than 38 mm by 64 mm and metal connector plates fabricated from galvanized steel not less than 1 mm in nominal thickness with projecting teeth not less than 8 mm long;

b) metal-web wood trusses that are not less than 286 mm deep with wood chords not less than 38 mm by 64 mm and V-shaped webs made from galvanized steel not less than 1 mm in nominal thickness with plate areas having teeth not less than 8 mm long; or

c) fingerjoined wood trusses that are not less than 330 mm deep with fingerjoined connections, chord members not less than 38 mm by 64 mm, and web members not less than 38 mm by 38 mm glued together with a R-14 phenol-resorcinol resin conforming to CSA O112.10, "Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure)."

5) Wood I-joists are to be not less than 241 mm deep with flanges that are not less than 38 mm by 38 mm and an oriented strandboard or plywood web that is not less than 9.5 mm thick.

6) The dimensions for dressed lumber given in CSA O141, "Softwood Lumber," are to be used for wood studs, joists, I-joists and trusses.

7) Cold-formed-steel studs for non-loadbearing walls are to consist of galvanized steel that is not less than 0.5 mm thick and not less than 63 mm wide, and have a flange that is not less than 31 mm wide.

8) Cold-formed-steel studs in non-loadbearing wall assemblies are to be installed with not less than a 12 mm clearance between the top of the stud and the top of the runner to allow for expansion in the event of a fire. Where the studs are required to be attached for alignment purposes during erection, they must be attached to the bottom runners only.

9) Cold-formed-steel studs for loadbearing walls are to consist of galvanized steel that is not less than 0.912 mm thick but not greater than 1.52 mm thick, with a C-shaped cross-section not less than 92 mm deep by 41 mm wide and 12.7 mm stiffening lips.

10) Cold-formed-steel studs in loadbearing wall assemblies are to be installed with diagonal cross-bracing.

11) Cold-formed-steel floor joists (C-shaped joists) are to be not less than 41 mm wide by 203 mm deep by 1.22 mm material thickness.

12) The allowable spans for wood joists listed in the Span Tables in Part 9 are provided for floors supporting specific occupancies.

D-2.3.7. Plaster Finish

The thickness of plaster finish shall be measured from the face of gypsum or metal lath.

D-2.3.8. Edge Support for Gypsum Board in Wall Assembly

Gypsum board installed over framing or furring in a wall assembly shall be installed so that all edges are supported, except that 15.9 mm Type X gypsum board may be installed horizontally with the horizontal joints unsupported when framing members are at 400 mm o.c. maximum.

D-2.3.9. Membrane Fastening

1) Except as provided in Sentences (2) to (5), Table D-2.3.4.-B and Sentence D-2.3.5.(5), the application of lath and plaster finish shall conform to CSA A82.30-M, "Interior Furring, Lathing and Gypsum Plastering," and of gypsum board finish shall conform to ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board."

2) Where a membrane referred to in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D or D-2.3.12. is applied to steel framing or furring, fasteners shall penetrate not less than 10 mm through the metal.

3) Except as provided in Sentence (4), where a membrane referred to in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D or D-2.3.12. is applied to wood framing or furring, minimum fastener penetrations into wood members shall conform to Table D-2.3.9. for the time assigned to the membrane.

Table D-2.3.9.
Membrane Fastening

Type of Membrane	Minimum Penetration of Fasteners for Membrane Protection on Wood Framing, mm					
	5 – 25	30 – 35	40	50	55 – 70	80
	Time,(1) min					
Single layer	20	29	32	—	—	—
Double layer	20	20	20	29	35	44
Gypsum lath	20	20	23	23	29	29

Notes to Table D-2.3.9.:
(1) Assigned contributions of membranes to fire resistance are listed in Tables D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D and D-2.3.12.

4) Where a membrane is applied in 2 layers, the fastener penetrations described in Table D-2.3.9. shall apply to the base layer. Fasteners for the face layer shall penetrate not less than 20 mm into wood supports.

5) In a double layer application of gypsum board on wood supports, fastener spacing shall conform to ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board."

D-2.3.10. Ceiling Membrane Openings – Combustible Construction

1) Except as permitted in Article D-2.3.12., where a floor or roof assembly of combustible construction is assigned a fire-resistance rating on the basis of this Subsection and incorporates a ceiling membrane described in Table D-2.3.4.-B, D-2.3.4.-C or D-2.3.4.-D, the ceiling membrane may be penetrated by openings leading to ducts within concealed spaces above the membrane provided:

a) the assembly is not required to have a fire-resistance rating in excess of 1 h,

b) the area of any openings does not exceed 930 cm^2 (see Sentence (2)),

c) the aggregate area of openings does not exceed 1% of the ceiling area of the fire compartment,

d) the depth of the concealed space above the ceiling is not less than 230 mm,

e) no dimension of any opening exceeds 310 mm,

f) supports are provided for openings with any dimension exceeding 150 mm where framing members are spaced greater than 400 mm o.c.,

g) individual openings are spaced not less than 2 m apart,

h) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and

i) the clearance between the top surface of the membrane and the bottom surface of the ducts is not less than 100 mm.

2) Where an individual opening permitted in Sentence (1) exceeds 130 cm^2 in area, it shall be protected by

a) a fire stop flap conforming to CAN/ULC-S112.2, "Standard Method of Fire Test of Ceiling Firestop Flap Assemblies," that activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the ducts, whether the air duct system is operating or shut down, or

b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Article D-2.3.10.).

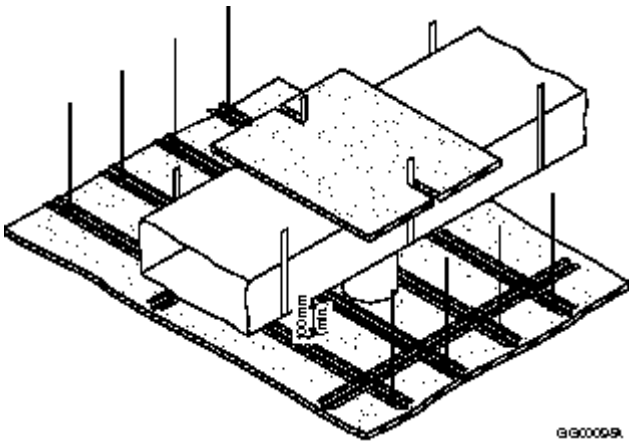


Figure D-2.3.10.
Thermal protection above a duct

D-2.3.11. Ceiling Membrane Openings – Noncombustible Construction

1) Except as permitted in Article D-2.3.12., where a floor or roof assembly of noncombustible construction is assigned a fire-resistance rating on the basis of this Subsection and incorporates a ceiling membrane described in Table D-2.3.4.-B, D-2.3.4.-C or D-2.3.4.-D, the ceiling membrane may be penetrated by openings leading to ducts located within concealed spaces provided:

a) the area of any opening does not exceed 930 cm^2 (see Sentence (2)),

b) the aggregate area of openings does not exceed 2% of the ceiling area of the fire compartment,

c) no dimension of any opening exceeds 400 mm,

d) individual openings are spaced not less than 2 m apart,

e) openings are located not less than 200 mm from major structural members such as beams, columns or joists,

f) the ducts above the membrane are sheet steel and are supported by steel strapping firmly attached to the framing members, and

g) the clearance between the top surface of the membrane and the bottom surface of the duct is not less than 100 mm.

2) Where an individual opening permitted in Sentence (1) exceeds 130 cm^2 in area, it shall be protected by

a) a fire stop flap conforming to CAN/ULC-S112.2, "Standard Method of Fire Test of Ceiling Firestop Flap Assemblies," that activates at a temperature approximately 30°C above the normal maximum temperature that occurs in the ducts, whether the air duct system is operating or shut down, or

b) thermal protection above the duct consisting of the same materials as used for the ceiling membrane, mechanically fastened to the ductwork and extending 200 mm beyond the opening on all sides (see Article D-2.3.10.).

D-2.3.12. Ceiling Membrane Rating

Where the fire-resistance rating of a ceiling assembly is to be determined on the basis of the membrane only and not of the complete assembly, the ratings may be determined from Table D-2.3.12., provided no openings described in Articles D-2.3.10. and D-2.3.11. are located within the ceiling membrane.

Table D-2.3.12.
Fire-Resistance Rating for Ceiling Membranes

Description of Membrane	Fire-Resistance Rating, min
15.9 mm Type X gypsum board with ≥ 75 mm mineral wool batt insulation above board	30
19 mm gypsum-sand plaster on metal lath	30
Double 14.0 mm Douglas Fir plywood phenolic bonded	30

Double 12.7 mm Type X gypsum board	45
25 mm gypsum-sand plaster on metal lath	45
Double 15.9 mm Type X gypsum board	60
32 mm gypsum-sand plaster on metal lath	60

D-2.3.13. Membrane Penetrations in Combustible and Noncombustible Construction

1) Where a wall, floor or roof assembly is assigned a fire-resistance rating on the basis of this Subsection and includes a membrane or membranes described in Table D-2.3.4.-A, D-2.3.4.-B, D-2.3.4.-C, D-2.3.4.-D or D-2.3.12., penetrations of the membrane or membranes must be firestopped in conformance with the applicable requirements in Article 3.1.9.1. or Sentence 9.10.9.6.(1).

D-2.3.14. Beams

1) Where a steel beam is included with an open-web steel joist and is protected by the same continuous ceiling, the beam is assumed to have a fire-resistance rating equal to that assigned to the rest of the assembly.

2) The ratings in this Subsection assume that the construction to which the beam is related is a normal one and does not carry unusual loads from the floor or slab above.

D-2.3.15. Wired Glass Assembly Support

1) Openings in a vertical fire separation having a fire-resistance rating of not more than 1 h are allowed to be protected by wired glass assemblies, provided the wired glass is

a) not less than 6 mm thick;

b) reinforced by a steel wire mesh in the form of diamonds, squares or hexagons having dimensions of

i) approximately 25 mm across the flats, using wire of not less than 0.45 mm diameter, or

ii) approximately 13 mm across the flats, using wire of not less than 0.40 mm diameter, the wire to be centrally embedded during manufacture and welded or intertwined at each intersection;

c) set in fixed steel frames with metal not less than 1.35 mm thick and providing a glazing stop of not less than 20 mm on each side of the glass; and

d) limited in area so that

i) individual panes are not more than 0.84 m^2, with neither height nor width more than 1.4 m, and

ii) the area not structurally supported by mullions is not more than 7.5 m^2.

2) It is intended that the structural mullions referred to in Subclause (1)(d)(ii) will not distort or be displaced to the extent that there would be a failure of the wired glass closure during the period for which a closure in the fire separation would be expected to function. Hollow structural steel tubing not less than 100 mm square filled with a Portland cement-based grout will satisfy the intent of the Subclause.

D-2.4. Solid Wood Walls, Floors and Roofs

D-2.4.1. Minimum Thickness

The minimum thickness of solid wood walls, floors and roofs for fire-resistance ratings from 30 min to 1.5 h is shown in Table D-2.4.1.

Table D-2.4.1.
Minimum Thickness of Solid Wood Walls, Roofs and Floors, mm(1)(2)

Type of Construction	Fire-Resistance Rating			
	30 min	45 min	1 h	1.5 h
Solid wood floor with building paper and finish flooring on top(3)	89	114	165	235

Solid wood, splined or tongued and grooved floor with building paper and finish flooring on top[4]	64	76	—	—
Solid wood walls of loadbearing vertical plank[3]	89	114	140	184
Solid wood walls of non-loadbearing horizontal plank[3]	89	89	89	140

Notes to Table D-2.4.1.:
[1] See CSA O141, "Softwood Lumber," for sizes.
[2] The fire-resistance ratings and minimum dimensions for floors also apply to solid wood roof decks of comparable thickness with finish roofing material.
[3] The assembly shall consist of 38 mm thick members on edge fastened together with 101 mm common wire nails spaced not more than 400 mm o.c. and staggered in the direction of the grain.
[4] The floor shall consist of 64 mm by 184 mm wide planks either tongued and grooved or with 19 mm by 38 mm splines set in grooves and fastened together with 88 mm common nails spaced not more than 400 mm o.c.

D-2.4.2. Increased Fire-Resistance Rating

1) The fire-resistance rating of the assemblies described in Table D-2.4.1. may be increased by 15 min if one of the following finishes is applied on the fire-exposed side:

a) 12.7 mm thick gypsum board,

b) 20 mm thick gypsum-sand plaster on metal lath, or

c) 13 mm thick gypsum-sand plaster on 9.5 mm gypsum lath.

2) Fastening of the plaster to the wood structure shall conform to Subsection D-2.3.

D-2.4.3. Supplementary Ratings

Supplementary ratings based on tests are included in Table D-2.4.3. The ratings given shall apply to constructions that conform in all details with the descriptions given.

Table D-2.4.3.
Fire-Resistance Rating of Non-Loadbearing Built-up Solid Wood Partitions[1]

Construction Details	Actual Overall Thickness, mm	Fire-Resistance Rating
Solid panels of wood boards 64 mm to 140 mm wide grooved and joined with wood splines, nailed together, boards placed vertically with staggered joints, 3 boards thick	58	30 min
Solid panels with 4 mm plywood facings[2] glued to 46 mm solid wood core of glued, tongued and grooved construction for both sides and ends of core pieces with tongued and grooved rails in the core about 760 mm apart	54	1 h

Notes to Table D-2.4.3.:
[1] The ratings and notes are taken from "Fire Resistance Classifications of Building Constructions," Building Materials and Structures Report BMS 92, National Bureau of Standards, Washington, 1942.
[2] Ratings for plywood faced panel are based on phenolic resin glue being used for gluing facings to wood frames. If other types of glue are used for this purpose, the ratings apply if the facings are nailed to the frames in addition to being glued.

D-2.5. Solid Plaster Partitions

D-2.5.1. Minimum Thickness

The minimum thickness of solid plaster partitions for fire-resistance ratings from 30 min to 4 h is shown in Table D-2.5.1.

Table D-2.5.1.
Minimum Thickness of Non-Loadbearing Solid Plaster Partitions, mm

Type of Plaster on Metal Lath[1]	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Portland cement-sand[2] or Portland cement-lime-sand	50[3]	—	—	—	—	—	—
Gypsum-sand	50[3]	50[3]	64	—	—	—	—
Gypsum-vermiculite, gypsum-perlite, Portland cement-vermiculite or Portland cement-perlite	50[3]	50[3]	50[3]	58	64	83	102

Notes to Table D-2.5.1.:
[1] Metal lath shall be expanded metal lath or welded woven wire fabric supported on 19 mm vertical light steel studs spaced not more than 600 mm o.c. Plaster shall be applied to both sides of the lath.
[2] For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).
[3] CSA A82.30-M, "Interior Furring, Lathing and Gypsum Plastering," does not permit solid plaster partitions less than 50 mm thick.

D-2.6. Protected Steel Columns

D-2.6.1. Minimum Thickness of Protective Covering

The minimum thickness of protective covering to steel columns is shown in Tables D-2.6.1.-A to D-2.6.1.-F for fire-resistance ratings from 30 min to 4 h.

Table D-2.6.1.-A
Minimum Thickness of Concrete or Masonry Protection to Steel Columns, mm

Description of Cover	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Monolithic concrete							
Type S concrete[1] (column spaces filled)[2]	25	25	25	25	39	64	89
Type N or L concrete[1] (column spaces filled)[2]	25	25	25	25	32	50	77
Concrete masonry units[3] or precast reinforced concrete units							
Type S concrete (column spaces not filled)	50	50	50	50	64	89	115
Type N or L concrete (column spaces not filled)	50	50	50	50	50	77	102
Clay or shale brick[4] (column spaces filled)[2]	50	50	50	50	50	64	77
Clay or shale brick[4] (column spaces not filled)	50	50	50	50	50	77	102
Hollow clay tile[5] (column spaces filled)[2]	50[6]	50[6]	50[6]	50[6]	[7]	[7]	[7]
Hollow clay tile[5] (column spaces not filled)	50[6]	50[6]	50[6]	—	—	—	—

Notes to Table D-2.6.1.-A:
[1] Applies to cast-in-place concrete reinforced with 5.21 mm diam wire wrapped around column spirally 200 mm o.c., or 1.57 mm diam wire mesh with 100 mm by 100 mm openings.
[2] The space between the protective covering and the web or flange of the column shall be filled with concrete, cement mortar or a mixture of cement mortar and broken bricks.
[3] Concrete masonry shall be reinforced with 5.21 mm diam wire or wire mesh with 1.19 mm diam wire and 10 mm by 10 mm openings, laid in every second course.
[4] Brick cover 77 mm thick or less shall be reinforced with 2.34 mm diam wire or 1.19 mm diam wire mesh with 10 mm by 10 mm openings, laid in every second course.
[5] Hollow clay tiles and masonry mortar shall be reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings, laid in every horizontal joint and lapped at corners.
[6] Hollow clay tiles shall conform to CAN/CSA-A82, "Fired masonry brick made from clay or shale."

(7) 50 mm nominal hollow clay tile, reinforced with 1.19 mm diam wire mesh with 10 mm by 10 mm openings laid in every horizontal joint and covered with 19 mm gypsum-sand plaster and with limestone concrete fill in column spaces, has a 4 h fire-resistance rating.

Table D-2.6.1.-B
Minimum Thickness of Plaster Protection to Steel Columns, mm

Description	Fire-Resistance Rating(1)(2)						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Gypsum-sand plaster on 9.5 mm gypsum lath(3)	13	13	13	20	—	—	—
Gypsum-perlite or vermiculite plaster on 9.5 mm gypsum lath(3)	13	13	13	20	25	—	—
Gypsum perlite or vermiculite plaster on 12.7 mm gypsum lath(3)	13	13	13	20	25	32	50
Gypsum perlite or vermiculite plaster on double 12.7 mm gypsum lath(3)	13	13	13	20	25	25	32
Portland cement-sand plaster on metal lath(4)(5)	25	25	25	—	—	—	—

Notes to Table D-2.6.1.-B:
(1) Fire-resistance ratings of 30 min and 45 min apply to columns whose M/D ratio is 30 or greater. Fire-resistance ratings greater than 45 min apply to columns whose M/D ratio is greater than 60. Where the M/D ratio is between 30 and 60 and the required fire-resistance rating is greater than 45 min, the total thickness of protection specified in the Table shall be increased by 50%. (To determine M/D, refer to Article D-2.6.4.)
(2) Where the thickness of plaster over gypsum lath is 25 mm or more, wire mesh with 1.57 mm diam wire and openings not exceeding 50 mm by 50 mm shall be placed midway in the plaster.
(3) Lath held in place by 1.19 mm diam wire wrapped around lath 450 mm o.c.
(4) Expanded metal lath 1.36 kg/m^2 fastened to 9.5 mm by 19 mm steel channels held in vertical position around column by 1.19 mm diam wire ties.
(5) For mixture of Portland cement-sand plaster, see Sentence D-1.7.2.(2).

Table D-2.6.1.-C
Minimum Thickness of Gypsum-Sand Plaster on Metal Lath Protection to Steel Columns, mm

M/D(1)	Fire-Resistance Rating					
	30 min	45 min	1 h	1.5 h	2 h	3 h
30 to 60	16	16	32	—	—	—
over 60 to 90	16	16	16	32	—	—
over 90 to 120	16	16	16	25	39	—
over 120 to 180	16	16	16	16	25	—
over 180	16	16	16	16	25	39

Notes to Table D-2.6.1.-C:
(1) To determine the M/D ratio, refer to Article D-2.6.4.

Table D-2.6.1.-D
Minimum Thickness of Gypsum-Perlite or Gypsum-Vermiculite Plaster on Metal Lath Protection to Steel Columns, mm

M/D(1)	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
30 to 60	16	16	20	32	35	—	—
over 60 to 90	16	16	16	20	26	35	45
over 90 to 120	16	16	16	16	26	35	45
over 120 to 180	16	16	16	16	20	32	35
over 180	16	16	16	16	16	26	35

Notes to Table D-2.6.1.-D:
(1) To determine the M/D ratio, refer to Article D-2.6.4.

Table D-2.6.1.-E
Steel Columns with Sheet-Steel Membrane and Insulation as Shown in Figures D-2.6.1.-A and D-2.6.1.-B

Type of Protection	Steel Thickness,(1) mm	Fastening(2)	Insulation	Fire-Resistance Rating
See Figure D-2.6.1.-A	0.51	No. 8 sheet-metal screws 9.5 mm long, 200 mm o.c.	50 mm mineral wool batts(3)	45 min
See Figure D-2.6.1.-B	0.64	Self-threading screws or No. 8 sheet-metal screws, 600 mm o.c.	2 layers 12.7 mm gypsum board	1.5 h
See Figure D-2.6.1.-A	0.64	No. 8 sheet-metal screws, 9.5 mm long 200 mm o.c.	75 mm mineral wool batts,(3) 12.7 mm gypsum board	2 h
See Figure D-2.6.1.-B	0.76	Crimped joint or No. 8 sheet-metal screws, 300 mm o.c.	2 layers 15.9 mm gypsum board	2 h

Notes to Table D-2.6.1.-E:
(1) Minimum thickness, galvanized or wiped-zinc-coated sheet-steel.
(2) Sheet-steel shall be securely fastened to the floor and superstructure, or where sheet-steel cover does not extend floor to floor, firestopping shall be provided at the level where sheet-steel protection ends. In the latter case, an alternate type of fire protection shall be applied between the firestopping and the superstructure.
(3) Conforming to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification," Type 1A, minimum density 30 kg/m^3: column section and batts wrapped with 25 mm mesh chicken wire.

Table D-2.6.1.-F
Minimum M/D Ratio for Steel Columns Covered with Type X Gypsum Board Protection(1)

Minimum Thickness of Type X Gypsum Board Protection,(2) mm	Fire-Resistance Rating			
	1 h	1.5 h	2 h	3 h
12.7	75	—	—	—
15.9	55	—	—	—
25.4	35	60	—	—
28.6	35	50	—	—
31.8	35	40	75	—
38.1	35	35	55	—
41.3	35	35	45	—
44.5	35	35	35	—
47.6	35	35	35	—
50.8	35	35	35	75
63.5	35	35	35	45

Notes to Table D-2.6.1.-F:
(1) To determine the M/D ratio, refer to Article D-2.6.4.
(2) See Article D-2.6.5.

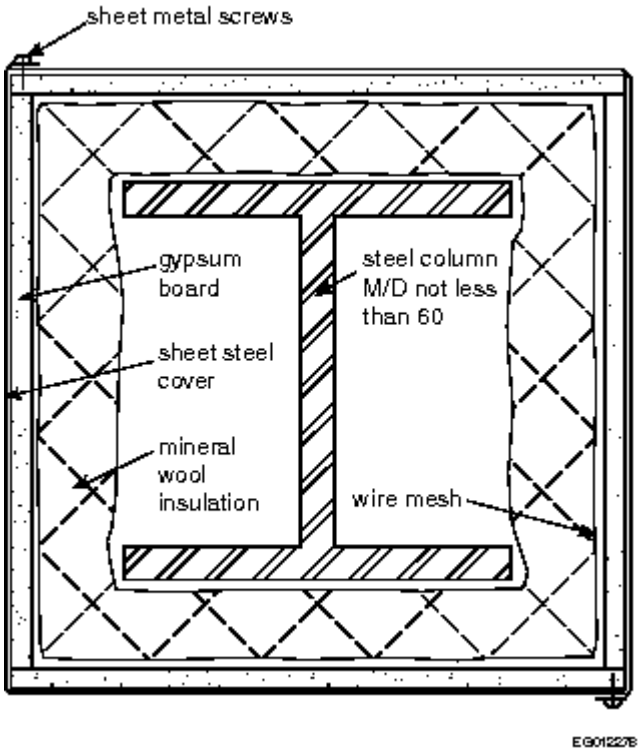


Figure D-2.6.1.-A
Column protected by sheet-steel membrane and mineral-wool insulation

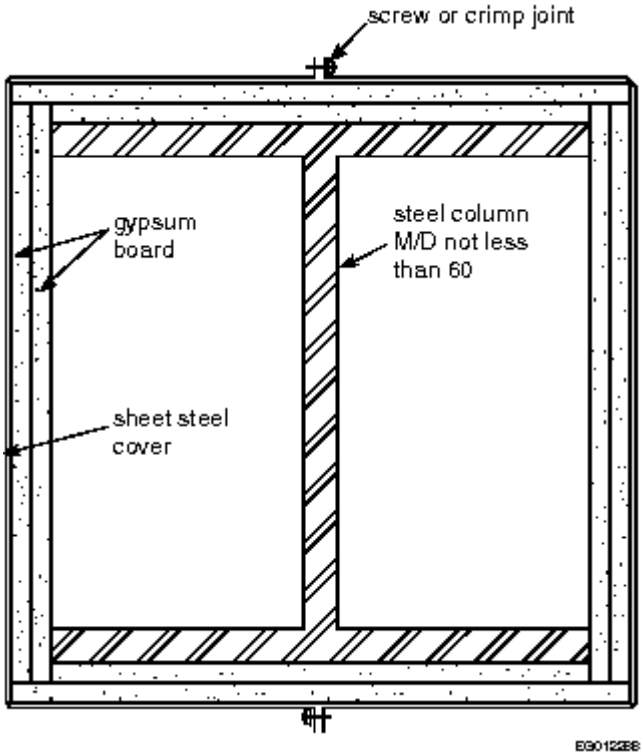


Figure D-2.6.1.-B

Column protected by sheet-steel membrane and gypsum board

D-2.6.2. Hollow Unit Masonry Columns

For hollow-unit masonry column protection, the thickness shown in Tables D-2.6.1.-A to D-2.6.1.-D is the equivalent thickness as described in Subsection D-1.6.

D-2.6.3. Effect of Plaster

The effect on fire-resistance ratings of the addition of plaster to masonry and monolithic concrete column protection is described in Subsection D-1.7.

D-2.6.4. Determination of M/D Ratio

1) The ratio M/D to which reference is made in Tables D-2.6.1.-B, D-2.6.1.-C, D-2.6.1.-D and D-2.6.1.-F shall be found by dividing "M," the mass of the column in kilograms per metre by "D," the heated perimeter of the steel column section in metres.

2) The heated perimeter "D" of steel columns, shown as the dashed line in Figure D-2.6.4.-A, shall be equal to 2 (B+H) in Examples (1) and (2), and 3.14B in Example (3). In Figure D-2.6.4.-B, the heated perimeter "D" shall be equal to 2 (B+H).

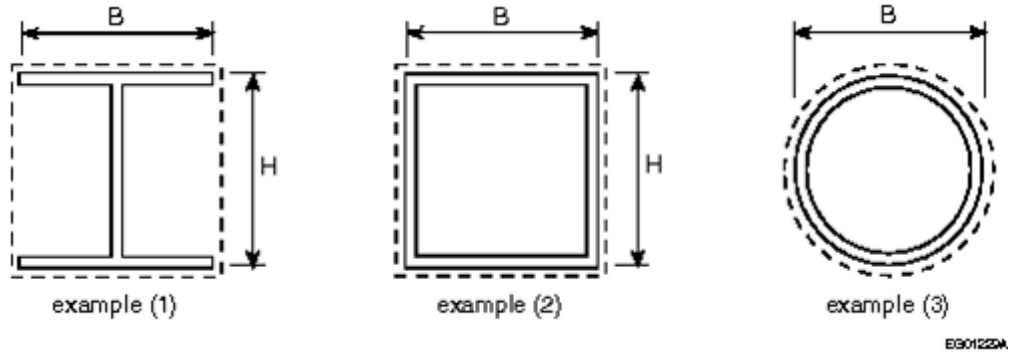


Figure D-2.6.4.-A

Example (1), standard or wide-flange beam; Example (2), hollow structural section (rectangular or square); Example (3), hollow structural section (round)

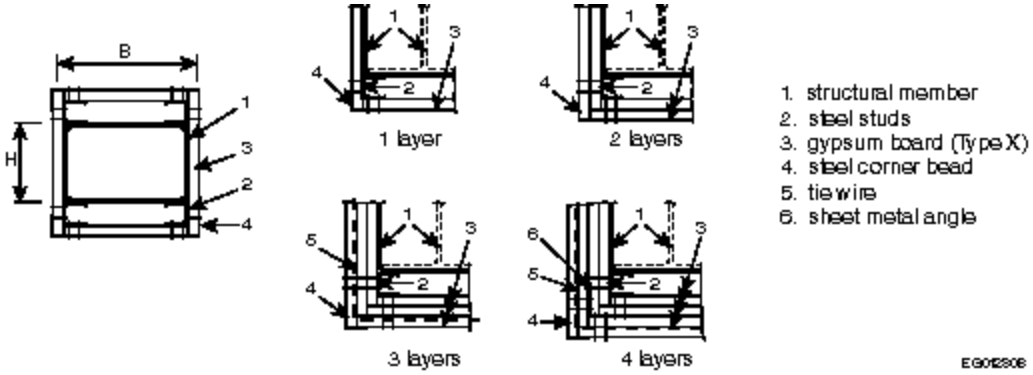


Figure D-2.6.4.-B

Columns protected by Type X gypsum board without sheet-steel membrane

D-2.6.5. Attachment of Gypsum Board

1) Where Type X gypsum board is used to protect a steel column without an outside sheet-steel membrane, the method of gypsum board attachment to the column shall be as shown in Figure D-2.6.4.-B and shall meet the construction details described in Sentences (2) to (7).

2) The Type X gypsum board shall be applied vertically without horizontal joints.

3) The first layer of gypsum board shall be attached to steel studs with screws spaced not more than 600 mm o.c. and other layers of gypsum board shall be attached to steel studs and steel corner beads with screws spaced at a maximum of 300 mm o.c. Where a single layer of gypsum board is used, attachment screws shall be spaced not more than 300 mm o.c.

4) Steel tie wires spaced at a maximum of 600 mm o.c. shall be used to secure the second last layer of gypsum board in 3- and 4-layer systems.

5) Studs shall be fabricated of galvanized steel not less than 0.53 mm thick and not less than 41.3 mm wide, with legs not less than 33.3 mm long and shall be 12.7 mm less than the assembly height.

6) Corner beads shall

a) be fabricated of galvanized steel that is not less than 0.41 mm thick,

b) have legs not less than 31 mm long,

c) be attached to the gypsum board or stud with 25.4 mm screws spaced not more than 300 mm o.c., and

d) have the attaching fasteners penetrate either another corner bead in multiple layer assemblies or the steel stud member.

7) In a 4-layer system, metal angles shall be fabricated of galvanized steel and shall be not less than 0.46 mm thick with legs not less than 51 mm long.

D-2.6.6. Concrete Filled Hollow Steel Columns

1) A fire-resistance rating, R, is permitted to be assigned to concentrically loaded hollow steel columns that are filled with plain concrete, steel-fibre reinforced concrete or bar-reinforced concrete, that are fabricated and erected within the tolerances stipulated in CSA S16, "Design of steel structures," and that comply with Sentences (2) and (3), provided:

$$C \leq C_{max}$$

where

C = axial compressive force due to dead and live loads without load factors, kN,

$$C_{max} = \left(\frac{a(f'_c + 20)D^{2.5}}{R(KL - 1000)}\right)^2$$

but shall not exceed

a) 1.0 C'_r for plain concrete filling (PC),

b) 1.1 C'_r for steel-fibre reinforced concrete filling (FC), and

c) 1.7 C'_r for bar-reinforced concrete filling (RC),

where

$$C'_r = 0.85\phi_c f'_c A_c \lambda_c^{-2}\left[\sqrt{1 + 0.25\lambda_c^{-4}} - 0.5\lambda_c^{-2}\right]$$

where

a = constant obtained from Table D-2.6.6.-A,

f'_c = specified compressive strength of concrete in accordance with CSA A23.3, "Design of concrete structures," MPa,

r_c = radius of gyration of the concrete area,

A_c = area of concrete, mm^2,

D = outside diameter of a round column or outside width of a square column, mm,

E_c = initial elastic modulus for concrete, considering the effects of long-term loading for normal-weight concrete = $\left(1 + \frac{S}{T}\right)2500\sqrt{f'_c}$, where f'_c is expressed in MPa, S is the short-term load, and T is the total load on the column,

R = specified fire-resistance rating, min,

KL = effective length of column as defined in CSA S16, "Design of steel structures," mm,

$$\lambda_c = \frac{KL}{r_c}\sqrt{\frac{f'_c}{\pi^2 E_c}}, \text{ and}$$

φ_c = 0.60

subject to the validity limits stated in Table D-2.6.6.-B.

Table D-2.6.6.-A
Values of Constant "a"

Filling Type	Concrete Type(1)	Steel Reinforcement	Circular Columns	Square Columns
PC	S	n/a	0.070	0.060
FC	S	≈ 2%	0.075	0.065
RC	S	1.5%-3%	0.080	0.070
RC	S	3%-5%	0.085	0.075
PC	N	n/a	0.080	0.070
FC	N	≈ 2%	0.085	0.075
RC	N	1.5%-3%	0.090	0.080
RC	N	3%-5%	0.095	0.085

Notes to Table D-2.6.6.-A:
(1) See Subsection D-1.4.

2) A pair of steam vent holes shall be provided at each end of the hollow steel column and at each intermediate floor level, and the holes shall be

a) not less than 13 mm in diameter,

b) located on opposite faces, 150 mm above or below a base plate, cap plate or concrete slab,

c) orientated so that adjacent pairs are perpendicular, and

d) not obstructed by other building elements.

3) Load application and reaction shall be through end bearing in accordance with CSA S16, "Design of steel structures."

Table D-2.6.6.-B
Validity Limits

Parameter	Type of Concrete Filling		
	PC	FC	RC
f'_c(MPa)	20 to 40	20 to 55	20 to 55
D (round) (mm)	140 to 410	140 to 410	165 to 410
D (square) (mm)	140 to 305	102 to 305	175 to 305
Reinforcement (%)	n/a	≈ 2% of the concrete mix by mass	1.5% to 5% of cross-sectional area(1)
Concrete Cover (mm)	n/a	n/a	≥ 25
R (min)	≤ 120	≤ 180	≤ 180

KL (mm)	2 000 to 4 000	2 000 to 4 500	2 000 to 4 500
Class[2]	1, 2 or 3	1, 2 or 3	1, 2 or 3

Notes to Table D-2.6.6.-B:
[1] Limits on size, number and spacing of bars and ties in accordance with CSA A23.3, "Design of concrete structures."
[2] Classification of sections in accordance with CSA S16, "Design of steel structures."

D-2.7. Individually Protected Steel Beams

D-2.7.1. Minimum Thickness of Protective Covering

The minimum thickness of protective covering on steel beams exposed to fire on 3 sides for fire-resistance ratings from 30 min to 4 h is shown in Table D-2.7.1.

Table D-2.7.1.
Minimum Thickness of Cover to Individual Protected Steel Beams, mm(1)

Description of Cover	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S concrete[2] (beam spaces filled solid)	25	25	25	25	32	50	64
Type N or L concrete[2] (beam spaces filled solid)	25	25	25	25	25	39	50
Gypsum-sand plaster on 9.5 mm gypsum lath[3]	13	13	13	20	—	—	—
Gypsum-perlite or vermiculite plaster on 9.5 mm gypsum lath[3]	13	13	13	13	25	—	—
Gypsum-perlite or gypsum-vermiculite on 12.7 mm gypsum lath[3]	13	13	13	20	25	39	50
Gypsum-perlite or vermiculite plaster on double 12.7 mm gypsum lath[3]	13	13	13	20	25	25	39
Portland cement-sand on metal lath[4]	23	23	23	—	—	—	—
Gypsum-sand on metal lath[4] (plaster in contact with lower flange)	16	20	25	39	—	—	—
Gypsum-sand on metal lath with air gap between plaster and lower flange[4]	16	16	16	25	25	—	—
Gypsum-perlite or gypsum-vermiculite on metal lath[4]	16	16	16	23	23	35	48[5]

Notes to Table D-2.7.1.:
[1] Where the thickness of plaster finish applied over gypsum lath is 26 mm or more, the plaster shall be reinforced with wire mesh with 1.57 mm diam wire and 50 mm by 50 mm openings placed midway in the plaster.
[2] Applies to cast-in-place concrete reinforced by 5.21 mm diam wire spaced 200 mm o.c. or 1.57 mm diam wire mesh with 100 mm by 100 mm openings.
[3] Lath held in place by 1.18 mm diam wire wrapped around the gypsum lath 450 mm o.c.
[4] Expanded metal lath 1.63 kg/m^2 fastened to 9.5 mm by 19 mm steel channels held in position by 1.19 mm diam wire.
[5] Plaster finish shall be reinforced with wire mesh with 1.57 mm diam wire and 50 mm by 50 mm openings placed midway in the plaster.

D-2.7.2. Types of Concrete

Concrete is referred to as Type S, N or L, depending on the nature of the aggregate used. This is described in Article D-1.4.1.

D-2.7.3. Effect of Plaster

The effect on fire-resistance ratings of the addition of plaster finish to concrete or masonry beam protection is described in Article D-1.7.1.

D-2.7.4. Exceptions

The fire resistance of protected steel beams depends on the means used to hold the protection in place. Because of the importance of this factor, no rating has been assigned in Table D-2.7.1. to masonry units used as protective cover to steel beams. These ratings, however, may be determined on the basis of comparison with column protection at the discretion of the authority having jurisdiction, if satisfactory means of fastening are provided.

D-2.7.5. Beam Protected by a Membrane

A steel beam or steel joist assembly that is entirely above a horizontal ceiling membrane will be protected from fire below the membrane and will resist structural collapse for a period equal to the fire-resistance rating determined in conformance with Subsection D-2.3. The support for this membrane shall be equivalent to that described in Subsection D-2.3. The rating on this basis shall not exceed 1.5 h.

D-2.8. Reinforced Concrete Columns

D-2.8.1. Minimum Dimensions

Minimum dimensions for reinforced concrete columns and minimum concrete cover for vertical steel reinforcement are obtained from Articles D-2.8.2. to D-2.8.5., taking into account the type of concrete, the effective length of the column and the area of the vertical reinforcement.

D-2.8.2. Method

1) The minimum dimension, t, in millimetres, of a rectangular reinforced concrete column shall be equal to

a) 75 f (R + 1) for all Types L and L40S concrete,

b) 80 f (R + 1) for Type S concrete when the design condition of the concrete column is defined in the second and fourth columns of Table D-2.8.2.,

c) 80 f (R + 0.75) for Type N concrete when the design condition of the concrete column is defined in the second and fourth columns of Table D-2.8.2., and

d) 100 f (R + 1) for Types S and N concrete when the design condition of the concrete column is defined in the third column of Table D-2.8.2.

where

f = the value shown in Table D-2.8.2.,

R = the required fire-resistance rating in hours,

k = the effective length factor obtained from CSA A23.3, “Design of concrete structures,”

h = the unsupported length of the column in metres, and

p = the area of vertical reinforcement in the column as a percentage of the column area.

2) The diameter of a round column shall be not less than 1.2 times the value t determined in Sentence (1) for a rectangular column.

Table D-2.8.2.
Values of Factor f(1)

Overdesign Factor(2)	Values of Factor f to be Used in Applying Article D-2.8.2.		
	Where kh is not more than 3.7 m	Where kh is more than 3.7 m but not more than 7.3 m	
		t is not more than 300 mm, p is not more than 3%(3)	All other cases(4)
1.00	1.0	1.2	1.0
1.25	0.9	1.1	0.9
1.50	0.83	1.0	0.83

Notes to Table D-2.8.2.:
(1) For conditions that do not fall within the limits described in Table D-2.8.2., further information may be obtained from Reference (7) in Subsection D-7.1.

(2) Overdesign factor is the ratio of the calculated load carrying capacity of the column to the column strength required to carry the specified loads determined in conformance with CSA A23.3, "Design of concrete structures."
(3) Where the factor f results in a t greater than 300 mm, the appropriate factor f for "All other cases" shall be applicable.
(4) Where p is equal to or less than 3% and the factor f results in a t less than 300 mm, the minimum thickness shall be 300 mm.

D-2.8.3. Minimum Thickness of Concrete Cover

1) Where the required fire-resistance rating of a concrete column is 3 h or less, the minimum thickness in millimetres of concrete cover over vertical steel reinforcement shall be equal to 25 times the number of hours of fire resistance required or 50 mm, whichever is less.

2) Where the required fire-resistance rating of a concrete column is greater than 3 h, the minimum thickness in millimetres of concrete cover over vertical steel reinforcement shall be equal to 50 plus 12.5 times the required number of hours of fire resistance in excess of 3 h.

3) Where the concrete cover over vertical steel required in Sentence (2) exceeds 62.5 mm, wire mesh reinforcement with 1.57 mm diameter wire and 100 mm openings shall be incorporated midway in the concrete cover to retain the concrete in position.

D-2.8.4. Minimum Requirements

The structural design standards may require minimum column dimensions or concrete cover over vertical steel reinforcement differing from those obtained in Sentences D-2.8.2.(1) and D-2.8.2.(2). Where a difference occurs, the greater dimension shall govern.

D-2.8.5. Addition of Plaster

The addition of plaster finish to the concrete column may be taken into account in determining the cover over vertical steel reinforcement by applying the multiplying factors described in Subsection D-1.7. The addition of plaster shall not, however, justify any decrease in the minimum column sizes shown.

D-2.8.6. Built-in Columns

The fire-resistance rating of a reinforced concrete column that is built into a masonry or concrete wall so that not more than one face may be exposed to the possibility of fire at one time may be determined on the basis of cover to vertical reinforcing steel alone. In order to meet this condition, the wall shall conform to Subsection D-2.1. for the fire-resistance rating required.

D-2.9. Reinforced Concrete Beams

D-2.9.1. Minimum Cover Thickness

The minimum thickness of cover over principal steel reinforcement in reinforced concrete beams is shown in Table D-2.9.1. for fire-resistance ratings from 30 min to 4 h where the width of the beam or joist is at least 100 mm.

Table D-2.9.1.
Minimum Cover to Principal Steel Reinforcement in Reinforced Concrete Beams, mm

Type of Concrete	Fire-Resistance Rating						
	30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S, N or L	20	20	20	25	25	39	50

D-2.9.2. Maximum Rating

No rating over 2 h may be assigned on the basis of Table D-2.9.1. to a beam or joist where the average width of the part that projects below the slab is less than 140 mm, and no rating over 3 h may be assigned where the average width of the part that projects below the slab is less than 165 mm.

D-2.9.3. Beam Integrated in Floor or Roof Slab

For the purposes of these ratings, a beam may be either independent of or integral with a floor or roof slab assembly.

D-2.9.4. Minimum Thickness

Where the upper extension or top flange of a joist or T-beam in a floor assembly contributes wholly or partly to the thickness of the slab above, the total thickness at any point shall be not less than the minimum thickness described in Table D-2.2.1.-A for the fire-resistance rating required.

D-2.9.5. Effect of Plaster

The addition of plaster finish to a reinforced concrete beam may be taken into account in determining the cover over principal reinforcing steel by applying the multiplying factors described in Subsection D-1.7.

D-2.10. Prestressed Concrete Beams

D-2.10.1. Minimum Cross-Sectional Area and Thickness of Cover

The minimum cross-sectional area and thickness of concrete cover over steel tendons in prestressed concrete beams for fire-resistance ratings from 30 min to 4 h are shown in Table D-2.10.1.

Table D-2.10.1.
Minimum Thickness of Concrete Cover over Steel Tendons in Prestressed Concrete Beams, mm(1)

Type of Concrete	Area of Beam, cm^2	Fire-Resistance Rating						
		30 min	45 min	1 h	1.5 h	2 h	3 h	4 h
Type S or N	260 to 970	25	39	50	64	—	—	—
	Over 970 to 1 940	25	26	39	45	64	—	—
	Over 1 940	25	26	39	39	50	77	102
Type L	Over 970	25	25	25	39	50	77	102

Notes to Table D-2.10.1.:
(1) Where the thickness of concrete cover over the tendons exceeds 64 mm, a wire mesh reinforcement with 1.57 mm diam wire and 100 mm by 100 mm openings shall be incorporated in the beams to retain the concrete in position around the tendons. The mesh reinforcement shall be located midway in the cover.

D-2.10.2. Minimum Cover Thickness

The cover for an individual tendon shall be the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouted ducts the assumed cover thickness shall be the minimum thickness of concrete between the surface of the duct and the surface of the beam. For beams in which several tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. The cover for any individual tendon shall be not less than half the value given in Table D-2.10.1. nor less than 25 mm.

D-2.10.3. Applicability of Ratings

The ratings in Table D-2.10.1. apply to a beam that is either independent of or integral with a floor or roof slab assembly. Minimum thickness of slab and minimum cover to steel tendons in prestressed concrete slabs are contained in Subsection D-2.2.

D-2.10.4. Effect of Plaster

The addition of plaster finish to a prestressed concrete beam may be taken into account in determining the cover over steel tendons by applying the multiplying factors described in Subsection D-1.7.

D-2.10.5. Minimum Cover

1) Except as provided in Sentence (2), in unbonded post-tensioned prestressed concrete beams, the concrete cover to the tendon at the anchor shall be not less than 15 mm greater than the minimum required away from the anchor. The concrete cover to the anchorage bearing plate and to the end of the tendon, if it projects beyond the bearing plate, shall be not less than 25 mm.

2) The requirements in Sentence (1) do not apply to those portions of beams not likely to be exposed to fire (such as the ends and the tops of flanges of beams immediately below slabs).

D-2.11. Mass Timber Elements

D-2.11.1. Determination of Ratings

1) The calculation methods described in this Subsection are intended to be used to determine fire-resistance ratings for structural mass timber elements on the basis of the elements being subjected to the standard fire exposure conditions described in CAN/ULC-S101, “Standard Method of Fire Endurance Tests of Building Construction and Materials.”

2) Loadbearing mass timber members, such as beams and columns, subjected to the conditions described in Sentence (1) are assigned a fire-resistance rating that relates to the time at which the applied load is no longer sustained.

3) Mass timber wall, floor and roof assemblies subjected to the conditions described in Sentence (1) are assigned a fire-resistance rating that relates to the lesser of the times at which

a) an average temperature rise of 140°C or a maximum temperature rise of 180°C at any individual location is recorded on the unexposed side of the assembly,

b) there is passage of flame or gases hot enough to ignite cotton pads through the unexposed side of the assembly, or

c) the applied load is no longer sustained, where the assembly is loadbearing.

D-2.11.2. Applicability of Calculation Methods

1) Method A described in Article D-2.11.3. applies to glued-laminated timber beams and columns required to have fire-resistance ratings greater than those afforded under the provisions of Article 3.1.4.6.

2) Method B described in Article D-2.11.4. applies to mass timber elements, including solid sawn timber and glued-laminated timber beams and columns, required to have fire-resistance ratings greater than those afforded under the provisions of Article 3.1.4.6.

3) The calculation methods described in Articles D-2.11.3. and D-2.11.4. are separate and independent methods that use different approaches to determine fire-resistance ratings for mass timber elements.

D-2.11.3. Method A for Glued-Laminated Timber Beams and Columns

1) The fire-resistance rating of glued-laminated timber beams and columns in minutes is permitted to be taken as equal to

a) 0.1 fB [4 − 2(B/D)] for beams that may be exposed to fire on 4 sides,

b) 0.1 fB [4 − (B/D)] for beams that may be exposed to fire on 3 sides,

c) 0.1 fB [3 − (B/D)] for columns that may be exposed to fire on 4 sides, and

d) 0.1 fB [3 − (B/2D)] for columns that may be exposed to fire on 3 sides,

where

f = the load factor shown in Figure D-2.11.3.-A,

B = the full dimension of the smaller side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.3.-B],

D = the full dimension of the larger side of a beam or column in millimetres before exposure to fire [see Figure D-2.11.3.-B],

k = the effective length factor obtained from CSA O86, “Engineering design in wood,”

L = the unsupported length of a column in millimetres.

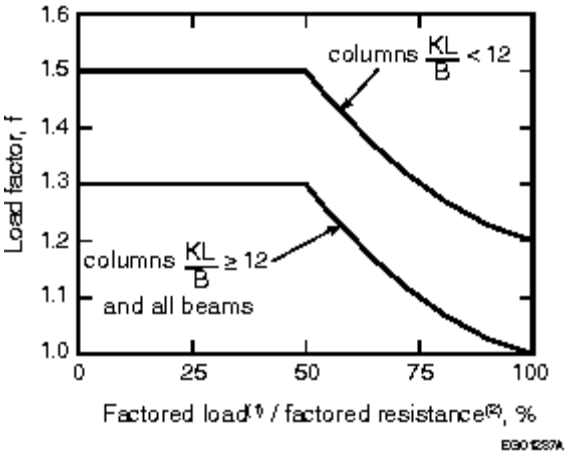


Figure D-2.11.3.-A
Factors to compensate for partially loaded columns and beams

Notes to Figure D-2.11.3.-A:
(1) In the case of beams, use bending moment in place of load.
(2) See Sentence (2).

2) The factored resistance of a beam or column shall be determined by using the specified strengths in CSA O86, "Engineering design in wood."

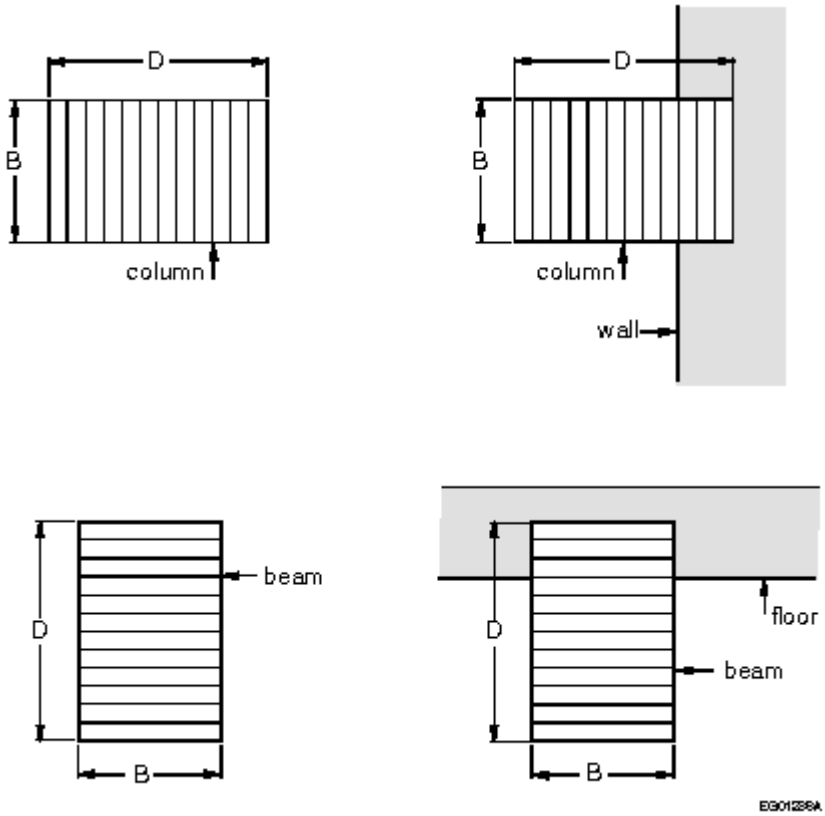


Figure D-2.11.3.-B
Full dimensions of glued-laminated beams and columns

D-2.11.4. Method B for Mass Timber Elements

1) The fire-resistance rating of structural mass timber members, such as beams and columns constructed of glued-laminated timber, solid sawn timber, or structural composite lumber, is permitted to be determined using the calculation method described in Annex B, Fire resistance of large cross-section wood elements, of CSA O86, "Engineering design in wood."

2) Except as provided in Sentences (3) to (6), the fire-resistance rating of mass timber wall, floor and roof assemblies, including those constructed of cross-laminated timber, is permitted to be determined using the calculation method described in Annex B, Fire resistance of large cross-section wood elements, of CSA O86, "Engineering design in wood."

3) Except as provided in Sentence (4), the assemblies described in Sentence (2) shall be protected to maintain the integrity and thermal insulation properties of the assembly for the time period corresponding to the calculated fire-resistance rating as follows:

a) except as provided in Clause (b), for floor and roof assemblies, by applying at least one of the following layers to the unexposed surface of the assembly:

   i) OSB or plywood not less than 12.5 mm thick, with the joints in the layer staggered relative to those in the assembly,

   ii) concrete topping not less than 38 mm thick, or

   iii) gypsum-concrete topping not less than 25 mm thick,

b) for plank decking designed in accordance with Clause B.10 of CSA O86, "Engineering design in wood," by applying at least one of the layers described in Clause B.10.4 of CSA O86 to the unexposed surface of the assembly,

c) for interior wall assemblies, by applying at least one of the following layers to at least one side of the assembly, with the joints in the layer staggered relative to those in the assembly:

   i) OSB or plywood not less than 12.5 mm thick, or

   ii) Type X gypsum board not less than 12.7 mm thick, and

d) for exterior wall assemblies, by applying at least one of the following layers to at least one side of the assembly, with the joints in the layer staggered relative to those in the assembly:

   i) OSB or plywood not less than 12.5 mm thick,

   ii) Type X gypsum board not less than 12.7 mm thick,

   iii) gypsum sheathing not less than 12.7 mm thick applied to the exterior (unexposed) side of the assembly, or

   iv) rock or slag insulation sheathing not less than 50 mm thick applied to the exterior (unexposed) side of the assembly.

4) For wall, floor and roof assemblies constructed of cross-laminated timber, the joints between cross-laminated timber panels in the assembly need not be protected in accordance with Sentence (3), provided the joints are either lapped or splined to maintain the integrity and thermal insulation properties of the assembly for the time period corresponding to the calculated fire-resistance rating. (See Figure D-2.11.4.(4).)

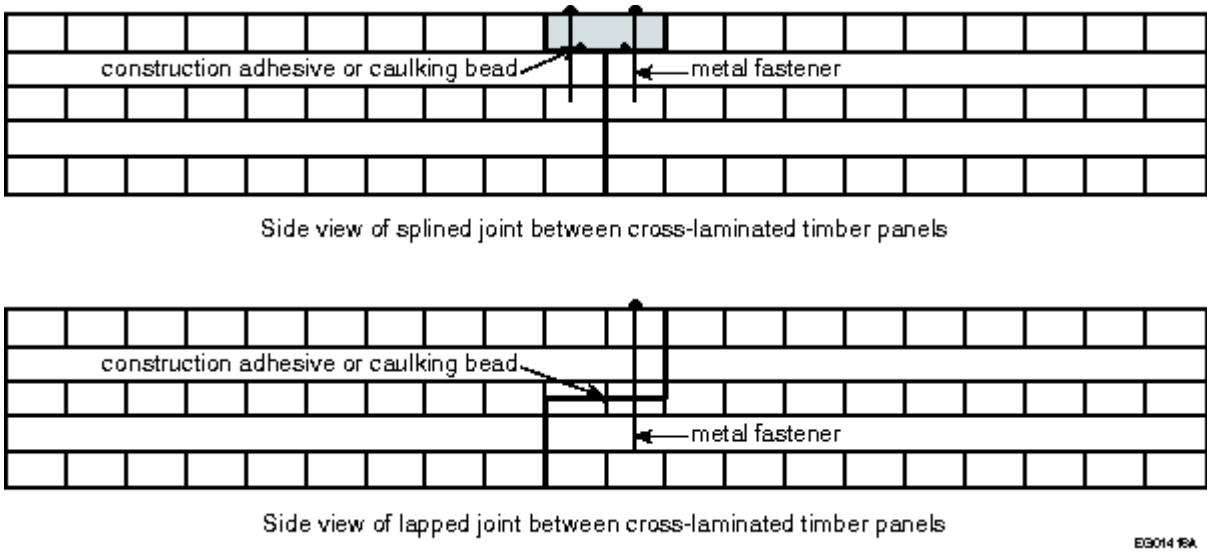


Figure D-2.11.4.(4)
Joints between cross-laminated timber panels in wall, floor and roof assemblies

5) For interior wall assemblies, the additional times assigned in Clause B.8.1 of CSA O86, "Engineering design in wood," shall only be applied to the calculated fire-resistance rating where both sides of the assembly are protected in accordance with Clause B.8 of CSA O86. Where the level of protection differs on the two sides, the additional time corresponding to the lesser level of protection shall be applied.

6) For exterior wall assemblies, the additional times assigned in Clause B.8.1 of CSA O86, "Engineering design in wood," shall only be applied to the calculated fire-resistance rating where

a) the interior (fire-exposed) side of the assembly is protected in accordance with Clause B.8 of CSA O86, and

b) except where the assembly is constructed of cross-laminated timber panels with lapped or splined joints as described in Sentence (4), the exterior (unexposed) side of the assembly is protected in accordance with Clause (3)(d).

Section D-3 Flame-Spread Ratings and Smoke Developed Classifications

D-3.1. Interior Finish Materials

D-3.1.1. Scope of Information

Tables D-3.1.1.-A and D-3.1.1.-B show flame-spread ratings and smoke developed classifications for combinations of some common interior finish materials. The values are based on all the evidence available at present. Many materials have not been included because of lack of test evidence or because of inability to classify or describe the material in generic terms for the purpose of assigning ratings.

Table D-3.1.1.-A
Assigned Flame-Spread Ratings and Smoke Developed Classifications for Combinations of Wall and Ceiling Finish Materials and Surface Coatings(1)

Materials	Applicable Material Standard	Minimum Thickness, mm	Surface Coating	
			Unfinished	Paint or Varnish not more than 1.3 mm Thick, Cellulosic Wallpaper not more than One Layer(2)(3)
Brick, concrete, tile	None	None	0/0	25/50
Steel, copper, aluminum	None	0.33		
Gypsum plaster	CSA A82.22-M	None		
Gypsum board	CAN/CSA A82.27-M	9.5	25/50	25/50
	ASTM C1396/C1396M			
Lumber	None	16	150/300	150/300
Douglas Fir plywood(4)	CSA O121	11	150/100	150/300
Poplar plywood(4)	CSA O153			
Plywood with Spruce face veneer(4)	CSA O151			
Douglas Fir plywood(4)	CSA O121	6	150/100	150/100
Fibreboard low density	CAN/ULC-S706.1	11	X/100	150/100
Particleboard	ANSI A208.1	12.7	150/300	(5)
Waferboard, OSB	CSA O437.0	—	(5)	(5)
	CSA O325	—	(5)	(5)

Notes to Table D-3.1.1.-A:
(1) See Sentence D-1.1.1.(5) for standards used to assign flame-spread ratings and smoke developed classifications.
(2) Flame-spread ratings and smoke developed classifications for paints and varnish are not applicable to shellac and lacquer.
(3) Flame-spread ratings and smoke developed classifications for paints apply only to alkyd and latex paints.
(4) The flame-spread ratings and smoke developed classifications shown are for those plywoods without a cellulose resin overlay.
(5) Insufficient test information available.

Table D-3.1.1.-B
Flame-Spread Ratings and Smoke-Developed Classifications for Combinations of Common Floor Finish Materials and Surface Coatings(1)

Materials	Applicable Standard	FSR/SDC(2)
Hardwood or softwood flooring either unfinished or finished with a spar or urethane varnish coating	None	300/300
Wool carpet (woven), pile weight not less than 1120 g/m^2, applied with or without felt underlay(3)	CAN/CGSB-4.129	300/300
Nylon carpet, pile weight not less than 610 g/m^2 and not more than 800 g/m^2, applied with or without felt underlay(3)	CAN/CGSB-4.129	300/500
Nylon carpet, pile weight not less than 610 g/m^2 and not more than 1355 g/m^2, glued down to concrete	CAN/CGSB-4.129	300/500
Wool/nylon blend carpet (woven) with not more than 20% nylon and pile weight not less than 1120 g/m^2	CAN/CGSB-4.129	300/500

Nylon/wool blend carpet (woven) with not more than 50% wool, pile weight not less than 610 g/m^2 and not more than 800 g/m^2	CAN/CGSB-4.129	300/500
Polypropylene carpet, pile weight not less than 500 g/m^2 and not more than 1200 g/m^2, glued down to concrete	CAN/CGSB-4.129	300/500

Notes to Table D-3.1.1.-B:

(1) Tested on the floor of the tunnel in conformance with provisions of CAN/ULC-S102.2, "Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies."

(2) Flame-Spread Rating/Smoke Developed Classification.

(3) Type 1 or 2 underlay as described in CGSB 4-GP-36M, "Carpet Underlay, Fiber Type."

D-3.1.2. Ratings

The ratings shown in Tables D-3.1.1.-A and D-3.1.1.-B are arranged in groups corresponding to the provisions of this By-law. The ratings apply to materials falling within the general categories indicated.

D-3.1.3. Table Entries

In Tables D-3.1.1.-A and D-3.1.1.-B, the first number of each entry relates to flame spread and the second number to smoke developed limit. For example:

25/50 represents a flame-spread rating of 0 to 25 and a smoke developed classification of 0 to 50,

150/300 represents a flame-spread rating of 75 to 150 and a smoke developed classification of 100 to 300, and

X/X applied to walls and ceilings means a flame-spread rating over 150 and a smoke developed classification over 300.

D-3.1.4. Effect of Surface Coatings

Thin surface coatings can modify flame-spread characteristics either upward or downward. Table D-3.1.1.-A includes a number of thin coatings that increase the flame-spread rating of the base material, so that these may be considered where more precise control over flame-spread hazard is desired.

D-3.1.5. Proprietary Materials

1) Information on flame-spread rating of proprietary materials and fire-retardant treatments that cannot be described in sufficient detail to ensure reproducibility is available through the listing and labeling services of ULC Standards, Intertek Testing Services NA Ltd., or other recognized testing laboratory.

2) A summary of flame-spread test results published prior to 1965 has been prepared by NRC (see Item (1) in Subsection D-7.1.).

D-3.1.6. Limitations and Conditions

1) The propagation of flame along a surface in the standard test involves some finite depth of the material or materials behind the surface, and this involvement extends to the depth to which temperature variations are to be found during the course of the test; for many commonly used lining materials, such as wood, the depth involved is about 25 mm.

2) For all the combustible materials described in Table D-3.1.1.-A, a minimum dimension is shown, and this represents the thickness of the test samples on which the rating has been based; when used in greater thicknesses than that shown, these materials may have a slightly lower flame-spread rating, and thinner specimens may have higher flame-spread ratings.

3) No rating has been included for foamed plastic materials because it is not possible at this time to identify these products with sufficient accuracy on a generic basis. Materials of this type that melt when exposed to the test flame generally show an increase in flame-spread rating as the thickness of the test specimen increases.

D-3.1.7. Referenced Standards

In Tables D-3.1.1.-A and D-3.1.1.-B, the standards applicable to the materials described are noted because the ratings depend on conformance with these specifications.

Section D-4 Noncombustibility

D-4.1. Test Method

D-4.1.1. Determination of Noncombustibility

1) Noncombustibility is required of certain components of buildings by the provisions of this By-law, which specifies noncombustibility by reference to CAN/ULC-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials."

2) The test to which reference is made in Sentence (1) is severe, and it may be assumed that any building material containing even a small proportion of combustibles will itself be classified as combustible. The specimen, 38 mm by 51 mm, is exposed to a temperature of 750°C in a small furnace. The essential criteria for noncombustibility are that the specimen does not flame or contribute to temperature rise.

D-4.2. Materials Classified as Combustible

D-4.2.1. Combustible Materials

Most materials from animal or vegetable sources will be classed as combustible by CAN/ULC-S114, "Standard Method of Test for Determination of Non-Combustibility in Building Materials," and wood, wood fibreboard, paper, felt made from animal or vegetable fibres, cork, plastics, asphalt and pitch would therefore be classed as combustible.

D-4.2.2. Composite Materials

Materials that consist of combustible and noncombustible elements in combination will in many cases also be classed as combustible, unless the proportion of combustibles is very small. Some mineral wool insulations with combustible binder, cinder concrete, cement and wood chips and wood-fibred gypsum plaster would also be classed as combustible.

D-4.2.3. Effect of Chemical Additives

The addition of a fire-retardant chemical is not sufficient to change a combustible product to a noncombustible product.

D-4.3. Materials Classified as Noncombustible

D-4.3.1. Typical Examples

Noncombustible materials include brick, ceramic tile, concrete made from Portland cement with noncombustible aggregate, plaster made from gypsum with noncombustible aggregate, metals commonly used in buildings, glass, granite, sandstone, slate, limestone and marble.

Section D-5 Protection of Openings in Fire-Rated Assemblies

D-5.1. Scope

D-5.1.1. Installation Information

1) The information in this Section specifies requirements for the installation of fire doors and fire dampers in gypsum-board-protected stud wall assemblies.

D-5.2. Installation of Fire Doors and Fire Dampers

D-5.2.1. References

1) Fire doors and fire dampers in gypsum-board-protected steel stud non-loadbearing walls required to have a fire-resistance rating shall be installed in conformance with Section 9.24. and the applicable requirements of NFPA 80, "Standard for Fire Doors and Other Opening Protectives."

2) Fire doors and fire dampers in gypsum-board-protected wood stud walls required to have a fire-resistance rating shall be installed in conformance with Section 9.23. and the applicable requirements of NFPA 80, "Standard for Fire Doors and Other Opening Protectives."

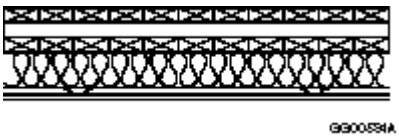
Section D-6 Fire Performance of Exterior Wall Assemblies

D-6.1. Scope

D-6.1.1. Exterior Wall Assemblies

Table D-6.1.1. shows construction specifications for exterior wall assemblies that are deemed to satisfy the criteria of Clause 3.1.5.5.(1)(b) when tested in accordance with CAN/ULC-S134, "Standard Method of Fire Test of Exterior Wall Assemblies."

Table D-6.1.1.
Construction Specifications for Exterior Wall Assemblies that Are Deemed to Satisfy the Criteria of Clause 3.1.5.5.(1)(b) when Tested in Accordance with CAN/ULC-S134

Wall Number	Structural Members	Absorptive Material	Sheathing	Cladding	Design
EXTW-1	38 mm × 89 mm wood studs spaced at 400 mm o.c.(1)(2)	89 mm thick rock or slag fibre in cavities formed by studs(3)(4)	—	12.7 mm thick fire-retardant-treated plywood siding(5)	
EXTW-2	38 mm × 140 mm wood studs spaced at 400 mm o.c.(1)(2)	140 mm thick rock or slag fibre in cavities formed by studs(3)(4)	Gypsum sheathing ≥ 12.7 mm thick	Noncombustible exterior cladding	
EXTW-3	38 mm × 140 mm wood studs spaced at 400 mm o.c.(1)(2)	140 mm thick rock or slag fibre in cavities formed by studs(3)(4)	15.9 mm thick fire-retardant-treated plywood(6)	Noncombustible exterior cladding	
EXTW-4	38 mm × 140 mm wood studs spaced at 600 mm o.c.(1)(7) attached to cross-laminated timber (CLT) wall panels ≥ 38 mm thick(8)	140 mm thick glass, rock or slag fibre in cavities formed by studs(3)	Gypsum sheathing ≥ 12.7 mm thick	Noncombustible exterior cladding	
EXTW-5	89 mm horizontal Z-bars spaced at 600 mm	89 mm thick rock or slag fibre in cavities	—	Noncombustible exterior cladding attached to 19	

	o.c. attached to CLT wall panels ≥ 105 mm thick[8]	formed by Z-bars[3][4]		mm vertical hat channels spaced at 600 mm o.c.	

Notes to Table D-6.1.1.:

[1] The stated stud dimensions are maximum values. Where wood studs with a smaller depth are used, the thickness of the absorptive material in the cavities formed by the studs must be reduced accordingly.

[2] Horizontal blocking between the vertical studs or horizontal stud plates must be installed at vertical intervals of not more than 2 324 mm, such that the maximum clear length between the horizontal blocking or stud plates is 2 286 mm.

[3] The absorptive material must conform to CAN/ULC-S702.1, "Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification."

[4] The absorptive material must have a density not less than 32 kg/m^3.

[5] The fire-retardant-treated plywood siding must conform to the requirements of Article 3.1.4.5. and must have been conditioned in conformance with ASTM D2898, "Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing," before being tested in accordance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

[6] The fire-retardant-treated plywood must conform to the requirements of Article 3.1.4.5.

[7] Horizontal blocking between the vertical studs or horizontal stud plates must be installed at vertical intervals of not more than 2 438 mm, such that the maximum clear length between the horizontal blocking or stud plates is 2 400 mm.

[8] A water-resistant barrier is permitted to be attached to the face of the CLT wall panels.

Section D-7 Background Information

D-7.1. Fire Test Reports

Summaries of available fire test information have been published by NRC as follows:

(1) M. Galbreath, Flame Spread Performance of Common Building Materials. Technical Paper No. 170, Division of Building Research, National Research Council Canada, Ottawa, April 1964. NRCC 7820.

(2) M. Galbreath and W.W. Stanzak, Fire Endurance of Protected Steel Columns and Beams. Technical Paper No. 194, Division of Building Research, National Research Council Canada, Ottawa, April 1965. NRCC 8379.

(3) T.Z. Harmathy and W.W. Stanzak, Elevated-Temperature Tensile and Creep Properties of Some Structural and Prestressing Steels. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 186 (DBR Research Paper No. 424) NRCC 11163.

(4) T.Z. Harmathy, Thermal Performance of Concrete Masonry Walls in Fire. American Society for Testing and Materials, Special Technical Publication 464, 1970, p. 209 (DBR Research Paper No. 423) NRCC 11161.

(5) L.W. Allen, Fire Endurance of Selected Non-Loadbearing Concrete Masonry Walls. DBR Fire Study No. 25, Division of Building Research, National Research Council Canada, Ottawa, March 1970. NRCC 11275.

(6) A. Rose, Comparison of Flame Spread Ratings by Radiant Panel, Tunnel Furnace, and Pittsburgh-Corning Apparatus. DBR Fire Study No. 22, Division of Building Research, National Research Council Canada, Ottawa, June 1969. NRCC 10788.

(7) T.T. Lie and D.E. Allen, Calculation of the Fire Resistance of Reinforced Concrete Columns. DBR Technical Paper No. 378, Division of Building Research, National Research Council Canada, Ottawa, August 1972. NRCC 12797.

(8) W.W. Stanzak, Column Covers: A Practical Application of Sheet Steel as a Protective Membrane. DBR Fire Study No. 27, Division of Building Research, National Research Council Canada, Ottawa, February 1972. NRCC 12483.

(9) W.W. Stanzak, Sheet Steel as a Protective Membrane for Steel Beams and Columns. DBR Fire Study No. 23, Division of Building Research, National Research Council Canada, Ottawa, November 1969. NRCC 10865.

(10) W.W. Stanzak and T.T. Lie, Fire Tests on Protected Steel Columns with Different Cross-Sections. DBR Fire Study No. 30, Division of Building Research, National Research Council Canada, Ottawa, February 1973. NRCC 13072.

(11) G. Williams-Leir and L.W. Allen, Prediction of Fire Endurance of Concrete Masonry Walls. DBR Technical Paper No. 399, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13560.

(12) G. Williams-Leir, Prediction of Fire Endurance of Concrete Slabs. DBR Technical Paper No. 398, Division of Building Research, National Research Council Canada, Ottawa, November 1973. NRCC 13559.

(13) A. Rose, Flammability of Fibreboard Interior Finish Materials. Building Research Note No. 68, Division of Building Research, National Research Council Canada, Ottawa, October 1969.

(14) L.W. Allen, Effect of Sand Replacement on the Fire Endurance of Lightweight Aggregate Masonry Units. DBR Fire Study No. 26, Division of Building Research, National Research Council Canada, Ottawa, September 1971. NRCC 12112.

(15) L.W. Allen, W.W. Stanzak and M. Galbreath, Fire Endurance Tests on Unit Masonry Walls with Gypsum Wallboard. DBR Fire Study No. 32, Division of Building Research, National Research Council Canada, Ottawa, February 1974, NRCC 13901.

(16) W.W. Stanzak and T.T. Lie, Fire Resistance of Unprotected Steel Columns. Journal of Structural Division, Proc., Am. Soc. Civ. Eng., Vol. 99, No. ST5 Proc. Paper 9719, May 1973 (DBR Research Paper No. 577) NRCC 13589.

(17) T.T. Lie and T.Z. Harmathy, Fire Endurance of Concrete-Protected Steel Columns. A.C.I. Journal, January 1974, Title No. 71-4 (DBR Technical Paper No. 597) NRCC 13876.

(18) T.T. Lie, A Method for Assessing the Fire Resistance of Laminated Timber Beams and Columns. Can. J. Civ. Eng., Vol. 4, No. 2, June 1977 (DBR Technical Paper No. 718) NRCC 15946.

(19) T.T. Lie, Calculation of the Fire Resistance of Composite Concrete Floor and Roof Slabs. Fire Technology, Vol. 14, No. 1, February 1978 (DBR Technical Paper No. 772) NRCC 16658.

(20) M.A. Sultan, Y.P. Séguin and P. Leroux. Results of Fire Resistance Tests on Full-Scale Floor Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, May 1998, IRC-IR-764.

(21) M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Y.P. Séguin and J.P. Henrie, Results of Fire Resistance Tests on Full-Scale Floor Assemblies - Phase II, Institute for Research in Construction, National Research Council Canada, Ottawa, March 2005, RR-184.

(22) M.A. Sultan and G.D. Lougheed, Results of Fire Resistance Tests on Full-Scale Gypsum Board Wall Assemblies, Institute for Research in Construction, National Research Council Canada, Ottawa, August 2002, IRC-IR-833.

(23) V.K.R. Kodur, M.A. Sultan, J.C. Latour, P. Leroux, R.C. Monette, Experimental Studies on the Fire Resistance of Load-Bearing Steel Stud Walls, Research Report, National Research Council Canada, Ottawa, August 2013, RR-343.

(24) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using Lightweight Wood Frame Construction with Gypsum Sheathing (Test EXTW-1), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.4.

(25) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using a Simulated Cross-Laminated Timber Wall Assembly with Gypsum Sheathing (Test EXTW-2), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.5.

(26) E. Gibbs, B.C. Taber, G.D. Lougheed, J.Z. Su and N. Bénichou, Solutions for Mid-Rise Wood Construction: Full-Scale Standard Fire Test for Exterior Wall Assembly Using Lightweight Wood Frame Construction with Interior Fire-Retardant-Treated Plywood Sheathing (Test EXTW-3), Report to Research Consortium for Wood and Wood-Hybrid Mid-Rise Buildings, National Research Council Canada, Ottawa, December 2014, A1-100035-01.6.

(27) E. Gibbs and J. Su, Full Scale Exterior Wall Test on Nordic Cross-Laminated Timber System, National Research Council Canada, Ottawa, January 2015, A1-006009.1.

D-7.2. Obsolete Materials and Assemblies

Building materials, components and structural members and assemblies in buildings constructed before 1995 may have been assigned ratings based on earlier editions of the Supplement to the National Building Code of Canada 1990 or older reports of fire tests. To assist users in determining the ratings of these obsolete assemblies and structural members, the following list of reference documents has been prepared. Although some of these publications are out of print, reference copies are available through NRC.

(1) M. Galbreath, Fire Endurance of Unit Masonry Walls. Technical Paper No. 207, Division of Building Research, National Research Council Canada, Ottawa, October 1965. NRCC 8740.

(2) M. Galbreath, Fire Endurance of Light Framed and Miscellaneous Assemblies. Technical Paper No. 222, Division of Building Research, National Research Council Canada, Ottawa, June 1966. NRCC 9085.

(3) M. Galbreath, Fire Endurance of Concrete Assemblies. Technical Paper No. 235, Division of Building Research, National Research Council Canada, Ottawa, November 1966. NRCC 9279.

(4) Guideline on Fire Ratings of Archaic Materials and Assemblies. Rehabilitation Guideline #8, U.S. Department of Housing and Urban Development, Germantown, Maryland 20767, October 1980.

(5) T.Z. Harmathy, Fire Test of a Plank Wall Construction. Fire Study No. 2, Division of Building Research, National Research Council Canada, Ottawa, July 1960. NRCC 5760.

(6) T.Z. Harmathy, Fire Test of a Wood Partition. Fire Study No. 3, Division of Building Research, National Research Council Canada, Ottawa, October 1960. NRCC 5769.

D-7.3. Assessment of Archaic Assemblies

Information in this document applies to new construction. Please refer to early editions of the Supplement to the National Building Code of Canada 1990 for the assessment or evaluation of assemblies that do not conform to the information in this edition of the Building By-law. As with other documents, this By-law is revised according to the information presented to the standing committee responsible for its content, and with each update new material may be added and material that is not relevant may be deleted.

D-7.4. Development of the Component Additive Method

The component additive method was developed based upon the following observations and conclusions drawn from published as well as unpublished test information.

Study of the test data showed that structural failure preceded failure by other criteria (transmission of heat or hot gases) in most of the tests of loadbearing wood-framed assemblies. The major contributor to fire resistance was the membrane on the fire-exposed side.

Fire tests of wood joist floors without protective ceilings resulted in structural failure between 8 and 10 min. Calculation of the time for wood joists to approach breaking stress, based upon the charring rate of natural woods, suggested a time of 10 min for structural failure. This time was subtracted from the fire-resistance test results of wood joist floors and the remainder considered to be the contribution of the membrane.

The figures obtained for the contribution of membranes were then applied to the test results for open web steel joist floors and wood and steel stud walls and values of 20 min for the contribution of wood stud framing and 10 min for steel framing were derived.

The fire-resistance rating has been limited to 1.5 h as this method of developing ratings for framed assemblies was new and untried. Although this is the subject of current review, no decision has been made to extend the ratings beyond 1.5 h.

(1) M. Galbreath, G. C. Gosselin, and R. B. Chauhan, Historical Guide to Chapter 2 of the Supplement to the National Building Code of Canada, Committee Paper FPR 1-3, Prepared for the Standing Committee on Fire Performance Ratings, May 1987.

Example showing fire-resistance rating of a typical membrane assembly, calculated using the component additive method.

1 hour Gypsum Board/Wood Stud Interior Partition

A 1 h fire-resistance rating is required for an interior wood framed partition, using 12.7 mm Type X gypsum board.

(a) Since gypsum board is used (Sentence D-2.3.4.(2) and Table D-2.3.4.-A) time assigned to 12.7 mm Type X gypsum board membrane on the fire-exposed side of the partition = 25 min

(b) Time assigned to wood framing members at 400 mm o.c. (Sentence D-2.3.4.(3) and Table D-2.3.4.-E) = 20 min

(c) Time assigned to insulation, if the spaces between the studs are filled with preformed insulation of rock or slag fibres conforming to CAN/ULC-S702.1, “Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification,” (Sentence D-2.3.4.(4) and Table D-2.3.4.-G) = 15 min

(d) Time assigned to the membrane on the non-fire-exposed side (Sentence D-2.3.5.(1)) = 0 min
Fire-resistance rating = 25 + 20 + 15 = 60 min

BOOK I (GENERAL) - DIVISION C

Part 1
General

Section 1.1. Application

1.1.1. Application

1.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 1.2. Terms and Abbreviations

1.2.1. Definitions of Words and Phrases

1.2.1.1. Non-defined Terms

1) Words and phrases used in Division C that are not included in the list of definitions in Article 1.4.1.2. of Division A shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.

2) Where objectives and functional statements are referred to in Division C, they shall be the objectives and functional statements described in Parts 2 and 3 of Division A.

3) Where acceptable solutions are referred to in Division C, they shall be the provisions stated in Parts 3 to 10 of Division B.

4) Where alternative solutions are referred to in Division C, they shall be the alternative solutions mentioned in Clause 1.2.1.1.(1)(b) of Division A.

1.2.1.2. Defined Terms

1) The words and terms in italics in Division C shall have the meanings assigned to them in Article 1.4.1.2. of Division A.

1.2.2. Symbols and Other Abbreviations

1.2.2.1. Symbols and Other Abbreviations

1) The symbols and other abbreviations in Division C shall have the meanings assigned to them in Article 1.4.2.1. of Division A.

Section 1.3. Interpretation, Intent and Prohibitions

1.3.1. General Interpretation

1.3.1.1. Interpretation

1) This By-law shall, despite any other provision herein, be interpreted in accordance with this Section.

2) The Schedules attached to this Part 1 form part of this By-law.

1.3.2. General Intent

1.3.2.1. Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the *City*, the *Chief Building Official* or any employee of the *City* to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any *permit*, including an *occupancy permit*, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the *Chief Building Official* shall be construed as internal administrative directions which do not create a duty.

1.3.2.2. Reliance on Registered and Certified Professionals

1) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *registered professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents sealed with professional seals, and related documents received from *registered professionals*, and on *field reviews* carried out by or under the supervision of *registered professionals*, as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions, and substantially complies with any other applicable enactments.

2) The *City* and the *Chief Building Official* do not have the resources to deal with matters which fall within the expertise of *certified professionals* and the *City* and the *Chief Building Official* rely on letters of assurance, documents stamped with professional stamps, and related documents received from *certified professionals*, on site reviews carried out by *certified professionals*, and on field reviews monitored by *certified professionals* as evidence that the design and *construction* of *buildings* complies with the provisions of this By-law, including alternate solutions and substantially complies with any other applicable enactments.

1.3.2.3. No Representation or Warranty

1) No person shall rely on a *permit* issued by the *Chief Building Official* or an inspection carried out by the *Chief Building Official* as establishing compliance with this By-Law or any other enactment or assume or conclude that this By-Law has been administered or enforced according to its terms.

2) All persons shall make such independent investigations as they deem necessary to determine whether a *building* complies with this By-law or any other enactment.

1.3.3. General Prohibitions

1.3.3.1. Contravention

1) No person shall fail to comply with an order or notice issued by the *Chief Building Official*.

1.3.3.2. No Work Without Permit

1) No person shall work or authorize or allow work to proceed on a *project* for which a *permit* is required unless a valid *permit* exists for the work to be done.

1.3.3.3. Deviation Needs Prior Approval

1) No person shall deviate from the plans and supporting documents forming part of the *permit*, without having first paid all necessary fees and obtained all necessary *permits* and approvals from the *Chief Building Official*.

1.3.3.4. No Occupancy Without Permission

1) No person shall occupy a *building* or authorize or allow the *occupancy* of a *building* without having first obtained the permission of the *Chief Building Official*.

1.3.3.5. Unsafe Conditions

(See Note A-1.3.3.5.)

1) No person who is an *owner* or who is involved in the *construction*, relocation or *occupancy* of a *building* shall cause, allow or maintain any *unsafe condition*.

1.3.3.6. Work on Public Property

(See Note A-1.3.3.6.)

1) No person shall excavate or undertake work on public property, or erect or place any *construction* or work or store any materials thereon without approval having first been obtained in writing from the *Chief Building Official* over such public property.

1.3.3.7. Changes in Ground Elevation and Limiting Distance

(See Note A-1.3.3.7.)

1) No person shall change or alter the ground elevations or grading of a *building* site without first obtaining the necessary *permits*.

2) No person shall change or alter the *limiting distance* of an *exposing building face* without first obtaining the necessary *permits.*

1.3.3.8. Compliance with By-law and Other Enactments

1) No person shall work, or authorize or allow work to proceed, or undertake any *building*, *construction*, work or *occupancy* which is in contravention of this By-law or any other enactment.

1.3.3.9. False Information

1) No person shall submit false or incorrect information to the *Chief Building Official*.

1.3.3.10. Tampering with a Posted Notice or Order

1) No person, except for the *Chief Building Official*, shall reverse, alter, deface, cover, remove or in any way tamper with any notice or order which has been posted on or affixed to a *building* pursuant to this By-law.

Section 1.4. Obligations of the Owner and Contractor

1.4.1. Obligations of the Owner

1.4.1.1. Right of Entry of Chief Building Official

1) The *owner* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.1.2. Permit Required

1) The *owner* shall obtain all *permits* or approvals prior to commencing the work to which they relate.

1.4.1.3. Compliance with Permit

1) The *owner* shall comply with all conditions of a *permit* or a staged *permit*.

1.4.1.4. Posting a Permit

1) The *owner* shall ensure that the *permit* authorizing the work, or a true copy of the *permit*, is posted conspicuously on the site or is affixed to the exterior of the *building* during the entire *project*.

1.4.1.5. Compliance with By-law and Other Enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.

2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.

3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.

4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.

5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

1.4.1.6. Compliance with Stop Work Order

1) The *owner* shall not carry out work or *construction* or suffer, permit or allow work or *construction* to be carried out in contravention of a stop work order issued by the *Chief Building Official*.

1.4.1.7. Compliance with Development Permit Plans

1) The *owner* shall ensure that the plans and supporting documents submitted for a *permit* conform substantially with the approved Development Permit plans and supporting documents, except that where differences exist, the *owner* shall make application for a "Development Permit Amendment" as required by the Zoning and Development By-law.

1.4.1.8. Owner's Undertaking

1) The *owner* shall submit a completed *Owner's* Undertaking letter to the *Chief Building Official* in support of and prior to the issuance of a *permit*, in the applicable form set out in Schedules E-1 and E-2 at the end of this Part.

1.4.1.9. Letters of Assurance

1) When required by this By-law, the *owner* shall provide to the *Chief Building Official* any applicable letters of assurance in the forms set out in Schedules A, B, C-A and C-B at the end of Part 2 of Division C of Books I and II of this By-law or in the forms set out in Schedules D and C-D at the end of Part 5 of Division B of Book I (General) of this By-law.

1.4.1.10. Project Directory

(See Note A-1.4.1.10.)

1) The *owner* shall, prior to commencing work, give notice in writing to the *Chief Building Official*, of the name, address, electronic mail address and telephone number of the *owner*, the *constructor* or other person in charge of the work, the *designer* reviewing the work, and any inspection or testing agency engaged to monitor the work.

2) During the course of the *construction*, the *owner* shall give immediate notice in writing to the *Chief Building Official*, of any change in employment of persons listed in the notice given pursuant to Sentence (1).

1.4.1.11. Other Notices

1) The *owner* shall give such other notices to the *Chief Building Official* as may be required by the *Chief Building Official*, by this By-law, or by another enactment.

1.4.1.12. Construction Safety

1) Where a *Construction Safety Plan* is required by Section 8.2 of Division B of Book I (General) of this By-law, the *owner* shall

a) prior to commencing work, ensure that the *Construction Safety Plan* has been submitted to the *Chief Building Official*, and

b) during *construction*, ensure that the *Construction Safety Plan* is posted at all times and is amended from time to time in accordance with the requirements of this By-law.

2) Where a *building* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law to be professionally designed and reviewed, the *owner* shall, prior to commencing work, ensure that the *contractor* provides a full-time *construction safety officer* at the worksite.

1.4.1.13. Plans Required on Site

1) The *owner* shall ensure that the plans and specifications on which the issuance of the *permit* was based are available at the worksite for inspection during working hours by the *Chief Building Official*.

1.4.1.14. Site Cleared of Debris

1) The *owner* shall ensure that upon completion of *demolition* procedures, all debris and fill is cleared and the site levelled or graded, to the satisfaction of the *Chief Building Official*.

1.4.1.15. Tests to Establish Compliance

(See Note A-1.4.1.15.)

1) Where required by the *Chief Building Official* the *owner* shall make or have made, at the *owner's* expense, tests or inspections, as necessary to establish compliance with this By-law and shall promptly provide a copy of all such tests or inspection reports to the *Chief Building Official*.

1.4.1.16. Up-to-Date Survey

1) The *owner* shall provide to the *Chief Building Official* a survey, which has been certified by a registered land surveyor no more than 6 months before the date of delivery of the survey to the *Chief Building Official*

a) in the case of an *existing building* and site, if required by the *Chief Building Official* to substantiate the *building* location and size, above, at and below ground level, relative to the site,

b) in the case of an *existing building* and site, if required by the *Chief Building Official* to establish the relationship of the *building* to neighbouring grades, and

c) in the case of all new *buildings*, upon completion of foundations and footings and before any further *construction*, and the survey must include the elevation of a bench mark on the front of the foundation wall, to substantiate its size, location, and elevation relative to the site and to neighbouring grades.

1.4.1.17. Covering Work Prior to Inspection, Site Review or Field Review

1) The *owner* shall not cover work prior to inspection, site review or *field review*.

1.4.1.18. Request for Inspection

1) The *owner* shall give at least 24 hours notice to the *Chief Building Official* when requesting an inspection of work that is required or ordered to be inspected.

1.4.1.19. Uncovering Work

1) The *owner* shall uncover any work that has been covered without inspection, when required to do so by the *Chief Building Official*. (See Note A-1.4.1.19.(1).)

2) An *owner* who is required to uncover work by the *Chief Building Official* shall uncover and replace such work at the *owner's* expense.

1.4.1.20. Reinspection

1) If the *Chief Building Official* discovers faulty or incomplete work or faulty materials during an inspection, the *owner* shall apply for a reinspection.

2) Every applicant for a reinspection of a *project* shall pay the applicable reinspection fees set out in the Fee Schedule, prior to the reinspection.

1.4.1.21. Report of Building, Demolition or Excavation Failure

1) When a *building*, *demolition* or excavation failure occurs which causes or has the potential to cause injury or loss of life, the *owner* shall

a) immediately report the failure to the *Chief Building Official*,

b) submit a report, if required to do so by the *Chief Building Official*, in accordance with Article 1.5.3.1., and

c) carry out any repairs or remedial work required by the *Chief Building Official*.

1.4.1.22. Removing Unsafe Conditions

1) When a *building* or part thereof is in an *unsafe condition*, the *owner* shall forthwith take all necessary action to put the *building* in a safe condition.

1.4.1.23. Damage to City Property

1) The *owner* is responsible for the cost of repair of any damage to *City* property or works located thereon that occurs as a result of undertaking work for which a *permit* or a street use permit was required.

1.4.1.24. Requirements Regarding Street Addresses

1) An *owner* shall not post any number or letter on a *building* or *suite* entry except for a *street* address or *suite* number that has been designated by the *Chief Building Official*.

2) Every *owner* shall place and maintain the designated *street* address on the *building* in a place that is easily visible from the *street*, and the address shall be mounted on a contrasting background and shall conform with the minimum character size requirements in Table 1.4.1.24.

Table 1.4.1.24.
Requirements Regarding Street Addresses
Forming part of Sentence 1.4.1.24.(2)

Building Setback from Street	Minimum Non-illuminated Character Size	Minimum Illuminated Character Size
0 - 15 m	100 mm	80 mm
15 - 20 m	150 mm	100 mm
Greater than 20 m	200 mm	150 mm

3) Where landscaping or other structures obscure the visibility of a *building* from the *street*, the *owner* shall erect a sign no larger than 0.4 m2 displaying the *street* address, on the *building* property within sight of the *street*.

4) Every *owner* shall place and maintain a designated *suite* number on a contrasting background and of a character size of no less than 25 mm at the *suite* entry. (See also Article 3.8.3.13. of Division B of Book I (General) of this By-law for design requirements for persons with a visual impairment.)

5) If a *suite* number is assigned to an exterior principal *suite* entry, every *owner* shall place and maintain the designated *suite* number in conformance with this Section.

6) Every *owner* shall ensure that designated *street* addresses and *suite* numbers are made of durable materials and are affixed securely to the *building*.

1.4.1.25. Requirements regarding Professional Design and Review

1) In addition to the obligations listed in this section, the *owner* of a *building* to which the provisions of Part 2 of Division C of Book I (General) of this By-law apply, shall also comply with the *owner's* obligations in that Part.

1.4.2. Obligations of the Contractor

1.4.2.1. Construction Safety

1) The *contractor* shall ensure that all requirements of this By-law relating to *construction* safety are complied with, and shall ensure that every sub-*contractor* of the *project* has retained a *trades safety coordinator* as required by Sentence (2).

2) Every sub-*contractor* shall retain a qualified *trades safety coordinator* whose responsibilities shall include appropriate training of all persons working for the sub-*contractor* at the worksite in safe *construction* and installation practice.

3) The *trades safety coordinator* shall provide certification respecting training to the *Chief Building Official* upon request.

1.4.2.2. Work on Public Property

1) The *contractor* shall ensure that no excavation or other work is undertaken on public property, and that no *building* is erected or materials stored thereon, without first having obtained approval in writing from the appropriate government authority.

1.4.2.3. Compliance with By-law and Other Enactments

1) The *contractor* shall ensure that all work, *building*, *construction*, or *occupancy* is carried out in accordance with this By-law and with all other applicable enactments.

1.4.2.4. Right of Entry of Chief Building Official

1) The *contractor* shall allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law.

1.4.2.5. Compliance with Stop Work Order

1) The *contractor* shall not carry out work or *construction*, or suffer, permit or allow work or *construction* to be carried out, in contravention of a stop work order issued by the *Chief Building Official*.

Section 1.5. Authority of the Chief Building Official

1.5.1. Administration

1.5.1.1. Administrator

1) The *Chief Building Official* is authorized to administer this By-law.

1.5.1.2. Filing Documents

1) The *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is required by law.

2) Despite the provisions of Sentence (1), the *Chief Building Official* is authorized to keep copies of applications received, *permits* and orders issued, inspections and tests made and papers and documents connected with the administration of this By-law, for such time as is necessary, in the opinion of the *Chief Building Official*, to support the administration of this By-law.

1.5.1.3. Inspection of Records

1) The *Chief Building Official* is authorized to provide plans and documents filed pursuant to the provisions of this By-law for inspection, subject to the provisions of the Freedom of Information and Protection of Privacy Act.

1.5.1.4. Fees for Inspection of Records

1) The *Chief Building Official* shall charge a fee as set out in the Fee Schedule, payable in advance, for the inspection of records referred to in Article 1.5.1.3.

2) No refund shall be issued for any fees or portion of fees, resulting from any outstanding costs incurred by the *City* for the inspection of records pursuant to Article 1.5.1.4.

1.5.2. Authorities

1.5.2.1. Power of Entry

(See Note A-1.5.2.1.)

1) The *Chief Building Official*, and any person authorized to act on behalf of the *Chief Building Official*, may enter any *building* or premises at any reasonable time for the purpose of administering or enforcing this By-law, or immediately if there is reason to believe an *unsafe condition* exists.

1.5.2.2. Review of Value of Work

1) The *Chief Building Official* may review the value of the proposed work in an application for a *permit* and may substitute a different value, in accordance with Articles 1.6.2.3. and 1.6.2.4., for the purpose of determining applicable *permit* fees.

1.5.2.3. Construction Safety

1) The *Chief Building Official* may review a *Construction Safety Plan* and may require that the *Construction Safety Plan* be changed or amended.

1.5.2.4. Permit Issuance

1) The *Chief Building Official* shall issue a *permit* when the applicable requirements of this By-law have been met.

1.5.2.5. Permit Refusal

1) The *Chief Building Official* may refuse to issue a *permit*

a) if plans or supporting documents are incomplete or do not comply with the provisions of this By-law,

b) if plans or supporting documents contain false or incorrect information, or

c) for any *building*, *construction*, work or *occupancy* that would not be permitted by this By-law or by another enactment.

2) The *Chief Building Official* shall provide reasons for the refusal to issue a *permit*, on the request of an applicant or *owner*.

1.5.2.6. Permit with Incomplete Application

(See Note A-1.5.2.6.)

1) The *Chief Building Official* may issue a *permit* for a *building* based on an incomplete application if the incomplete information is of a secondary nature and is unavailable at the time of *permit* issuance.

2) If the *Chief Building Official* issues a *permit* pursuant to Sentence (1) the *Chief Building Official* may impose conditions requiring submission of further information by a specified date.

3) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Sentence (1), if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.7. Conditions on Permits

1) The *Chief Building Official* may impose conditions on *permits* including, but not limited to, conditions regarding

a) notifications and notices,

b) safety,

c) health,

d) design requirements,

e) *construction* requirements,

f) timing of *construction*,

g) deadlines for completion of *construction*,

h) reviews and inspections,

i) responsibilities of the *owner*, *constructor*, *registered professional* and *certified professional*,

j) compliance with this By-law and other enactments,

k) use and *occupancy*, and

l) temporary *buildings* and *occupancies*.

1.5.2.8. Permits for Existing Buildings

1) The *Chief Building Official* may issue a *permit* for an *existing building* in accordance with the provisions of Part 11, Division B, Book I and may impose conditions on the *permit*.

2) The *Chief Building Official* may permit an alternative solution to the alternative compliance method provided in this By-law for the conversion of an *existing building* if

a) the *owner* demonstrates, to the satisfaction of the *Chief Building Official*, that the level of upgrade required presents an extraordinary hardship for the *owner*, and

b) the *owner* proposes an alternative solution which achieves the objectives of the alternative compliance method prescribed by this By-law, to the satisfaction of the *Chief Building Official*.

1.5.2.9. Combustible Construction for Minor Repairs in Existing Buildings

1) If *additions* and new work are required to be *noncombustible construction* pursuant to Subsection 3.2.2. of Division B, the *Chief Building Official* may permit minor repairs to existing floor or wall assemblies to be *combustible construction* provided

a) the minor repair of the floor assembly does not exceed 5 per cent of the *floor area* of the room in which it is located, and

b) the minor repair of the wall assembly does not exceed 5 per cent of the wall area of the wall plane on which it is located.

1.5.2.10. Permits for Plumbing, Mechanical and Sprinkler Systems

1) The *Chief Building Official* may issue a *permit* for a plumbing system, mechanical system or *sprinkler system* in accordance with the provisions of Subsection 1.6.3.

2) The *Chief Building Official* may relax the rainwater management requirements of Division B, Sentences 2.4.2.5.(4), (5) and (6) of Book II (Plumbing Systems) of this By-law as provided in Division B, Sentence 2.4.2.5.(9) of Book II (Plumbing Systems) of this By-law.

1.5.2.11. Permits in Designated Flood Plain

1) If a *building* is located on a *designated flood plain* the *Chief Building Official* may

a) require plans and supporting documents to demonstrate that the elevation or design of the *buildings* incorporates *flood construction level requirements* intended to reduce the risk of flood damage,

b) require that a covenant acknowledging the risk of flood damage be registered against the land, and

c) withhold issuance of a *permit* until the requirements of the *Chief Building Official* have been satisfied.

2) The *Chief Building Official* may increase the *flood construction level requirements* or the setback requirements as provided in Article 2.2.10.5.

3) The *Chief Building Official* may relax the *flood construction level requirements* or the setback requirements in this By-law as provided in Article 2.2.10.6.

1.5.2.12. Permit for Staged Construction

(See Note A-1.5.2.12.)

1) Where a *permit* for staged *construction* is applied for pursuant to Subsection 1.6.5., the *Chief Building Official* may authorize the excavation or *construction* of a portion of a *building*, and may impose conditions to ensure compliance with this By-law, before all the plans and supporting documents for the *building* have been accepted, at the risk of the *owner*.

2) The *Chief Building Official* may suspend or revoke a *permit* issued pursuant to Subsection 1.6.5. if the holder of the *permit* fails to comply with the conditions imposed by the *Chief Building Official*.

1.5.2.13. Minor Revisions to Permit

1) The *Chief Building Official* may accept an application for minor revisions to an existing *permit* if the proposed revisions do not add or delete additional *storeys* or *major occupancy* classifications to or from the *project*.

1.5.2.14. Requirement for New Permit

1) The *Chief Building Official* may require that an applicant for revisions to an existing *permit* apply for a new *permit*, if the proposed revisions would add or delete *floor area*, *storeys*, *dwelling units* or *major occupancy* classifications to or from the *project*.

1.5.2.15. Permit Suspension

1) The *Chief Building Official* may suspend a *permit* by issuing an order to stop work.

1.5.2.16. Permit Revocation

1) The *Chief Building Official* may revoke a *permit* if

a) there is a contravention of any condition under which the *permit* was issued,

b) the *permit* was issued in error, or

c) the *permit* was issued on the basis of false or incorrect information.

1.5.2.17. Permit Extension

1) The *Chief Building Official* may extend a *permit* in accordance with Subsection 1.6.7. of this Part.

1.5.2.18. Designation of Street Addresses

1) The *Chief Building Official* may, at any time, number, renumber or assign a series of numbers or *suite* numbers to any *building*, or part thereof.

2) Upon the issuance of a *building permit*, the *Chief Building Official* shall designate the *street* address or series of *suite* numbers required for the *building*, or any portion of the *building*.

3) Upon registration of a parcel of land in the Land Title Office, the *Chief Building Official* shall designate the *street* address or series of numbers required for the parcel.

1.5.2.19. Renumbering of Street Addresses

1) Where an *owner* has requested a renumbering and has paid the applicable fees set out in the Fee Schedule, the *Chief Building Official* may renumber any *building* or *suite* within a *building*, or parcel of land.

1.5.2.20. Proof of Compliance

1) The *Chief Building Official* may direct that tests of materials, equipment, devices, *construction* methods, structural assemblies or foundations be made, or sufficient evidence or proof be submitted, at the expense of the *owner*, where such evidence or proof is necessary, in the opinion of the *Chief Building Official*, to determine whether the material, equipment, device, *construction*, structural assembly or foundation condition complies with this By-law.

1.5.2.21. Occupancy Permit for Building at Variance with By-law

1) The *Chief Building Official* may issue an *occupancy permit* for a *building* which varies in a minor respect from the requirements of this By-law if, in the opinion of the *Chief Building Official*, such variation will not substantially interfere with the objectives of this By-law.

1.5.2.22. Occupancy Permit Prior to Completion

1) The *Chief Building Official* may issue an *occupancy permit* to allow the *occupancy* of a *building* or a part thereof for the approved use, prior to commencement or completion of the *construction* or *demolition* work.

2) The *Chief Building Official* may impose conditions on an *occupancy permit* issued in accordance with Sentence (1).

1.5.3. Authorities Regarding Unsafe and Unsanitary Conditions

1.5.3.1. Report of Failure

1) Where any *building*, *construction* or excavation failure occurs which causes or has the potential to cause injury or loss of life, the *Chief Building Official* may require the *owner* to submit a report which includes

a) the name and address of the *owner*,

b) the address or location of the *building*, *demolition* or excavation,

c) the name and address of the constructor,

d) the nature of the failure,

e) the cause of the failure,

f) a remedial plan to correct the failure, and

g) a plan to prevent future failure.

1.5.3.2. Hazardous Material

1) The *Chief Building Official* may require that any person supervising or doing work to install or remove *building* materials provide evidence of their training, certification or qualifications, if the installation or removal of *building* materials may create an *unsafe condition* or affect the structural safety or fire protection of a *building*.

1.5.3.3. Order to Remove Unsafe Condition

1) When any *building*, *construction* or excavation or part thereof is in an *unsafe condition*, the *Chief Building Official* may issue a written order to the *owner*, certifying the existence of an *unsafe condition* and requiring correction of any *unsafe condition* found on a *building* site, within a specified time.

1.5.3.4. Order to Repair Plumbing or Mechanical Systems

1) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* is defective, unsanitary or inadequate, may notify the *owner* or occupant thereof of such condition and may order that such *plumbing system*, or part thereof, be placed in a proper, safe and sanitary condition.

2) The *Chief Building Official*, if of the opinion that the *plumbing system*, or any part of it, in any *building* may has become dangerous or defective on account of the settlement of the *building* or through abuse, accident or for any other cause whatsoever, may order the *owner* or occupant thereof to have a *plumbing contractor* conduct a smoke test on the waste and *vent pipes* of the *building* to ascertain whether any dangerous or defective condition exists.

3) The *Chief Building Official*, if of the opinion that the *mechanical system*, or any part of it, in any *building* is defective or inadequate, may notify the *owner* or occupant thereof of such condition and may order such *mechanical system*, or part thereof, be placed in a proper, safe and working condition.

1.5.3.5. Corrective Measures

1) If the *Chief Building Official* has issued an order in accordance with Article 1.5.3.3. or 1.5.3.4. and an *owner* has failed to comply with that order, the *Chief Building Official* may

a) authorize *demolition*, removal, posting of security guards or fire wardens, or enclosure of a *building*, *construction*, excavation or part thereof, at the expense of the *owner*,

b) recover such expense in the manner set out in Article 1.5.3.6., and

c) take such other measures as may be necessary to protect the public.

1.5.3.6. Immediate Measures

1) When immediate measures must be taken to avoid an imminent danger or risk of accident, the *Chief Building Official* may take such action as is appropriate, without prior notice and at the expense of the *owner*.

2) Where immediate security measures must be taken to limit the risk of damage, vandalism, theft, loss, or the creation of *unsafe conditions*, the *Chief Building Official* may board-up or otherwise secure a *building* against unauthorized entry without prior notice and at the expense of the *owner*.

1.5.3.7. Recovery of City Costs

1) The cost of the measures described in Articles 1.5.3.5. and 1.5.3.6. shall be recoverable from the *owner*

a) in any Court of competent jurisdiction, or

b) by entry of such cost in the real property roll with respect to the property and by collection in the same manner as the taxes shown in the real property roll.

1.5.4. Notices and Orders

1.5.4.1. Notices or Orders

1) The *Chief Building Official* may issue in writing such notices or orders as may be necessary to inform the *owner* of a contravention of this By-law, in the manner set out in this By-law.

1.5.4.2. Scope of Orders

1) The *Chief Building Official* may order

a) a person to comply with the provisions of this By-law within a specified time,

b) a person to allow the *Chief Building Official* to enter any *building* or premises at any reasonable time for the purpose of administering and enforcing this By-law,

c) work to stop on a *building* or any part thereof, if such work is proceeding in contravention of a provision of this By-law or another enactment, or if there is deemed to be an *unsafe condition*,

d) the removal of an unauthorized encroachment on public property,

e) the removal of any *building* or part thereof constructed in contravention of a provision of this By-law,

f) the cessation of any *occupancy* in contravention of a provision of this By-law,

g) the cessation of any *occupancy* if an *unsafe condition* exists,

h) the correction of an *unsafe condition*,

i) the correction of an unsanitary condition,

j) a person to provide a written assessment of a specified condition by a *registered professional* if there is deemed to be an *unsafe condition, and*

k) a person to secure a building against unauthorized entry.

1.5.4.3. Contents of Notice

1) A notice shall state the nature of any contravention and specify the date or the phase of *construction* by which remedial measures must be completed.

1.5.4.4. Delivery of Notice

1) A notice may be posted on a *building*, and may be delivered by regular mail or by hand to the person listed as the *owner* in the records of the Assessment Authority of British Columbia or to a representative of the *owner*.

1.5.4.5. Contents of Order

1) An order shall specify any contraventions of this By-law or any *unsafe condition* or unsanitary condition and may require *demolition*, removal, or compliance with this By-law, by a specified phase of *construction*, or within a specified time after the date of mailing or posting the order.

2) Despite Sentence (1), an order to stop work, board up or cease *occupancy* shall state the nature of the contravention or *unsafe condition*, and may order the immediate suspension of *construction* or of *occupancy* and the rectification of the contravention or *unsafe condition*.

1.5.4.6. Delivery of Order

1) The *Chief Building Official* may deliver an order

a) by mailing the order by registered mail or by regular mail to the *owner* at the *owner's* address as it appears on a Tax Certificate or a State of Title Certificate, and posting the order on the premises which is the subject of the order,

b) by sending the order by electronic mail to the electronic mail address of the *owner* or a representative of the *owner*, or

c) by delivery of the order by hand to the *owner* or a representative of the *owner*.

2) When a building is at imminent or unreasonable risk of collapse which could pose a danger to building occupants or the public, the Chief Building Official may post an order to cease occupancy on the premises which is the subject of the order, which shall be deemed to comply with the requirements of Sentence (1).

3) Delivery of an order in accordance with the provisions of Sentences (1) or (2) shall be deemed to be good and sufficient service of the order.

Section 1.6. Permits, Applications and Fees

1.6.1. Permits

1.6.1.1. When a Permit is Required

1) Except as permitted by Sentence (2), a *permit* is required before any work regulated by this By-Law is undertaken.

2) A building *permit* is not required for an outdoor patio

a) which is not more than 25 m^2 with a deck of not more than 0.6 m in height, and

b) if it includes demountable lightweight non-structural elements, those elements consist of an open frame with or without an overhead covering made of flexible material, such as textile and vinyl that:

i) is located not more than 3 m above the patio surface

ii) does not interfere with overhead public utilities,

iii) if of *combustible* material, conforms to the appropriate requirements for resistance to fire as set out in CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films", or NFPA 701, "Standard Method of Fire Tests for Flame Propagation of Textiles and Films, and

iv) is not connected to or supported by a *building* structure.

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(See Note C-1.6.1.1.(2).)

1.6.1.2. Construction without a Permit

1) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall

a) make application for any necessary *permits* in accordance with Subsection 1.6.2. of this By-law, and

b) pay to the *City*, double the fee set out in the Fee Schedule to a maximum of $20,000, but in no case less than $500.

2) If *construction* for which a *permit* is required has been commenced before a *permit* has been issued, the *owner* shall, if ordered to do so by the *Chief Building Official*,

a) provide proof that the *construction* complies with this By-law and any other applicable enactments,

b) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine whether or not the *construction* complies with this By-law,

c) carry out tests and investigations by independent agencies, at the cost of the *owner*, to determine appropriate remedial measures to ensure that the *construction* complies with this By-law,

d) provide to the *Chief Building Official*, at the cost of the *owner*, the results of any tests and investigations ordered by the *Chief Building Official*, and

e) provide documentation to the satisfaction of the *Chief Building Official* to establish that all remedial measures to ensure the *construction* complies with this By-law have been completed.

1.6.1.3. Additional Permits

1) In addition to a *permit* required by Article 1.6.1.1., other *permits* and supporting documents necessary for specific *building* components, services and uses, may be required by the *Chief Building Official*.

1.6.2. Application for Permit

1.6.2.1. Owner Requirement

1) To obtain a *permit*, the *owner* shall file an application in writing in the form prescribed by the *Chief Building Official*.

1.6.2.2. Application Requirements

(See Note A-1.6.2.2.)

1) Except as otherwise provided in this By-law, every application shall

a) describe the work, *building*, *construction* or and *occupancies* for which the *permit* is required,

b) provide a legal description and address for the land on which the work is to be done,

c) include plans and other supporting documents which conform with Section 2.2. of Division C,

d) state the value of the proposed work calculated in accordance with Article 1.6.2.3.,

e) include the requisite *permit* fee, in accordance with the Fee Schedule at the end of this Part,

f) include the appropriate *owner's* undertaking letter in the applicable form set out in Schedule E-1 or E-2 at the end of this Part,

g) include any other plans or supporting documents required by the *Chief Building Official* to establish that the work, *building*, *construction* and *occupancy* complies with this By-law or any other enactment, and

h) list the names, addresses, electronic mail addresses and telephone numbers of all *owners*, designers and constructors.

1.6.2.3. Valuation for Permit

(See Note A-1.6.2.3.)

1) The value of the proposed work for new construction stated on the application for the permit shall be determined as

a) the net floor area in square meters (m^2) multiplied by $2691.25 ($250/ft^2) for a single detached house or duplex,

b) the net floor area in square meters (m^2) multiplied by $2691.25 ($250/ft^2$) for an *ancillary residential building*, or

c) the total current monetary worth of all proposed materials, construction and work related to the building for all other cases.

2) The value of the proposed work for an *alteration* to an *existing building* stated on the application for the permit shall be determined as

a) the renovated *floor area* in square meters (m^2) multiplied by $1937.69 (180/ft^2$) for a single detached house, duplex, or *ancillary residential building*,

b) the new or renovated vertical wall area in square meters (m^2) where only the walls are being altered or added, multiplied by $968.85 ($90/ft=) for a single detached house, duplex or *ancillary residential building*, or

c) the total current monetary worth of all proposed materials, construction and work related to the building for all other cases.

3) The value of the proposed work established in Clause (1)(c) and (2)(c) shall include the total current monetary worth of all labour and all fees and costs incurred for design, investigative testing, consulting services, *construction*, *construction* management, *contractor's* profit and overhead, sales taxes, and *construction* insurance related to the *building*.

4) The total current monetary worth referred to in Clauses (1)(c) and (2)(c), and Sentence (3) shall include the market value of all labour, including unpaid labour provided by an *owner* or volunteer, and the market value of all materials, including donated, recycled or used materials.

5) The total current monetary worth referred to in Clause (1)(a) and Sentence (2) shall include all components of the *building*, notwithstanding the fact that some components of the *building* may be subject to other *permits* and fees

1.6.2.4. Review of Valuation by Chief Building Official

1) The *Chief Building Official* may review the value of the proposed work stated in an application, and may substitute a different value for the proposed work, based on a cost estimate prepared by a registered quantity surveyor using an *acceptable* valuation method.

1.6.2.5. Fee Schedule

1) Except as permitted by Sentence (2), *permit* fees shall be calculated in accordance with the Fee Schedule at the end of this Part and the fees for construction without a permit are as outlined in Article 1.6.1.2.

2) The *Chief Building Official* may reduce *permit* fees in accordance with Part A, Section 4 of the Fee Schedule at the end of this Part for a *building* considered Social Housing, as defined in the Zoning and Development By-law.

1.6.2.6. No Refund

1) Except as permitted in Article 1.6.2.7., no *permit* fees or part thereof shall be refunded if

a) *construction* authorized by a *permit* has commenced,

b) the *permit* has expired pursuant to Article 1.6.7.1., or

c) the application has lapsed as outlined in Article 1.6.2.8.

1.6.2.7. Partial Refund and Set-off

1) If *construction* authorized by *permit* has not commenced and the *Chief Building Official* approves, the Director of Finance may refund a portion of the fees related to the *permit*, after deduction of any outstanding costs incurred by the *City* in processing the application for the *permit* and in carrying out any work pursuant to Article 1.5.3.5. or Article 1.5.3.6.

2) Where fees have been submitted to the *City* as part of an application for an alternative solution or an *operating permit*, and the *Chief Building Official* approves, the Director of Finance may refund a portion

of the fees related to the application, after deduction of the administrative fee set out in the Schedule of Fees at the end of this Part.

1.6.2.8. Lapse of Application

1) Subject to the provisions of Article 1.6.2.9., an *owner* shall comply with all the necessary requirements to complete an application for a *permit* within 6 months after the date of receipt of the application by the *Chief Building Official*.

2) If an *owner* fails to comply with the requirements of Sentence (1), the application for a *permit* shall lapse.

3) An application for a *permit* which has lapsed is expired and shall not be renewed except in accordance with Article 1.6.2.9.

1.6.2.9. Renewal of Lapsed Application

1) The *Chief Building Official* may renew a lapsed application for a *permit* if the *Chief Building Official* determines that

a) no more than 3 months have passed since the date the application lapsed, and

b) the failure to complete the requirements of the original application for a *permit* was reasonable in the circumstances.

2) Despite the provisions of Sentence (1), the *Chief Building Official* shall not renew a lapsed application for a *permit* more than once.

3) An application for a *permit* which has been renewed pursuant to Sentence (1) must comply with any amendments to this By-law made since the date of receipt of the original application by the *Chief Building Official*.

1.6.3. Additional Requirements for Plumbing, Mechanical and Sprinkler Permits

1.6.3.1. Application Requirements

1) The *Chief Building Official* may issue a *permit* for a *plumbing system*, *mechanical system* or *sprinkler system* if the applicant is authorized to obtain such a *permit* in accordance with the provisions of this Section.

1.6.3.2. Permit for Plumbing System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *plumbing system* to a licensed *plumbing contractor*.

1.6.3.3. Permit for Mechanical System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *mechanical system* to a *plumbing contractor*, licensed electrical *contractor* or a gas *contractor*.

2) The *Chief Building Official* shall only issue a *permit* to install a *mechanical system* that includes a *heat pump* to a *plumbing contractor*, a licensed electrical *contractor* or a gas *contractor* who holds a *Municipal Heat Pump Certification*.

1.6.3.4. Permit for Sprinkler System

1) The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *sprinkler system* to a licensed *sprinkler contractor*.

1.6.3.5. Permit for Plumbing System to Licensed Contractor

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to a licensed *contractor*

a) to install *sewers*, *sumps*, *catch basins*, and water lines outside of a *building*, or

b) to install backflow devices or other similar protection devices inside a *building*.

1.6.3.6. Permit for Plumbing System to Owner

1) Despite the provisions of Article 1.6.3.2., the *Chief Building Official* may issue a *permit* to the *owner* of a residential *building* with not more than one principal *dwelling unit* to do plumbing work in that *building* if the *owner* is the occupier of the *building*.

1.6.3.7. No Permit for Minor Repairs to Plumbing, Mechanical or Sprinkler System

1) Despite the provisions of Article 1.6.3.1., no *permit* is required to repair or replace a valve, sprinkler head, faucet, *fixture*, *fixture outlet pipe* or *service water heater*, to clear a stoppage, or to repair a leak, if there is no change to any other piping.

1.6.3.8. Requirement for Inspection

1) A *plumbing system*, *mechanical system* or *sprinkler system* shall be inspected by the *Chief Building Official*, unless the *Chief Building Official* determines that an inspection is not necessary.

1.6.4. Applications by Certified Professionals

1.6.4.1. Applications for Permits by Certified Professionals

1) A *Certified Professional* may apply for a *permit* on behalf of an *owner*.

1.6.4.2. Requirements for Permit

1) A *Certified Professional* who applies for a *permit* on behalf of an *owner* must comply with the requirements of Section 1.6 of this By-law.

1.6.4.3. Application Review for Permit

1) The *Chief Building Official* may issue a *permit* based upon a modified review of the drawings and other supporting documents submitted with the application for a *permit* by a *Certified Professional*.

1.6.4.4. Site Review for Permit

1) A *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* and to support the *construction* of the entire *building*.

1.6.5. Applications for Staged Construction by Certified Professionals

1.6.5.1. Requirements for Staged Construction

1) The *Chief Building Official* may issue a *permit* to construct a *building* in stages if

a) the applicant for the staged *construction* is a *Certified Professional*,

b) the *Certified Professional* also applies for permission to construct the entire *building*,

c) the *Certified Professional* submits complete plans and all supporting documents for each portion of the work for which a *permit* for staged *construction* is sought, and

d) the *Certified Professional* submits all documents required pursuant to the Certification of Professionals By-law.

1.6.5.2. Owner's Risk

1) The issuance of a staged *permit* creates no obligation on the *Chief Building Official* to issue any other staged *permits* or to issue a *permit* to construct the entire *building*.

2) An *owner* who commences *construction* of a *building* in accordance with a staged *permit* does so at the *owner's* risk.

1.6.5.3. Owner's Responsibility

1) An *owner* who fails to complete the work authorized by a *permit* for staged *construction* or who fails to comply with the conditions of a *permit* for staged *construction* shall restore the site to a safe condition, to the satisfaction of the *Chief Building Official*.

1.6.5.4. Application Review for Permit for Staged Construction

1) Where a *Certified Professional* complies with all application requirements for a *permit* for staged *construction*, the *Chief Building Official* may issue a *permit* for staged *construction* based upon a modified review of the drawings and other supporting documents submitted for the *permit* for staged *construction*.

1.6.5.5. Site Review of Staged Construction

1) Where a *permit* for staged *construction* is issued, the *Certified Professional* shall carry out detailed site reviews and shall be responsible for monitoring and follow-up necessary to support the *construction* authorized by the *permit* for staged *construction* and to support the *construction* of the entire *building*.

1.6.6. Revisions

1.6.6.1. Revisions to Applications

1) All applications for revisions to the original application shall comply with Article 1.6.2.2.

2) When revisions to the original application result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.

3) When application documents are either incomplete or changed to the extent that an additional plan review is necessary, an additional revision fee shall be charged in accordance with the Fee Schedule at the end of this Part.

1.6.6.2. Minor Revisions to Permits

1) All applications for minor revisions to the original *permit* shall comply with Article 1.6.2.2. to the extent required by the *Chief Building Official*.

2) When applications for minor revisions to the original *permit* result in an increase in the value of the proposed work, the *Chief Building Official* shall review the valuation and recalculate the *permit* fee in accordance with this By-law.

3) An additional revision fee shall be charged for applications for minor revisions to the original *permit* in accordance with the Fee Schedule at the end of this Part.

1.6.7. Permit Expiry and Extension

1.6.7.1. Permit Expiry

1) Except as provided in this Subsection, a *permit* shall expire and the rights of the *owner* under the *permit* shall terminate if in the opinion of the *Chief Building Official*

a) the work authorized by the *permit* is not commenced within 6 months from the date of issue of the *permit*,

b) the work although commenced is not continuously and actively carried out thereafter, or

c) the work has been substantially discontinued for a period of 6 months. (See Note A-1.6.7.1.(1).)

2) Except as provided in this Subsection 1.6.7., a *permit* for a temporary *building* or *occupancy* shall expire and the rights of the *owner* under the *permit* shall terminate on the expiry date noted on the *permit*.

1.6.7.2. Application to Chief Building Official for Extension

1) An *owner* who wishes to seek an extension of a *permit* shall make application to the *Chief Building Official* prior to the expiry of the *permit*.

2) An *owner* who wishes to seek an extension of a *permit* shall submit the application in writing accompanied by the requisite extension fee.

1.6.7.3. Extension of Permit by Chief Building Official

1) If the *Chief Building Official* is of the opinion that substantial completion of the work has been prevented because of exceptional circumstances, the *Chief Building Official* may extend the *permit*, provided that, in the meantime, no applicable amendments have been made to this By-law.

2) If the *Chief Building Official* is of the opinion that a *building* or *occupancy* is temporary, the *Chief Building Official* may extend the *permit* for a temporary *building* or *occupancy*, provided that, in the meantime, no applicable amendments have been made to this By-law.

1.6.8. Permits for Temporary Buildings, Including Tents and Air-Supported Structures

1.6.8.1. Definition of "Temporary"

1) In this Subsection, "temporary" means for a time period not exceeding 12 consecutive months or a fixed term of occupancy not to exceed 3 years where *acceptable*.

1.6.8.2. Compliance with By-law

1) Except as otherwise provided in this Subsection or in Part 13, Division B, Book I, no person shall erect a temporary *building*, including a tent or *air-supported structure*, which does not comply with this By-law.

1.6.8.3. Permit Required

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure* without a *permit*.

1.6.8.4. Compliance with Permit Conditions

1) No person shall erect, or use or occupy a temporary *building*, including a tent or *air-supported structure*, in contravention of the conditions of a *permit*.

1.6.8.5. Application Requirements

1) The application for a *permit* for a temporary *building*, including a tent or *air-supported structure*, shall be accompanied by

a) plans showing the location of the temporary *building*, tent or *air-supported structure* on the site, all other *existing buildings* on the same property and all other *buildings* on adjacent property located within at least 10 feet of the property line of the site,

b) *construction* details of the *building*, tent or *air-supported structure*,

c) a statement by the *owner* indicating the intended use and intended duration of such use.

2) The application for a temporary *occupancy permit* for a tent or *air-supported structure* shall be accompanied by documentation sufficient to establish that the tent or *air-supported structure* complies with Subsection 3.1.6. of Division B of Book I (General) of this By-law.

1.6.8.6. Time Limited Permits for Temporary Buildings and Structures

1) The *Chief Building Official* may issue a *permit* authorizing the *construction*, use or *occupancy* of a temporary *building*, including a tent or *air-supported structure*, and may attach conditions to such *permit*, including conditions allowing for selective compliance with the provisions of this By-law, if the *Chief Building Official* determines that the *construction*, use or *occupancy* will exist for a short time, and the circumstances do not warrant complete compliance with this By-law.

1.6.8.7. Permit End Date

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, shall state the date after which the *permit* is no longer valid.

1.6.8.8. Permit Extension

1) A *permit* for a temporary *building*, including a tent or *air-supported structure*, may only be extended if an extension is granted by the *Chief Building Official* prior to the expiry of the *permit*.

2) An *owner* who wishes to seek an extension of a *permit* for a temporary *building* from the *Chief Building Official* shall submit an application in writing to the *Chief Building Official* accompanied by the requisite extension fee.

3) If the *Chief Building Official* is of the opinion that the temporary *building* complies with the life safety requirements of this By-law, the *Chief Building Official* may extend the *permit*, and the *Chief Building Official* may require documentation from *registered professionals* to verify that the requirements of this By-law are being met.

1.6.9. Operating Permits

1.6.9.1. Operating Permit Required

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, without an *operating permit*.

1.6.9.2. Compliance with Permit Conditions

1) No person shall install or retain existing equipment or systems for which an *operating permit* is required under this By-law, in contravention of the conditions of an *operating permit*.

1.6.9.3. Application Requirements for New Operating Permits and Renewals

1) To obtain or renew an *operating permit*, the owner of the equipment, device, apparatus, or system, or their authorized representative, shall file an application in writing in the form prescribed by the *Chief Building Official*.

2) The application for a new *operating permit* or the renewal of an *operating permit* shall be accompanied by the *operating permit* fees and any documentation required by the *Chief Building Official* to verify that the requirements of this By-law are being met.

3) Except as provided in Sentences (4) and (5), *operating permits* are valid for a one year period, and shall be renewed on an annual basis.

4) *Operating permits* for *emergency once through cooling equipment* and *maintenance once through cooling equipment* will be valid for a period deemed appropriate by the *Chief Building Official*, and if valid for a period of

a) less than one year, may not be renewed, or

b) one year, shall be renewed on an annual basis.

5) *Operating permits* for *once through cooling equipment* permitted to retain an existing connection to the *City's* water system under Sentence 2.2.11.4.(4) of Division B of Book II (Plumbing Systems) of this By-law shall be valid for a one year period and renewed on an annual basis until the expiry date established by the *Chief Building Official*.

1.6.9.4. Owner Must be Certified

1) The owner of the equipment, device, apparatus, or system, or their authorized representative, must be certified under the Environmental Operators Certification Program, except that this requirement does not apply to *once through cooling equipment*. (See Note A-1.6.9.4.(1).)

1.6.9.5. Conditions on Operating Permits

1) The *Chief Building Official* may impose conditions on *operating permits* including, but not limited to, conditions regarding

a) notifications and notices,

b) safety,

c) health,

d) design requirements,

e) *construction* requirements,

f) timing of *construction*,

g) deadlines for completion of *construction*,

h) reviews and inspections,

i) responsibilities of the owner of the equipment, device, apparatus, or system, the *constructor*, the *registered professional* and the *certified professional*,

j) compliance with this By-law and other enactments,

k) use and *occupancy*, and

l) temporary *buildings* and *occupancies*.

1.6.9.6. Operating Permit Fees

1) *Operating permit* fees are as set out in the Schedule of Fees at the end of this Part.

Section 1.7. Permission to Occupy Buildings

1.7.1. General

1.7.1.1. Occupancy Permit Required

1) Except as otherwise provided in this By-law, no person shall occupy or allow the *occupancy* of any *building* or part thereof unless the *owner* has obtained an *occupancy permit* from the *Chief Building Official*.

2) No person shall occupy any *building* for a purpose other than the *occupancy* stipulated in an *occupancy permit* issued by the *Chief Building Official*.

1.7.1.2. Occupancy Permit

(See Note A-1.7.1.2.)

1) Every *owner* shall obtain an *occupancy permit* from the *Chief Building Official* prior to any

a) *occupancy* of a *building* or part thereof after *construction* or *alteration* of that *building*,

b) change in the *major occupancy* of any *building* or part thereof, or

c) change in the permitted *occupancy* within the same Division of the *major occupancy* Group, where the occupant load or the fire load has increased.

1.7.1.3. Exemptions from Occupancy Permit

1) Despite the requirements of Articles 1.7.1.1. and 1.7.1.2., an *occupancy permit* is not required for

a) residential *building* with not more than two principal *dwelling units*, or

b) a change in the permitted *occupancy* within the same *major occupancy* classification provided the *occupant load* is not increased and no *construction* has taken place.

1.7.1.4. Posting of Lawful Use

1) In any *building* not requiring an *occupancy permit*, the *Chief Building Official* may post a notice which describes the uses to which the *building* may be lawfully put.

1.7.2. Occupancy Permit Process

1.7.2.1. Owner's Obligation

1) An *owner* who wishes to obtain an *occupancy permit* shall file an application in the form required by the *Chief Building Official*.

1.7.2.2. Requirements for Occupancy Permit Application

1) The *permit* application requirements described in Article 1.6.2.2. do not apply to an application for an *occupancy permit* if the application includes

a) a letter from the *owner* declaring that the work complies with the By-law, the necessary *permits*, including *operating permits*, have been obtained and the *building* conforms with the accepted plans, in any case where a professional is not required by Subsection 2.2.7., Division C, Book I,

b) the appropriate letters of assurance in any case where a professional *field review* is required by Subsection 2.2.7. of Division C of Book I (General) of this By-law,

c) the anticipated date of completion,

d) the classification of the *building*,

e) the number of *storeys* in the *building*,

f) the gross *floor area* of each *storey*,

g) the allowable *live loads* for each *floor area*, and

h) an annual permit as required by the Electrical By-law.

1.7.2.3. Scheduling of Construction, Fire and Life Safety Systems Inspection

1) Prior to the issuance of an *occupancy permit*, the *owner* of a *building* shall call for and coordinate a final inspection of *construction*, fire and life safety systems in the *building*.

1.7.2.4. Requirements prior to Construction, Fire and Life Safety Systems Inspection

1) At least 24 hours prior to the final inspection for an *occupancy permit*, every *owner* shall submit to the *Chief Building Official*

a) proof of compliance with the By-law for all materials, equipment and methods of *construction*,

b) letters of assurance in the applicable forms attached as Schedules C-A and C-B, at the end of Part 2 of Division C,

c) a *contractor's* material and test certificate, certifying that the *sprinkler systems* have been flushed, inspected and tested,

d) a certificate of verification and a manufacturer's inspection report for the fire alarm system,

e) a fire safety plan and record of installed fire safety systems, conforming to the Fire By-law, and

f) a letter from a fire protection consultant verifying that the special devices or methods forming part of the alternative solution achieves the alternative solution.

1.7.2.5. Requirements during Construction, Fire and Life Safety Systems Inspection

1) During the final inspection of *construction*, fire and life safety systems in the *building*, the *owner* of the *building* shall make available

a) a copy of the fire safety plan,

b) a copy of the record of installed fire safety systems, and

c) a preventive maintenance and testing schedule and a maintenance log book for the life and fire safety systems.

1.7.2.6. Notice of Change Prior to Occupancy

1) Every *owner* shall give notice in writing to the *Chief Building Official* of any change to the *owner's* address or any change in the *ownership* of the *building* which occurs

a) prior to the issuance of an *occupancy permit*, or

b) prior to the *occupancy* of the *building*.

1.7.3. Partial Occupancy Permit for Building Under Construction

1.7.3.1. Partial Occupancy Permit

1) The *Chief Building Official* may issue a partial *occupancy permit* for part of a *building* which is under *construction* if, in the opinion of *Chief Building Official*, such partial *occupancy* would not jeopardize life or property.

2) The *Chief Building Official* may impose conditions on a partial *occupancy permit*.

3) The *Chief Building Official* may revoke a partial *occupancy permit* if the *permit* holder fails to comply with the conditions imposed by the *Chief Building Official*.

4) The *Chief Building Official* may revoke a partial *occupancy permit* if the *owner* fails to comply with any *permit* relating to the *building*.

1.7.3.2. Owner's Obligation regarding Unsafe Conditions

1) The *owner* of a *building* for which a partial *occupancy permit* has been issued shall ensure that there are no *unsafe conditions* in the *building*.

1.7.4. Temporary Occupancy Permit

1.7.4.1. Temporary Occupancy Permit

1) The *Chief Building Official* may issue a temporary *occupancy permit* for a temporary use within an *existing building*, or for the limited use of a *building* approved according to Subsection 1.6.8. or as otherwise provided in this By-law.

1.7.5. Re-Occupancy Permit

1.7.5.1. Re-occupancy Permit

1) Every *owner* shall obtain a re-*occupancy permit* from the *Chief Building Official* prior to any *occupancy* of a *building* or part thereof in respect of which the *Chief Building Official* has issued an order to cease *occupancy* due to an *unsafe condition*.

Section 1.8. Street Regulations

1.8.1. Encroachments

1.8.1.1. Encroachment Defined

1) In this Section an encroachment means a *building*, or a *building* appurtenance or fixture, including an existing areaway, a new or existing ornamental projection, awning, canopy, mechanical apparatus, or emergency *exit* apparatus, projecting in a *street*, whether above, at or below ground level.

1.8.1.2. Measurement of Encroachment

1) An encroachment shall be measured at right angles from a theoretical vertical plane located at the property line, to the outermost point of the encroachment in the *street*.

1.8.1.3. No Encroachment without Permission

1) No encroachment shall project into a *street*, unless permission has first been granted by the *City*.

1.8.1.4. Maintenance and Repair of Encroachment

1) Encroachments shall be repaired and maintained to the satisfaction of the *City Engineer* and the *Chief Building Official*.

1.8.1.5. Prohibited Encroachments

1) An encroachment shall not obstruct or interfere with

a) public utility poles or equipment,

b) firefighting equipment or fire rescue operations,

c) *street* trees or lamp standards, or

d) *street* furniture.

1.8.1.6. Compliance with Encroachment By-law

1) The *Chief Building Official* shall not issue a *permit* to construct an encroachment unless the encroachment complies with this By-law and with the Encroachment By-law.

1.8.2. Existing Encroachments

1.8.2.1. Existing Encroachments

1) An existing encroachment which complies with the Encroachment By-law and does not conform with this By-law may be continued if the encroachment is not altered.

1.8.2.2. Damage to Existing Encroachment

1) Subject to the provisions in Sentence (2), an existing encroachment which is damaged may be repaired.

2) Despite the provisions of Sentence (1) if the cost of the repair to an existing encroachment is more than 50 per cent of the current replacement cost of the damaged encroachment, the repair shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.3. Alteration to Existing Encroachment

1) Except for signs permitted by the Sign By-law, any enlargement or *alteration* of an existing encroachment shall constitute a new encroachment and shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.2.4. Signs

1) Signs permitted by the Sign By-law which encroach in a *street* shall comply with this By-law.

1.8.2.5. Door Swings

1) Except as provided in Subsection 1.8.11., doors, security gates and other moveable barriers, whether open or closed, shall not encroach in a *street*.

1.8.3. New Encroachments

1.8.3.1. Application

1) This Section applies to

a) new encroachments, and

b) *alterations* to existing encroachments which do not comply with the provisions of Subsection 1.8.2.

1.8.3.2. Dimensions and Clearances

1) Unless otherwise provided in this By-law, all new encroachments shall comply with the applicable *construction*, clearance and dimension requirements in Subsections 1.8.5. to 1.8.10.

1.8.3.3. Design and Construction of New Encroachments

1) A new encroachment shall be designed and constructed so that, in the event of its removal from the *building*, the *building* will comply with the provisions of this By-law.

1.8.3.4. Compliance with By-laws

1) A new encroachment shall comply with the provisions of this By-law and the Encroachment By-law.

1.8.3.5. Encroachments in Narrow Streets

1) Unless otherwise permitted by this Section, new encroachments or encroachments which do not comply with the provisions of Subsection 1.8.2. are not permitted in a *street* which is 10 m or less in width.

1.8.4. Repair or Removal of Encroachment

1.8.4.1. Removal or Repair by Owner

1) The *owner* of a *building* which encroaches in a *street* shall repair, alter or remove the encroachment if so ordered

a) by the *Chief Building Official*, in accordance with this By-law, or

b) by the *City Engineer*, in accordance with the Encroachment By-law.

1.8.4.2. Repair of Building after Removal of Encroachment

1) Upon removal of an encroachment from a *building*, the *owner* shall promptly repair the *building* and shall ensure that the *building* complies with this By-law.

1.8.4.3. Repair of Building at Owner's Expense

1) If the *Chief Building Official* has issued an order in accordance with Article 1.8.4.1. and an *owner* has failed to comply with that order, the *Chief Building Official* may

a) authorize *demolition* or removal of an encroachment, posting of security guards or fire wardens, or enclosure of such encroachment, *building*, *construction*, excavation or part thereof, at the expense of the *owner*,

b) recover such expense in the manner set out in this By-law, and

c) take such other measures as may be necessary to protect the public.

1.8.5. Areaways

1.8.5.1. Areaway Defined

1) In this Subsection an areaway means an existing underground *building* or *building* appurtenance, which encroaches in a *street* and forms part of or serves an adjacent *building*.

1.8.5.2. Design and Structural Requirements

1) The *Chief Building Official* shall refuse to issue a *permit* for *alteration* of an areaway unless the design has been first approved by the *City Engineer*.

2) Areaways shall be constructed with reinforced concrete walls and roofs which are capable of supporting the *street* surface, any superimposed *live loads*, surcharge loads and seismic loads, to the satisfaction of the *City Engineer*.

3) Notwithstanding Sentences (1) and (2), the provisions of Part 4, Division B, Book I of this By-law apply to the *construction* of an areaway.

1.8.5.3. Surface Construction Requirements

1) If any part of an areaway interfaces with the *street* surface, the areaway shall be

a) *noncombustible construction*,

b) constructed with solid non slip surfaces at the *street* surface interface, and

c) level with the *street* surface at the *street* surface interface.

1.8.5.4. Removal of Areaway

1) A person who wishes to remove an areaway shall

a) apply for and obtain all necessary *permits*,

b) install a cut-off wall integral to the *building*, to the satisfaction of the *Chief Building Official*,

c) waterproof the cut-off wall, to the satisfaction of the *Chief Building Official*, and

d) backfill and restore the *street* surface in accordance with the Encroachment By-law, to the satisfaction of the *City Engineer*.

1.8.6. Ornamental Projections and Existing Windows

1.8.6.1. Ornamental Projections Defined

1) In this Subsection, ornamental projections mean new and *existing building* appurtenances and fixtures which encroach in a *street*, and include

a) cornices,

b) copings, and

c) belt courses and other minor architectural trim such as water tables, column capitals and bases.

1.8.6.2. Construction

1) Except as permitted in Sentence (2), all ornamental projections, including their connections and supports, which encroach in a *street*, shall be *noncombustible construction*, and if constructed of metal, shall be no less than 0.56 mm in thickness.

2) Where roof *construction* is permitted to be of wood, the *Chief Building Official* may also permit a cornice to be of *combustible* materials, if

a) the cornice only consists of roof members cantilevered over the *street* and covered by a roof deck, and

b) the underside of the cornice is exposed, without a boxed-in soffit.

1.8.6.3. Ornamental Projections in Streets

1) For the purposes of this Article 1.8.6.3., the height of an ornamental projection shall be determined by vertical measurement from the lowest point of the encroachment to the *street* level immediately below.

2) Subject to the provisions of Sentence 1.8.6.3.(3), an ornamental projection may encroach into a *street* which is at least 10 m wide, no more than:

a) 75mm for a projection located below 2.75m above the *street*,

b) 500mm for a projection located between 2.75m and 5.2m above the *street*,

c) 915mm for a projection located between 5.2m and 7.62m above the *street*, and

d) 1370mm for a projection located more than 7.62m above the *street*.

3) The provisions of Sentence 1.8.6.3.(2) do not apply to an existing encroaching ornamental projection which is designated by by-law as protected heritage property or is the subject of a heritage revitalization agreement.

4) An ornamental projection may encroach in a *street* which is less than 10 m wide, if

a) it is located no less than 7.62 m above the *street*,

b) it does not encroach more than 915 mm beyond the property line, and

c) it does not interfere with overhead public utilities.

1.8.6.4. Existing Encroaching Windows

1) An oriel or bay window shall not encroach in a *street* except that *alterations* may be made to an existing oriel or bay window if

a) it encroaches no more than 600 mm beyond the property line,

b) it is located no less than 5.2 m above the *street*, and

c) the *street* is no less than 10 m in width.

2) The provisions of Sentence (1) do not apply to an existing encroaching oriel or bay window which is designated in accordance with a heritage designation by-law or is the subject of a heritage revitalization agreement with the *City*.

1.8.7. Awnings

1.8.7.1. Awning Defined

1) In this Subsection, an awning means a light detachable structure which encroaches in a *street* and which consists of a covering of fabric, sheet metal or other relatively flexible material on a fixed or retractable structural frame attached to and entirely supported by a *building*.

1.8.7.2. Attachments

1) No electrical wiring, illuminated device, electrical equipment or apparatus shall be attached to or incorporated in an awning, except that drive mechanisms and attachments to the structural frame required for the operation of collapsible awnings may be permitted by the *Chief Building Official*.

1.8.7.3. Structural Design

1) Except as permitted in Sentence (3), the structural frame of an awning and its connections to the supporting *building* shall be designed in conformance with Part 4 of Division B of Book I (General) of this By-law.

2) The structural frame of an awning and its connections to the supporting *building* shall be *noncombustible*.

3) A fabric covered retractable awning shall be designed to withstand wind, rain, snow, and seismic design loads applied to the closed awning.

1.8.7.4. Clearances

1) The horizontal distance from the outer edge of an awning measured to the outer face of the *street* curb shall be no less than 600 mm.

2) No portion of an awning shall be less than 2.75 m above the level of the street surface or established *building* grade, except that if the *street* surface or established building grade below the awning slopes more than 0.1 m over the length of the awning, the vertical clearance may be no less than 2.6 m, except that a soft fringe attached to the awning and made of canvas or cloth may have a clearance of no less than 2.3 m.

1.8.7.5. Combustible Material Requirements

1) *Combustible* materials used in awnings shall conform to the appropriate requirements for resistance to fire as set out in CAN/ULC-S109, “Flame Tests of Flame-Resistant Fabrics and Films”, or NFPA 701, “Standard Method of Fire Tests for Flame Propagation of Textiles and Films.”

2) *Combustible* materials shall not be used in an awning which is above the second *storey* of a *building*.

3) *Combustible* materials shall not be used in an awning which is attached to an exterior wall required to be of *noncombustible construction*.

1.8.7.6. Vertical Height

1) The vertical dimensions of the front and sides of an awning shall not exceed 3.65 m at any point, unless otherwise permitted by the *Chief Building Official*.

1.8.7.7. Awning Not to Span Unprotected Openings

1) An awning shall not span *unprotected openings* in separate *fire compartments*.

1.8.8. Canopies

1.8.8.1. Canopy Defined

1) In this Subsection, a canopy means a structure encroaching in a *street* that provides pedestrian weather protection and has a covering of glass, metal or other rigid material on a fixed detachable rigid frame that is attached to and entirely supported by a *building*.

1.8.8.2. Requirements for Materials

1) A canopy shall be

a) constructed of *noncombustible* materials, except as provided in Sentence (2) and Clause (3)(c),

b) supported entirely by the *building* to which the canopy is attached, and

c) constructed so that its removal conforms to Sentence 1.8.3.3.(1).

2) Despite Clause (1)(a), if the *building* or the exterior wall to which the canopy is attached is of *combustible construction*, a canopy may be constructed of *combustible* materials.

3) The deck and roof of a canopy shall be constructed of

a) wired or laminated safety glass,

b) metal no less than 0.56 mm in thickness, or

c) wood plank no less than 60 mm in thickness, sheathed on the top and the soffit with metal or other *noncombustible* material, and constructed and fire stopped to the satisfaction of the *Chief Building Official*.

1.8.8.3. Clearances

1) The vertical distance from the lowest point of a canopy to the *street* surface shall be no less than 2.75 m.

2) The horizontal distance from the outer edge of a canopy to the outer face of the *street* curb shall be no less than 750 mm.

3) A canopy shall be no less than 600 mm from an adjoining property line or from the production of the property line into the *street*, unless the canopy is constructed entirely of *noncombustible* materials.

4) Despite the provisions of Sentence (3), if a property line is adjacent to a *lane*, a canopy shall be located no less than 600 mm from the production of the property line into the *street*.

5) A canopy shall be no less than 600 mm from a utility pole or lamp standard.

1.8.8.4. Vertical Dimensions of Canopy

1) Unless otherwise accepted by the *Chief Building Official*, the vertical dimensions of the front and sides of a canopy shall not exceed 3.65 m at any point.

1.8.8.5. [UTV Deleted]

1.8.8.6. Canopy Drainage System

1) Unless otherwise permitted by the *Chief Building Official*, a canopy roof shall be provided with a drainage system conforming to Part 2 of Division B of Book II (Plumbing Systems) of this By-law and connected to the *building storm water* system.

2) Downpipes for canopies shall not encroach more than 75 mm in the *street*.

1.8.8.7. Structural Design of Canopies

1) A canopy shall be designed to

a) support the expected loads due to weather, and

b) withstand seismic design loads

1.8.9. Solar Shading Device

1.8.9.1. Solar Shading Device Defined

1) In this Subsection, a solar shading device means a structure encroaching in a *street*, that prevents solar heat gain through windows and has a fixed detachable rigid frame that is attached to and entirely supported by a *building.*

1.8.9.2. Requirements for Materials

1) A solar shading device shall be

a) constructed of *noncombustible* materials, except as provided in Sentence (2) and Clause (3)(c),

b) supported entirely by the *building* to which the solar shading device is attached, and

c) constructed so that its removal conforms to Sentence 1.8.3.3.(1).

2) Despite Clause (1)(a), if the *building* or the exterior wall to which the solar shading device is attached is of *combustible construction*, a solar shading device may be constructed of *combustible* materials.

3) The solar shading device shall

a) if constructed of glass, use wired or laminated safety glass,

b) if constructed of metal, shall be no less than 0.56 mm in thickness, or

c) if constructed of wood plank, shall be no less than 60 mm in thickness, sheathed on the top and the soffit with metal or other *noncombustible* material, and constructed and fire stopped to the satisfaction of the *Chief Building Official*.

4) Solar shading devices shall be of *noncombustible* construction where installed on an exposing wall face required to be *noncombustible* in accordance with Division B, Subsection 3.2.3.7.

1.8.9.3. Clearances

1) The horizontal distance from the outer edge of a solar shading device to the outer face of the *street* curb shall be no less than 600 mm.

2) For the purposes of this Article 1.8.9.3., the height of a solar shading device shall be determined by vertical measurement from the lowest point of the encroachment to the *street* level immediately below.

3) The maximum projection of a solar shading device into a *street* which is at least 10 m wide, shall be

a) 500 mm for a solar shading device located between 2.75 and 5.2m above the *street*,

b) 915 mm for a solar shading device located between 5.2m and 7.62m above the street, and

c) 1370 mm for a solar shading device located more than 7.62m above the street except that a solar shading device must also conform to the requirements of Sentence 1.8.9.3.(1).

4) A solar shading device may encroach in a *street* which is less than 10 m wide, if

a) it is located no less than 7.62 m above the *street*,

b) it does not encroach more than 915 mm beyond the property line, and

c) it does not interfere with overhead public utilities.

5) A solar shading device shall be no less than 600 mm from an adjoining property line or from the production of the property line into the *street*, unless the solar shading device is constructed entirely of *noncombustible* materials.

6) Despite the provisions of Sentence (5), if a property line is adjacent to a *lane*, a solar shading device shall be located no less than 600 mm from the production of the property line into the *street*.

1.8.9.4. Solar Shading Device Not to Span Unprotected Openings

1) A solar shading device shall not span *unprotected openings* in separate *fire compartments*.

1.8.9.5. Structural Design of Solar Shading Device

1) A solar shading device shall be designed to

a) support the expected loads due to weather,

b) withstand seismic design loads, and

c) shed snow and ice in a manner that minimizes risk to persons and property below.

1.8.10. Mechanical Apparatus

1.8.10.1. Clearances

1) Exterior hose connections for fire-fighting equipment, ventilation intakes and outlets, *chimneys* and air conditioning units shall not encroach in a street unless permitted by the *City Engineer*.

2) Fire alarm bells and fire gongs may encroach up to 300 mm in a *street*, except that such encroachments shall be located no less than 2.6 m above the *street* surface or established *building* grade.

1.8.11. Emergency Exits

1.8.11.1. Stairways and Fire Escapes

1) The *Chief Building Official* may permit stairways and balconies for fire escapes to encroach in a *street*, except that the lowest part of such stairways and balconies shall be no less than 5.2 m above the *street* surface.

1.8.11.2. Emergency Exit Doors

1) Emergency *exit* doors may encroach no more than 300 mm in a *street* which is no less than 10 m in width.

2) Despite Sentence (1), the *City Engineer* may permit an emergency *exit* door to encroach in a *street* which is less than 10 m in width, provided that such door does not encroach more than 300 mm in the *street*.

Section 1.9. Temporary Occupancy of a Street for Construction Purposes

1.9.1. General Requirements

1.9.1.1. Permit Required Prior to Occupancy of Street

1) No person shall occupy a *street* or the air space above a *street* in connection with, or incidental to the *construction* or maintenance of any *building*, without first obtaining a street use permit from the *City Engineer*.

1.9.1.2. Permit Required Prior to Excavation in Street

1) No person shall excavate or backfill any part of a *street* without first obtaining a street use permit from the *City Engineer*.

1.9.1.3. Liability Disclaimer

1) An application for a street use permit shall contain an undertaking by the *owner* to save harmless the *City* against all claims, liabilities, judgments, costs and expenses in consequence of, or in any way incidental to the granting of such *permit*, in a form satisfactory to the Director of Legal Services.

1.9.2. Overhead Construction

1.9.2.1. Permit Required for Overhead Construction

1) No person shall cause a swing scaffold or *construction* hoisting device to occupy the air space above a *street* without first obtaining a street use permit from the *City Engineer*.

1.9.2.2. Prevention of Public Entry

1) The *street* under a swing scaffold or *construction* hoisting device shall be fenced, roped off or otherwise protected against public entry to the satisfaction of the *City Engineer*.

1.9.3. Public Safety

1.9.3.1. Construction Site Protection of the Public Required

1) No person shall construct, alter or repair any *building* unless fencing, boarding, barricades or covered walkways as required by Part 8 of Division B of Book I (General) of this By-law have first been erected on or adjacent to the *street*, to the satisfaction of the *Chief Building Official*.

2) The *Chief Building Official* may modify the requirements of Sentence (1) if satisfied that the location of the *construction* is sufficiently protected or remote from areas frequented by the public.

1.9.3.2. Permit Required for Fencing, Boarding, Barricades or Covered Walkways

1) No person shall erect fencing, boarding, barricades or covered walkways on a *street*, without first obtaining a street use permit from the *City Engineer*.

Section 1.10. Addressing Buildings and Parcels of Land

1.10.1. Address Numbering System

1.10.1.1. Numeric Addresses

1) Addressing of *buildings*, *suites* within a *building* or parcels of land shall be numeric.

1.10.1.2. East/West Addresses

1) East/West addresses shall run in series, commencing with the unit block and increasing in numeric value in a westerly direction from the west side of Ontario Street or the west side of Carrall Street and commencing with the unit block and increasing in numeric value in an easterly direction from the east side of Ontario Street or the east side of Carrall Street.

2) *Buildings* on the north side of *streets* running in an east or west direction shall have odd numbers, and *buildings* on the south side of such *streets* shall have even numbers.

1.10.1.3. North/South Addresses

1) North/South addresses shall run in series, commencing with the unit block and increasing in numeric value in a northerly direction from the north side of Dundas Street and commencing with the unit block and increasing in numeric value in a southerly direction from the south side of Dundas Street.

2) *Buildings* on the west side of *streets* running in a north or south direction shall have odd numbers, and *buildings* on the east side of such *streets* shall have even numbers.

1.10.1.4. Multiple Suite Addresses

1) Where a *building* with a non-continuous *public corridor* or direct exterior access contains multiple addressable *suites*, addresses of *suites* on *floor areas* shall be assigned in an increasing numeric order commencing from the point of entry as determined by the *Chief Building Official* and moving in a direction as determined by the *Chief Building Official*.

2) Where a *building* with a continuous *public corridor* contains multiple addressable *suites*, addresses of *suites* on *floor areas* shall be assigned in an increasing numeric order commencing from the point of entry as determined by the *Chief Building Official* and moving in a direction as determined by the *Chief Building Official*.

1.10.1.5. Principal Buildings

1) Except is permitted by Sentences (2) and (3), every *building,* or substantive portion of a *building* that is provided with a separate exterior principle access designed such that it will function as a separate and distinct

entity, on a site shall be assigned a separate numeric *street* address where sufficient numeric street addresses are available.

2) In the case where there is an insufficient number of numeric street addresses available, the Chief Building Official may assign the same street number to one or more adjacent buildings on a site provided

a) that suite numbers are assigned between the affected buildings in a simple and logical manner that makes the location of each suite self-evident,

b) sufficient and clear signage is provided and visible on approach so as to make clear what sequence of suite number assignment is,

c) a principle fire department access *acceptable* to the Chief Building Official and the fire department will be provided to the site, and

d) a graphic map is provided at the principle fire department access that shows the location of each of the buildings and suites.

3) Not more than one laneway house may be assigned a *suite* number that is subordinate to the principal residential *building* in accordance with Article 1.10.1.4., provided

a) that the laneway house along with the principal residential *building* shall consist of a single real-estate entity that is not subdivided into separate strata lots pursuant to the “Strata Property Act”,

b) *suite* numbers are assigned between the affected *buildings* in a simple and logical manner that makes the location and relationship of each *suite* self-evident as if the laneway house formed a part of the principal residential *building*, and

c) sufficient and clear signage is provided and visible on approach so as to make clear the sequence of suite number assignment.

SCHEDULE E-1

Forming Part of Sentence 1.6.2.2.(1), Division C of the Building By-law

Building Permit Number (for CoV Use)

OWNER'S UNDERTAKING

Notes:

i) This letter must be submitted before issuance of a *building permit*.
ii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re:

Name of Project (Print)

Address of Project (Print)

In consideration of the *City* accepting and processing an application for a *building permit* for the *project* identified above, and as required by the Building Bylaw, the following representations, warranties and indemnities are given to the City by the *owner*.

1. **[If an individual is the owner]**

   ( ) That I am the *owner* of the above property,

   or

   [If a corporation is the owner]

   ( ) _____ is the *owner* of the above property.
   (Name of Corporation)

2. The *owner* will comply with and cause those employed for this project to comply with all applicable bylaws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this letter is submitted.

3. The *owner* fully understands the requirements herein, and acknowledges full responsibility for carrying out the work, or gives assurance that the work will be carried out, in accordance with all bylaws governing the construction of the *building*. The *owner* understands and acknowledges that the issuance of any *permit*, including an *occupancy permit*, or the inspection or approval or passage of work by the *City* is not a representation or warranty that any bylaw has been complied with and the *owner* remains responsible at all times to assure compliance. The *owner* has read and understands Articles 1.3.2.1. and 1.4.1.5. of Division C of Book I of the Building Bylaw which are set out below.

4. The *owner* hereby agrees to indemnify and save harmless the *City* and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all bylaws, statutes and regulations relating to any work or undertaking in respect of which this letter is submitted.

5. Where words "work" or "undertaking" are used herein, the *owner* understands this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated *construction*.

6. I am authorized to give these representations, warranties, assurances and indemnities to the *City*.

Owner's Undertaking (continued)

Building Permit Number (for CoV Use)

[Where owner is an individual]

Signed and delivered in the presence of:

Owner's Signature	Witness Signature
Owner's Name (Print)	Witness's Name (Print)
Date	Date
Phone No. and Email address	Witness's address

[Where owner is a corporation]

Signed, sealed and delivered in the presence of:

Name of Corporation	Witness Signature
Per: Authorized Signatory	Witness's Name (Print)
Name (Print)	Date
Date	Witness's address
Phone No. and Email address	

Referenced Articles *below*

Building Bylaw, Division C, Article 1.3.2.1. Intent

1) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the *city*, the *Chief Building Official* or any employee of the *city* to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any *permit*, including an *occupancy permit*, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the *Chief Building Official* shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and Other Enactments

1) The *owner* shall comply with this By-law and all other applicable enactments.
2) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.
3) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.
4) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.
5) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

SCHEDULE E-2

Forming Part of Sentence 1.6.2.2.(1), Division C of the Building By-law

_____
Building Permit Number (for CoV Use)

BUILDING BY-LAW OWNER'S AND TENANT'S UNDERTAKING

[to be used when a tenant is carrying out the project]

Notes:

i) This letter must be submitted before issuance of a *building permit*.
ii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re:

_____
Name of Project (Print)

_____
Address of Project (Print)

In consideration of the *City* accepting and processing the above application for a *building permit* for the *project* identified above, and as required by the Building By-law, the following representations, warranties and indemnities are given to the *City* by the *owner* and by the tenant.

1. **[If an individual is the owner]**

   ( ) I am the *owner* of the above property.

   or

   [If a corporation is the owner]

   ( ) _____ is the *owner* of the above property.
   (Name of Corporation)

   [If an individual is the tenant]

   ( ) I am the tenant of the above property.

   or

   [If a corporation is the tenant]

   ( ) _____ is the tenant of the above property.
   (Name of Corporation)

2. The *owner* will use its reasonable efforts to require the tenant to comply with, and cause those employed for this *project* to comply with all applicable by-laws of the *City* and other statutes and regulations in force in the *City* relating to the development, work, undertaking or permission in respect of which this application is made.

3. The *owner* understands and acknowledges that the issuance of any *permit*, including an *occupancy permit*, or the inspection or approval or passage of work by the *City* is not a representation or warranty that any by-law has been complied with and the *owner* remains responsible at all times to use its reasonable efforts to require compliance by the tenant. The *owner* has read and understands Article 1.3.2.1. and Article 1.4.1.5. of Division C Book I of the Building By-law which are set out on the reverse side hereof.

4. The *owner* hereby agrees to use its reasonable efforts to require that the tenant does indemnify and save harmless the *City* and its employees from all claims, liability, judgments, costs and expenses of every kind including negligence which may result from the failure to comply fully with all by-laws, statues and regulations relating to any work or undertaking in respect of which this application is made.

5. Where used herein the words "work" or "undertaking" in respect of which this application is made, the *owner* understands this to include all trade work, including but not limited to: electrical, plumbing, mechanical, gas and other works necessary to complete the contemplated *construction*.

6. The *owner* and the tenant are authorized to give these representations, warranties, assurances and indemnities to the *City*.

Schedule E-2 (continued)

Building Permit Number (for CoV Use)

Project Address: _____

Owner's signature

[Where owner is an individual]

_____
Owner's Signature

_____
Owner's Name (Print)

_____
Date

_____
Phone No. and Email address

Signed and delivered in the presence of:

_____
Witness Signature

_____
Witness's Name (Print)

_____
Date

_____
Witness's address

[Where owner is a corporation]

_____
Name of Corporation

_____
Per: Authorized Signatory

_____
Name (Print)

_____
Date

_____
Phone No. and Email address

Signed, sealed and delivered in the presence of:

_____
Witness Signature

_____
Witness's Name (Print)

_____
Date

_____
Witness's address

Schedule E-2 (continued)

Building Permit Number (for CoV Use)

Project Address: _____

Tenant's signature

[Where the tenant is an individual]

_____
Owner's Signature

_____
Owner's Name (Print)

_____
Date

_____
Phone No. and Email address

Signed and delivered in the presence of:

_____
Witness Signature

_____
Witness's Name (Print)

_____
Date

_____
Witness's address

[Where the tenant is a corporation]

_____
Name of Corporation

_____
Per: Authorized Signatory

_____
Name (Print)

_____
Date

_____
Phone No. and Email address

Signed, sealed and delivered in the presence of:

_____
Witness Signature

_____
Witness's Name (Print)

_____
Date

_____
Witness's address

Referenced Articles *below*

Building Bylaw, Division C, Article 1.3.2.1. Intent

2) This By-Law sets standards in the general public interest. It is enacted and retained on the understanding and specifically expressed condition that it creates no duty whatsoever on the *city*, the *Chief Building Official* or any employee of the *city* to enforce its provisions, and on the further condition that a failure to administer or enforce its provisions, or the incomplete or inadequate administration or enforcement of its provisions, shall not give rise to a cause of action in favour of any person whatsoever. The issuance of any *permit*, including an *occupancy permit*, is not a representation, warranty or statement that this By-Law or any other enactment has been complied with, and the issuance thereof in error shall not give rise to a cause of action. Accordingly, words in this By-law defining the responsibilities and authority of the *Chief Building Official* shall be construed as internal administrative directions which do not create a duty.

Building By-law, Division C, Article 1.4.1.5. Compliance with By-law and Other Enactments

6) The *owner* shall comply with this By-law and all other applicable enactments.
7) The *owner* shall ensure that all work, *construction*, or *occupancy* is carried out in accordance with this By-law and all other applicable enactments.
8) The *owner* shall ensure that the *occupancy* of a *building* or part of a *building* complies with the *occupancy permit*.
9) The issuance of a *permit*, the acceptance of plans and supporting documents submitted for a *permit*, or the making of inspections by the *Chief Building Official* shall not relieve the *owner* of a *building* from the full responsibility for carrying out the work or having the work carried out in accordance with this By-law and all other applicable enactments.
10) The *owner* shall ensure that all underground storage tanks on the subject property that are intended for the storage of heating oil but have not been used for over 2 years are removed and any associated contamination is remediated to the applicable standards as prescribed in the Contaminated Sites Regulation. All work must be completed in accordance with the requirements of the Vancouver Fire By-law.

Schedule of Fees

PART A – BUILDING

1. The fees hereinafter specified shall be paid to the City with respect to and upon the application for the issue of a PERMIT as follows:

(a) Except as provided for in Clause (b) and Section 4 for the CONSTRUCTION of any BUILDING, or part thereof:

When the estimated cost of the work, being the valuation referred to in Article 1.6.2.3. of Book I, Division C and Book II, Division C of this By-law, does not exceed $5,000 or for the first $5,000 of the estimated cost of the work $217.00

For each $1,000, or part thereof, by which the estimated cost of the work exceeds $5,000 but does not exceed $50,000. ..... $13.90

For each $1,000, or part thereof, by which the estimated cost of the work exceeds $50,000. ..... $7.04

(b) For the installation, CONSTRUCTION, re- construction, ALTERATION or repair of, or ADDITION to:

(i) any CHIMNEY, FIREPLACE, INCINERATOR, VENTILATING SYSTEM, AIR- CONDITIONING SYSTEM, or HEATING SYSTEM, the fee shall be in accordance with Clause (a), except that a fee shall not be charged when the cost of such work is less than $500

(ii) any PHOTOVOLTAIC PANELS, and related roof ALTERATION or repair. $138.00

(c) For an OCCUPANCY PERMIT not required by this By-law but requested. $314.00

(d) For the demolition of a BUILDING, not including a SINGLE DETACHED HOUSE, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3:

For each DWELLING UNIT. $1,570.00

For each sleeping room in a multiple conversion dwelling, hotel or other BUILDING, which is or has been a principal dwelling or residence of a person, family or household. $1,570.00

(e) For the demolition of a SINGLE DETACHED HOUSE, which has at any time since November 1, 1986 provided RESIDENTIAL OCCUPANCY, subject to Section 3. ..... $1,570.00

2. The fees hereinafter specified shall be paid to the City as follows:

(a) For a required permit inspection for compliance with this By-Law which cannot be carried out during normal working hours and where there is a request to carry out the inspection after hours, the fee to be based on the time actually spent in making such inspection, at a minimum inspection time of four (4) hours, including traveling time:

For each hour or part thereof. $427.00

(b) For a plan review where an applicant requests in writing that the review be carried out during overtime:

For each hour or part thereof. $427.00

(c) For each special inspection of a BUILDING or structure to determine compliance with this By-law, and in respect of which no specific fee is otherwise prescribed, the fee to be based on the time actually spent in making the inspection:

For each hour or part thereof $282.00

(d) For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected. $282.00

(e) For each inspection of a drainage tile system:

For a single detached house or duplex. $291.00

For all other drain tile inspections:

When the estimated cost of the CONSTRUCTION of the BUILDING, being the valuation referred to in Article 1.6.2.3. of Book I, Division C and Book II, Division C does not exceed $500,000. ..... $568.00

When the estimated cost of the work exceeds $500,000 but does not exceed $1,000,000. ..... $1,140.00

When the estimated cost of the work exceeds $1,000,000. ..... $1,430.00

For the special search of records pertaining to a BUILDING to advise on the status of outstanding orders and other matters concerning the BUILDING:

For a residential building containing not more than 2 principal dwelling units. $364.00

For all other BUILDINGS. $729.00

(g) To access plans (electronic or on microfilm) or documents for viewing or copying. $62.00

(h) For each microfilm image or electronic file copied. $17.10

(i) For a request to renumber a BUILDING. $1,340.00

(j) For the extension of a BUILDING PERMIT where requested in writing by an applicant pursuant to Article 1.6.7.2. of Book I, Division C and Book II, Division C ..... 50% of the original BUILDING PERMIT fee to a maximum of $521.00

(k) For the extension of a building permit by Council where requested in writing by an applicant pursuant to Article 1.6.7.4. of Book I, Division C and Book II, Division C. $3,240.00

(l) For an evaluation of plans, specifications, building materials, procedures or design methods for the purpose of revisions to an application or a permit in accordance with Article 1.5.2.13. and Subsection 1.6.6. of Book I, Division C and Book II, Division C where the PERMIT relates to a SINGLE DETACHED HOUSE or a SECONDARY SUITE..... $282.00
plus for each hour, or part thereof, exceeding one hour $282.00
where the PERMIT relates to any other BUILDING..... $856.00
plus for each hour, or part thereof, exceeding one hour $427.00

(m) For each RE-OCCUPANCY PERMIT after rectification of an UNSAFE CONDITION and related By-law violations $519.00

(n) For review of plans, specifications, building materials, procedures or design methods for the purpose of acceptance of an alternative solution for new or existing construction under Article 2.3.2.1. of Book I, Division C for each application ..... $1,190.00 #14688

(o) **Deleted.**

(p) For review by the Alternative Solution Review Panel $3,840.00

(q) For the evaluation of a resubmission or revised submission made under Clauses (n) or (o) of this Section 2..... $427.00

(r) For each refund issued pursuant to Sentence 1.6.2.7.(2) of Book I, Division C, and Book II, Division C the administrative fee to be deducted ..... $97.00 #14414

(s) For the service of the City providing a Development Cost Levy (DCL) deferral prior to the issuance of an initial building permit $1,000.00

(t) For the service of the City providing a Amenity Cost Charge (ACC) deferral prior to the issuance of an initial building permit.....$1,000.00 #14820

3. Upon written application of the payor and on the advice of the General Manager of Community Services, the Director of Finance shall refund to the payor, or a designate of the payor, the fees paid pursuant to Clauses (d) and (e) of Section 1:

(a) for all demolished dwelling units in a building that will be replaced by a social housing or co-operative development that has received a Project Commitment Letter from the British Columbia Housing Management Commission or the Canada Mortgage and Housing Corporation; and

(b) for each demolished dwelling unit that has been replaced by a dwelling unit occupied by rental tenants and not created pursuant to the Strata Property Act.

4. Upon written application by the payor and on the advice of the Director of Planning, the Chief Building Official shall reduce the fees paid pursuant to Clause (a) of Section 1 by percentage for that part of a building designated as Social Housing. 20%

PART B - PLUMBING

Every applicant for a Plumbing PERMIT shall, at the time of application, pay to the City the fees set out hereunder:

1. INSTALLATIONS

For the Installation of:

One, two or three FIXTURES. $282.00

Each additional FIXTURE. $88.70

Note: For the purpose of this schedule the following shall also be considered as FIXTURES:

- Every "Y" intended for future connection;
- Every ROOF DRAIN, swimming pool, dishwasher, and interceptor;
- Every vacuum breaker in a lawn sprinkler system; and
- Every back-flow preventer

Alteration of Plumbing (no FIXTURES involved):

For each 30 m of piping or part thereof..... $415.00

For each 30 m of piping or part thereof, exceeding the first 30 m. $115.00

Connection of the City water supply to any hydraulic equipment. $156.00

2. INSPECTIONS OF FIRELINE SYSTEMS:

Hydrant & Sprinkler System:

First two inspections for each 30 m of water supply pipe or part thereof. $415.00

Each additional inspection for each 30 m of water supply pipe or part thereof..... $171.00

Sprinklers:

First head, single detached house or duplex. $471.00
First head, all other buildings. $1,004.00
First head, renovations to existing sprinkler systems. $292.00
Each additional head, all buildings (no limit on number). $5.16

Firelines:
Hose Cabinets. $54.50
Hose Outlets. $54.50

Wet & Dry Standpipes. $54.50
Standpipes. $54.50
Dual Check Valve In-flow Through Devices. $54.50
Backflow Preventer. $282.00

Wet & Dry Line Outlets:
Each connection $54.50
NOTE: A Siamese connection shall be considered as two dry line outlets.

Each Fire Pump $441.00
Each Fire Hydrant $136.00

3. REINSPECTIONS
For each REINSPECTION made necessary due to faulty work or materials or incomplete work requested to be inspected $282.00

4. SPECIAL INSPECTIONS
Each inspection to establish fitness of any existing fixture for each hour or part thereof $282.00
An inspection outside normal working hours and at a minimum inspection time of four (4) hours, including traveling time, for each hour or part thereof $427.00

5. BUILDING SEWER INSPECTIONS
First two inspections for each 30 m of BUILDING SEWER or part thereof $415.00
Each additional inspection for each 30 m of BUILDING SEWER or part thereof $171.00

PART C – OPERATING PERMITS

Every applicant for an OPERATING PERMIT shall, at the time of application for a new OPERATING PERMIT or renewal of an OPERATING PERMIT, pay to the City the fees set out hereunder:
For each OPERATING PERMIT relating to equipment or systems in a BUILDING $216.00
For not renewing an OPERATING PERMIT on or before the renewal date
The OPERATING PERMIT renewal fee plus $122.00
For each reinspection made necessary due to non-compliance with this By- law $270.00
For each change of permit holder on an OPERATING PERMIT $122.00

PART D – MECHANICAL PERMITS

Every applicant for a MECHANICAL PERMIT shall, at the time of application, pay to the City the fees set out hereunder:
For a MECHANICAL PERMIT for a single private residential deck, patio, or balcony in a DWELLING UNIT $263.00
For a MECHANICAL PERMIT in a 1-3 storey BUILDING $432.00
plus $15.30 per 1kW #14539
For a MECHANICAL PERMIT in a BUILDING of 4 storeys and above $985.00
plus for each electric heat pump installation above 6 total heat pump units, to a maximum of $2,500.00 ..... $122.00

Notes to Part 1

Administrative Provisions

This Appendix is included for explanatory purposes only and does not form Part of the requirements except as defined in Division A Sentence 1.1.3.1.(1). The numbers that introduce each Appendix Note correspond to the applicable requirements in this Division.

A-1.3.3.5. Unsafe Conditions. Although words such as alteration, occupancy, building and unsafe conditions are defined in Article 1.4.1.2. of Division A, such words as removal and relocation contained here and in the definitions are adequately defined in dictionaries and need not be defined herein.

A-1.3.3.6. Work on Public Property. The appropriate government authority may be federal, provincial or city, depending on the nature of the public property.

A-1.3.3.7. Changes in Ground Elevation and Limiting Distance. If a new or existing building is built as close to a boundary line as the regulations permit, moving the property boundary could result in contravention of the By-law in regards to spatial separations. In those circumstances, this Subsection would not apply.

A-1.4.1.10. Project Directory. This Subsection requires the owner to inform the Chief Building Official of changes in responsibilities of certain employees. It is not intended to limit the owner's right to change the constructor, engineer, architect or inspection or testing agency, but rather to let the building official know of any such change so that construction will not be held up because of any misunderstanding as to who is responsible. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.15. Tests to Establish Compliance. Where a manufacturer, fabricator or erector is required to conform to specified requirements, such as those referenced by Articles 4.3.1.2. and 4.3.3.1. of Division B, Book I, it is intended that proof of such compliance be filed with the Chief Building Official. See Letters of Assurance at the end of Part 2 of Division C.

A-1.4.1.19.(1) Uncovering Work. The requirement to uncover and replace work will normally apply only if Article 1.4.1.17. has not been complied with, that is, if work requiring inspection has been covered prematurely. Complete uncovering may not be necessary. Here, again, the judgment of the designated official is required to determine if partial uncovering, test holes or similar actions will be sufficient to indicate compliance, the purpose being to promote compliance not to penalize the constructor.

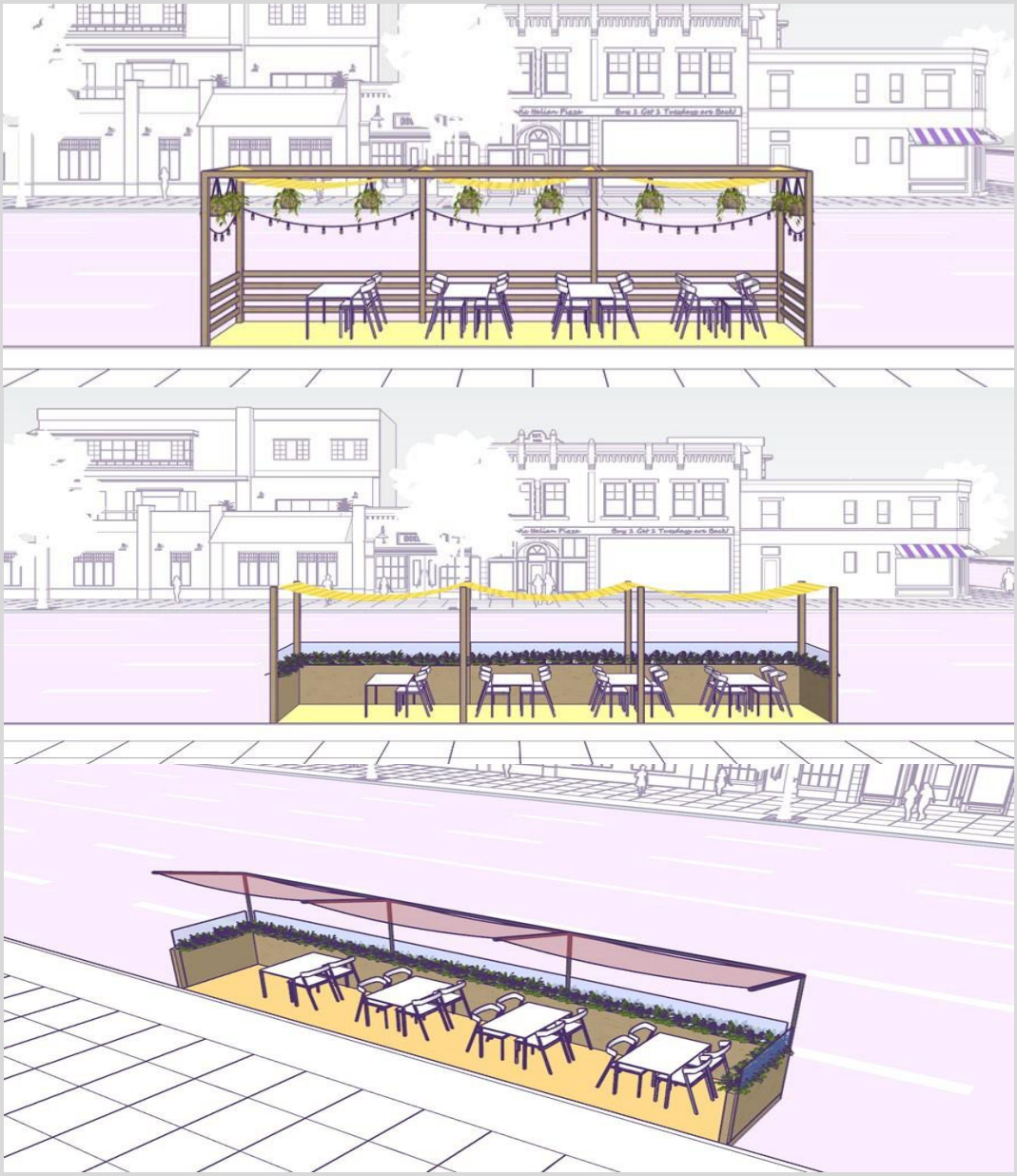
A-1.5.2.1. Power of Entry. Since these requirements apply to both new construction and existing buildings, the Chief Building Official (i.e., the designated official) has the power to enter any existing buildings as well as new construction, but only for the purpose of administering or enforcing these requirements.

In other words, if there is reason to believe that unauthorized alterations or a change of occupancy has occurred or an unsafe condition exists in respect of fire, structural safety or health, an inspection may be made. The designated official should be informed of any unsafe conditions found in the course of fire inspections.

A-1.5.2.6. Permit with Incomplete Application. A permit may be issued if additional information required is of secondary importance and the foundation or structure is not dependent on it. Information of this type might pertain to building services, such as heating, ventilating, air-conditioning, electrical or plumbing or to partitioning which may not be determined until leases have been arranged.

A-1.5.2.12. Permit for Staged Construction. If the Chief Building Official issues a permit for a foundation before submission of the plans of the complete building, there is no assurance that a permit will be issued for the superstructure when the plans are submitted later. Such issuance will depend upon, among other things, the adequacy of the foundation.

A-1.6.1.1.(2) Sentence 1.6.1.1.(2) enables the introduction of outdoor patios without triggering requirements for a building permit when certain design criteria is met. The following illustrated the intent of this Sentence:



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A-1.6.2.2. Application Requirements. In addition to the information required by this provision, further information is required by Subsection 2.3.4. of Division C, Structural and Foundation Drawings and Calculations, and Subsection 2.3.5. of Division C, Heating, Ventilating, Air-Conditioning and Energy Utilization Drawings and Specifications.

A-1.6.2.3.(1)(b) and (c) Value of Proposed Work. The value of proposed work is a reference construction value used for the purposes of determining the applicable permit fees for a given project.

For new detached homes, duplexes, and ancillary residential building such as laneway houses, this may be determined through a simplified process based on the net floor area. This refers to the total aggregate floor space within the building and any associated accessory structures supporting human occupancy or storage. The area so established is to be considered the sum of all horizontal floor area located within the outermost extents of the exterior walls on each floor level, inclusive of all normally occupied space. This is intended to include service rooms or ancillary uses to support normal building operation and maintenance.

The total area to be used in the determination of the value of proposed work is to be determined to the first decimal place. This is multiplied by the factor identified in Sentences 1.6.2.3.(1) or (2) as applicable in order to establish the value of the proposed work.

A-1.6.7.1.(1) Permit Expiry. The owner must provide documentation to establish that the work has not been substantially discontinued for 6 months.

A-1.6.8.3.(2) Permits for Temporary Decks, Patios, Tents, and Stages. Smaller temporary structures such as decks, patios, tents, or stages may be exempt from the requirement for a building permit provided that they meet the requirements of Sentence 1.6.8.3.(2). However, this does not relieve the owner or operator of the temporary structure from compliance with the requirements of the Building By-law.

It remains the responsibility of the owner to demonstrate that temporary structure complies with the structural, fire and life safety requirements of the Building By-law, and to obtain all necessary permissions and authorizations from the relevant authorities.

An owner may, by retaining appropriate registered professionals, submit a Schedule B (Structural) as evidence of suitable structural capacity and a Schedule B (Architectural) as evidence of compliance with fire and life safety requirements.

Regardless of the provision of this By-law, an owner may still be required by the Architect's Regulations of the Professional Governance Act, be obligated to engage the services of a registered architect.

A-1.6.9.4.(1) Owner Must be Certified. The Environmental Operators Certification Program (EOCP) Building Water Systems (BWS) certification is the required minimum certification level, except that for non-potable water systems accepted by the Chief Building Official as an alternative solution, a more advanced water or wastewater certification may be required. Certification under the ASSE/IAPMO/ANSI 12080 Standard "Professional Qualifications Standard for Legionella Water Safety and Management Personnel" is an acceptable equivalent to the EOCP Building Water Systems certification.

A-1.7.1.2. Occupancy Permit. An occupancy permit is required for a temporary occupancy.

Part 2
Administrative Provisions

Section 2.1. Application

2.1.1. Application

2.1.1.1. Application

1) This Part applies to all *buildings* covered in this By-law. (See Article 1.1.1.1. of Division A.)

Section 2.2. Administration

2.2.1. Administration

2.2.1.1. Conformance with Administrative Requirements

1) This By-law is made pursuant to Section 306 of the Vancouver Charter, and Section 199.01 with respect to fees.

2.2.1.2. Structural Design

1) Except as required in Sentence (2), for design carried out in accordance with Part 4 of Division B, the designer shall be a *registered professional* skilled in the work concerned. (See Note A-2.2.1.2.(1).)

2) For the design of a Part 3 Division B *building*, carried out in accordance with Part 4 of Division B, the designer shall be a *registered professional* designated by the Association of Professional Engineers and Geoscientists of British Columbia as a *Designated Structural Engineer (Struct. Eng.)* and shall

a) assume overall responsibility for the design work and *field reviews* of the primary structural components of a *building* that falls within the scope of Article 1.3.3.2. of Division A of Division A,

b) apply his or her professional (P.Eng.) seal and Struct. Eng. stamp, sign and date the plans and supporting documents prepared by, or under the supervision of the *Designated Structural Engineer*, and

c) apply his or her professional (P.Eng.) seal and Struct. Eng. stamp and sign and date the Letters of Assurance described in Subsection 2.2.7.

2.2.2. Information Required for Proposed Work

2.2.2.1. General Information Required

1) Sufficient information shall be provided to show that the proposed work will conform to this By-law and whether or not it may affect adjacent property.

2) Plans shall be drawn to scale and shall indicate

a) the nature and extent of the work or proposed *occupancy* in sufficient detail to establish that, when completed, the work and the proposed *occupancy* will conform to this By-law,

b) the applicable edition of the By-law,

c) whether the *building* is designed under Part 3 or Part 9,

d) the *major occupancy* classifications of the *building*,

e) the *building area* and *building height*,

f) the number of *streets* the *building* faces,

g) the *accessible* entrances, work areas and washrooms, and

h) the *accessible* facilities particular to the *occupancies*.

i) **Deleted**.

3) When proposed work is changed during construction, information on the changes shall comply with the requirements of this Section for proposed work.

2.2.2.2. Site Plans

1) Site plans shall be referenced to an up-to-date survey and, when required to prove compliance with this By-law, a copy of the survey shall be provided.

2) Site plans shall show

a) by dimensions from property lines, the location of the proposed *buildling*,

b) the similarly dimensioned location of every adjacent existing *buildling* on the property,

c) existing and finished ground levels to an established datum at or adjacent to the site,

d) the access routes for firefighting, and

e) the *accessible* paths of travel to the *building* from

i) the sidewalk, roadway or *street*, and

ii) if provided, exterior parking stalls for *persons with disabilities* and exterior passenger-loading zones, and

f) the exterior entrances and key plan for each *storey* indicating the location and number of *suites*.

2.2.2.3. Information Required on Building Plans for Addressing Purposes

1) Architectural floor plans provided for addressing purposes shall

a) measure 280 mm by 430 mm,

b) identify the location and designated *street* number of the principal entrance of a *building* and the location and designated *suite* number of all interior and exterior *suite* entrances.

2.2.3. Fire Protection, Mechanical and Plumbing Components

2.2.3.1. Information Required for Fire Protection Components

1) Information shall be submitted to show the major components of fire protection including

a) the division of the *building* by *firewalls*,

b) the *building area*,

c) the degree of *fire separation* of *storeys*, shafts and special rooms or areas, including the location and rating of *closures* in *fire separations*,

d) the source of information for *fire-resistance ratings* of elements of construction (to be indicated on large-scale sections),

e) the source of information for *encapsulation ratings* of mass timber elements of construction (to be indicated on large-scale sections),

f) the location of *exits*, and

g) fire detection, suppression and alarm systems.

2.2.3.2. Plans of Sprinkler Systems

1) Before a sprinkler system is installed or altered, plans showing full details of the proposed sprinkler system and essential details of the *building* in which it is to be installed shall be drawn to an indicated scale.

2.2.3.3. Information Required on Plumbing Drawings and Related Documents

1) If the *Chief Building Official* requires an application for a *permit* in respect of *plumbing systems*, plumbing drawings and related documents submitted with the application shall show

a) the location and *size* of every *building drain* and of every *trap* and *cleanout* fitting that is on a *building drain*,

b) the *size* and location of every *soil-or-waste pipe*, *trap* and *vent pipe*, and

c) a layout of the *potable water distribution system*, including pipe *sizes* and valves.

2.2.3.4. Information Required on Mechanical Drawings and Related Documents

1) If the *Chief Building Official* requires an application for a *permit* in respect of a *mechanical system*, mechanical drawings and related documents submitted with the application shall show

a) the location and *size* of all mechanical *appliances*,

b) the *size* of all major pipes and components,

c) the *heat loss calculation*, and

d) the full *mechanical system* being installed, drawn to an indicated scale.

2.2.4. Structural and Foundation Drawings and Calculations

2.2.4.1. Application

1) This Subsection applies only to *buildings* covered in Part 4 of Division B. (See Article 1.3.3.2. of Division A.)

2.2.4.2. Professional Seal and Signature of Designer

1) Structural drawings and related documents submitted with the application to build shall be dated and shall bear the authorized professional seal and signature of the designer as defined in Sentence 2.2.1.2.(1).

2.2.4.3. Information Required on Structural Drawings

1) Structural drawings and related documents submitted with the application to build shall indicate, in addition to those items specified in Article 2.2.4.6. and in Part 4 of Division B applicable to the specific material,

a) the name and address of the person responsible for the structural design,

b) the date of issue of the By-law and standards to which the design conforms,

c) the dimensions, location and size of all structural members in sufficient detail to enable the design to be checked,

d) sufficient detail to enable the dead loads to be determined,

e) all effects and loads, other than dead loads, used for the design and construction of the structural members and exterior cladding, including the roof assembly, and

f) the Importance Category of the *building*.

2.2.4.4. Drawings of Parts or Components

1) Structural drawings of parts or components including guards designed by a person other than the designer of the *buildling* shall be dated and shall bear the authorized professional seal and signature of the designer of such parts or components.

2.2.4.5. Design Calculations and Analysis

1) The calculations and analysis made in the design of the structural members, including parts and components, of a *building* shall be available for inspection upon request.

2.2.4.6. Information Required on Foundation Drawings

1) *Foundation* drawings submitted with the application to build or excavate shall be provided to indicate

a) the type and condition of the *soil* or rock, as well as the groundwater conditions, as determined by the subsurface investigation,

b) the factored bearing pressures on the *soil* or rock, the factored loads when applicable and the design loads applied to foundation units, and

c) the earth pressures and other loads applied to the supporting structures of supported excavations.

2) When required, evidence that justifies the information on the drawings shall be submitted with the application to excavate or build.

2.2.4.7. Altered Conditions

1) Where conditions as described under Sentences 4.2.2.4.(1) and (2) of Division B are encountered, or where foundation units or their locations are altered, this information shall be recorded on appropriate drawings or new "as constructed" drawings.

2.2.5. Drawings and Specifications for Environmental Separators and Other Assemblies Exposed to the Exterior

2.2.5.1. Application

1) This Subsection applies to *building* materials, components and assemblies to which Part 5 of Division B applies. (See Article 1.3.3.2. of Division A.)

2.2.5.2. Information Required on Drawings and Specifications

1) Information shown on drawings and in specifications shall be clear and legible, and shall contain sufficient details to demonstrate conformance with this By-law. (See Note A-2.2.6.2.(1).)

2.2.6. Heating, Ventilating and Air-conditioning Drawings and Specifications

2.2.6.1. Application

1) This Subsection applies only to *buildings* covered in Part 6 of Division B. (See Article 1.3.3.2. of Division A.)

2.2.6.2. Information Required on Drawings

1) The information shown on architectural drawings and on drawings for heating, ventilating and air-conditioning systems shall be clear and legible and shall contain all necessary details to demonstrate conformance with this By-law. (See Note A-2.2.6.2.(1).)

2.2.7. Professional Design and Review

(See Note A-2.2.7.)

2.2.7.1. Application

1) The requirements of this Subsection apply to

a) *buildings* within the scope of Part 3 of Division B, which include *buildings* designed and constructed in accordance with Subsection 3.2.10. of Division B,

b) *buildings* within the scope of Part 9 of Division B that are designed with common egress systems for the occupants and require the use of *firewalls* according to Article 1.3.3.4. of Division A,

c) the following, in respect of *buildings* within the scope of Part 9 of Division B other than *buildings* described in Clause (b),

   i) structural components that are not within the scope of Part 9 of Division B

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(See Note A-2.2.7.1.(1)(c)(i).),

ii) geotechnical conditions at *building* sites that are not within the scope of Part 9 of Division B,

iii) sprinkler systems designed to NFPA 13, "Installation of Sprinkler Systems", NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies", or NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes", and

iv) standpipe and hose systems designed to NFPA 14, "Installation of Standpipe and Hose Systems",

d) a *building* that is designed according to Article 1.3.3.5. of Division A,

e) a *building* that is within the scope of Part 5 of Division B,

f) *additions* which are subject to Part 11 of Division B, and

g) a change of *major occupancy* which is subject to Part 11 of Division B.

2.2.7.2. Owner Responsibilities

1) Before the construction of or the *alteration* to a *building*, the *owner* shall

a) retain a *coordinating registered professional* to coordinate all design work and *field reviews* of the *registered professionals of record* required for the project in order to ascertain that (see Note A-2.2.7.2.(1)(a))

i) the design will substantially comply with the Building By-law and other applicable enactments respecting safety, and

ii) the construction of the project will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects,

b) if a *building* permit is required, deliver to the *Chief Building Official* letters in the forms set out in Schedules A and B (See the end of Division C and Note A-2.2.7.2.(1)(b).),

c) provide reasonable and timely written notice of any work or excavation that would directly or indirectly affect private property adjacent to the excavation site, to the *owner* of the affected property, and deliver a copy of the notice to the *Chief Building Official*. (See Note A-2.2.7.2.(1)(c).)

2) If an occupancy permit or final inspection from the *Chief Building Official* is required and before an *owner* occupies or receives permission to occupy the *building*, the *owner* or *coordinating registered professional* shall deliver to the *Chief Building Official* letters in the forms set out in Schedules C-A and C-B (See the end of Division C and Note A-2.2.7.2.(2).)

2.2.7.3. Registered Professional Responsibilities

(See Note A-2.2.7.3.)

1) A *registered professional of record* who signs a letter, the form of which is set out in a Schedule to this Subsection, and an *owner* who signs or has an agent sign a letter the form of which is set out in a Schedule to this Subsection, shall comply with this Subsection, Part 1, and the provisions of the letter that apply to the person signing.

2) A *registered professional of record* or *coordinating registered professional* who is responsible for a *field review* shall keep a record of the *field review* and of any corrective action taken as a result of the *field review* and shall submit monthly summary reports to the *Chief Building Official*.

3) A *registered professional of record* who is retained to undertake design work and *field reviews* and who is required to provide letters pursuant to Clause 2.2.7.2.(1)(b) shall

a) place their professional seal or stamp on the plans submitted by them in support of the application for a *building* permit, after ascertaining that they substantially comply with the Building By-law and other applicable enactments respecting safety,

b) provide to the *Chief Building Official* a letter in the form of Schedule C-B (see the end of Division C) after ascertaining that the components of the project for which the *registered professional of record* is responsible are constructed so as to substantially comply, in all material respects, with

i) the plans and supporting documents prepared by the *registered professional of record*, and

ii) the requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects.

2.2.7.4. Termination

1) An *owner* must not terminate the appointment of a *coordinating registered professional* or *registered professional of record* unless

a) the *owner* immediately replaces the *coordinating registered professional* or *registered professional of record*, or

b) the *owner* has complied with Clause (1)(b) and Sentence (2) of Article 2.2.7.2. by delivering letters in the forms set out in Schedule A, B, C-A and C-B, as applicable, to the *Chief Building Official*.

2) In respect of a *project* to which this Subsection applies,

a) if the *coordinating registered professional* ceases to be retained at any time before the completion of the project, both the *owner* and the *coordinating registered professional* shall notify the *Chief Building Official*, and

b) if a *registered professional of record* ceases to be retained at any time before the completion of the *project*, both the *coordinating registered professional* and the *registered professional of record* shall notify the *Chief Building Official*.

3) Notification under Sentences (1) and (2) shall be made,

a) if possible, before the *coordinating registered professional* or *registered professional of record*, as the case may be, ceases to be retained, or

b) if advance notice is not possible, as soon as possible.

2.2.8. Commissioning Plan and Preliminary Commissioning Report

(See Note A-2.2.8.)

2.2.8.1. Application

1) The requirements of this Subsection apply to a *building* within the scope of Part 3 of Division B.

2.2.8.2. Responsibilities

1) Prior to the issuance of a *building permit*, the *owner* shall submit an *acceptable commissioning* plan prepared by a *commissioning provider*.

2) Prior to the *occupancy* of a *building*, the *owner* shall submit an *acceptable* preliminary *commissioning* report prepared by a *commissioning provider*.

2.2.8.3. Information Required in a Commissioning Plan and Preliminary Commissioning Report

1) The *commissioning* plan and preliminary *commissioning* report required by Article 2.2.8.2. shall comply with Article 10.2.2.22 of Division B. (See Note A-2.2.8.3.)

2.2.9. Deleted

2.2.10. Buildings on Designated Flood Plains

2.2.10.1. Exemptions from Flood Construction Level Requirements

1) *Flood construction level requirements* do not apply to:

a) *alteration* of an *existing building*, not including reconstruction as defined in this By-law. (See A-11.2.1.2. of Div C),

b) *alteration* of an *existing building* to increase the *building area* by less than 25 per cent of the total *building area* existing as of July 29, 1999, if

i) the number of *dwelling units* is not increased,

ii) there is no further encroachment into setbacks required by this By-law, and

iii) there is no further reduction in the *flood construction level*,

c) enclosed parking areas, including bicycle and residential storage areas, in a multiple dwelling, if there is

i) an unobstructed non-mechanized means of pedestrian ingress and egress to the areas, above the *flood construction level*, and

ii) a sign posted at all entry points warning of the risk of flood damage,

d) *buildings* and portions of *buildings* used as a carport or garage,

e) non-residential accessory *buildings*, and

f) loading facilities used for water oriented industry.

2.2.10.2. Design Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, the *building* designer shall comply with by-law requirements regarding *construction* materials and service equipment installations below *flood construction level requirements*, to the satisfaction of the *Chief Building Official*. (See Article 1.5.2.11. of Division C.)

2.2.10.3. Construction Considerations on Designated Flood Plains

1) For *buildings* constructed on *designated flood plains*, *construction* of the *buildings* to *flood construction level requirements* shall be achieved, to the satisfaction of the *Chief Building Official*, by

a) the structural elevation of the floor system of the *building*

b) the use of adequately compacted fill, or

c) a combination of structural elevation and compacted fill.

2) No person shall install furnaces, electrical switchgear, electrical panels, fire protection systems or other fixed *building* services susceptible to flood damage, below the *flood construction level*, unless such services are protected from flood damage and accessible for servicing during a flood, to the satisfaction of the *Chief Building Official*.

3) No person shall store hazardous or toxic substances below the *flood construction level*.

4) All piping, wiring and conduit penetrations shall be water stopped and sealed to prevent water seepage into the *building*.

2.2.10.4. Setback Requirements on Designated Flood Plains

1) Subject to the provisions of this By-law, no *building*, structural support or fill shall be constructed or located within

a) 30 m of the *natural boundary* of the Fraser River,

b) 15 m of the *natural boundary* of Burrard Inlet, English Bay or False Creek,

c) 5 m of the *natural boundary* of Still Creek,

d) 7.5 m of any structure erected for flood protection or seepage control, or

e) in the case of a *building*, structural support, or fill located on a bluff in a *designated flood plain*, where the toe of the bluff is subject to erosion or is closer than 15 m from the *natural boundary*, a setback measuring 3.0 times the height of the bluff as measured from the toe to the crest of the bluff.

2.2.10.5. Increase of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official*, in consultation with the *City Engineer*, may increase the *flood construction level requirements* or the setback requirements in this By-law if, in the opinion of the *Chief Building Official*, a higher *flood construction level* or a greater setback is necessary as the result of a site-specific geological or hydrological feature.

2.2.10.6. Relaxation of Flood Construction Level and Setback Requirements on Designated Flood Plains

1) The *Chief Building Official*, in consultation with the *City Engineer*, may relax the *flood construction level requirements* in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the *flood construction level requirements*,

b) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, the proposed *construction* methods are designed to mitigate flood damage, and

c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a lower *flood construction level* is applied.

2) The *Chief Building Official*, in consultation with the *City Engineer*, may relax the setback requirements in this By-law in accordance with Article 1.5.2.11., if

a) the *owner* demonstrates to the satisfaction of the *Chief Building Official*, that, due to existing site characteristics and the location of existing infrastructure, it is impractical to meet the setback requirements,

b) if considered necessary by the *Chief Building Official*, the *owner* agrees to construct erosion protection works to mitigate flood damage and erosion, and

c) the *owner* provides a report, to the satisfaction of the *Chief Building Official*, stamped by a professional engineer, certifying that the habitable space in the *building* will be safe during a flood if a reduced setback requirement is applied.

2.2.11. Buildings in the Groundwater Protection Area

2.2.11.1. Application

1) Except as provided in Sentence (2), this Subsection applies to *buildings* located in whole or in part within the *groundwater protection area.*

2) This Subsection does not apply to *alterations* of *existing buildings* if there is no further encroachment into the setbacks required by Article 2.2.11.3. and the *building* area is increased by less than 25 percent of the total *building* area existing as of January 1, 2026.

2.2.11.2. Design consideration

1) The *building* designer shall design the *building* assembly to withstand continuous hydrostatic pressure by means permitted in Subsection 5.7.2. of Division B.

2) The *building* designer shall design the drainage system to comply with Sentence 2.4.2.4.(3) of Division B of Book II (Plumbing Systems).

2.2.11.3. Setback Requirements

1) Except as required by Sentence (2), no normally occupied area, enclosed parking area, storage area or mechanical room of a *building* shall be constructed more than 6.5 m below *grade*.

2) Within 30 m of the *natural boundary* of Still Creek or within 30 m of the inside wall of a culvert enclosing Still Creek, no normally occupied area, enclosed parking area, storage area or mechanical room of a *building* shall be constructed below *grade*. #14603

Section 2.3. Alternative Solutions

2.3.1. Alternative Solutions

(See Note A-2.3.1.)

2.3.1.1. Application

1) For the purposes of Clause 1.2.1.1.(1)(b) of Division A, on written request by the *owner* of a *building* or an authorized agent of that *owner*, the *authority having jurisdiction* shall accept a measure as an alternate solution to an acceptable solution for the *building* if satisfied that

a) the measure will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and #14488

b) the acceptable solution does not expressly require conformance to a provincial enactment other than the Building By-law.

2.3.1.2. Documentation

1) The *Chief Building Official* may require a person requesting the use of an alternative solution to provide documentation to demonstrate that the proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A. #14488

2) The documentation referred to in Sentence (1) shall include

a) a Code analysis outlining the analytical methods and rationales used to determine that a proposed alternative solution will achieve at least the level of performance required by Clause 1.2.1.1.(1)(b) of Division A, and

b) information concerning any special maintenance or operational requirements, including any building component commissioning requirements, that are necessary for the alternative solution to achieve compliance with the By-law after the *building* is constructed.

3) The Code analysis referred to in Clause (2)(a) shall identify the applicable objectives, functional statements and acceptable solutions, and any assumptions, limiting or restricting factors, testing procedures, engineering studies or building performance parameters that will support a Code compliance assessment.

4) The Code analysis referred to in Clause (2)(a) shall include information about the qualifications, experience and background of the person or persons taking responsibility for the design.

5) The information provided under Sentence (3) shall be in sufficient detail to convey the design intent and to support the validity, accuracy, relevance and precision of the Code analysis.

6) Where more than one person is responsible for the design of a *building* or facility that includes a proposed alternative solution, the person requesting the use of the alternative solution shall identify a single person to co-ordinate the preparation of the design, Code analysis and documentation referred to in this Article.

2.3.1.3 Alternative Solution Expiry

1) The *Chief Building Official* may rescind a request or application made pursuant to the requirements of this Subsection if in the opinion of the *Chief Building Official*

a) there has been no substantial progress or activity by the *owner* of a *building* or an authorized agent of that *owner* to demonstrate that the level of performance specified by Clause 1.2.1.1.(1)(b) of Division A will be achieved,

b) the work to install measures describe in the alternative solution although commenced is not continuously and actively carried out thereafter, or

c) the work to install measures describe in the alternative solution has been substantially discontinued for a period of 6 months.

2.3.2. Additional Requirements for Fire and Life Safety Alternative Solutions

2.3.2.1. Design Criteria

1) Alternative solutions, as described in Article 2.3.1.2., shall be based upon an *acceptable* report sealed by an *acceptable registered professional* and provided to the *Chief Building Official*, which shall include

a) a thorough description of the *building*,

b) an analysis of the *building* that identifies all deviations from the requirements of this By-law,

c) the life safety principles considered in developing the proposed alternative solutions and their rationale, based upon NRC fire research reports and other approved agencies where applicable,

d) a proposal for alternative solutions,

e) an evaluation of the proposed alternative solutions based upon generally recognized studies,

f) evidence of reliable performance of the proposed alternative solutions,

g) a method of monitoring the design of the proposed alternative solutions, and

h) a commitment to perform field review of the proposed alternative solutions.

2) The report described in Sentence (1) shall be sufficiently detailed to permit evaluation of the proposed alternative solutions.

3) Upon acceptable of a proposed alternative solution by the *Chief Building Official*, the *registered professional* who has placed their seal on the report shall

a) submit a letter to the *Chief Building Official*, assuring that the alternative solution, as installed, will perform as represented in the report, and

b) at the request of the *Chief Building Official*, submit an acceptable field commissioning and testing report.

2.3.3. Alternative Solution Review

2.3.3.1. Request for Review by Alternative Solution Review Panel

1) An applicant may apply to the *Chief Building Official* to request the appointment of an alternative review panel to review an alternative solution application.

2) An applicant who requests the appointment of an alternative review panel must pay the fees set out in the Fee Schedule.

3) At the request of the applicant, the *Chief Building Official* may appoint an alternative solution review panel of up to three experts to review the alternative solution application, to hear from the applicant and *City* staff and to advise the applicant and the *Chief Building Official* regarding the proposed solution.

4) A decision of an alternative solution review panel is not binding on the *Chief Building Official*.

2.3.3.2. Independent Review by Third Party

1) Where *acceptable* to the *Chief Building Official*, an applicant may, during the course of the *Chief Building Official's* review of an alternative solution, supplement the application with a report by an *acceptable* third party that provides a technical overview to the *Chief Building Official* with respect to

a) the scope, assumptions and assessment of consequence,

b) the suitability and applicability of the chosen methodology,

c) the accuracy, relevance and strength of the technical analysis, and

d) sufficiency of documentation and performance measurements.

2) The third party shall be an individual *acceptable* to the *Chief Building Official* that

a) is a *registered professional* in good standing with their professional association, and

b) has relevant and recognized experience, expertise or credentials with respect to the application of the Building By-law, local construction codes and subject matter related to the proposed alternative solution.

3) The third party shall provide a declaration that they have not been involved in the preparation of the alternative solution or otherwise employed by the *owner* or applicant, and have no real or apparent interest,

a) in the completion or financial outcome of the subject construction project, or

b) from business or contractual interests with the *owner* or alternative solution proponent, which would influence the outcome of the independent review.

4) The *owner* shall bear the costs of retaining the third party, and provide a written confirmation that the terms of engagement of the third party are not contingent or otherwise dependant upon the outcome of their review or of the determination of the *Chief Building Official*.

5) The review of an alternative solution as referred to in Sentence (1), is not binding on the *Chief Building Official*.

SCHEDULE A

Forming Part of Sentence 2.2.7.2.(1), Division C of the Building By-law

Building Permit Number (for CoV Use)

CONFIRMATION OF COMMITMENT BY OWNER AND COORDINATING REGISTERED PROFESSIONAL

Notes: i) This letter must be submitted before issuance of a *building permit*.
ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

Re: Design and *Field Review* of *Construction* by a *Coordinating Registered Professional*

To: The *Chief Building Official*

(Professional's Seal and Signature)

Re: _____
Name of Project (Print)

_____
Address of Project (Print)

_____
Date

The undersigned has retained _____ as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals of record* required[1] for this *project*. The *coordinating registered professional* shall coordinate the design work and *field reviews* of the *registered professionals of record* required for the *project* in order to ascertain that the design will substantially comply with the Building By-law and other applicable enactments respecting safety and that the *construction* of the *project* will substantially comply with the Building By-law and other applicable enactments respecting safety, not including the construction safety aspects.

"*field reviews*" are defined in the Building By-law to mean those reviews of the work

(a) at a *project* site of a development to which a *building permit* relates, and
(b) where applicable, at fabrication locations where *building* components are fabricated for use at the *project* site that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional of record* for which the *building permit* is issued.

The *owner* and the *coordinating registered professional* have read Subsection 2.2.7., Division C of the Building By-law. The *owner* and the *coordinating registered professional* each acknowledge their responsibility to notify the *Chief Building Official* of the date the *coordinating registered professional* ceases to be retained by the *owner* before the date the *coordinating registered professional* ceases to be retained or, if that is not possible, then as soon as possible. The *coordinating registered professional* acknowledges the responsibility to notify the *Chief Building Official* of the date a *registered professional of record* ceases to be retained before the date the *registered professional of record* ceases to be retained or, if that is not possible, then as soon as possible.

[1]It is the responsibility of the *coordinating registered professional* to ascertain which *registered professionals of record* are required, and to initial each Schedule B prior to submission to the *Chief Building Official*.

Certified Professional's Stamp and Signature
(if applicable)

SCHEDULE A - continued

Building Permit Number (for CoV Use)

Project Address

The *owner* and the *coordinating registered professional* understand that where the *coordinating registered professional* or a *registered professional of record* ceases to be retained at any time during *construction*, work on the above *project* will cease until such time as

(a) a new *coordinating registered professional* or *registered professional of record*, as the case may be, is retained, and
(b) a new letter in the form set out in Schedule A or in the forms set out in Schedules B, as the case may be, is filed with the *Chief Building Official*.

The undersigned *coordinating registered professional* certifies that he or she is a *registered professional* as defined in the Building By-law, and agrees to coordinate the design work and *field reviews* of the *registered professionals of record* required for the *project* as outlined in the attached Schedules B including coordination and integration of functional testing of fire protection and life safety systems. (See A-2.2.7.3. in Appendix A.)

Coordinating Registered Professional

Coordinating Registered Professional's Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

Owner

Owner's Name (Print)

Address (Print)

Address (Print) (continued)

Name Agent of Signing Officer (Print)

Date

Owner's or Owner's appointed agent's Signature (If owner is a corporation the signature of a signing officer must be given here. If the signature is that of the agent, a copy of the document that appoints the agent must be attached)

Phone Number and Email Address

(If the *coordinating registered professional* is a member of a firm, complete the following:)

I am a member of the firm _____ and I sign this letter on behalf of the firm.
(Print name of firm)

Note: The above letter must be signed by a *coordinating registered professional*, who is also a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Certified Professional's Stamp and Signature (if applicable)

SCHEDULE B

Forming Part of Sentence 2.2.7.2.(1), Division C of the Building By-law

Building Permit Number (for CoV Use)

Discipline

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Notes:

i) This letter must be submitted prior to the commencement of *construction* activities of the components identified below. A separate letter must be submitted by each *registered professional of record*.

ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.

iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re:

Name of Project (Print)

Address of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional of record*. All the disciplines will not necessarily be employed on every *project*.)

_____ **ARCHITECTURAL**

_____ **STRUCTURAL**

_____ **MECHANICAL**

_____ **PLUMBING**

_____ **FIRE SUPPRESSION SYSTEMS**

_____ **ELECTRICAL**

_____ **GEOTECHNICAL — temporary**

_____ **GEOTECHNICAL — permanent**

(Professional's Seal and Signature)

Date

components of the plans and supporting documents prepared by this *registered professional of record* in support of the application for the *building permit* as outlined below substantially comply with the Building By-law and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during *construction* as indicated on the "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" below.

Certified Professional's Stamp and Signature
(if applicable)

CRP Initials

SCHEDULE B - continued

Building Permit Number (for CoV Use)

Project Address

Discipline

The undersigned also undertakes to notify the *Chief Building Official* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during *construction*.

I certify that I am a *registered professional* as defined in the Building By-law.

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

(If the *Registered Professional of Record* is a member of a firm, complete the following.)

I am a member of the firm _____ and I sign this letter on behalf of the firm.
(Print name of firm)

Note: The above letter must be signed by *registered professional of record*, who is a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Certified Professional's Stamp and Signature (if applicable)

CRP Initials

SCHEDULE B - continued

Building Permit Number (for CoV Use)

Project Address

Discipline

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

(Initial applicable discipline below and cross out and initial only those items not applicable to the *project*.)

_____ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Egress systems, including *access to exit* within *suites* and *floor areas*
1.5 Performance and physical safety features (guardrails, handrails, etc.)
1.6 Structural capacity of architectural components, including anchorage and seismic restraint
1.7 Sound control
1.8 Landscaping, screening and site grading
1.9 Provisions for firefighting access
1.10 *Access* requirements for *persons with disabilities*
1.11 Elevating devices
1.12 Functional testing of architecturally related fire emergency systems and devices
1.13 Development Permit and conditions therein
1.14 Interior signage, including acceptable materials, dimensions and locations
1.15 Review of all applicable shop drawings
1.16 Interior and exterior finishes
1.17 Dampproofing and/or waterproofing of walls and slabs below grade
1.18 Roofing and flashings
1.19 Wall cladding systems
1.20 Condensation control and cavity ventilation
1.21 Exterior glazing
1.22 Integration of building envelope components
1.23 Environmental separation requirements (Part 5)
1.24 Building envelope, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
1.25 Building envelope, testing, confirmation or both as per Part 10 requirements

(Professional's Seal and Signature)

Date

Certified Professional's Stamp and Signature (if applicable)

_____ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings
2.4 Structural aspects of unbonded post-tensioned concrete design and *construction*
2.5 Independent review of structural designs

_____ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 Fire dampers at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings
3.8 Mechanical systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
3.9 Mechanical systems, testing, confirmation or both as per Part 10 requirements

CRP Initials

SCHEDULE B - continued

Building Permit Number (for CoV Use)

(Initial applicable discipline below and cross out and initial only those items not applicable to the *project*.)

Project Address

Discipline

_____ **PLUMBING**

4.1 Roof *drainage* systems
4.2 Site and *foundation drainage systems*
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings
4.9 *Plumbing systems*, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
4.10 *Plumbing systems*, testing, confirmation or both as per Part 10 requirements

_____ **FIRE SUPPRESSION SYSTEMS**

5.1 Suppression system classification for type of *occupancy*
5.2 Design coverage, including concealed or special areas
5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
5.5 Qualification of welder, quality of welds and material
5.6 Review of all applicable shop drawings
5.7 Acceptance testing for ''Contractor's Material and Test Certificate'' as per NFPA Standards
5.8 Maintenance program and manual for suppression systems
5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
5.10 For partial systems — confirm sprinklers are installed in all areas where required
5.11 Fire Department connections and hydrant locations
5.12 Fire hose standpipes
5.13 Freeze protection measures for fire suppression systems
5.14 Functional testing of fire suppression systems and devices

(Professional's Seal and Signature)

_____ **ELECTRICAL**

6.1 Electrical systems and devices, including high *building* requirements where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings
6.9 Electrical systems, Part 10 requirements (ASHRAE, NECB, ZEBP, etc)
6.10 Electrical systems, testing, confirmation
6.11 Radio Antenna Systems

Date

_____ **GEOTECHNICAL — Temporary**

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary *construction* dewatering

Certified Professional's Stamp and Signature (if applicable)

_____ **GEOTECHNICAL — Permanent**

8.1 Bearing capacity of the soil
8.2 Geotechnical aspects of *deep foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of soil, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

CRP Initials

SCHEDULE C-A

Forming Part of Sentence 2.2.7., Division C of the Building By-law

Building Permit Number (for CoV Use)

ASSURANCE OF COORDINATION OF PROFESSIONAL FIELD REVIEW

Notes:

i) This letter must be submitted after completion of the *project* but before the *occupancy permit* is issued or a final inspection is made, by the *Chief Building Official.*
ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Re:

Name of Project (Print)

Address of Project (Print)

(The *coordinating registered professional* shall complete the following:)

Coordinating Registered Professional's Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* of the *registered professionals of record* required for the *project* as outlined in Subsection 2.2.7., Division C of the Building By-law and in the previously submitted Schedule A, ''CONFIRMATION OF COMMITMENT BY OWNER AND BY COORDINATING REGISTERED PROFESSIONAL,''

b) I have coordinated the functional testing of the fire protection and life safety systems to ascertain that they substantially comply in all material respects with

i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and
ii) the plans and supporting documents submitted in support of the application for the *building permit*,

c) I have coordinated the *field reviews* to ascertain that the *project* substantially complies in all material respects with

i) the applicable requirements of Part 10, and
ii) the plans and supporting documents submitted in support of the application for the *building permit*,

d) I am a *registered professional* as defined in the Building By-law.

(If the *coordinating registered professional* is a member of a firm, complete the following:)

I am a member of the firm _____ and I sign this letter on behalf of the firm.

(Print name of firm)

Note: The above letter must be signed by a *coordinating registered professional*, who is also a *registered professional*. The Building By-law defines a *registered professional* to mean

a) a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Certified Professional's Stamp and Signature (if applicable)

SCHEDULE C-B

Forming Part of Sentence 2.2.7., Division C of the Building By-law

Building Permit Number (for CoV Use)

ASSURANCE OF PROFESSIONAL FIELD REVIEW AND COMPLIANCE

Notes:

i) This letter must be submitted after completion of the *project* but prior to final inspection by the *Chief Building Official*. A separate letter must be submitted by each *registered professional of record*.
ii) This letter is endorsed by: Architectural Institute of B.C. and the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
iii) In this letter the words in italics have the same meaning as in the Building By-law.

To: The *Chief Building Official*

Discipline (e.g. Architectural, etc.) (Print)

Re:

Name of Project (Print)

Address of Project (Print)

(Each *registered professional of record* shall complete the following:)

Name (Print)

Address (Print)

Address (Print) (continued)

Phone Number and Email Address

(Professional's Seal and Signature)

Date

I hereby give assurance that

a) I have fulfilled my obligations for coordination of *field reviews* as outlined in Subsection 2.2.7.2., Division C of the Building By-law and in the previously submitted Schedule B, ''ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW", and
b) those components of project opposite my initials in Schedule B substantially comply in all materials respects with
   i) the applicable requirements of the Building By-law and other applicable enactments respecting safety, not including construction safety aspects, and
   ii) the plans and supporting documents submitted in support of the application for the *building permit*,
c) I am a *registered professional of record* as defined in the Building By-law

(If the *registered professional of record* is a member of a firm, complete the following:)

I am a member of the firm _____ and I sign this letter on behalf of the firm.
(Print name of firm)

Note:
The above letter must be signed by a *registered professional of record*, who is a *registered professional*. The Building Bylaw defines a *registered professional* to mean

a) a person who is registered as an Architect with the Architectural Institute of British Columbia under the Professional Governance Act, or
b) a person who is registered as a professional engineer or professional licensee engineering with the Association of Professional Engineers and Geoscientists of the Province of British Columbia under the Professional Governance Act.

Certified Professional's Stamp and Signature (if applicable)

CRP Initials

Notes to Part 2

Administrative Provisions

A-2.2.1.2.(1) Structural Design. Part 4 of Division B is written on the assumption that structural design will be carried out by a professional who is qualified to perform such design. Sentence 2.2.1.2.(1) is not intended to imply that a professional may not also be required in the application of requirements in other Parts of the Vancouver Building By-law.

A-2.2.6.2.(1) Information Required on Drawings and Specifications. Examples of information that should be shown on architectural drawings and drawings for heating, ventilating and air-conditioning systems, and building enclosure assemblies are:

(a) the name, type and location of the building,

(b) the name of the owner,

(c) the name of the architect,

(d) the name of the engineer or designer,

(e) the north point,

(f) the dimensions and height of all rooms,

(g) the intended use of all rooms,

(h) the details or description of the wall, roof, ceiling and floor construction, including insulation,

(i) the details or description of the windows and outside doors, including the size, weatherstripping, storm sashes, sills and storm doors,

(j) the size and continuity of all pipes, ducts, shafts, flues and fire dampers,

(k) the location, size, capacity and type of all principal units of equipment,

(l) the size, shape and height of all chimneys and gas vents,

(m) the size and location of all combustion air and ventilation openings, and

(n) the location and fire-resistance rating of required fire separations,

(o) the heat lost calculations for heating and cooling of the building, and

(p) the dimensions of the edge, field and corner zones of the roof, and load values for each affected area of a wall and roof assembly (see Figures 4.1.7.6.-A through 4.1.7.6.-C in Article 4.1.7.6. of Division B).

A-2.2.7. Professional Design and Review. This Subsection provides for the use of what are generally called Letters of Assurance. The letters themselves, known as Schedules A, B, C-A and C-B and located at the end of Division C, are intended to put on paper the responsibilities of the owner and the various registered professionals in a construction project. The Letters of Assurance do not impose any additional responsibilities on the registered professionals nor are they intended to alter the roles and responsibilities of the authorities having jurisdiction.

The Schedules have been very carefully scrutinized by the Province of British Columbia, Union of BC Municipalities, Building Officials' Association of British Columbia, Architectural Institute of British Columbia, Association of Professional Engineers and Geoscientists of British Columbia and their respective legal counsel. The precise wording in the letters is extremely critical and must not be modified. Any notations on these Schedules which are absolutely necessary to suit a particular project must be clearly and legibly marked in ink on the copies.

It is typical that the registered professional responsible for the design is also responsible for the field review. There are instances where this is not the case and having a different registered professional doing the field reviews is unavoidable. Schedule C-B requires that the registered professional who provides the field review provide assurance that the building as finally constructed is in substantial conformance with the By-law. In the event that another registered professional is to provide field review, the field reviewer takes on the responsibility to confirm that the construction substantially complies with the plans and supporting documents that were submitted for the building permit. The responsibility for code compliance of the design remains with the

original registered professional who undertook the design. In this event, the Schedule C-B must be modified by the field reviewer by crossing out and initialing Clause (b)(i) and providing the effective transition date.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed, sealed and submitted to the authority having jurisdiction, as applicable for each specific project. Conditional or qualified Schedules are not typically acceptable. Any fire and life safety issue relative to the Schedule B disciplines is to be remedied before the Schedules C-A / C-B are released, not accommodated by conditions or qualifications placed on the Schedule or by any attached document. See the Guide to Letters of Assurance, available from the Building and Safety Standards Branch Web site, for more details.

A-2.2.7.1.(1)(c)(i) Structural Components. The reference to "structural components of buildings that fall within the scope of Part 4" includes the situation where a building is classified under Part 9 due to its size and occupancy but also contains some structural components (such as beams supporting concentrated loads) which must be designed under Part 4. In this situation only Schedules B and C-B for the structural components are required. Schedule A and Schedules B, C-A and C-B relating to non-structural components are not required.

A-2.2.7.2.(1)(a) Coordinating Registered Professional. The coordinating registered professional is responsible to ascertain that all Code related aspects which are relevant to the project are clearly identified by each of the registered professionals in the collection of Schedules B. If a registered professional of record has crossed out any item on their Schedule B, the coordinating registered professional must confirm this item is not applicable to the project or resolve the issue with the registered professional of record.

A-2.2.7.2.(1)(b) Schedule B. The purpose of Schedule B is to clearly identify the appropriate registered professional of record who has the overall responsibility in each discipline for compliance with the various Code related aspects of the project. Detailed design of certain building components may be undertaken by other registered professionals. The registered professional of record is responsible for monitoring the design work and field review of the other registered professionals within their discipline for components listed in Schedule B. In the event that the other registered professionals provide design and field review, the registered professional of record must be satisfied that such design and field reviews have been performed and is responsible for Schedule C-B.

A-2.2.7.2.(1)(c) Shoring Works in Street or Lane. Where shoring works are proposed to be left in the street and/or lane permanently, an application for the proposal should be made by the owner to the City Engineer. Where the City Engineer is satisfied as to the safety and advisability of the proposal, the City Engineer may approve the basis on which the shoring works may be allowed to remain

A-2.2.7.2.(2) Schedule C-A. Schedule C-A provides confirmation that the coordinating registered professional has completed the obligation to coordinate the various registered professionals engaged in the project. It also confirms that the testing of the interrelated fire and life safety systems, such as fire alarms and sprinklers, has been completed and the systems function as intended.

A-2.2.7.3. Demonstration of the Coordinated Fire and Life Safety Systems. The design drawings and supporting documents must clearly indicate all essential details of the Coordinated Fire and Life Safety Systems prior to the construction of or the alteration to a building. Demonstration of the proper, integrated operation of the Fire and Life Safety Systems must be conducted prior to occupancy.

Note that Schedules A, B, C-A & C-B, as required by Subsection 2.2.7., must be signed and sealed and submitted to the authority having jurisdiction, as appropriate for each specific project.

The following is an example of the steps required to coordinate the installation and testing of fire and life safety systems in buildings.

1.0. General

Referencing Schedule B:

• Item No. 1.14 "Functional Testing of Architecturally Related Fire Emergency Systems and Devices,"

• Item No. 3.4 "Functional Testing of Mechanically Related Fire Emergency Systems and Devices,"

• Item No. 4.5 "Functional Testing of Plumbing Related Fire Emergency Systems and Devices,"

• Item No. 5.14 "Functional Testing of Fire Suppression Systems and Devices," and

• Item No. 6.3 "Functional Testing of Electrical Related Fire Emergency Systems and Devices."

The Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) must demonstrate that the Fire and Life Safety Systems' design has been coordinated prior to the issuance of the Building Permit. That is, the CRP/RPRs must accumulate and submit the necessary documentation, such as:
• complete drawings,
• schedules,
• schematic diagrams,
• a fire alarm system sequencing description showing coordination between mechanical and electrical fire protection and life safety systems,
• mechanical fire protection and life safety schematic riser diagrams,
• an electrical fire alarm riser diagram,
• a motor data list coordinated with fire alarm system sequencing, and
• other documentation, as appropriate,

to demonstrate that the interface of the Fire and Life Safety Systems has been designed and coordinated so that when built correctly they will function as an integrated system. Further, it is intended that when the construction of the Fire & Life Safety Systems is indicated by the Contractor to be complete, the RPRs/CRP witness the demonstration of the testing of the Fire and Life Safety Systems to confirm compliance that the as-built systems function as intended by the design.

The required list of items will depend on the simplicity or complexity of the Project. The following is a comprehensive list of items for Fire and Life Safety Systems for a complex project, which must be coordinated in order to demonstrate compliance:

Notes: *It is the responsibility of the Coordinating Registered Professional (CRP) and Registered Professionals of Record (RPRs) to determine the best method of "How To" demonstrate to the Authority Having Jurisdiction (AHJ) that the Fire and Life Safety Systems have been coordinated for each project. That is, the method(s) used (i.e., charts, drawings, matrices, tables, etc.) for demonstration purposes should be project-specific and relate only to that project.*

It is not the intent of this Appendix material to dictate or produce "checklists" or other prescriptive methods for demonstrating compliance since this is best left to the professional discretion of the appropriate CRP/RPRs.

2.0. Design Phase — Building Permit Application Stage & Final Construction Phase — Occupancy Permit Application Stage

2.1. Fire Protection and Life Safety Systems

2.1.1. Automatic Sprinkler Systems

- design requirements to appropriate Standard

2.1.2. Standpipe Systems

- design requirements to appropriate Standard
- Class I/Class II
- locations
- coverage
- F.D. connections

2.1.3. Fire Pump Systems

- design requirements to appropriate Standard

2.1.4. Fire Alarm Systems

- one/two stage system(s)
- no. of systems
- design requirements to appropriate Standard
- sequence of operation
- fire alarm system zoning
- location of fire alarm system devices

- annunciator panel (location and design criteria)
- annunciator panel shop drawings (detail design)
- sprinkler zone/waterflow device
- smoke detectors
- smoke alarms
- manual pull stations
- signals to Fire Department via an acceptable central monitoring station
- activation of ancillary devices

2.1.6. Emergency Telephone System

- each exit stair

2.1.7. Emergency Power

- design requirements to appropriate Standard
- supervisory provisions for fire alarm
- emergency electrical load
- emergency generator

2.1.8. Emergency Lighting

- exits
- access to exits
- public corridors
- other floor areas

2.1.9. Exit Signs

2.2. Additional Requirements for High Buildings

2.2.1. Interface Condition between Highrise and Lowrise Components (Measure 'N' Vestibules)

2.2.2. Smoke Control — Measure A

- design requirements to appropriate Standard
- venting above-grade stairs
- separation of above-grade and below-grade stairs
- venting below-grade stairs
- pressurization of below-grade stairs at bottom
- above-grade elevator shaft serving below-grade protected with a "protected" vestibule
- additional controls at CACF (annunciator panel shop drawings)

2.2.3. Smoke Venting

2.2.4. Fire Fighters' Elevators

- fire fighting controls
- emergency recall

2.2.5. Protection of Emergency Electrical Conductors

- highrise elevator

- emergency generator(s)
- fire pump(s)
- smoke control systems
- smoke venting systems
- fire alarm and emergency voice communication systems

2.2.6. Emergency Voice Communications

- integrated with fire alarm system
- audible to appropriate Standard
- zoning of speakers

3.0. Roles and Responsibilities for the Demonstration of the Coordinated Fire and Life Safety Systems

3.1. Roles and Responsibilities for the Design, Commissioning and Functional Testing of Fire and Life Safety Systems

3.1.1. Design Phase

RPRs will clearly indicate on their drawings and supporting documents the details of the fire and life safety systems for each applicable item of Section 2 for their particular discipline. RPRs will also coordinate the design of the components in their system with the designs of other RPRs on the project. RPRs are to indicate what functional testing, system verification, etc., must be performed by the Contractor or subtrades and establish the documentation to be provided.

The CRP will develop the project-specific test protocol and procedures in consultation with the RPRs. The CRP will act as the facilitator for the coordination of the design of the fire and life safety systems among the various RPRs.

3.1.2. Construction Phase

The Contractor will coordinate the activities of the subtrade contractors for the installation of the fire and life safety systems in accordance with the contract documents.

RPRs will provide field reviews to ascertain that the construction of the fire and life safety systems substantially complies with their design.

RPRs will review shop drawings of the fire and life safety systems to determine that they accurately reflect their design intent. They will also coordinate their reviews with those of the other RPRs on the project.

The CRP will coordinate the shop drawing reviews and field reviews by the RPs with the objective that the entire fire and life safety system will correctly operate as an integrated system.

3.1.3. Occupancy Phase

The Contractor will coordinate the subtrade contractors for the commissioning and functional testing of the fire and life safety systems. The Contractor will also collect all of the required Occupancy Permit submission documents from the various subtrade contractors and forward them to the CRP.

The CRP will take the lead role in coordinating the activities of the RPRs required for the commissioning and functional testing of the fire and life safety systems. The CRP will distribute the test protocol and test procedures, as developed in the Design Stage, to the various parties involved in the process.

RPRs will ascertain that the appropriate commissioning and functional testing of the fire and life safety systems of the components in their disciplines have been satisfactorily completed by the subtrade contractors. They will also determine that the appropriate Occupancy Permit submission documents have been submitted and filled in correctly.

The CRP will be responsible for collecting all of the required Occupancy Permit submission documents, reviewing them for completeness and accuracy, and forwarding them to the AHJ in a complete package at least 24 hours prior to the Coordinated Final AHJ Review.

3.2. Sample Summary of Roles and Responsibilities for Demonstration of the Coordinated Fire and Life Safety Systems

The following is a sample summary (only) of the roles and responsibilities for a typical highrise building with underground parking. The precise roles and responsibilities for each project will vary depending on the complexity. The CRP will ascertain that the appropriate roles and responsibilities for each project are fulfilled by the RPRs.

3.2.1. Coordinating Registered Professional

Design Phase

• Determine the appropriate RPRs required for the project and make arrangements with the owner for their services.

• Clarify the roles and responsibilities of the various RPRs.

• Coordinate the design of the fire and life safety systems by the RPRs.

• Coordinate and develop the test protocol and procedures for functional testing of the fire and life safety systems.

• Coordinate the submission of the design drawings and supporting documents for the Building Permit application.

Construction Phase

• Coordinate and monitor the field reviews of the RPRs.

• Coordinate and monitor the review of shop drawings by the RPRs.

• Facilitate the information flow among the RPRs and Contractor.

Occupancy Phase

• In conjunction with the RPRs, finalize the project-specific test protocol and procedures for the fire and life safety systems, and review the requirements with the Contractor, subtrades and RPRs.

• Finalize the list of project-specific occupancy permit submission documents and the schedule for submissions and confirm completeness with AHJ.

• Organize the "Coordinated Final Consultant Review" at least one week prior to "Coordinated AHJ Final Review."

• Take a lead role in coordinating the functional testing of the fire and life safety systems during the "Coordinated Final Consultant Review."

• Coordinate the RPRs' review of Occupancy Permit submission documents for completeness and accuracy. • Coordinate Certification of Equivalencies, if applicable.

• Collect all of the required Occupancy Permit submission documents and submit them in a complete package to the AHJ.

• Organize the "Coordinated AHJ Final Review."

• Record any deficiencies identified at the "Coordinated AHJ Final Review" and monitor RPRs' field review of the corrective actions by the subtrades.

• Assist in finalizing the list of outstanding requirements which need to be met for the issuance of the Occupancy Permit.

• Follow-up on minor deficiencies post-Occupancy.

3.2.2. Architectural Design Phase

• Establish the conceptual design for the fire and life safety systems in consultation with RPRs.

• Determine equivalency reports required and coordinate the implementation on the drawings and supporting documents.

• Clearly indicate on drawings and supporting documents:

  • Major occupancies and code classifications.

  • Fire separations and fire-resistance ratings.

• Closures:

  • Fire-protection rating

  • Temperature rise requirements

    - Amount of glazing
- Hardware for closures
    - Panic hardware
    - Hold-open devices
    - Electromagnetic locks
- Egress systems.
- Provisions for fire fighting access.
- Interior and exterior finishes.
- Elevating devices c/w integrated controls to the fire alarm panel.
- Signage coordinated with fire alarm system and annunciation.

Construction Phase

- Provide field reviews of architectural components.
- Review shop drawings for architectural components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence architectural components.

Occupancy Phase

- Ascertain that the architectural components substantially conform to the architectural drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the architectural components of the fire and life safety systems.
- Coordinate the signage with the fire alarm annunciator and the fire safety plans.
- Review the architecturally-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the architectural Schedule C-B and other assurance letters required for the Occupancy Permit.

3.2.3. Mechanical/Plumbing Design Phase

- Coordinate mechanical/plumbing clearances and functional requirements with other RPRs.
- Clearly indicate on drawings and supporting documents:
    - Details of the mechanical/plumbing components of the fire and life safety systems.
    - Schematic diagram of the smoke venting system showing all fans, ducts, motorized dampers, fusible link dampers and backdraft dampers.
    - Location and fire-protection ratings of fusible link fire dampers and fire stop flaps.
    - Location and fire-protection ratings of motorized fire dampers.
    - Location and fire-resistance ratings of fire-rated duct enclosures.
    - Fire stop systems for mechanical/plumbing penetrations of fire separations.
    - Kitchen exhaust system/suppression system.
- Mechanical fans/motorized dampers sequence of operations:
    - Describe operation under normal mode
    - Describe operation under fire alarm mode
    - Indicate fire alarm initiation devices that activate change of operation

Construction Phase

• Provide field reviews of mechanical/plumbing components.

• Review shop drawings for mechanical/plumbing components and coordinate requirements with other RPRs.

• Review shop drawings for other disciplines which may influence mechanical/plumbing components.

Occupancy Phase

• Ascertain that the mechanical/plumbing components substantially conform to the mechanical/plumbing drawings and supporting documents.

• Perform an active role in witnessing the functional testing of the mechanical/ plumbing components of the fire and life safety systems.

• Review the mechanical/plumbing related occupancy permit submission documents provided by the Contractor and subtrades for completeness and accuracy.

• Prepare and forward to the CRP the mechanical/plumbing Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.4. Fire Suppression

The design of sprinkler systems can be accomplished by at least two possible scenarios:

Scenario 1

• The engineer of record undertakes the complete detailed design prior to the building permit application.

• The engineer of record submits Schedule B with the BP application.

• The engineer of record provides field reviews during construction and submits a Schedule C-B prior to Occupancy Permit.

Scenario 2 (where acceptable to the Chief Building Official)

• The engineer of record provides a detailed performance specification for the sprinkler design, as well as sufficient drawings to demonstrate/assure layout feasibility and interface with other components.

• The engineer of record submits Schedule B with the BP application for overall coordination of the sprinkler design. Schedule B can be annotated "For Performance Specification Only."

• The performance specifications may include a requirement that a separate sprinkler design engineer be responsible for detailed sprinkler design, preparation of sprinkler shop drawings and hydraulic calculations, letter of assurance Schedule B, (for field review during construction), and Schedule C-B (for Detailed Design) prior to Occupancy Permit.

• The engineer of record reviews the detailed sprinkler design and shop drawings to ascertain that they substantially comply with the performance specifications.

• The engineer of record provides a Schedule C-B prior to Occupancy Permit to confirm overall coordination of the sprinkler design and installation. Schedule C-B can be annotated "For Performance Specification Only." The engineer of record is entitled to rely upon the professional seal of the sprinkler design engineer for the detailed design and field review of the sprinkler system.

For purposes of this example, Scenario 2 Roles and Responsibilities are outlined below:

Design Phase by Engineer of Record

• Coordinate fire suppression spatial and functional requirements with other RPRs/CRP.

• Clearly indicate on the drawings and performance specification:

  • Fundamental design parameters for the fire suppression system to appropriate Standard.

  • Location of fire department siamese hose connections.

  • Location and size of standpipes and hose connections.

  • Details of special sprinkler protection as per equivalent reports.

  • Fire stop systems for pipe penetrations of fire separations.

• Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified in the performance specifications.

Construction Phase by Sprinkler Design Engineer

• Prepare, sign and seal shop drawings and hydraulic calculations, clearly indicating:

• Details of the fire suppression components of the fire and life safety systems.

• Schematic riser diagram of sprinkler and standpipe systems c/w all devices that will be connected to the fire alarm system (flow switches, tamper switches, pressure switches, freeze monitoring, heat trace monitoring).

• Location of fire department siamese hose connections.

• Location and size of standpipes and hose connections.

• Details of special sprinkler protection as per equivalent reports.

• Zoning of the sprinkler system to be coordinated with the electrical engineer for the fire alarm annunciation and clearly identified on the sprinkler shop drawings.

• Coordinate fire suppression location and functional requirements with engineer of record/CRP.

• Provide field reviews of fire suppression components.

Construction Phase by Engineer of Record

• Review shop drawings and hydraulic calculations for fire suppression components to determine substantial conformance to the performance specifications.

• Provide field reviews of fire suppression components to determine substantial conformance to the performance specifications.

• Monitor the field reviews by the Sprinkler Design Engineer to determine substantial conformance with the performance specifications.

• Review shop drawings for other disciplines which may influence fire suppression components.

Occupancy Phase by the Engineer of Record

• Ascertain that the fire suppression components substantially conform to the performance specifications.

• Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.

• Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.

• Collect the Schedule C-B from the Sprinkler Design Engineer, review for accuracy and completeness and forward to the CRP.

• Collect other Occupancy Permit documents from the subtrade contractor (e.g., Contractor's Material and Test Certificates), review for completeness and forward to the CRP.

• Prepare and forward to the CRP the fire suppression Schedule C-B for overall coordination of the fire suppression system.

Occupancy Phase by the Sprinkler Design Engineer

• Ascertain that the fire suppression components substantially conform to the sprinkler shop drawings and supporting documents.

• Perform an active role in witnessing the functional testing of the fire suppression components of the fire and life safety systems.

• Review the fire suppression-related Occupancy Permit submission documents by the Contractor and subtrades for completeness and accuracy.

• Prepare and forward to the Engineer of Record the fire suppression Schedule C-B and other assurance letters and documentation required for the Occupancy Permit.

3.2.5. Electrical

Design Phase

- Coordinate with the CRP and RPRs the test protocol and procedures for functional testing of the fire and life safety systems.
- Details of the electrical components of the fire and life safety systems.
- Clearly indicate on drawings and supporting documents:
    - Fire Alarm System
        - Location of fire alarm annunciator panel and central alarm control facility
        - Location of fire alarm initiating devices (smoke detectors, heat detectors, manual pull stations) • Fire alarm riser diagram c/w ancillary device connections
        - Audibility of fire alarm signal throughout floor area
        - Zoning of fire alarm initiation devices and audible signal appliances
        - Monitoring of fire alarm
        - Routing and method of protection of emergency conductors
        - Wiring methods for equipment
        - Testing/verification requirements and the documentation to be submitted to the RPR
    - Sprinkler System
        - Coordinate design with sprinkler design engineer
        - Sprinkler system alarm initiation and monitoring to be indicated on the fire alarm riser diagram (flow, tamper, pressure, etc.)
        - Detailed diagrams for freeze protection systems (heat trace monitoring, low temperature monitoring, etc.)
    - Fire Pump Systems
        - Riser diagram to indicate monitoring of the fire pump (pump running, power failure, phase reversal, wiring details for device connections)
        - Routing and method for protection of fire pump feeders from fire and power source, so that a fire from one source will not interrupt power from the other source
        - Electrical requirements to appropriate Standard and documents to be submitted to RPR (overcurrent protection details, location of controller and transfer switches, voltage drop, etc.)
    - Kitchen Exhaust/Fire Suppression System
- Emergency Generator
    - Generator load calculations
    - Details and wiring diagram for monitoring through the fire alarm system
    - Details for testing to appropriate Standard and documents to be submitted to RPR
- Smoke Venting Systems
    - Coordinate design with the mechanical engineer
    - Fire alarm riser diagram to indicate smoke venting fans and motorized dampers and HVAC/exhaust fan shutdown
    - Detailed wiring diagrams for fan shut-offs, exhaust fan operation, pressurization fan operation, damper operation (opening, closing, throttling)
    - Sequence of operation of smoke venting system in a narrative form
    - Describe operation under normal mode
    - Describe operation under fire alarm mode
    - Indicate fire alarm initiating devices that activate changes of operation/sequence

    - Routing methods for protection of emergency conductors
- Electromagnetic Locks and Hold-Open Devices
    - Coordinate design with the architect
    - Sequence of operation in both normal and fire alarm mode
    - Wiring diagrams for connection of devices
    - Locations of devices on the floor plans
- Elevators
    - Sequence of operation in a narrative form
    - Wiring diagram details
    - Routing and method of protection of emergency conductors
    - Fire stop systems for electrical penetrations of fire separations
    - Coordinate electrical equipment location and functional requirements with other RPRs/CRP.

Construction Phase

- Provide field reviews of electrical components.
- Review shop drawings for electrical components and coordinate requirements with other RPRs.
- Review shop drawings for other disciplines which may influence electrical components.

Occupancy Phase

- Ascertain that the electrical components substantially conform to the electrical drawings and supporting documents.
- Perform an active role in witnessing the functional testing of the electrical components of the fire and life safety systems.
- Review the electrical-related Occupancy Permit submission documents provided by the Contractor and subtrades for completeness and accuracy.
- Prepare and forward to the CRP the electrical Schedule C-B and other assurance letters and documents required for the Occupancy Permit.

4.0. Sample Occupancy Demonstration/Witnessing Flowchart

DEVELOP TESTING PROTOCOL/PROCEDURE (Design Stage)

CRP/RPRs develop Testing Demonstration/Witness Protocol

— Issue to Authorities Having Jurisdiction & Contractor

||

V

DOCUMENTATION SUBMISSION

Contractor/Subtrades submit/deliver all appropriate documentation to CRP/RPRs, including:

— The original Contractor's Materials and Test Certificate for the sprinkler system

— Fire Pump Flow Test Certificate(s)

— Back Flow Prevention Certificate(s)

— Emergency generator commissioning and verification reports

— The original Certificate of Verification for the fire alarm system

— Appendix "A" to the fire alarm verification report

— ULC Certificate for Protective Signaling Service

— Other documentation, as appropriate

||

v

CONTRACTOR DEMONSTRATION — CONSTRUCTION COMPLETE

Contractor & Subtrades

(Mechanical, Electrical, Elevator, Sprinkler, Fire Alarm, etc.) as appropriate

||

v

COORDINATED FINAL CONSULTANT REVIEW DEMONSTRATION/WITNESSING CRP/RPRs

(Architect, Mechanical Engineer, Electrical Engineer, Sprinkler Engineer, Equivalency Consultant, etc.) as appropriate

||

v

OCCUPANCY SUBMISSION DOCUMENTS

CRP to collect all submission documents, including Schedule Cs from RPRs, and submit to AHJ in a complete package

||

v

COORDINATED FINAL AHJ REVIEW DEMONSTRATION/WITNESSING

Contractor, Subtrades, CRP/RPRs demonstrate to AHJ

(Building, Fire, Mechanical, Electrical and Sprinkler)

||

v

OP ISSUED

A-2.2.8.3. Commissioning Plan and Preliminary Commissioning Report for New Equipment in New and Existing Buildings

Commissioning Plans

The Commissioning Plan must provide organization, documentation, requirements, and tools to evaluate and document that the design, construction, and operation of the new components and systems in new and existing buildings.

The following is an example of the details required within a Commissioning Plan for new components and systems in new and existing buildings.

1. Overview of the Cx activities developed specifically for the project;
2. Roles and responsibilities for the project team throughout the project;
3. Declaration of whether the CxP is affiliated with the design or construction team. If the CxP is affiliated with the design or construction team, include a conflict-of-interest management plan disclosing the relationship between the CxP and other design and construction team members, and clarify how the CxP will remain independent and able to objectively inform the owner of issues uncovered during the commissioning process;
4. Documentation of general communication channels, including the distribution of the Cx Plan during the design and construction process;
5. Detailed description of Cx Activities and a schedule of activities;
6. Project design documentation evaluation procedures;
7. General description of Cx activities that will occur during design, construction, and occupancy and operations;
8. Guidelines and format that will be used to develop the Cx documentation, including Systems Manual and training plans;

9. Listing and format for Design Review, checklists and testing forms, issues and resolution log, and Cx Progress Reports that will be used during the project to communicate and track critical Cx Activities information;
10. List of project's commissioned systems and assemblies, and description of evaluation procedures; and,
11. The framework for procedures to follow whenever Cx evaluation does not meet the owner's project requirements.

Preliminary Commissioning Reports

The Preliminary Commissioning Report must clearly indicate all essential details to demonstrate the proper, integrated operation of commissioned components and systems prior to occupancy.

The following is an example of the details required within a Preliminary Commissioning Report for new components and systems in new and existing buildings.

1. Executive summary identifying the systems and assemblies commissioned;
2. Copy of the final Cx Plans;
3. Copy of Cx design and submittals review reports;
4. Completed copy of the approved supplier, contractor, and CxP evaluations, and Cx start-up and test forms, including those used during the occupancy and operations activity;
5. Location of record drawings of commissioned systems;
6. Location of warranties for commissioned systems;
7. Copy of all Cx Progress Reports;
8. Copy of all issues and resolution logs, including the descriptions of the issues and the measures taken to correct them, and a discussion of systems or assemblies that do not perform in accordance with the owner's project requirements;
9. For all incomplete issues, delayed or seasonal tests, include a resolution plan with recommended timelines for completion and identify who is responsible for resolution. This section is to be accepted and approved by the Owner; and
10. Listing of incomplete deliverable and open issues for resolution during the project closeout phase.

A-2.3.1. Alternative Solutions. Beyond the purposes of demonstrating compliance and acquiring a building permit, there are other important reasons for requiring that the proponent of an alternative solution submit project documentation (i.e. a compliance report) to the authority having jurisdiction and for the authority having jurisdiction to retain that documentation for a substantial period following the construction of a building:

• Alternative solutions made possible by objective-based codes may have special maintenance requirements, which would be described in the documentation.

• Documentation helps consultants perform code compliance assessments of existing buildings before they are sold and informs current owners or prospective buyers of existing buildings of any limitations pertaining to their future use or development.

• Documentation provides design professionals with the basic information necessary to design changes to an existing building.

• An alternative solution could be invalidated by a proposed alteration to a building. Designers and regulators must therefore know the details of the particular alternative solutions that were integral to the original design. Complete documentation should provide insight as to why one alternative solution was chosen over another.

• Documentation is the "paper trail" of the alternative solution negotiated between the designer and the regulator and should demonstrate that a rational process led to the acceptance of the alternative solution as an equivalency.

• It is possible that over time a particular alternative solution may be shown to be inadequate. It would be advantageous for a jurisdiction to know which buildings included that alternative solution as part of their design: documentation will facilitate this type of analysis.

• Project documentation provides important information to a forensic team that is called to investigate an accident or why a design failed to provide the level of performance expected.

This subject is discussed in further detail in "Recommended Documentation Requirements for Projects Using Alternative Solutions in the Context of Objective-Based Codes," which was prepared for the CCBFC Task Group on Implementation of Objective-Based Codes and is available on the NRC's website.

Part 3
Appeals, Offences and Penalties and Transition Provisions

Section 3.1. Appeals

3.1.1. Building Board of Appeal

3.1.1.1. Appeal Within 30 Days

1) Any person dissatisfied with a decision of the *Chief Building Official* relating to matters described in Article 3.1.1.2. may appeal the decision to the *Building* Board of Appeal who shall have such powers relating to this By-law as are set out in this By-law and in the *Building* Board of Appeal By-law.

3.1.1.2. Limits of Appeal

1) An appeal lies to the *Building* Board of Appeal from any decision of the *Chief Building Official* regarding

a) the interpretation of this By-law,

b) the use of new *construction* methods or materials,

c) upgrading *existing buildings,* or

d) permitting alternative proposals.

3.1.1.3. Filing of Appeal

1) An application for an appeal shall be filed with the Secretary of the Board, in writing, within 30 days of the decision which gives rise to the appeal.

2) An application for an appeal shall include

a) the address of the *building* to which the decision relates,

b) the applicable provisions of the By-law, and

c) sufficient detail to describe the factual and technical basis for the appeal.

Section 3.2. Offences and Penalties

3.2.1. Violation of By-law

3.2.1.1. Offences

1) Every person who

a) violates any of the provisions of this By-law,

b) suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this By-law,

c) neglects to do or refrains from doing anything required to be done by any of the provisions of this By-law,

d) does any act which violates any of the provisions of this By-law, or

e) fails to comply with an order or notice given under this By-law, is guilty of an offence against this By-law and liable to the penalties hereby imposed.

3.2.2. Fines and Penalties

3.2.2.1. Minimum Fine

1) Every person who commits an offence against this By-law is liable to a fine of no less than $250 and not more than $10,000 for each offence.

3.2.2.2. Continuing Offence

1) Every person who commits an offence of a continuing nature against this By-law is liable to a fine of not less than $250 and no more than $10,000 for each day such offence is continued.

3.2.2.3. Unsafe Condition

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who permits *occupancy* to occur while an *unsafe condition* exists in or about a *building* or the premises is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.4. Failure to Comply with an Order

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to comply with an order or notice issued by the *Chief Building Official* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.5. Work Without a Permit

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who works without *permit* is liable to a fine of no less than $500 and not more than $10,000 for each offence.

3.2.2.6. Failure to Permit Entry

1) Despite the minimum fine referred to in Article 3.2.2.1., every person who fails to allow the *Chief Building Official* entry to a *building* or premises is liable to a fine of not less than $500 and not more than $10,000 for each offence.

Section 3.3. Transition Provisions

3.3.1. General

3.3.1.1. Validity of Permits Issued under Previous By-law

1) Subject to the provisions of Articles 1.5.2.4. and 3.3.1.2., *buildings* for which *permits* were obtained under may be constructed in accordance with the provisions of that By-law.

3.3.1.2. Grace Period

1) Where an *owner* has applied for a *permit* prior to September 15, 2025, a *building* may be constructed in accordance with By-law No. 12511 if, in the opinion of the *Chief Building Official*, the *owner* has commenced the work authorized by the *permit* within 6 months of the date of issuance of the *permit* and the *owner* has continued work to completion without interruption other than work stoppages which are standard in the *building* industry.

3.3.1.3. Reserved.

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3.3.1.4. Seismic Regulation Transition

1) A *building* required to meet the seismic design provisions of Subsection 4.1.8., Section 9.23, and Appendix C of Division B of this By-law may, as an alternative, meet the seismic design provisions of Subsection 4.1.8., Section 9.23, and Appendix C of Division B of the 2019 Building By-law where

a) a substantially complete application for a *building permit* is submitted on or after the effective date of this By-law but before September 15, 2026,

b) a *building permit* is required and the *owner* submits a substantially complete application for a *building permit* on or after the effective date of this By-law but before March 08, 2027, and

   i) a substantially complete development permit application has been submitted to the *City* in relation to the *building* before the effective date of this By-law, or

   ii) a rezoning application has been submitted to the *City* in relation to the *building* before the effective date of this By-law, or

c) a*building permit* is not required, and the *construction* or *alteration* of the *building* substantially starts after the effective date of this By-law but before March 08, 2027.

2) An *owner* obtaining a *permit* and exercising the alternative seismic requirements permitted by Sentence (1) shall commence the work authorized by the *permit* within 6 months of the date of issuance of the *permit* and continue work to completion without interruption, other than work stoppages considered reasonable in the building industry, or the *Chief Building Official* may require that the *owner* apply for a revision to the *permit*.