File No.: 04-1000-20-2025-439

July 18, 2025

s.22(1)

Dear s.22(1)

Re: **Request for Access to Records under the Freedom of Information and Protection of Privacy Act (the "Act")**

I am responding to your request of July 4, 2025 under the ***Freedom of Information and Protection of Privacy Act*** for:

> **Record of the public review documents for proposed changes to Vancouver Building By-law Code Change numbers 24-0001, 24-0002, 24-0003, 24-0004, 24-0005, 24-0006, 24-0007, 24-0008, 24-0009, 24-0010, 24-0011, 24-0012, 24-0013, 24-0014, 24-0015, 24-0016, 24-0017, 24-0018, 24-0019, 24-0020, 24-0021, 24-0022, 24-0023, 24-0024, 24-0025, and 24-0026 (originally available on the City's website).**

All responsive records are attached.

Please note that Building Policy Branch staff have advised our office that the responsive records had been recently removed from the City website now that the changes have been incorporated into the 2025 Vancouver Building By-law.

Under Part 5 of the Act, you may ask the Information & Privacy Commissioner to review any matter related to the City's response to your FOI request by writing to: Office of the Information & Privacy Commissioner, info@oipc.bc.ca or by phoning 250-387-5629.

If you request a review, please provide the Commissioner's office with: 1) the request number (2025-439); 2) a copy of this letter; 3) a copy of your original request; and 4) detailed reasons why you are seeking the review.

Yours truly,

[Signed by Cobi Falconer]

Cobi Falconer, MAS, MLIS, CIPP/C
Director, Access to Information & Privacy

If you have any questions, please email us at foi@vancouver.ca and we will respond to you as soon as possible. You may also contact 3-1-1 (604-873-7000) if you require accommodation or do not have access to email.

Encl. (Response Package)

:lg

Vancouver Building By-Law 2025 – August 2024 Public Review of Proposed Changes

What is the purpose of this engagement?
In late 2023, the Province of British Columbia released the newest version of the BC Building Code. This started a process of review by the Chief Building Official and Building Policy staff at the City of Vancouver to develop new regulations for consideration by City Council for adoptions as a new Building By-law.

The Chief Building Official invites your comment and feedback with respect to the proposed substantive new Unique to Vancouver changes that will be incorporated into a new Building By-law substantially based upon an adoption of the 2024 BC Building Code, and carrying forward the existing unique to Vancouver requirements from the previous Building By-law.

Background Information
Building codes establish requirements for building design and construction and specify minimum levels of performance in many areas. Many of these requirements have been harmonized across the country through the Canadian Model Codes system to promote consistent performance of buildings across the country in the areas of health, safety, accessibility, the protection of buildings from fire or structural damage, and the protection of the environment. This also facilitate the certification and use of products, materials, and equipment, and the employment of skilled trades.

The National Model Codes have no legal authority until they are adopted by a government authority with the appropriate jurisdiction. In Vancouver, this is by enacted through the Building By-law, which is substantially based on the Provincial Building Code, which includes the National Model Building Code through a similar process of adoption.

At the direction of Chief Building Official, Building Policy staff have identified several significant policy changes for consideration that address local priorities and local concerns, and help promote Vancouver leadership in the areas of building performance and climate adaptation. If adopted, these new provisions will be incorporated into the Building By-law along with existing unique to Vancouver requirements and the 2024 BC Building Code as the base document.

Your Feedback
Your feed back is important, and will help inform City decision making in further developing construction regulations that:

- Are Clearly Understandable
- Are Technically Accurate, and
- Reduce the likelihood of Unintended Consequence

This survey is voluntary, and a response is encouraged, but is not required.

Issued: July 22, 2024

How do I provide feedback?
In order to provide the City with feedback, please email the Chief Building Official your responses to CBO@vancouver.ca by **September 28th** end of day.

You may comment on any or all of the items, and if your responses are numerous or lengthy, consider using the attached response form template for each item.

In your response, please identify the specific change proposal, if you support it, your comments and suggestions, and the rational or basis for your suggestions. A response template is provided for your convenience.

The Chief Building Official also welcomes other suggestions for change or new areas of work, although they may not act on all provided suggestions.

This review is informal, and City staff will review your comments and suggestions. Staff may also contact you for additional information provided that you have provided us with contact information.

Information Sessions
In addition to the write ups provided for each proposed code change, City staff will be hosting information sessions on changes related to energy and environment, as well as healthy homes, and 2024 BC Building Code seismic requirements. For more information on these sessions and to sign-up, please visit the Vancouver Building By-law webpage.

Vancouver Building By-law 2025 - Proposed Significant Changes – Phase I
The following is a list of proposed code change topics. Each topic includes its own write up explaining the intended change and general rational behind the change.

Fire and Life Safety:
- CCR-24-0001 Sprinkler protection design requirements
- CCR-24-0002 Spatial Separation of Shared Residential Garages Up to 5 Vehicles
- CCR-24-0003 Exit Exposure for Detached Houses and Duplexes
- CCR-24-0004 Storage Garage Security
- CCR-24-0005 Overhead Di-electric Liquid Filled Transformers
- CCR-24-0006 Fire Department Extended Access Path
- CCR-24-0007 Interconnected Floors in Dwelling Units

Health and Security:
- CCR-24-0008 Adaptability
- CCR-24-0009 Gender Neutral Washrooms
- CCR-24-0010 Seasonal Patio Washrooms

Ventilation & Indoor Air Quality:
- CCR-24-0011 Healthy Homes
- CCR-24-0012 Ventilation Rates for Buildings

Energy & Environment:
- CCR-24-0013 Energy requirements for Four Storey Buildings
- CCR-24-0014 Updated Energy Modelling Guidelines

- CCR-24-0018 Exclusion of Lighting Power Trade-off
- CCR-24-0019 Commissioning of Buildings
- CCR-24-0020 Submetering of Buildings
- CCR-24-0021 Airtightness of Buildings
- CCR-24-0022 Embodied Carbon
- CCR-24-0024 Alteration Provisions to Accommodate Reconstruction

Note: In response to Council direction, staff are developing additional proposed changes related to energy efficiency and carbon emissions, and these proposed changes will be included in a follow-up invitation to comment.

A second phase of this public review is expected towards the end of August, and will include further change proposal related to existing buildings and temporary buildings or uses.

Privacy Statement
Your comments and feedback are collected by the City of Vancouver under sections 26(c) and 26(e) of the Freedom of Information and Protection of Privacy Act, for the purpose of soliciting feedback on the Vancouver Building By-law. Please do not include any personal information about yourself and/or others including phone numbers and email addresses in the body of your comments.

*****

Vancouver Building By-Law 2025
July 2024 Public Review – Proposed Change Response Template

Contact Name:

Contact information email or phone number (optional):

Organization or Affiliation (if any):

Role (if any):

Proposed Change:

Do you support this change:
(Support) / (Support with modifications) / (Do not Support)

Proposed modification(s):

Comments/Rational:

Issued: July 22, 2024

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Sprinkler Design

Topic: Simplification and Harmonization of the Application of Sprinkler Design Standards

Code change number: 24-0001

Code reference: Book I, Division B, 3.2.5.12.

Description of the proposed change

Simplification and Harmonization of the Application of Sprinkler Design Standards

Justification

This proposal addresses one of the more significant challenges with current VBBL regulations with respect to sprinkler regulations, which is that the current regulations do not adequately consider the impacts of ancillary residential units such as secondary suites and lock-off suite which are increasingly prevalent in Vancouver low density housing forms due to the high cost and limited availability of land.

In addition, with recent revision to single family zoned land into multiple family zoned land permitting up to 8 residential suites to facilitate housing, there is a need to further simplify the design of sprinklers.

Further to this, the fire sprinkler industry has expressed significant amounts of frustration with permit applications based on the general application of NFPA 13 and its derivative standards, particularly when this is not consistent with the typical grouping established by those standards.

The intent of this proposed changes is to better correlate the referenced sprinkler design standard with the building typology, with less reliance on the form of ownership. This approach more closely aligns with the application statement of the applicable sprinkler standard, and therefore also better aligns with the industry expectations for the use of these standards. This is expected to result in fewer major concerns in application, since the fundamental design approach is more likely to coincide with the Building By-law requirements and is therefore more likely to be suitable for adjustment without extensive redesign.

In addition, the language in Article 3.2.5.12. has been updated to include the use of the term “principal dwelling unit” to clarify that ancillary residential units need not be included for the purpose of the determining the applicable sprinkler standard. This aligns with the City’s current and historical policy of considering the principal dwelling unit and all its subordinate units as a single entity for the purposes of mechanical and electrical system design. This is potentially a more cost-effective arrangement, though it leaves the responsibility for maintaining the operation of the sprinkler system serving subsidiary dwelling units with the owner/resident of the principal dwelling unit. This is not deemed to be a concern since

ancillary residential units may not be separately owned, so the responsibility for maintenance in an operational state clearly remains the owner responsibility, unless otherwise contractually established.

This approach is also expected to largely resolve the issues associated with requiring fire department connections for construction that are essentially detached houses, or duplexes, where the fire department is unlikely to use such systems. NFPA 13D does not require fire department connections, and this would now be more regularly applicable to houses and duplexes.

Language improvements have also been included that removed the reference to testing, this being already identified at length in NFPA 13 and other associated standards, and language improvements related to flow through system arrangement with respect to water closets has been removed, in favour of consistent language with the definition and explanation within the NFPA 13D standard for a passive purge system.

Sentence (13) has been expanded to include carports, which were not previously captured but have a similar function to garages.

Lastly two new sentences have been added to address practical installation concerns.

a) Sentence (14) expands the use of Polyethylene pipe to include designs required to be NFPA 13R, but of a size or scope more consistent with NFPA 13D.

b) Sentence (15) addresses a know problem with steeply pitched roofs, and codifies current policy thus promoting a consistent approach and making this accessible to all designers.

Additional clarifying notes have been added as background material related to the proposed new Sentence (15).

Proposed VBBL content

Legend

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3.2.5.12. Automatic Sprinkler Systems

[…]

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 ~~and testing~~ 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 one tank-type water closet is supplied with water from the sprinkler head which is located farthest from the main water supply,~~ 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) ~~except for a *secondary suite,*~~ no principal *dwelling unit* or its *ancillary residential unit* is located above another principal *dwelling unit* or its *ancillary residential unit*,

ii) all ~~*suites*~~ 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, and

ii) ~~sprinklers are provided in each attached garage or carport, notwithstanding the exemptions set out in NFPA 13D,~~

iii) ~~a one tank-type water closet is supplied with water from the sprinkler head which is located farthest from the main water supply.~~ 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))

~~iv) the path of travel for firefighters complies with Clause 3.2.5.5.(3)(a),~~

~~v) each *dwelling unit* has direct access to an exterior *exit* facility complying with Sentence 3.3.4.4.(3);~~

(See Note A-3.2.5.12.(2); also see 3.2.5.5. and 9.10.20.4.)

[…]

11) Except as permitted by Sentence (12), ~~Notwithstanding the requirements of Sentences (1) and (2) and except as permitted by Sentence (12), automatic sprinkler protection shall be provided for~~ 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.

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 two principal *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) In a residential building designed to NFPA 13D or 13R, residential sprinklers may be installed under steeply sloped roofs with a pitch that exceeds 8 in 12, provided that the hydraulic design area is increased by 30% or as otherwise acceptable to the Chief Building Official. (see Note A-3.2.5.12.(15))

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. Multi-family residential arrangements (i.e. larger than duplexes) wherein which principal dwelling units are superimposed above another principal

dwelling 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.(15) Steeply pitched roofs. Steeply pitched roofs are addressed in NFPA 13, 13R and 13D, and require the use of listed sprinklers, for which there are no readily available sprinklers with a Canadian certification. The provisions of Sentence 3.2.5.12.(15) are intended to provide an interim solution until such sprinkler are widely available. The permission presented in Sentence (15) is reflective of recommended design practice by sprinkler manufacturers, to use an increased design area to accommodate the possibility that this arrangement could lead to additional sprinkler operating. Users addressing steeply pitched roofs should consult with the Chief Building Official to ensure that the needs of the specific application have been adequately addressed.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Subsidiary Garages and Carports

Topic: Residential garages and carports to be subsidiary

Code change number: 24-0002

Code reference: Book I, Division B, 9.10.2.1.(2)

Description of the proposed change

Adding a new provision to permit Residential Garages and Carports serving multiple residential buildings to be evaluated as subsidiary to the residential occupancy that they serve.

Justification

This proposal addresses a reoccurring concern where a storage garage serves one or more residential buildings which are not attached to the building containing the storage garage. A fundamental assumption of the Building By-law is that the requirements pertain to a single building. So that a review of the Code requirements associated with a storage garage serving other buildings would lead to the conclusion that the storage garage is own major occupancy.

This is problematic, when this is looked at in combination with other attached Group C residential uses, or even as a standalone building, as the application Article 3.2.5.12. would lead to the conclusion that the building must be sprinklered to NFPA 13, which is inconsistent with scale and building typology.

Further to this, the fire sprinkler industry has expressed significant amounts of frustration with permit applications based on the general application of NFPA 13 and its derivative standards and has expressed the general opinion the scope of required work is generally unnecessarily large for a building of this type, and does not offer addition protection which is commensurate to the relative cost and effort involved.

The proposed changes are intended to bring the scale of work in a detached building that is subordinate to one or more principal building on a site. While such a structure may contain a use that could be serving other buildings, the nature of its use remains consistent with that of the attached structure, which would clearly be ancillary to the principal building and this has historically been seen as an extension to the dwelling unit.

Allowances in the Building By-law already exist for both attached or detached garage serving a single dwelling unit, so it does not seem unreasonable to take the position that even if serving other residential units in separate buildings built to a similar standard on the same site should then perform at least as well as that of a single building.

The principal risk with this arrangement is that since such a garage would then be serving multiple dwelling units, occupants of one garage unit allotment (suite) may not be intimately aware of the specific hazards or contents of the other unit allotment. However, since all buildings would be part of a single residential site, it is expected that the owners would at least be passingly familiar with the general activities and use of the garage. Likewise, the presence of multiple garage allotments (forming part of another suite), continues to require the provision of a suite separation as required by other By-law requirements, which has generally been seen to be sufficient to protect the occupants of adjacent suites from each other.

Proposed VBBL content

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9.10.2. Occupancy Classification

9.10.2.1. Occupancy Classification

1) Except as provided in Article 9.10.2.2., 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 9.10.2.1.

Table **9.10.2.1.**

Occupancy Classifications

Forming Part of Sentence 9.10.2.1.(1)

Group	Division	Description of *Major Occupancies*(1)
C	—	*Residential occupancies*
D	—	*Business and personal services occupancies*
E	—	*Mercantile occupancies*
F	2	*Medium-hazard industrial occupancies*
F	3	*Low-hazard industrial occupancies* (Does not include *storage garages* serving individual *dwelling units*)

Notes to Table 9.10.2.1.:
(1) See Note A-3.1.2.1.(1).

2) A *storage garage* or carport that serves one or more residential *buildings*, may be considered an ancillary use to a Group C *major occupancy* provided that
a) it serves *buildings* of only *residential occupancy*,
b) the *storage garage* or carport contains no other *major occupancy*, and
c) the *storage garage* or carport is on the same property as the *building* to which it is deemed ancillary.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Exit Exposure for Sprinklered Houses

Topic: Exit Exposure for Sprinklered Houses

Code change number: 24-0003

Code reference: 9.9.4.4.; 9.9.4.5.; 9.9.4.6.

Description of the proposed change

Exit Exposure for Sprinklered Houses

Justification

There are significant divergence of opinion with respect on the appropriateness of exit exposure protection for housing constructed to Part 9. The provision of Subsection 9.9.4. from the national and provincial codes clearly indicate that exit exposure protection is intended. However, there is evidence from plan and field review, that many home designers are either unaware or do not coordinate such protection with the relevant trades.

Industry has also raised many concerns about the provision of exit exposure. It has been broadly expressed that the level of protection may be overly onerous given that the city requires sprinkler protection of all houses. It is also recognized that not all municipalities enforce such requirements, which is further contributing to the confusion.

This proposed revision, proposes to delete explicit requirements for protection of exit exposure for stair, ramps, and doors in detached houses and duplexes where the building is fully sprinklered, and has at least two means of egress that can be used to reach a street, lane, or public throughfare.

Exit exposure protection for dwelling units in Part 9 for dwelling units under the NBCC and BCBC are applicable only in limited circumstances to a detached house. This limited protection presumes that the detached house is not sprinkler protected and does not contain multiple independent dwelling units, and limited occupant load.

The proposed change is intended to recognize the significant fire safety benefits offered by fully sprinklered detached house or duplex, and the relatively low level of risk that occupant would become exposed to a fire within an adjacent dwelling unit.

Other fire safety standards such as NFPA 80A-2022 have recognized significant fire safety benefits from sprinkler generally stating (ref. Article 5.6.3. and A.5.6.3.) fires in a sprinklered building can be assumed to be controlled and no exposure hazard considered to exist.

NFPA's fire statistics from an analysis of US fires have shown that where the sprinkler system has operated, this was effective at controlling the fire 97% of cases, of which in 77% of cases one sprinkler was sufficient to extinguish or control the fire (https://www.nfpa.org/education-and-research/research/nfpa-research/fire-statistical-reports/us-experience-with-sprinklers).

VFRS has generally confirmed similarly the substantial benefits from sprinklers.

Proposed VBBL content

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9.9.4.4. Openings Near Unenclosed Exterior Exit Stairs and Ramps

1) *Unprotected openings* in exterior walls of the *building* shall be protected with wired glass in fixed steel frames, ~~or~~ glass block conforming to Articles 9.10.13.5. and 9.10.13.7., or protection complying with the requirements of Sentence 3.2.3.13.(5)., where

a) an unenclosed exterior *exit* stair or *ramp* provides the only *means of egress* from a *suite* and is exposed to fire from *unprotected openings* in the exterior walls of

i) another *fire compartment*, or

ii) another *dwelling unit*, ancillary space or common space in ~~a house with a *secondary suite*~~ an *ancillary residential unit*, and

b) *unprotected openings* in the exterior walls of the *building* are within 3 m horizontally and less than 10 m below or less than 5 m above the *exit* stair or *ramp*.

2) A *sprinklered* detached house or duplex with not more than 2 *dwelling units* and provided with more than one path of travel from each dwelling unit conforming to the dimensional requirements of Article 9.10.20.3., need not be provided with the opening protection referred to in Sentence (1).

9.9.4.5. Openings in Exterior Walls of Exits

1) Either openings in exterior walls of an *exit* or openings in adjacent exterior walls of the *building* the *exit* serves shall be protected with wired glass in fixed steel frames or glass block installed in accordance with Articles 9.10.13.5. and 9.10.13.7., where

a) the *exit* enclosure has exterior walls that intersect the exterior walls of the *building* at an angle of less than 135° measured on the outside of the *building*, and

b) the openings in the exterior walls of the *building* are within 3 m horizontally and less than 2 m above the openings in the exterior walls of the *exit*.

(See Note A-9.9.4.5.(1).)

2) The opening protection referred to in Sentence (1) may conform to Sentence 3.2.3.13.(4).

9.9.4.6. Openings Near Exit Doors

1) Where an exterior *exit* door in one *fire compartment* is within 3 m horizontally of an *unprotected 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 with

a) wired glass in fixed steel frames conforming to Article 9.10.13.5., ~~or~~

b) glass block conforming to Article 9.10.13.7., or

c) protection complying with the requirements of Sentence 3.2.3.13.(5).

~~**2)** The opening protection referred to in Sentence (1) may conform to Sentence 3.2.3.13.(4)~~

2) A *sprinklered* detached house or duplex with not more than 2 *dwelling units* and provided with more than one path of travel from each dwelling unit conforming to the dimensional requirements of Article 9.10.20.3., need not be provided with the opening protection referred to in Sentence (1).

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Parkade Security Requirements

Topic: Parkade Security Requirements

Code change number: 24-0004

Code reference: Book I, Division B, 3.3.7.7.(2), (4)

Description of the proposed change

The proposed change are revision to the Storage Garage security provisions that will permit the interconnection of storage garage stairs exit, with egress from the ground floor areas. This is reflective of changing building design priorities and challenges.

Justification

Owners, developers and designers, and staff have often raised concerns about Vancouver's parkade security requirements, specifically with respect to the need for dedicated and direct access to exterior from exit stairs. This has been identified as difficult to achieve in the modern context due to the building being larger, multi-use, and the cost of floor space being several orders of magnitude larger.

This also appears to have historically been inconsistently applied, and presents great difficulty in enforcement, particularly for older buildings, since developers are challenged in providing such space and in older buildings, the corridor/exit arrangements are already established and not easily modified.

Prior discussion with staff and recent approved Development permits have indicated they are no longer concerned about the mixing of populations.

This proposal provides an additional option for developers, and designers that eliminates the need for dedication of additional ground floor space dedication to corridors connecting parkade exit stairs to the exterior by allowing certain interconnection with other ground floor spaces provided certain conditions are met to reduce risk to occupants.

This proposal considers the general CPTED concepts of:

- natural surveillance by requiring clear lines of sight and glass for visibility,
- territoriality and maintenance through increased minimum lighting levels to 220 lx average illuminations (typical office illumination level),
- security measures - leveraging modern access controls to improve occupant awareness, support legitimate activities, and discourage intrusion and loitering.

This is an incremental improvement, which is expected to work for most modest size buildings where straight line of sight can reasonably be maintained to the exterior. Larger more complex buildings may have increased challenges, since the route to the exterior may involve longer distances, turns, or changes in elevation which would limit the effectiveness of line-of-sight solutions. In such cases, more detailed review is required, and alternative solutions may be required to ensure that an appropriate level of performance is achieved. Such solutions may involve the use of other technology solutions such as surveillance cameras, voice paging, mirrors or additional electronic access control, which need to be evaluated on a project specific basis.

Proposed VBBL content

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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, the stair tower or vestibule shall be constructed

a) with *closures* glazed with clear wired glass in steel frames or fire protective glazing in fire-resistive frames complying with 3.1.8.16., which provide the greatest possible unobstructed view from the *storage garage* into the stair tower or vestibule,

b) as a *fire separation* with a *fire-resistance rating* of not less than 1 hr,

c) with full or half glazed *closures* with a *fire-protection rating* of not less than 45 min between the *storage garage* and the vestibule and between the vestibule and the stair tower, and

d) 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.

(See Note A-3.3.7.7.(2).)

3) A stair shaft serving a *storage garage* and which is connected to a *storey* containing an *occupancy* other than a *storage garage*, shall terminate at that *storey*.

4) Except for open-air *storage garages* and *buildings* of *residential occupancy*, a *storage garage* shall be provided with *exits* ~~which only serve the *storage garage* and which exit directly outside the *building*.~~

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 the *exit* level where

i) the *exit* from the stair extends in a straight line 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 *storage garage exit* from *floor areas* other than the *storage garage* are provided with electromagnetic locking hardware in accordance with Sentence 3.4.6.16.(5) to secure access into the *exit* except during emergencies, and

iv) the *exit* corridor is provided with an average illumination level of at least 220 lx.

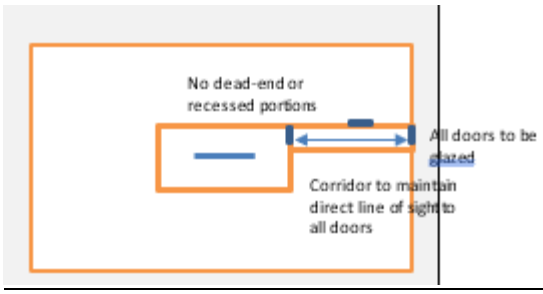
(see Note A-3.3.7.7.(3) and (4))

5) […]

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 ensure that occupant are not subject to an unacceptable risk of physical assault. Occupants using the exit are made aware of conditions in the exit due to increased visibility through glazed doors and clear sightlines, and can remain in a place of safety until they exit. Ancillary doors providing access to the exit serving the storage garage are to be provided with security measures to prevent general use of the exit by unauthorized persons, except for emergency egress.



[Placeholder diagram]

Figure A-3.3.7.7.(3) & (4)

Public Review

Vancouver Building By-law (VBBL)

Proposed change to non-combustible construction (clarification)

Topic: Clarification on non-combustible construction

Code change number: 24-0005

Code reference: 3.7.2.1.(5);

Consequential changes to 3.7.2.1.(1), and a new explanatory note A-3.7.2.1.(5).

Description of the proposed change

The proposed change adds a new provision that clarifies what constitutes non-combustible construction where such protection required by the Canadian Electrical Code where a building is in close proximity to Di-electric liquid filled transformers.

Justification

The Canadian Electrical Code currently prohibits openings within 6 m of pole mounted dielectric filled transformers in accordance with CEC Rule 26-014. Furthermore, the transformers must not be located within 6 m of any combustible surfaces or material on a building, any door or window, or any ventilation inlet or outlet.

The CEC requirements address known risks of fire or explosion from overhead di-electric filled transformers. While the CEC provide guidance with respect to appropriate clearances, it provides only a general statement regarding non-combustibility with respect to adjacent surfaces which could be exposed to fire.

The construction industry has stated that the application of non-combustible construction as defined in the VBBL is onerous, and it very problematic in lane oriented housing, and presumably also so for new multiplex housing. Therefore, in the absence of specific construction guidance in the CEC, this code change proposal introduces protection focusing on noncombustible or fire-resistant cladding and roofing to protect against the expected fire exposure.

The intent of these changes is that Clause (a) addresses the explosion, (i.e. the shock which could break windows and possible projectiles), Clause (b) addresses the higher intensity, largely downward flow of di-electric material and has a smaller diameter, and Clause (c) addresses the initial outward ejection of burning droplets, vented in the initial explosion or depressurization. This, while a larger area, isn't expected to provide for sustained burning due to limited fuel unless adjoining combustibles are ignited.

In some cases, tiles, pavers, or other roof coverings may be present which will have gaps, which must be limited to reduce the risk of fire spread into concealed spaces. The specified limits are intended to minimize the potential for such spread by either limiting the potential oxygen to sustain burning, or by flame arresting.

Proposed VBBL content

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3.1.5.25. Di-electric Liquid Filled Equipment

1) Where noncombustible surfaces are required by the "*Electrical Safety Regulations*", 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 it 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 from 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 non-combustible 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) non-combustible roofing materials, and

c) except as otherwise required by Clause (b), where on or within a sphere 6 m from 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Fire Fighter Path of Travel

Topic: Extended path of travel for fire fighters

Code change number: 24-0006

Code reference: Book I, Division B, Sentence 3.2.5.5.(3); Sentence 9.10.20.3.(8)

Description of the proposed change

Revision of Firefighters' extended path of travel requirements to reduce confusion in application and facilitate sprinkler design.

Justification

The mechanisms in Sentences 3.2.5.5.(3) and 9.10.20.3.(8) which require the upgrading of the sprinkler design standard from NFPA 13D to NFPA 13R, or form NFPA 13R to NFPA 13, have proven to be challenging for sprinkler designers due to a variety of factors. This creates a significant barrier to construction and for sprinkler installations.

This proposal is to remove the sprinkler standard upgrade mechanism, which is confusing and difficult to achieve for industry. Instead, it is proposed that a simpler additional sprinkler discharge density be provided to the hydraulic calculation to account for potential fire growth due to any potential increase in VFRS response time due to increased travel and set-up time. Statistics by NFPA have shown that in most fires within appropriately sprinklered single dwelling units, only a single sprinkler head will activate. The additional design density will provide additional suppressive power or to permit an additional sprinkler head to operate to compensate for delays in fire department response due to the extended travel distance.

This proposal also seeks to address the issue of water service size, since upgrades to the sprinklers standard have generally been associated with greater water demand, which could exceed the typical expected size (1-1/2") of a low-density detach home water supply. Design previously stepping up from NFPA 13D to 13R, or even to NFPA 13 would require progressively large amounts of flowing sprinklers which often pushed a design from a conventional residential water supply to a commercial water supply. This is both initially expensive to provide, and costly to maintain, and is not favoured by City Engineering as it provides a potentially less precise

flow/quantity measurement for small water flows (domestic typically), which could lead to under billing for water, and/or wasted water.

OS1.3 provision removed from unique to Vancouver 9.10.20.3.(5) & (6) provision to address multiplex designs, and for consistency with Part 3 objectives.

Proposed VBBL content

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3.2.5.5. Location of Access Routes and Paths of Travel

1) Except as provided by Sentences (2) and (3), ~~A~~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* conforming with Article 3.3.4.4. provided directly to the exterior at adjacent *grade*, 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 for the operation of at least 2 sprinklers, or with a 25% increase in the required discharge density where two or more spinklers would otherwise be required ~~to the NFPA 13, except that the *sprinkler system* may be designed to the hydraulic design criteria and sprinkler coverage requirements of NFPA 13R where the *building* would otherwise be permitted to be NFPA 13D~~,

iii) 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*,

iv) *sprinkler systems* are monitored by a fire alarm system or residential fire warning system and by an off-site monitoring service,

v) 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

vi) the *building* is provided with a fire alarm system and graphic annunciator, or

b) 90 m where

i) the requirements of Subclauses (a)(i) to (a)(vi) 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 (c)(ii) is indicated on the fire alarm system graphic annunciator.~~, and~~

~~v) the *building* is *sprinklered* to NFPA 13.~~

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).)

~~2) Access routes shall be provided to a *building* so that~~

~~a) for a *building* provided with a fire department connection, a fire department pumper vehicle can be located adjacent to the hydrants referred to in Article 3.2.5.15.,~~

~~b) for a *building* not provided with a fire department connection, a fire department pumper vehicle can be located so that the length of the access route from a hydrant to the vehicle plus the unobstructed path of travel for the firefighter from the vehicle to the *building* is not more than 90 m, and~~

~~c) the unobstructed path of travel for the firefighter from the vehicle to the *building* is not more than 45 m.~~

~~3) The unobstructed path of travel for the firefighter required by Sentence (2) from the vehicle to the *building* shall be measured from the vehicle to the fire department connection provided for the *building*, except that if no fire department connection is provided, the path of travel shall be measured to the principal entrance of the *building*.~~

~~4) If a portion of a *building* is completely cut off from the remainder of the *building* so that there is no access to the remainder of the *building*, the access routes required by Sentence (2) shall be located so that the unobstructed path of travel from the vehicle to one entrance of each portion of the *building* is not more than 45 m.~~

9.10.20.3. Fire Department Access to Buildings

[…]

8) ~~In a single detached house or duplex within the scope of Division A, Article 1.3.3.3., access routes are permitted to be located so that the path of travel for firefighters to the principal entrance of each *dwelling unit* or~~

~~ancillary *floor area* is not more than~~ A single detached house or duplex may have access routes and a path of travel for firefighters to the principal entrance of each *dwelling unit* or ancillary *floor area* of not more than

a) 45 m where

i) there are at least two paths of travel by which an occupant may reach a *street*, lane, or public thoroughfare, or

ii) the path of travel by which an occupant may reach a *street*, lane, or public thoroughfare is protected from fire exposure from *unprotected openings* in accordance with Article 9.9.4.4.,

b) 65 m where

i) there are at least two paths of travel by which an occupant may reach a *street*, lane, or public thoroughfare,

ii) the *building* is provided with *sprinklers* hydraulically designed for the operation of at least two sprinklers in a fire compartment, or a 25% increase in the required discharge density where two or more sprinklers would otherwise already be required ~~in accordance with NFPA 13, except that the *sprinkler system* may be designed to the hydraulic design criteria and sprinkler coverage requirements of NFPA 13R where the *building* would otherwise be permitted to be NFPA 13D~~,

~~iii) despite the requirements of Subclause (b)(ii) a fire department connection is not required,~~

iii~~i~~v) the *sprinkler system* is connected to internal smoke alarms within the *dwelling unit*, provided with an exterior audible alarm, ~~and off-site monitoring,~~ and

iv~~v~~) 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*, or

c) 90 m where

i) the requirements of Subclauses (b)(i) to (b)(iv) are met, ~~there are at least two paths of travel by which an occupant may reach a *street*, lane, or public thoroughfare,~~

ii) no principal *dwelling unit* or its *ancillary residential unit* is located above another *dwelling unit*,

~~iii) the *building sprinkler system* is designed to the NFPA 13,~~

~~iv) despite the requirements of Subclause (c)(iii) a fire department connection is not required,~~

~~v) the *sprinkler system* is connected to internal *smoke alarms* within the *dwelling unit*, provided with an exterior audible alarm, and off-site monitoring,~~

~~vi) 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*,~~

iii~~vii~~) an access path of at least 1.2 m wide is provided from each principal *dwelling unit* entry to the *street*, and

iv~~viii~~) 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Fire Separation of Floors in Dwelling units (Part 3)

Topic: Interconnected Floors in Part 3 Dwelling Units

Code change number: 24-0007

Code reference: 3.3.4.2.(3)

Description of the proposed change

Fire separation of Floors in Part 3 Dwelling Units

Justification

Dwelling units constructed under Part 9 are not limited in term of the height of the interconnected storeys unlike Part 3 dwelling units. This is becoming an increasing problem since the form of current development now frequently includes 3 store townhouse structures installed overtop of a common parkade, with direct access, storage, or service rooms located on the parkade level. This is usually resolved through alternative solutions but these are quite varied and occur on a large proportion of projects.

The proposed changes are intended to introduce a common set of features from frequently submitted alternative solutions, that provide an acceptable solution to reduce potential delays in building permits, and providing a baseline for performance should the applicant desire to approach this from an alternative solution standpoint.

The principal concern is that fire or the products of a fire could lead to occupants on upper storeys being trapped due to a delay in notification on account of occupants on upper floors being remote from a fire on lower storeys. Therefore, the provision for an area of refuge where occupants could shelter until rescued is proposed as a means to provide occupants with an alternative in the event they find their means of egress from the suite compromised.

The provisions of Clauses (6)(c)(ii) to (iv) are based upon the standard of performance established for a balcony used as an area of refuge in the 2024 BCBC 3.3.1.7.(4). The provisions are consistent with commonly accepted alternative solutions, and accounts for potential delays during fire department response.

In dwelling units in a Part 9 building, there is no height limitation for a dwelling unit or number of levels that could be interconnected per Sentence 9.10.9.4.(2). However, these are inherently limited to not more than 3 storeys plus 1 level of garage by the application of Part 9. While the code provides no maximal height for each storey, the general economics of traditional residential units designs lead to storey heights of about 3 m (8.5' to 9' ceiling, plus 1' floor assembly). This means that the total height of interconnection within the typical dwelling unit could be as much as 12 m.

The proposed acceptable solution limits dwelling units with similar interconnected level in a Part 3 building to a similar size and construction. It is proposed to set an upper boundary of 10 m (~3 storeys), so that more substantive heights may be reviewed by Staff and Fire Department through the alternative solution process.

Proposed VBBL content

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3.3.4.2. Fire Separations

[…]

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*.

[…]

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 directly accessed from the top most storey, that

i) is not more than 10 m above grade,

iii) be not less than 1500 mm deep from the outside face of the exterior wall to the inside edge of the balcony with a clear perpendicular dimension of not less than 1700 mm, and

iv) provide not less than 2 m^2 of balcony space for each *accessible* sleeping room or bed space, and

e) The balcony or deck required by Clause (d), shall be separated from the remainder of the *dwelling unit* 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).

(see Note A-3.3.4.2.(6))

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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Adaptable Dwelling Unit Requirements

Topic: Adaptable Dwelling Units requirements

Code change number: 24-0008

Code reference: Book I, Div. B, Subsection 3.8.5.

Description of the proposed change

Harmonization of Adaptable Dwelling Units requirements.

Justification

The 2024 BCBC has introduced mandatory adaptability for Apartment/Condo dwelling units, and limited adaptability for ground-oriented (lower density) dwelling units. These requirements are not fully consistent with existing VBBL requirements for adaptability. Council have asked staff to explore harmonization options for the Building By-law, considering both the city's leadership in key areas, and considering the urgent need for housing.

As directed by City Council in May of 2024, city staff are seeking to integrate the BCBC 2024 adaptability requirements and existing City of Vancouver adaptability requirements. This will allow Vancouver to gain the benefits of harmonization of a single standard for adaptability with respect to apartment/condo type constructions, and maintain Vancouver's leadership position with respect to equity and inclusiveness with respect to adaptability in lower density forms of housing.

The current BCBC 2024 requirements provide for mandatory adaptability pertaining to two types of dwelling unit:

1. Apartment/Condo type units – requiring full adaptability, and
2. Ground-oriented (lower density) housing – requiring only reinforcement/backing in the walls of the bathroom.

The key concern with this approach are two-fold:

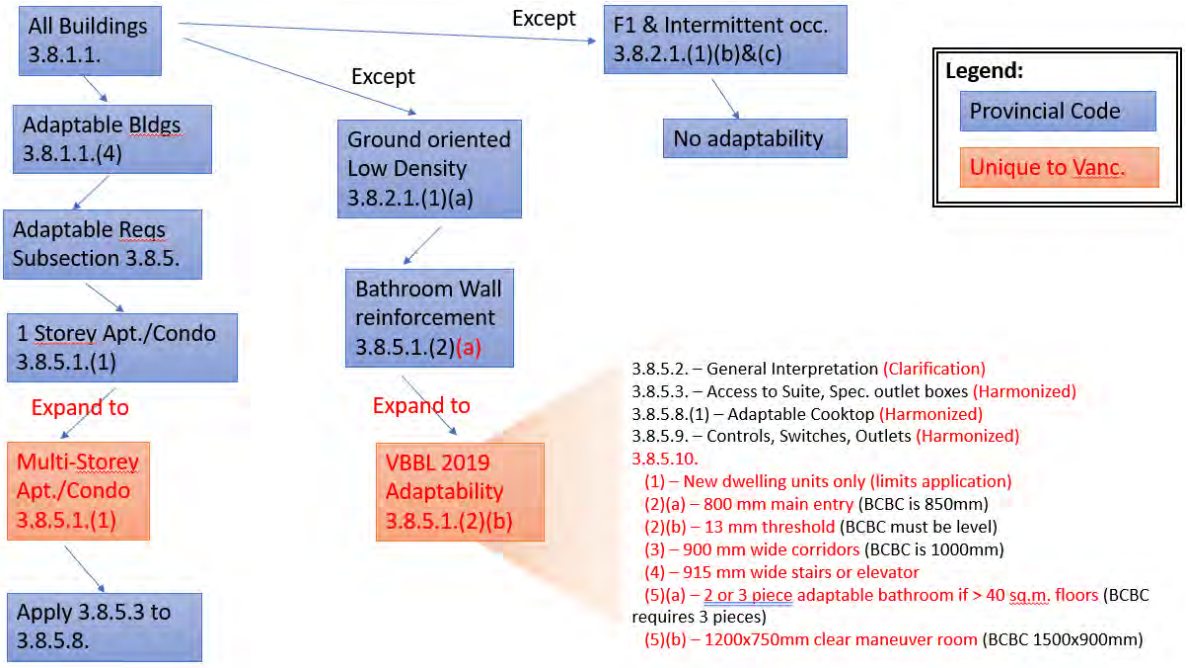
1. For apartment/condo housing, the provisions go further in terms of the space requirements and extent of their application, within forms of housing that are already severely space constrained and highly price sensitive; and

2. For ground-oriented forms of housing, this is a step backwards with respect to what the VBBL 2019 has been requiring, in forms of housing that are typically less space constrained.

Further to this, for apartment/condo type units, the application of adaptability requirements in the BCBC applies only to single storey units. Multi-storey units are not subject to adaptability. This does not appear to be consistent with the goals of adaptability or equitable given that these are less common, less space constrained, and likely less price sensitive.

Over the last 10 years, the industry has become somewhat accustomed to Vancouver's adaptability requirements. Inspectors and plan reviewers are reporting a generally high level of success in multifamily projects, and there is general uptake on lower density forms of housing, although with room for improvement. Interestingly, it does appear that anecdotally the remaining resistance appears to be from the larger and more expensive detach housing projects.

Given the above, it is proposed that the adaptability requirements of the 2024 BCBC and a harmonized variation of the 2019 VBBL be blended with the resultant following structure.



This approach will maximize standardization opportunities to the benefit of industry, and further Vancouver's inclusivity and equity objectives.

The intent of these changes is that all apartment/condo type dwelling units will be adaptable, in a manner fully consistent with the 2024 BCBC, and that for ground-oriented forms of housing, that these will incorporate enhancements aligned with the prior 2019 VBBL adaptability requirements, but harmonized with the 2024 BCBC standard where reasonable.

Council has already recognized adaptability to be an important need for persons with disability, and for preparing the City for an aging population. Without mandating adaptability (and more broadly accessibility) for all, it is quite possible that builders would provided almost no adaptable or accessible units.

It is acknowledge that this is a difficult balance of needs that is to be achieved, as it touches on issues of importance for all Vancouverites. Adaptability is already required for all new units in Vancouver as of April 2014. This proposal seeks to adapt Vancouver's existing provision to harmonize with the 2024 BCBC, which generally only impacts apartment/condo typologies.

Proposed VBBL content

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3.8.5. Adaptable Dwelling Units

3.8.5.1. Application

1) Except as provided in Sentences (2) and (3), this Subsection applies to

a) ~~one *storey*~~ *dwelling units* served by an *accessible* interior *public corridor* and an *accessible* common *building* entrance, as required to be *accessible* by Articles 3.8.2.2. and 3.8.2.3., and

b) common spaces and facilities intended for use by the residents of the *dwelling units* described in Clause (a) including common rooftop *occupancies*.

2) *Buildings* described in Clause 3.8.2.1.(1)(a) including ~~*secondary suites*~~ *ancillary residential unit* and all other *dwelling units* to which this Section applies shall

a) as required by Sections 3.7. and 9.31., provide at least one bathroom with walls reinforced in accordance with Clause 3.8.5.7.(1)(e), and

b) comply with the requirements of Articles 3.8.5.2., 3.8.5.3., 3.8.5.9. and .3.8.5.10., and Sentence 3.8.5.8.(1).

3) This Subsection need not apply to

a) hotels, motels, *single room accommodation* and similar commercial occupancies,

b) boarding houses, lodging homes, dormitories and similar facilities, or

c) *dwelling units* subsidiary to non-residential uses.

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 of this Subsection and, as required by this Subsection, to *access* requirements for *buildings* of *residential occupancy* elsewhere in this Code By-law.

2) Unless otherwise required, clear areas and spaces required in this Subsection are permitted to overlap with other clear area and space requirements.

3) This Subsection does not require an *adaptable dwelling unit* be provided with a living space, a bedroom, a bathroom or a kitchen, but when provided, those spaces and the paths connecting them shall conform to the applicable requirements of this Subsection.

3.8.5.3. Building Access Requirements

1) Common areas, spaces and facilities and all common exterior and interior paths of travel serving *adaptable dwelling units* shall be *accessible* in accordance with Subsection 3.8.2. with *floor areas* protected in conformance with Article 3.3.1.7.

2) Common corridors and passageways serving *adaptable dwelling units* shall be equipped to provide illumination, measured at floor or tread level, of not less than 50 lx.

3) Each *adaptable dwelling unit* shall be provided with special outlet boxes and cover plates as described in Sentences 3.2.4.19.(7).

4) Unless otherwise required by this Section, common spaces and paths of travel that are not intended to serve the residents of *adaptable dwelling units* need not be *accessible*.

3.8.5.4. Adaptable Dwelling Unit Doorways

1) The principal entrance door to *adaptable dwelling units* shall have a clear width of not less than 850 mm when the door is in the open position. (See Note 3.8.5.4.(1))

2) Except as provided in Sentence (5), there shall be a clear floor space in accordance with Sentences 3.8.3.6.(14) and (15) adjacent to and on both sides of the *adaptable dwelling unit* entrance door described in Sentence (1).

3) Within an *adaptable dwelling unit*, every doorway along a path of travel connecting the entrance door described in Sentence (1) with a living space, adaptable bedroom, adaptable bathroom, and adaptable kitchen shall have a clear width of not less than 850 mm when the door is in the open position.

4) Except as provided in Sentence (5), there shall be a clear floor space in accordance with Sentences 3.8.3.6.(14) and (15) adjacent to and on both sides of the doorways described in Sentence (3).

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).

3.8.5.5. Adaptable Dwelling Unit Hallways, and Corridors, and Stairs

1) Hallways and corridors in *adaptable dwelling units* forming a path of travel connecting the entrance door described in Sentence 3.8.5.4.(1) with a living space, adaptable bedroom, adaptable bathroom and adaptable kitchen shall have a clear width conforming to Sentences 3.8.3.2.(1) and (2).

2) *Buildings* described in Clause 3.8.2.1.(1)(a) including *secondary suites* and all other *dwelling units* to which this Section applies shall, as required by Sections 3.7. and 9.31., provide at least one bathroom with walls reinforced in accordance with Clause 3.8.5.7.(1)(e).

3.8.5.6. Adaptable Dwelling Unit Bedrooms

1) At least one bedroom or sleeping space in an *adaptable dwelling unit* shall have

a) a floor area 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 850 mm wide, that could be unobstructed by a bed, to allow functional use of the bedroom, and

c) at least one closet that provides

i) a clear opening width of not less than 900 mm, and

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 in diameter or 1 700 mm by 1 500 mm on at least one side of the closet. (See Note A-3.8.5.6.(1).)

3.8.5.7. Adaptable Dwelling Unit Bathrooms

1) At least one bathroom in an *adaptable dwelling unit* shall be designed to be adaptable for use by *persons with disabilities* by providing

a) a clear lateral transfer space adjacent a water closet conforming to Clause 3.8.3.12.(1)(b),

b) a distance between the centre line of the water closet and the wall on one side of 460 mm to 480 mm,

c) a *plumbing system* that accommodates the future installation of a lavatory with a clear space in accordance with Clauses 3.8.3.16.(1)(a) to (f) that does not impede the space for or use of other fixtures described in this Article (see Note A-3.8.5.7.(1)(c) and (d)),

d) a *plumbing system* that accommodates the future installation of a

i) shower described in Sentence 3.8.3.17.(1) that does not impede the space for or use of other fixtures described in this Article, or

ii) bathtub described in Sentence 3.8.3.18.(1) that does not impede the space for or use of other fixtures described in this Article (see Note A-3.8.5.7.(1)(c) and (d)), and

e) walls adjacent the water closet and shower or bathtub location reinforced to accommodate the future installation of grab bars conforming to

i) Clauses 3.8.3.12.(1)(f) and (g) for water closets, and

ii) Clause 3.8.3.17.(1)(f) for showers or Clauses 3.8.3.18.(1)(f) for bathtubs (see Note A-3.8.5.7.(1)(e)).

3.8.5.8. 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) A clear floor space shall be provided in the kitchen area that is not less than 1 700 mm in diameter or 1 700 mm by 1 500 mm.

3) The *plumbing system* serving the kitchen shall accommodate the future installation of a kitchen sink that could be installed in accordance with the requirements for the installation of a lavatory as described in Clauses 3.8.3.16.(1)(b) to (f). (See Note A-3.8.5.7.(1)(c) and (d).)

3.8.5.9. Controls, Switches and Outlets

1) Except as provided in Sentence (2), controls and switches for *building* systems and outlets in *adaptable dwelling units*, that are intended for frequent operation by occupants, shall not require activities for operation below 400 mm from the floor or above 1 200 mm from the floor.

2) Sentence (1) does not apply to controls, switches and dedicated outlets for equipment or appliances.

3) In multi-level *dwelling unit,* at least one electrical receptacle shall be provided in the vicinity of the stair serving floors levels required to be adaptable ~~required by Sentence 3.8.5.4.(3).~~

3.8.5.10. Adaptable Ground Oriented Housing

1) New *dwelling units* in a *building* described in Clause 3.8.2.1.(1)(a), other than hotels, motels, single room accommodation and similar commercial occupancies, shall comply with the requirements of Sentence (2) to (7).

2) Doorways 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 not more than 13 mm above the floor.

3) Corridors shall have a clear width of at least 900 mm.

4) At least one set of stairs providing access between floor levels shall have a minimum width of 915 mm., except for

a) interior stairs in an *ancillary residential building*, or

b) floor levels accessible by a private elevator.

5) At least one bathroom in a *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),

f) bath and shower controls required for a bath or shower required by Clause (5)(c) shall be

i) easily accessible from an open floor space or offset which does not require entry into the bath or shower to operate, and

ii) equipped with lever-type controls or hardware that does not require a tight grasp or twisting action of the wrist.

g) 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)).

6) The washroom required by Sentence (5) shall be located on

a) the principal floor exceeding 40 m^2 contain living space with level access to an entry at the adjacent ground level, or

b) 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)).

7) All washbasins shall be equipped with lever-type faucets or hardware that does not require a tight grasp or twisting action of the wrist.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Gender Neutral Washrooms

Topic: Gender Neutral Washrooms

Code change number: 24-0009

Code reference: Book I, Division B, 3.7.2.9. (was 3.7.2.11.)

Description of the proposed change

Update to the Gender Neutral Washroom requirements to align with current best Architectural practice, industry norms, and alignment with REFM washroom standards.

These changes support City objective towards Equity, Diversity and Inclusion.

Justification

Industry feedback has been that current Gender Neutral washroom requirements are incomplete and do not align with public needs and industrial practice in this area.

This update aligns with current best Architectural practice, industry norms, and alignment with REFM washroom standards.

These changes support City objective for Equity, Diversity and Inclusion.

Much of these requirements have been developed based on recommended best practice from Public Service Canada's guide for supporting Trans employees, research and survey by Penn State University, Stalled!, and other publications by organizations conducting work in this area.

Cost for buildings up to 200 persons occupant load are expected to be minimal as this does not create any new requirements, since the current universal washroom can fulfill these requirements. However, there may be additional competition for floor space to include an additional washroom, where conventional gendered washrooms are still desired.

Non-gendered washrooms are slowly gaining broader recognition that this is beneficial for all persons, and this is a low barrier requirement in that it leverages requirements already required for accessibility. Actual construction costs are expected to be low since the requirements do not call for nonstandard equipment, or more equipment than is already typically provided.

Where an owner chooses to forgo traditional gendered washrooms entirely, the gender neutral washroom, could possibly reduce floor space costs.

Proposed VBBL content

Legend

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3.7.2.9. Gender Neutral Washroom Requirements

(See Note A-3.7.2.9.)

1) Except as permitted by Sentence (6), a *building* or non-residential *suite* with an occupant load exceeding 200 persons, at least one gender neutral washroom facility 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.

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 clear opening height of no less than 150 mm and no more than 300 mm, measured from the finished floor to the underside of the partition wall or door~~ a minimum height of 2000 mm (6’-7”) and clear space above of 50 mm, ~~and~~

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) A duress alarm is required in the common area, and additional duress alarms are to be located within each stall.

3) The main entrance door serving the gender neutral washroom facilities shall have

a) ~~have~~ no door, or

b) fully or partially glazed doors have a door with ~~have~~ an open transom or louvered grill.

4) Provide a minimum 42” zone of circulation space in front of the sink area.

5) Be provided with a minimum lighting level of 200 lx at the floor

5) Be provided with appropriate signage identifying the washroom.

6) Individual self-contained washroom facilities including a water closet, lavatory, shelf and mirror providing a washroom capacity on the same basis as that required by Sentence (1).

7) At least one stall or 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Occupant Load Seating

Topic: Determination of occupant load for seasonal patio seating areas

Code change number: 23-0010

Code reference: 3.7.2.1.(5);

Consequential changes to 3.7.2.1.(1), and a new explanatory note A-3.7.2.1.(5).

Description of the proposed change

The proposed change adds a new provision that clarifies how occupant load is to be assessed for patio seating areas that are seasonal and ancillary to interior building area.

A clarifying note is added to identify the intent of the provisions and their intended application.

Justification

It has been frequently raised by owners and tenants of buildings, and the business improvement associations that current minimum washroom requirements are overly demanding, particularly for temporary seasonal patios.

It has further been stated that seasonal use patios are only used during fair weather and spaces in the buildings are not used as much during fair weather where patio seating is available.

It has also been identified that the current washroom minimum stated only reference the building and are based on an occupant load referencing only the floor area of the building, which is limited to interior floor space only. Therefore, the patio is not explicit regulated.

It is understood, however that interior washroom will nonetheless be utilized by tenant/building occupants, and so should be sized appropriately.

It is expected that there will be little anticipated implications as current minimum washroom requirements for health purposes, particularly for assembly use, are generally understood to be smaller than the current minimum washroom requirements for buildings. Current washroom requirements consider the availability time of a washroom fixtures (a measure of convenience) which leads to high washroom minimums.

In research by D.N. Henning (1977), it was documented that in certain assembly occupancies, there are scheduled periods of high peak usage due to the nature of the occupancy (such as theatres) that lead to situations where washroom usage was maximized, and queueing would occur. By comparison, in other occupancy types, where usage is better distributed and not time limited, code compliant washrooms provide more than ample capacity in most cases.

In addition, washroom counts in other North American standards references lower washroom counts to satisfy minimum health requirements, which suggest that excess capacity exists solely to increase washroom availability. Under the ICC (2021) this is 1:75 for restaurants and assembly food service, in contrast to 1:40 for assembly use where surge loads could be expected.

Work by Henning also seems to suggest that the ratios of washrooms could be adjusted to increase efficiency. In this regards, a move towards gender neutral washrooms might help increase efficiency of washroom usage thus enabling the reduction of elimination fixtures as a whole. This is not specifically considered as part of this proposal since gender neutral washrooms are not yet mandated, but this may be an offsetting factor for smaller assembly uses, which have frequently been observed to be using the existing Vancouver unique provision to use gender neutral washrooms for a slightly more favourable washroom count.

Based on a data from the market research NPD Group (2020), parties of three represent about 14% of occurrences, and the most common table size is for four. As a very broad extrapolation, this suggests that at least one unoccupied seat is available for each table about 14% of the time, thereby freeing up the equivalent amount of washroom capacity based on the assumed full occupant load.

Further to this, Council has previously adopted a provision for allowance of up to 12 seats for temporary patios in 2017, and this would a logical complement to this existing policy. (Ref.: https://council.vancouver.ca/20170614/documents/cfsc4.pdf)

Proposed VBBL content

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3.7.2.1. Plumbing and Drainage Systems

1) Except as provided in Sentence (2) and (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, patio seating areas that are only seasonally occupied and ancillary to the use of interior restaurant and food services, shall have an occupant load determined in accordance with Subsection 3.1.17., that may be reduced by the greater of

a) 12 persons, or

b) 25% of the total number of persons for which the patio is designed.

(See Note A-3.7.2.1.(5).)

3.7.2.1. Plumbing and Drainage Systems	
(3)	[F72-OH2.1]
(4)	[F72-OH2.1]

A-3.7.2.1.(5) Washrooms Units serving Seasonal Patios. Many commercial occupancies, include permanent or semi-permanent patio spaces intended for ancillary seating area during fair weather days. During good weather, it is expected that occupants will preferentially choose to occupy exterior open-air patio seating, and that interior seating will not reach full utilization. Where it can be demonstrated that the patio design is intended to facilitate occasional, fair weather use, the occupant load used to establish of washroom capacity may be determined on the basis of a reduced occupant load. Features promoting occasional fair weather use could include the use of substantially open roof or wall designs, which would limit the use of such spaces during poor inclement weather.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Improve Air Quality

Topic: Healthy Homes

Code change number: 24-0011

Code reference: New Healthy Home requirements (Parts 3, 6, and 8)

Description of the proposed change

Several best practice construction indoor air quality management practices such as the use of low-emitting materials and testing of air quality prior to occupancy were requirements in the 2017 Green Building Policy for Rezonings. These requirements, along with best practices for construction indoor air quality management are recommended to be added to the VBBL to improve indoor air quality in large new multi-family buildings to support occupant health.

Construction air quality management practices applicable to all Part 3 construction:

1) Protection of HVAC systems and ductwork during construction (Part 6 HVAC)
2) use MERV 8 filters during construction if using HVAC (Part 6 HVAC)

Construction air quality management practices applicable to all buildings:

3) protect absorptive materials from moisture (Part 8 Safety Measures at Construction and Demolition Sites)
4) Implement dust mitigation strategies and contain dust-generating activities to designated areas (Part 8 Safety Measures at Construction and Demolition Sites)

Applicable only to Part 3 residential construction:

5) VOC emissions limits on Paints and Coatings, and Sealants and Adhesives (Part 6 HVAC)
6) IAQ testing for VOCs and formaldehyde prior to occupancy (Part 6 HVAC)

Justification

Several best practice construction indoor air quality management, use of low-emitting materials, and testing of air quality prior to occupancy were requirements in the 2017 Green

Building Policy for Rezonings. These requirements are recommended to be added to the VBBL to apply to more buildings improve construction air quality and in new buildings.

Items 1, 2, 3 and 4 are best practice construction indoor air quality management techniques. Industry feedback indicates that most large construction sites are employing these strategies already, thus these strategies should not add cost to construction, and can make significant improvements to the indoor air quality of the building post-occupancy and during construction. Construction and demolition of buildings can have serious impacts on construction, including an increased risk of Chronic Obstructive Pulmonary Disease. Good construction IAQ practices limit dust from accumulating and mold from developing in the space during construction, prevent these toxins from settling and growing in the occupied space once construction is completed and limiting exposure to construction workers during construction.

Item 5 & 6 (use of low-emitting paints, coatings, sealants, and adhesives) are familiar requirements as most projects under the 2017 Green Buildings Policy for Rezonings (approx 200 projects in Vancouver) were required to meet these as a rezoning condition. Costs for using low VOC content paints, coatings, adhesives and sealants at this time are minimal due to product availability.

Projects under the 2017 Green Buildings Policy for Rezonings were also required to provide low-emitting materials for 2 additional product categories: flooring, and composite wood products. These two additional product categories are not being proposed for 2025 VBBL in order to minimize costs associated with code changes at this time. However, staff recommend these products be evaluated for availability and cost-effectiveness for future VBBL changes as these products contribute to improving indoor air quality.

Volatile organic compounds (VOCs) are gases that are emitted from various products, including solid and liquid products. The use of low VOC products reduces human exposure to VOC levels in conventional products that can cause physiological responses ranging from allergic reactions to system level damage such as kidney, liver, and central nervous system damage. Using low-emitting materials does not only benefit the building occupant; it also benefits construction workers.

Testing for indoor air contaminants (item #6) is a simple and effective way to confirm that low-emitting materials are being installed in the project without the need for extensive documentation, and that construction air quality practices (items 1-4) were followed. For typical projects adhering to items 1-5, meeting the contaminant limits should be straightforward. In past projects in Vancouver, failures for IAQ limits were often attributed to testing too early when contaminant generating work, such as painting, drywall sanding, etc was on-going during testing, or high emitting cleaning products are used prior to testing.

Proposed VBBL content

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The following 2 construction air quality management practices applicable to all Part 3 construction:

6.2.1.6. Installation – General

Add;

4) During construction, all heating, ventilation or air-condition systems and ductwork shall be protected from construction dust and debris and ingress of moisture.

(See Note A.6.2.1.6.(4)).

New note A.6.2.1.6.(4) Protection of HVAC system and ductwork.

Strategies to comply with this requirement includes storing uninstalled ductwork and equipment away from dust-producing areas and sealing off HVAC system components to prevent the migration and accumulation of dust and debris in the duct system. For example, if the HVAC system is not used during construction, seal off the supply and return air system openings, seal off diffusers and grilles, wrap terminal units in plastic, provide end caps for duct sections, etc.

6.3.2.14. Cleaning Devices

Add;

2) Any ventilation systems designed to supply ventilation required by Sentence 6.3.1.1.(1) that are operated during the construction stage must be provided with filtration devices with Minimum Efficiency Reporting Value (MERV) of 8, as defined by ANSI/ASHRAE 55.2., and must be replaced with filtration devices meeting Sentence 6.3.2.14 prior to occupancy.

The following 2 construction air quality management practices are applicable to all buildings:

New **Section 8.1.5 Construction Air Quality Management**

8.1.5.1 Protection of absorptive materials

(1) Absorptive materials stored and installed on-site shall be protected from dust and moisture damage.

(See Note A8.1.5.(1))

8.1.5.2 Mitigating dust

(1) Dust-control measures shall be applied to the site and dust-generating activities shall be contained to designated areas.

(See Note A.8.1.5.2.(1))

New Note A.8.1.5.1.(1) Protection of absorptive materials

Absorptive materials include drywall, carpets, acoustical ceiling panels, fabric wall coverings, insulation, upholstery, furnishings, etc, and if unprotected during construction these materials can become a source for mould or bacterial growth. Strategies to comply with this requirement include developing and implementing a moisture control plan to protect stored on-site and installed absorptive materials from moisture damage, and immediately remove from site and properly dispose of any materials susceptible to microbial growth and replace with new, undamaged materials.

New Note A8.1.5.2.(1) Mitigating dust

Dust is a suspension of fine solid particulate matter and can pose risks to the environment and to human health. Strategies to mitigate dust in construction sites include suppressing dust with wetting agents or sweeping compounds, using an efficient and effective dust collecting method such as a damp cloth, wet mop, or vacuum with particulate filters, immediate clean up upon completion or at the end each day. For high dust-generating activities, use dust guards or collectors to capture generated dust, and isolate dust-generating work using dust barriers or differential pressurization, or scheduling activities that produce dust for unoccupied periods if possible.

Dust-generating activities include cutting, grinding, drywall sanding, masonry work, wood sawing, and some types of insulating.

The following 2 requirements are applicable only to Part 3 residential construction:

6.3.1.6. Indoor Air Contaminants

(4) For *residential occupancies*, indoor air contaminant concentration testing shall be completed prior to the issuance of an *occupancy permit*. Indoor air contaminant concentration levels shall not exceed the limits listed in Table 6.3.1.6.(4) and obtained per the allowable methods, or shall be remedied to the satisfaction of the *Chief Building Official*.

(See Note A-6.3.1.6.(4))

Table 6.3.1.6.(4) Maximum Concentrations by Contaminant Type

Contaminant	Concentration Limit	Allowed Test Methods
Formaldehyde	20 µg/m3 (16 ppb)	Direct read instruments with third party calibration per manufacturer's instructions
Particulate Matter PM 2.5	12 µg/m^3	Particulate monitoring device with accuracy greater of 5 micrograms/m3 or 20% of reading and resolution (5 min average data) +/- 5 µg/m3
Particulate Matter PM 10	50 µg/m^3	
Ozone	0.07 ppm	Monitoring device with accuracy greater of 5 ppb or 20% of reading and resolution (5 min average data) +/- 5 ppb ISO

		13964 ASTM D5149 -– 02 EPA designated methods for Ozone
Total volatile organic compounds	500 µg/m³	Direct read instruments with third party calibration per manufacturer's instructions
Carbon monoxide	9 ppm; no more than 2 ppm above outdoor levels	ISO 4224, EPA Compendium Method IP-3. Direct calibrated electrochemical instrument with accuracy of (+/- 3% of reading and resolution of 0.1 ppm). NDIR CO Sensors with accuracy of 1% of 10 ppm full scale and display resolution of less than 0.1ppm

Edits to Note A-6.3.1.6. Indoor Air Contaminants.

Contaminants of Concern

Indoor air can contain complex mixtures of contaminants of concern such as formaldehyde, legionella, mould, ozone, particulate matter, and emissions from building materials (including volatile organic 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~~ is a useful reference~~s~~ 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.

New Note A-6.3.1.6.(4))

The number of sampling locations to test for contaminants depends on the size of the building – conduct air quality testing on at least 10% of the first 100 residential units, and 5% of all units above 100. Testing should be conducted after all interior finishes are installed, including millwork, doors, paint, carpet and acoustic tiles, etc. Tested spaces should be representative of building's various finishes and layouts. Select sampling locations for areas with the least ventilation and/or materials with potentially the greatest presumed contaminant source strength. Take samples in the breathing zone, between 0.9 and 1.8m above the floor, during normal occupied ours with the HVAC system operating at normal outdoor flowrates.

For amenity spaces used by residents, conduct one test for each space with unique interior finishes.

Section 3.7 Health Requirements

New 3.7.4 Low-Emitting Products

3.7.4.1 Paints and Coatings

1) For *residential occupancies*, all paints and coatings applied inside of the weather-proofing systems and applied on-site shall have volatile organic compounds content limits conforming to:

i) California Air Resource Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or

ii) South Coast Air Quality Management District (SCAQMD) Rule 1113 – Architectural Coatings, amended February 5, 2016, effective date 1/1/19.

(See note A.3.7.4.1.(1))

3.7.4.2. Adhesives and Sealants

1) For *residential occupancies*, all adhesives, sealants and sealant primers applied inside of the weather-proofing system and applied on-site shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168, effective July 1, 2005

(See note A.3.7.4.2.(1))

New **Note A.3.7.4.1.(1)**

Products in this category includes flat, nonflat, primer, sealer, and undercoater coatings and other architectural coatings.

New **Note A.3.7.4.2(1)**

Products in this category include carpet, resilient, and wood flooring adhesives; base cove adhesives; ceramic tile adhesives; drywall and panel adhesives; aerosol adhesives; adhesive primers; acoustical sealants; firestop sealants; HVAC air duct sealants; sealant primers; and caulks.

ADDITIONS TO FUNCTIONAL STATEMENTS

Add to Table 3.10.1.1 Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 3

3.7.4.1 Low-Emitting Products	
(1) & (2)	[F40, F50-OH1.1]

Add to Table 6.10.1.1 Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 6

6.2.1.6 Installation General	
(4)	[F40, F41, F50-OH1.1]
6.3.1.6 Indoor Air Contaminants	
(4)	[F40, F41, F50-OH1.1]
6.3.2.14 Cleaning Devices	
(2)	[F40, F41, F50-OH1.1]

Add to Table 8.3.1.1 Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 8

8.1.5.1 Protection of absorptive materials	
(1)	[F40, F41, F50-OS-5.6, OH1.1, OH1.3]
8.1.5.2 Mitigating dust	
(1)	[F40, F41, F50-OS-5.6, OH1.1]

For reference:

OH1.1 – inadequate indoor air quality

OH1.3 – contact with moisture

OS5.6 – exposure to hazardous substances and activities

F40 To limit the level of contaminants.

F41 To minimize the risk of generation of contaminants.

F50 To provide air suitable for breathing

Public Review

Vancouver Building By-law (VBBL)

Proposed to retain existing standard ASHRAE 62.1

Topic: ASHRAE 62.1

Code change number: 24-0012

Code reference: ASHRAE 62.1

Description of the proposed change

To continue to reference this same standard while both the NBC and BCBC reference a new version of the same standard (ASHRAE 62.1-2016).

The “62-2001 (except addendum n)” version of the ventilation standard has been referenced by the NBC, BCBC and VBBL for almost 2 decades but with sporadic speculation about its upgrade to a newer version. A potential upgrade has always been problematic because the ventilation rates have generally decreased with each subsequent version produced by ASHRAE (62.1-2004, 2007, 2010, 2013, 2016, 2019 etc) and would therefore increase the levels of CO2 in interior spaces, meanwhile the 2010’s were also a period of increased awareness of carcinogenic VOCs (off-gassing from new materials, glues and paints etc), and now a global awareness of the dangers of pathogens rooted in the experiences from the COVID-19 pandemic.

In 2013 a national committee was formed to review the latest ventilation standards available for possible replacement of the 62-2001 version in the NBC, however the task was difficult without baseline parameters to provide definitive reasons for a switch. In 2016, the national committee chose 62.1-2016 as the likely best candidate for incorporation into the NBC, but it was acknowledged this was done without any baseline parameter. (Throughout the process it was recognized there are numerous elements that determine IAQ however it was decided that CO2 is the best proxy for IAQ from a practical testing and measuring point of view.)

On March 19, 2021 Health Canada released their indoor air quality (IAQ) findings for CO2 levels, thus introducing a health risk and baseline parameters for consideration by the building industry, per the following;

Health Canada (March 19, 2021)

1. NEW: Federal Government recognizes a CO2 limit connected to Health. It lists specific physiological symptoms as "health effects of CO2";

Health effects of CO_2

As CO_2 increases, you may be at increased risk of:

- tiredness
- headache
- eye irritation
- sore or dry throat
- dizziness or difficulty concentrating
- stuffy, congested or runny nose, sneezing, coughing and rhinitis

These effects may not be from CO_2 exposure, but from poor indoor air quality in general.

2. NEW: Health Canada states a specific exposure limit of 1,000 ppm for CO2, based on "health effects"

Exposure limit for CO_2 in indoor air in Canada

We developed an exposure limit for CO_2 in Canadian homes based on:

- CO_2 sources
- exposure levels
- the health effects

The long-term exposure limit is 1800 $\mu g/m^3$ or 1000 parts per million (ppm) based on a 24-hour average.

3. NEW: Health Canada lists segments of the public who would be detrimentally affected if the CO2 limit is not adhered to;

This limit protects the health of Canadians including vulnerable populations such as:

- Indigenous peoples
- infants and children
- individuals living in low income housing
- those most susceptible to the effects of CO_2 including individuals with pre-existing health conditions such as:
  - asthma
  - allergies
  - cardiovascular conditions

4. NEW: Health Canada expects "public health officials and other professionals" to take this seriously;

The recommended exposure limit allows public health officials and other professionals to assess the risk from indoor air pollutants.

Justification

Justifications for NOT using ASHRAE 62.1-2016 include;

i) A federal (Health Canada) determination that CO2 levels are an official health risk,

ii) A federal (Health Canada) determination of a baseline limit parameter of 1,000ppm over 24 hours,

iii) Performance models showing the Health Canada limits of 1,000ppm are exceeded in some scenarios, and

iv) The primary responsibility of all registered professionals, per the following;

1. NEW: Ventilation can now be tied to the Code of Ethics for design professionals, AND building officials.

EGBC Code of Ethics Tenant #1: ***hold paramount*** *the safety,* ***health****, and welfare of the public, including the protection of the environment and the* ***promotion of health*** *and safety in the workplace;"*

2. NEW: Models of 62.1-2016 show CO2 levels will exceed 1,000ppm.

Activity in space	Occupancy Category	Room Type	Area of space (m^2)	Height of space (m)
Seated, very light work	Offices	Office space	100.00	2.75

v) If buildings are allowed to exceed the 1,000ppm levels there is a complete lack of any safeguard for the public to monitor their accumulated exposure as they transition from one building to another throughout the day. There is a professional and ethical responsibility for any building to not contribute to a health risk being exceeded, thus, if every building stays below the 1,000ppm limit then cumulative exposure over a 24 hour period cannot be reached.

vi) Meanwhile, the ambient CO2 levels are increasing at approximately 2ppm annually making it harder to flush buildings using outdoor air. Reducing ventilation rates and associated ductwork will make the flushing process increasingly more difficult over time.

vii) Note the orange line within the graph denoting the existing CO2 level limit within Federal Buildings is 800ppm.

Proposed VBBL content

Vancouver Building By-law content to remain unchanged.

ASHRAE	ANSI/ASHRAE 62-2001 (except Addendum n)	Ventilation for Acceptable Indoor Air Quality (except Addendum n)	6.3.1.1.(2) 10.2.2.3.(1)(b) 10.2.2.3.(1) A-9.25.5.2

Example: 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,

Public Review

Vancouver Building By-law (VBBL)

Proposed change to 10.2.1.3. 4 Storey Compliance Pathways

Topic: 4 storey residential building compliance pathways

Code change number: 24-0013

Code reference: 10.2.1.3. Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

Description of the proposed change

This includes changes to 10.2.1.3. to allow 4 storey residential buildings to comply with the requirements of either Sentence 10.2.1.5.(2) or Sentence 10.2.1.5.(3).

Justification

4 storey MURBs may benefit from a less onerous performance modelling process than the Energy Step Code methodology of 10.2.1.3. Immediate VBBL implementation would increase misalignment with the BCBC's ESC, however, if the feedback supports this option then we will confer with the province to include province wide.

- Note that 4 storey MURBs using the 10.2.1.5. option;
    - would still be Part 3 buildings requiring registered professionals rather than an EA, and
    - would no longer be subject to the commissioning of 10.2.2.18 that applies to 10.2.1.2 and 10.2.1.3 buildings.

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

Underlined Black Text – Proposed modification to Vancouver Building By-law content

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 through 10.2.1.5., or as permitted by Sentence (2),

a) shall be designed in compliance with energy and emissions performance per Article 10.2.2.5,

~~b) [UTV Deleted],~~ (renumbering to be confirmed at end of process)

~~c) [UTV Deleted],~~ (renumbering to be confirmed at end of process)

~~d) [UTV Deleted],~~ (renumbering to be confirmed at end of process)

e) shall be provided with vestibules in compliance with Article 10.2.2.8.,

f) shall be provided with metering equipment in compliance with Article 10.2.2.9,

g) shall be provided with lighting in compliance with Article 10.2.2.10.,

h) shall comply with Article 10.2.2.15., where domestic gas-fired fireplaces are provided,

i) shall *commission* equipment, controls, meters, submeters and systems in compliance with Article 10.2.2.18.,

j) shall provide airtightness testing in compliance with Article 10.2.2.21, and

k) may provide exterior heated spaces in compliance with Article 10.2.2.22.

2) A *building* that is entirely of Group C *major occupancy* except subsidiary *occupancies*, is not more than 4 *storeys* in *building height*, and does not include a Hotel or Motel, may comply with this Article by complying with the requirements of either Sentence 10.2.1.5.(2) or Sentence 10.2.1.5.(3).

Public Review

Vancouver Building By-law (VBBL)

Proposed change to adopt updated Energy Modeling Guidelines

Topic: Adoption of updated Energy Modeling Guidelines

Code change number: 24-0014

Code reference: 10.2.2.5. Building Energy and Emissions Performance

Description of the proposed change

Adopt updated Energy Modelling Guidelines

Justification

Currently, Section 10.2.2.5 of the VBBL references the 2017 version (aka v2.0) of the COV Energy Modelling Guidelines (EMGs), which has been in effect since March 17, 2017. This version has been applied to more than 200 projects in Vancouver to demonstrate compliance to the energy and carbon performance limits of VBBL Section 10.2.2.5 and is also used by projects outside of Vancouver to demonstrate compliance to the BC Energy Step Code. Over the last 6 years of energy modelling professionals applying this guideline, COV staff have been tracking common clarifications and gaps in methodology and areas of improvement. This update to the EMGs provides clarity and guidance to standard assumptions that reflect current knowledge.

Further, the energy and carbon performance limits are calculated based on historical climate data, which does not reflect current knowledge of the expected climate over life-cycle of new buildings over the next 60+ years. The update to the EMGs includes an analysis on the impacts to compliance using predicted future weather files.

Engagement Process

A fulsome engagement process was conducted with industry users to shape the proposed updates. In February 2023, Focal Engineering was retained to lead the update of version 3.0 of the Energy Modelling Guidelines. Focal and COV staff refined the list of topics be considered for the updates, and presented this list to over 50 energy modelling professionals via a workshop in April 2023. Based on feedback from this workshop, Focal completed technical analysis and provided recommended changes via a second workshop in October 2023 to over 130 participants. The draft proposed version of v3.0 along with a recording of the second workshop was released for public review over a 6-week period, and over 140 topic-specific comments

were received from ~30 respondents. Focal and COV staff reviewed all comments, and an updated proposed v3.0b draft was created along with a final report detailing the technical analysis.

This updated proposed draft v3.0b is to be released as part of the 2025 VBBL public review comment period in July 2024, and staff will monitor and respond to comments as they needed.

The notable changes that have the potential to impact energy compliance metrics are as follows:

1) Moving from using historical climate data to future-shifted weather files for both energy and overheating simulations to better reflect current and future climatic conditions for building performance
2) Revisions to guidance for modeling infiltration rates through the building envelope
3) Addition of an adjustment factor for slim and small buildings that were typically at a disadvantage when seeking compliance under floor area-based performance metrics
4) Reduction of the corridor adjustment factor maximum from 10 kWh/m²a to 5 kWh/m²a

Other changes with minor impacts are as follows:

5) Addition of a methodology for evaluating passive envelope performance
6) Clarifying existing definitions for modelled floor area (MFA) and TEDI for better consistency across the industry
7) Removal of the hydronic space heating sub-metering energy adjustment
8) Clarifying an optional pathway for energy compliance for buildings with commercial kitchen subsidiary occupancies that exist within major occupancy spaces with absolute performance limits
9) Alignment with the BCBC natural gas emissions factor under the Zero Carbon Step Code
10) Adding definitions for cooling energy demand intensity (CEDI) and greenhouse gas emissions of refrigerants (GHGI-R)

Additional stakeholder consultation was conducted to focus on two separate technical issues outside of Focal Engineering's scope: i) corridor pressurisation adjustment and ii) fenestration modelling. Based on feedback from the Oct 2023 public review period, the topic of reducing the corridor pressurization adjustment was given additional consideration with a staff-led industry focus group of 20 professionals, to understand the role of corridor pressurization and implications to code requirements such as smoke control, and the industry preference for stack effect control and odour management. Based on discussions by this focus group, COV staff recommend maintaining the reduction of the corridor pressurization adjustment to 5.

For the topic of modeling of fenestration product thermal performance, an industry advisory group comprising Fenestration Canada and National Fenestration Ratings Council (NFRC) representatives and energy modellers was convened over the course of a year to simplify compliance options relating to fenestration products. As a result of this advisory group,

Fenestration Canada and NFRC are developing technical tools to support the accuracy and accountability of fenestration thermal performance values.

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

Underlined Black Text – Proposed modification to Vancouver Building By-law content

Update reference to the City of Vancouver Energy Modelling Guidelines in Div B 1.3 Table 1.3.1.2

Issuing Agency	Document Number	Title of Document	By-law Reference
COV	~~2017~~ V3.0	City of Vancouver Energy Modelling Guidelines	10.2.2.5

City of Vancouver *Chief Building Official (CBO) and Building Code Policy*

Development, Building and Licensing – Building Policy Branch

City Hall 453 West 12th Avenue Vancouver BC V5Y 1V4 | website: vancouver.ca/CBO
Office of the Chief Building Official | tel: 604.873.7611 | fax: 604.873.7100 | email: cbo@vancouver.ca

Guideline

Energy Modelling Guidelines DRAFT 3.0b FOR REVIEW

Version ~~2.0~~ 3.0b DRAFT
Tracked changes from version 2.0 shown in red text

NOTE: This draft version 3.0b is released for public review in June 2024. This is the second draft of v3.0 of the COV Energy Modelling Guidelines and has been revised following an initial public review period in Fall 2023.

Effective ~~March 17, 2017~~ XX XX, 20XX EFFECTIVE DATE TO ALIGN WITH 2025 VBBL

Amended XX XX, 20XX

Authority: Chief Building Official

CITY OF VANCOUVER

Table of Contents

1. Introduction and Intent

The City of Vancouver Energy Modelling Guidelines (the "CoV Modelling Guidelines", or "the guidelines") provide clarity on energy modelling inputs for the purposes of showing compliance with absolute performance limits, as established in the City of Vancouver Green Buildings Policy for Rezonings (the "Policy"), and the Vancouver Building By-law ~~("the Policy",~~ "the VBBL", "By-law", or "code"). These guidelines are applicable to Part 3 new construction. This document is not intended to be an exhaustive set of technical and administrative requirements or best practices for energy modelling, and these guidelines are to be used in addition to the applicable requirements for energy performance modelling as written in the National Energy Code of Canada for Buildings (NECB), Part 8 of the applicable version referenced in the VBBL.

~~These guidelines are also referenced in the BC Energy Step Code and are applicable to projects designed to the BC Energy Step Code.~~ Some standards or programs other than City of Vancouver's policies and building by-laws reference these Guidelines (e.g. BC Energy or Zero Carbon Step Code) for modelling compliance. For such projects, use the referenced version of the Guidelines as required by the standard, program, or authority having jurisdiction (AHJ).

The objectives of the Modelling Guidelines are to:

a) Standardize and clarify inputs to ensure that modelled building performance is comparable between projects and with fixed performance limits; and,

b) Reduce the potential performance gap between energy models and actual operating performance of buildings.

The energy modelling professional(s) should adhere to the AIBC & EGBC Joint Professional Practice Guidelines - Whole Building Energy Modelling Services.

This document standardizes energy modelling inputs that may have a large impact on performance targets but are not integral to building system performance (for example, schedules). It also clarifies inputs where current industry practice for those inputs does not support intended outcomes or leads to performance gaps (for example, not fully accounting for total envelope heat loss through thermal bridges).

Design-related modelling inputs not specified in this document shall represent the actual design. Software limitations shall not limit the accuracy of energy modelling to show compliance with the Policy; consultants are expected to overcome software limitations with appropriate engineering calculations. All other modelling inputs not discussed in these guidelines shall be based on good engineering practice.

1.1. Guidelines are Additional to NECB Modelling Requirements

As stated above, these guidelines are intended to be used in addition to the applicable requirements for energy performance modelling as written in the NECB, Part 8. In the event of overlap between these guidelines and the modelling requirements of Part 8, the following conditions shall apply:

a) Semi-conditioned and unconditioned spaces shall be modelled as per the design. These spaces do not need to be modelled as fully-conditioned and do not contribute to annual unmet hours.
b) Infiltration shall be modelled as per Section 2.4 of these guidelines.
b) Components of the building envelope are to be modelled as per Section 3 of these guidelines.
c) In cases where the design ventilation rate exceeds the minimum required by code, ventilation rates shall be modelled as per the design.
d) For buildings or portions of buildings with absolute performance limits, a reference model is not required. For buildings or portions of buildings that do not have an absolute performance limit, refer to section 5.

e) All building components must be included in the energy model as required by these guidelines, and may not be excluded by meeting the prescriptive requirements of the NECB.

1.2. Modelled vs Actual Results

The results of models created to meet these guidelines are intended for regulatory purposes only, to enable the Authority Having Jurisdiction (AHJ) to determine whether a building complies with the applicable policy or code. Much like an emissions test on a car, test results are used for standardized comparison, and are not necessarily predictive of actual performance. The energy and thermal comfort performance of actual buildings will depend on many factors that can vary from these standardized assumptions, including: intensity and hours of use, weather, occupant behavior, as-built vs as-designed parameters, among many others. This applies to performance in both actively and passively cooled buildings.

In addition to varying from actual energy use, the standardized assumptions used may vary from those used in other ratings systems or modelling guidelines developed for their respective programs, which will cause differences in modelled performance. As noted above, the standardized inputs in these guidelines were developed to facilitate easy comparison with fixed limits and between projects, with better prediction of actual performance as a secondary goal. For this reason, some assumptions may be higher or lower than other references.

1.3. Definitions

Clear Field – An opaque wall or roof assembly with uniformly distributed thermal bridges, which are not practical to account for on an individual basis for U-value calculations. Examples of thermal bridging included in the clear field are brick ties, girts supporting cladding, and steel or wood studs. The heat loss associated with a clear field assembly is represented by a U-value (heat loss per unit area).

Cooling Energy Demand Intensity – The annual cooling energy demand for space conditioning and conditioning of ventilation air. This is the amount of cooling output, latent and sensible, from any and all types of cooling equipment per unit of Modelled Floor Area. Cooling equipment may include, but is not limited to, radiant systems, fan coils, air-handler cooling coils, split systems, VRF. CEDI does not include mechanical efficiencies of cooling equipment. Cooling output of any cooling equipment whose source is not directly provided by a utility (electricity, gas, or district systems) must still be counted towards the CEDI.

Note: End uses that may be categorized as process loads, such as refrigeration for food storage, would not be included in the CEDI. Cooling of electrical rooms is not a process cooling load.

Equation 1: Cooling Energy Demand Intensity

$$CEDI\ \left[\frac{kWh}{m^2 a}\right] = \frac{\sum Space\ and\ Ventilation\ Cooling\ Output\ \left[\frac{kWh}{a}\right]}{Modelled\ Floor\ Area\ [m^2]}$$

CEDI shall be reported in kWh/m^{2}a, where "a" represents annum (year).

Greenhouse Gas Intensity (GHGI) – The total greenhouse gas emissions associated with the use of all energy utilities on site, using the following emissions factors:

Table 1.3.1 ~~2~~ Emissions Factors by Fuel Type	
Fuel Type	Emissions Factor ($kgCO_{2e}/kWh$)
Natural Gas	~~0.185~~ 0.180[3]
Electricity	0.011
District Energy System	as provided by utility[1,2]

[1] The emissions factor of a district energy system shall be as provided by the utility (and as agreed by the utility and the AHJ).

[2] Where a district energy utility agrees to provide a development with energy at a carbon intensity that varies from that of the overall system, documentation of that agreement (or intent to enter an agreement), and any other measures or agreements required to secure the supply of low-carbon energy (such as those required by the CoV LCES Policy), shall be provided to the authority having jurisdiction.

[3] Where purchased "renewable" natural gas forms part of the fuel mixture is to be planned, refer to Section 1.4.1.

~~Refer to Section 1.3 for details on how these emissions factors may be reduced through renewable energy.~~

Equation 2: Greenhouse Gas Intensity (GHGI)

$$GHGI\ \left[\frac{kgCO_{2e}}{m^2a}\right] = \frac{\Sigma\left((Site\ Energy\ Use\ \left[\frac{kWh}{a}\right] - Site\ Renewable\ Energy\ Generation\ \left[\frac{kWh}{a}\right]) \times Emissions\ Factor\ \left[\frac{kgCO_{2e}}{kWh}\right]\right)}{Modelled\ Floor\ Area\ [m^2]}$$

GHGI shall be reported in kg CO_{2e}/m^2a, where a represents annum (year).

Greenhouse Gas Intensity from Refrigerants (GHGI-R) – The total greenhouse gas emissions associated with the use of refrigerants on site. May be used to calculate and report the life-cycle equivalent annual carbon dioxide emissions of each building, in $kgCO2e/m^2a$, from the emission of refrigerants.

Equation 3: Greenhouse Gas Intensity from Refrigerants (GHGi-R)

$$GHGI - R\ \left[\frac{kgCO2_e}{m^2a}\right] = \frac{[GWP_r * R_c * (0.02 * L + 0.1)]}{L * MFA}$$

Where:
GWP_r = 100-year Global Warming Potential of the refrigerant [$kgCO2_e/kg_r$]
Rc = Total Refrigerant Charge in the system [kg],
L = Life of the system [years],

MFA = Modelled Floor Area of the building [m^2]
0.02 = Assuming a 2% annual leakage rate
0.1 = Assuming a 10% end-of-life leakage rate

Table 1.3.2: Global Warming Potential of Refrigerants	
Refrigerant	**Global Warming Potential** ($kg\ CO_{2e}/kg_r$)
HFCs	
HFC-23	12,400
HFC-32	677
HFC-134a	1,300
HFC-245fa	858
HFC-404a	3,943
HFC-407c	1,624
HFC-410a	1,924
HFC-507a	3,985
Natural Refrigerants	
Carbon Dioxide (CO_2)	1
Ammonia (NH_3)	0
Propane (R-290)	3

Note: Reproduced from the Climate Registry 2023 Default Emissions Factors based on GWP-100 values from the Intergovernmental Panel on Climate Change Fifth Assessment (AR5) published in 2013.

Service life should be based on the system in question using Table 2 below. A different service life may be used if supported by documentation acceptable to the AHJ.

Table 1.3.3: Default Equipment Lifetime	
Equipment	**Default Equipment Lifetime**
Window air-conditioner, heat pump	10 Years
Unitary, split, packaged air-conditioner, package heat pump	15 years
Reciprocating and scroll compressor, reciprocating chiller	20 years
Absorption chiller	23 years
Water-cooled packaged air-conditioner	24 years
Centrifugal chiller	25 years

Note: Reproduced from the LEED Canada 2009 and v4 Reference Guides, with permission from the CaGBC

Interface Details – Thermal bridging related to the details at the intersection of building envelope assemblies and/or structural components. Interface details interrupt the uniformity of a clear field assembly and the additional heat loss associated with interface details can be accounted for by linear and point thermal transmittances (heat loss per unit length or heat loss per occurrence).

Modelled Floor Area (MFA) – The total enclosed floor area of the building (in m^2), as reported by the energy simulation software, excluding exterior areas and indoor (~~including underground~~ both above and below grade) parking areas. All other spaces shall be ~~including partially conditioned and unconditioned spaces~~ included in the MFA. This includes unconditioned spaces which are adjacent to vehicle parking areas such as separate bicycle storage rooms, mechanical rooms, and elevator shafts. Horizontal service spaces, which includes attics and crawl spaces which are concealed and generally inaccessible, are to be excluded from the MFA.

If the MFA differs by more than 5% from the gross floor area reported on the architectural drawings, the local AHJ may require a written explanation for the discrepancy within the energy modelling report or other compliance documentation. ~~The MFA must be within 5% of the gross floor area from the architectural drawings unless justification is provided demonstrating where the discrepancy arises and why the MFA should differ from the gross floor area by greater than 5%.~~

Other Building Types – Building types that do not have absolute performance limits established for energy use, heat loss, or greenhouse gases, and instead use a reference model to set targets specific to the proposed building. For these building types, please refer to Section 5.

Performance Limits – Absolute limits on TEUI, TEDI, and GHGI established in policy or code.

Site – The building(s) and all associated area where energy is used or generated. A site may include one or more buildings, either as independent structures or interconnected. For the purposes of these guidelines, sites containing multiple buildings may be divided into separate sites where desirable (e.g. where one building must register for LEED), and larger sites may be required to divide sites by block or parcel.

Site Energy Use – All energy used on site including all end-uses, such as heating, cooling, domestic hot water, fans, pumps, elevators, parkade lighting and fans, plug and process energy, interior and exterior lighting, among others. It incorporates all site efficiencies, including the use of heat pumps or re-use of waste heat, but does not include energy generated on site.

Note: For systems connecting to a district energy system, the modeller may choose to include the district system within the scope of the building systems – refer to section 1.6 District Energy Systems for more information.

Site Renewable Energy Generation – Energy generated on site from renewable sources, such as solar or wind. Energy generated on site may be accounted for in the calculation of the TEUI according to the TEUI definition. ~~Where a site is not able to send energy off site (for example, not connected to the electricity grid), only energy that can be consumed (or stored and then consumed) on site shall be counted as Site Renewable Energy Generation.~~

Thermal Energy Demand Intensity (TEDI) – The annual heating energy demand for space conditioning and conditioning of ventilation air. This is the amount of heating energy that is output from any and all types of heating equipment, per unit of Modelled Floor Area. Heating equipment includes electric, gas, hot water, or DX heating coils of central air systems (for example, make-up air units, air handling units, etc.), terminal equipment (for example, baseboards, fan coils, heat pumps, reheat coils, etc.), or any other equipment used for the purposes of space and ventilation conditioning. TEDI does not include mechanical efficiencies of heating equipment, and hot water or heat pump heating sources that are derived from a waste heat source, or a renewable energy

source, do not contribute to a reduction in TEDI. Heating output of any heating equipment whose source of heat is not directly provided by a utility (electricity, gas or district) must still be counted towards the TEDI.

Note: Specific examples of heating energy that are not for space conditioning and ventilation, and would not be included in the TEDI, include domestic hot water, maintaining swimming pool water temperatures, outdoor comfort heating (for example, patio heaters, exterior fireplaces), humidification, and heat tracing. Space and ventilation heating of vehicle parking areas horizontal service spaces, such as for freeze protection of utilities, are to be included in the TEDI unless the heating setpoint is equal to or less than 7°C. This does not affect whether these areas are included in the MFA – refer to the definition of MFA.

Equation 4: Thermal Energy Demand Intensity (TEDI)

$$TEDI\ \left[\frac{kWh}{m^2a}\right] = \frac{\sum Space\ and\ Ventilation\ Heating\ Output\ \left[\frac{kWh}{a}\right]}{Modelled\ Floor\ Area\ [m^2]}$$

TEDI shall be reported in kWh/m²a, where a represents annum (year).

Total Energy Use Intensity (TEUI) – The sum of all energy used on site (i.e. electricity, natural gas, district heat), minus all renewable energy generated on site, divided by the *Modelled Floor Area*.

Equation 5: Total Energy Use Intensity (TEUI)

$$TEUI\ \left[\frac{kWh}{m^2a}\right] = \frac{\sum Site\ Energy\ Use\ \left[\frac{kWh}{a}\right] - \sum Site\ Renewable\ Energy\ Generation\ \left[\frac{kWh}{a}\right]}{Modelled\ Floor\ Area\ [m^2]}$$

TEUI shall be reported in kWh/m²a, where a represents annum (year).

1.4. Renewable Energy

1.4.1 Deleted Section ~~Site-Generated Renewable Energy~~

~~As stated in the definition of TEUI, renewable energy generated on-site may reduce the TEUI. Additionally, the City of Vancouver Zero Emissions Building Plan states that if grid electricity is not 100% renewable, a building may achieve zero emissions by installing on-site renewable energy generation to offset the portion of grid electricity that is non-renewable. As electricity in BC is legislated to be a minimum of 93% renewable, an all-electric building can achieve zero emissions by installing renewable electricity generation equal to 7% of site electricity use, and in this case the electricity emissions factor is considered to be zero. For sites installing renewable electricity generation totaling less than 7% of site electricity use, the electricity emissions factor is reduced proportionally, to a minimum of zero. For the purposes of these guidelines, this may be read from Table 2 below or calculated as follows. Note: Specific examples of heating energy that are not for space conditioning and ventilation, and would not be included in the TEDI, include domestic hot water, maintaining swimming pool water temperatures, outdoor comfort heating (for example, patio heaters, exterior fireplaces), and heat tracing.~~

$$Emissions\ Factor_{elec}\ \left[\frac{kgCO_{2e}}{kWh}\right] = 0.157 \times \left(\frac{Site\ Generated\ Renewable\ Energy_{elec}}{Site\ Energy\ Use_{elec}}\right) + 0.011$$

~~**Table 1.3.1 Reduced Electrical Emissions Factors**~~

~~Percent of Electrical Site Energy Use Generated On Site~~	~~Reduced Electrical Emissions Factor ($kgCO_{2e}$/kWh)~~
~~0%~~	~~0.0110~~
~~1%~~	~~0.0094~~
~~2%~~	~~0.0079~~
~~3%~~	~~0.0063~~
~~4%~~	~~0.0047~~
~~5%~~	~~0.0032~~
~~6%~~	~~0.0016~~
~~7%~~	~~0.0000~~

1.4.2 Purchased Renewable Energy

Where renewable energy is purchased directly from utilities or renewable energy providers, and guarantees of long-term supply are provided to the satisfaction of the AHJ, an emissions factor of zero may be applied to the portion of the utility that is renewable.

Note: Guarantees of supply for the lifetime of the building must be provided for at least the portion of renewable energy used to demonstrate compliance with the limits.

1.5. Weather File

Projects shall use a future shifted weather file provided by the National Research Council of Canada (NRC) for the RCP 8.5 1.0°C global warming (GW) scenario (the "NRC GW1.0" weather file. The weather files for Vancouver are available here:

LINK TO BE PROVIDED FOR VANCOUVER

For locations outside of Vancouver, NRC weather files for future TMY scenarios can be found on the NRC website, or refer to the requirements of the AHJ:
https://nrc-digital-repository.canada.ca/eng/view/object/?id=bd339698-5eb8-4635-b411-63d4f670382b

~~file the Canadian Weather year for Energy Calculation (CWEC) 2016 weather file. The weather files for BC are available online from Environment Canada here:~~
~~ftp://client_climate@ftp.tor.ec.gc.ca/Pub/Engineering_Climate_Dataset/Canadian_Weather_year_for_Energy_Calculation_CWEC/ENGLISH/CWEC_v_2016/BC_CWEC.zip~~

~~An additional source for download is available here: http://climate.onebuilding.org/~~

1.6. District Energy

For buildings connecting to a district energy utility, the modeller may choose two options:

1. Model heat energy as delivered to site with 100% efficiency; or,

2. Model the building systems as including the total district energy system, and use the system efficiency as provided by the utility (and as agreed on by the utility and the AHJ) when calculating site energy use. Where district systems make use of biomass/biofuels to achieve low carbon supply yet are limited in maximum efficiencies, consideration may be given in the system efficiency agreed on with the AHJ.

2. Standardized Assumptions

2.1. Schedules

Occupancy, temperature setpoints, lighting, plug load, domestic hot water (DHW), and ventilation fan schedules shall generally be as per NECB 2020 ~~2011~~ for the corresponding building type or building function with the clarifications, additions and exceptions listed below. Where actual operating hours are expected to exceed the applicable NECB schedule, use of an alternate and more intensive schedule is permitted.

Table 2.1 Schedules

Building or Space Type	NECB 2020 ~~2011~~ Schedule
Residential	Table A-8.4.3.2(1)G
Office	Table A-8.4.3.2(1)A
Retail	Table A-8.4.3.2(1)C
Hotel	Table A-8.4.3.2(1)F
Other Building Types	To be selected by the modeller according to good engineering practice
Residential Corridors	Lighting at 24 hours per day
Enclosed Parking Garages	Lighting at 24 hours per day, Fans at 4 hours per day
Lighting Schedules only for spaces whose functions are not directly tied to the main building function (ex. stairways, mechanical and electrical rooms, etc.)	Use recommended lighting annual hours as guidance, provided in Appendix B of BC Hydro's New Construction Program's Energy Modelling Guideline
Exterior Lighting	Schedule on at night, using Astronomical data for location

2.2. Internal Gains and Domestic Hot Water

Occupancy, plug loads, lighting power and DHW shall be modelled according to the following:

2.2.1 Residential Suites

For Suites in residential buildings, use the following:

Occupancy – 2 people for the 1st bedroom, 1 additional person for each bedroom thereafter. Studios and Single Room Occupancies (SROs) ~~may~~ shall assume one person per unit.

Plug Loads – 5 W/m^2. If there are gas-fired cooking appliances, then 1 W/m^2 shall be assigned to gas and 4 W/m^2 shall be assigned to electricity. Credit for use of energy efficient appliances (for example, refrigerator, stove/range/oven, dishwasher, washer, dryer)

may be applied, provided that the appliances use less energy than current ENERGY STAR requirements for that appliance. Savings are to be determined based on the relative savings using the appliance kWh ratings, applied to the plug value of 5 W/m². If the appliance type in question does not have an ENERGY STAR rating available, then no credit is to be applied for that appliance.

Example – Total ENERGY STAR minimum kWh ratings for suite appliances,1,000 kWh.
Total project kWh use for selected suite appliances, 900 kWh.
Reduction in plug load = 5 W/m² x 900/1000 = 4.5 W/m²

Lighting – Suite lighting loads shall be modelled as per the design. For areas within residential suites that are intended for user-supplied lighting (e.g. dining area with ceiling rosette blank, bedroom with switched receptacle for floor lamp) or where a design is not complete, it is acceptable to apply the a target lighting power density of 5 W/m²~~, unless a complete suite lighting design is provided supporting lower alternative values~~. Target lighting power densities may not exceed 5 W/m². Design lighting power densities may exceed 5 W/m² if supported by the lighting design information.

Domestic Hot Water (DHW) – 0.0016 L/s/person (0.025 gpm/person) modelled as the peak hourly flow and modified by the schedule noted in Section 2.1. Reduction to this peak hourly flow is allowed and shall be determined using industry standard methods for hot water use estimates (for example, LEED Canada NC 2009, Water Efficiency Prerequisite 1) with savings calculated relative to BC ~~Building~~ Plumbing Code requirements for maximum fixture flow rates. Reductions are also permitted for installations of passive drain water heat recovery systems to a maximum of 15%, and for heat pump systems, which shall be modelled as per the design. Savings shall be determined using good engineering practice and relative to the areas in which the system is installed (i.e. the 15% reduction is only allowed if drain water heat recovery was installed on all DHW fixtures). Models shall assume an average domestic cold water inlet temperature of 5°C.

2.2.2 All Other Spaces

Except in residential suites, all occupancy, plug, and DHW loads shall be based on Table A-8.4.3.3.(1)B of NECB 2020 ~~2011~~. Lighting loads shall be modelled as per the design. Credit for lighting occupancy sensors may be applied as a reduction to the schedule or modelled lighting power density as per the methodology in NECB 2011, Section 4.3.2.10. Daylight sensors shall be modelled directly in the software, where credit will be as per actual modelled results. Credit for DHW savings is permitted using the methodology described for Residential Suites in Section 2.2.1.

2.3. Other Loads

2.3.1 Elevators

Elevators shall be modelled using an electrical load of 3 kW per elevator and the equipment schedule of the building type.

2.3.2 Other Process Loads

All process loads expected on the project site are to be included in the energy model. This includes but is not limited to: IT/data loads, exterior lighting, swimming pool heating, patio heaters, exterior fireplaces, and heat tracing~~, etc~~. All loads are to be estimated to reflect the actual design and using good engineering practice.

Note: electric car charging is not included in building process loads, as this is a growing load that is associated with transportation rather than buildings and may include sub-metering and/or re-sale of electricity.

For other building types that have a target based on a percentage improvement over a reference building, process loads savings may be applied for the use of ENERGY STAR equipment provided it is documented to the satisfaction of the AHJ.

2.3.3 Fireplaces

Where fireplaces are used as the primary means of space heating, they shall be modelled as any other zone heater. All other fireplaces (indoor and outdoor) shall be modelled using the capacity and schedule consistent with the design and intended use. At a minimum, fireplaces for individual homes shall assume that each fireplace has a capacity of 10 kW each and runs 2 hours per week. Fireplaces intended for communal use shall assume 10 hours per week to reflect greater usage. The energy and emissions shall be captured in the overall TEUI and GHGI results.

2.3.4 Commercial Kitchens

Commercial kitchens and their loads are to be included in the energy model. For the purposes of energy modelling, Commercial kitchens may be represented as a separate major occupancy for the purposes of establishing performance requirements for energy compliance. Performance requirements (TEDI, TEUI, GHGI) for this area are to be determined by a reference building model as per Section 5. Adjacent spaces associated with the kitchen (dining, storage, back of house, etc.) may be included with this separate occupancy for the purposes of establishing performance requirements to the satisfaction of the AHJ.

2.4. Infiltration

Infiltration rates used in the design phase shall be based on targeted whole building air leakage test rates, using the conversion methodology in section 2.4.1. Design teams should consider building geometry, assemblies, air barrier type, details, and construction team experience when setting a whole building air leakage target (if a target does not exist in code requirements), to increase the likelihood of meeting the design target at project completion. A tested air leakage rate of 1.5 L/s·m^2 of total enclosure area at 75 Pa is suggested as starting point, representing average airtightness performance. A leakage rate of 1.0 L/s·m^2 is considered a very good level of airtightness, and 0.70 L/s·m^2 is considered exceptional. These are approximate values, intended to provide rough guidelines only.

Projects targeting airtightness levels less than 1.30 L/s·m^2 may be requested to provide a professionally sealed narrative of building envelope products and design & construction strategies that support the target, to the satisfaction of the AHJ. For projects located in the City of Vancouver, refer to the City of Vancouver's Bulletin "Airtightness Testing Process and Requirements for New Buildings" for submittal requirements.

~~Except as permitted in 2.4.1, infiltration shall be modelled as a fixed rate of 0.20 L/s/m^2 at operating pressure, and is to be applied to the modelled above-ground wall area (i.e. walls and windows). For Part 9 residential buildings, infiltration is to be modelled using 9.36.6.4, Sentence 4.~~

~~2.4.1 Reduced Infiltration Rates~~

~~Projects pursuing a TEDI target of 30 or lower may model reduced infiltration rates. The level of reduction depends on the TEDI target, as indicated in Table 2.4.1.~~

~~**Table 2.4.1: Minimum Infiltration Rates for Energy Modelling**~~

~~TEDI Target (kWh/m^{2}a)~~	~~Minimum Modelled Infiltration Rate Permitted~~
~~> 30~~	~~0.20 L/s/m^2, as per Section 2.4~~
~~30 ≥ x > 15~~	~~≥ 0.10 L/s/m^2~~
~~≤ 15~~	~~≥ 0.05 L/s/m^2~~

~~If choosing to model a reduced infiltration rate, the project must commit to achieving the corresponding airtightness target, to be confirmed by mandatory air tightness testing.~~

~~Note: projects must provide all airtightness documentation required by the AHJ at each phase of project approval, and projects using reduced infiltration rates may have additional documentation requirements.~~

2.4.1 Modelling Methodology

Envelope air leakage test results at a pressure of 75 Pa can be converted to typical operating ~~ambient~~ pressures for use in energy modelling software by ~~multiplying the value by 0.112 as~~ applying Equation 6. Conversely, modelled infiltration rates may be converted to an air leakage target by applying Equation 6 ~~dividing by 0.112~~. Note that air leakage test results are often normalized by the total envelope surface area, which is different than the above ground wall area, due to the inclusion of floors and roofs. When converting from an air leakage test to modelled infiltration or vice-versa, the difference in surface areas must be accounted for.

Infiltration shall be modelled in all perimeter spaces based on their façade area, at a continuous rate using an "always on, 24 hour a day, 7 days a week" schedule.

Equation 6: Conversion formula for building envelope infiltration

$$\sout{I_{AGW} = 0.112 \times q_{75Pa} \times \frac{S}{A_{AGW}}}$$

$$I_{AGW} = 0.112 \times I_{75Pa} \times \frac{S}{A_{AGW}}$$

Where:

I_{AGW} = adjusted air leakage rate of the building envelope at a typical operating pressure differential of 5 Pa and relative to the area of the above-ground walls in [L/s·m^2] ~~infiltration rate [L/s·m^2] to be used for energy modelling, and applied to the modelled above ground wall area~~

I_{75Pa} ~~q_{75Pa}~~ = assumed or measured normalized air leakage rate of the building envelope [L/s·m^2] ~~as tested~~ at a pressure differential of 75 Pa,

Where the measured air leakage rate at the pressure differential of 75 Pa is calculated as $I_{75Pa} = Q/S$,
Where Q = volume of air flowing [L/s] through the building envelope when subjected to a pressure differential of 75 Pa, determined in accordance with ASTM E779, "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization"

~~q_{75Pa} = normalized envelope air leakage [L/s·m^2] as tested at 75 Pa~~

S = total area of the building envelope [m^2], typically measured at the plane of the building's air barrier assemblies and includes the surface area of doors, windows and the air control layer in the opaque building assemblies ~~total surface area [m^2] of the building envelope included in the air leakage test (i.e. the pressure boundary), including ground floors and roofs, and possibly below grade walls.~~

A_{AGW} = modelled area [m^2] of above-ground walls (including windows)

Example 1 – A six-storey residential building ~~with a TEDI target of 15~~ has:
6,000m^2 of total floor area,

3,600m^2 of above-ground wall area,
1,000m^2 of roof area and,
1,000m^2 of floor slab area.

Combining the above-ground wall, roof, and floor slab areas, this equates to a total envelope surface area of 5,600m^2 to be tested for air leakage. The design team is cautious and decides to start with a targeted leakage rage (I_{75Pa}) of 1.50 L/s·m^2. The design team converts this value to a modelled infiltration rate of 0.26 L/s·m^2 using Equation 5, to be applied to the façade area in the energy model.

$$I_{AGW} = 0.112 \times I_{75Pa} \times \frac{S}{A_{AGW}} = 0.112 \times 1.50 \times \frac{5{,}600}{3{,}600} = 0.26 \frac{L}{s} \cdot m^2$$

~~As this project has a TEDI target of 15, it is permitted to model an infiltration rate lower than stipulated in Section 2.4, and as low as 0.05 L/s/m^2, as per Table 2.4.1. During schematic design, the project chooses advanced airtightness as an energy savings measure, and chooses to model an infiltration rate of 0.10 L/s/m^2. The design team then converts this infiltration rate to an airtightness target, so the project can be designed and constructed to achieve the predicted level of performance.~~

~~$$q_{75Pa} = \frac{I_{AGW} \times A_{AGW}}{0.112 \times S} = \frac{0.10 \times 3{,}600}{0.112 \times 5{,}600} = 0.58\ L/s \cdot m^2 @ 75Pa$$~~

~~Note: The above is an example of modelling a reduced infiltration rate as permitted by this section, and the above calculation shows this represents an exceptional level of airtightness to be achieved. Projects modelling a reduced infiltration rate must consider the achievability of the corresponding airtightness target when deciding on the infiltration rate to be modelled.~~

Example 2 – The same six-storey residential building from Example 1 is tested for airtightness after construction and achieves a result of 0.90 ~~0.50~~ L/s·m^2 @ 75 Pa. The design team then converts this to an infiltration rate for use in the final energy model.

$$I_{AGW} = 0.112 \times I_{75Pa} \times \frac{S}{A_{AGW}} = 0.112 \times 0.90 \times \frac{5{,}600}{3{,}600} = 0.16\ L/s \cdot m^2$$

For more information on achieving airtight buildings and appropriate airtightness targets, refer to airtightness and infiltration references listed in section 6.~~, refer to BC Housing's "Illustrated Guide to Achieving Airtight Buildings".~~

~~For more resources on airtightness leakage targets, refer to RDH's paper "Building Enclosure Airtightness Testing in Washington State – Lessons Learned about Air Barrier Systems and Large Building Testing Procedures".~~

2.5. Ventilation

2.5.1 Ventilation Rates

Ventilation rates are to be modelled as per design, including but not limited to ventilation for occupants according to building code requirements, air distribution effectiveness (as applicable), make-up air for exhaust requirements, corridor pressurization make-up air in residential buildings, among others. Typically, modelled minimum ventilation rates per space must not be less than required as calculated according to the applicable ventilation standard for the project. ~~Note that for residential projects designing to ASHRAE~~

~~62-2001, make-up air quantities for the suites are typically not permitted to be lower than that required by Table 2: Outdoor Air Requirements for Ventilation - 2.3 Residential Facilities, of ASHRAE 62-2001 (except addendum n).~~

2.5.2 Corridor Pressurization in MURBs and Hotels/Motels

As the industry moves towards more airtight suites and buildings, direct ventilation in suites, and lower energy use, the quantity and purpose of air delivered into corridors is evolving. Designers are encouraged to evaluate on a project-specific basis the purpose and effectiveness of delivering higher than required ventilation volume of air to corridors. During this transition period, projects that provide additional airflow to corridors above the minimum required by code may subtract an adjustment value from the modelled TEUI, and TEDI~~, and GHGI~~ when demonstrating compliance with the performance limits. These adjustment values are to be implemented as a post-processing exercise, using the modelled outputs that are reflective of the actual ventilation design. Adjustments shall not be made to the simulation files themselves, and modellers will be required to report the TEUI, and TEDI ~~and GHGI~~ both pre- and post-adjustment. Note that projects using balanced or unbalanced HRVs or ERVs to supply corridor ventilation may also claim this adjustment based on supply air flow rate.

Adjustment values shall be calculated according to the equations below, to a maximum TEDI adjustment of ~~10~~ 5, and a minimum of 0.

Equation 7: TEDI and TEUI Adjustment for Corridor Pressurization

$$TEDI\ Adjustment = \frac{HDD \times \left((0.029 \times \#Suites\ \times (L/s/door)) - (0.0073 \times Corridor\ Area)\right)}{MFA}$$

$$TEUI\ Adjustment = TEDI\ Adjustment$$

~~$$GHGI\ Adjustment = TEUI\ Adjustment \times Emissions\ Factor$$~~

Where HDD is Heating Degree Days (18°C base temperature) for the site as stated in the building code in Division B, Appendix C, Table C-2.

The Corridor Area is based on corridors serving residential suites only; for example, corridors serving parkades, or a level of retail beneath residential floors should not be included. Similarly, L/s per door is calculated only using the air served to applicable corridors; for example, if the same MUA is ventilating vestibules/ corridors in a below-grade parkade, the air volume serving the parkade is not included.

~~The GHGI Adjustment shall use the emissions factor of the fuel used to heat air supplied to the corridors. Systems using heat pumps to heat corridor supply air, including heat pump make-up air units with natural gas backup, shall be considered electric.~~

Example – A 10,000m^2 residential building in Vancouver with 125 suites is designed to provide 7 L/s/door of supply air to 1,500m^2 of corridor space, using a gas-fired make-up air unit.

TEDI Adjustment = (~~2825~~ 2925 x ((0.029 x 125 x 7) – (0.0073 x 1,500))) / 10,000 = 4.~~2~~1 kWh/m^2

TEUI Adjustment = 4.~~2~~1 kWh/m^2

~~GHGI Adjustment = 4.1 x 0.185 = 0.8 kgCO2e/m^2~~

After the design is modelled and the as-designed TEUI and TEDI~~, and GHGI~~ have been documented, the calculated adjustment factors may be subtracted, and both the pre- and post-adjustment values reported when demonstrating compliance.

2.5.3 Demand Control Ventilation

Credit may be taken for demand control ventilation systems that monitor CO_2 levels by zone and that have the ability to modulate ventilation at either the zone or system level in response to CO_2 levels. Reductions in outdoor air shall be modelled as closely as possible to reflect the actual operation of the designed ventilation system and controls. The occupancy schedule from Section 2.1 can be used as a surrogate for CO_2 control in the model. For example, if a zone has the ability to decrease ventilation in response to CO_2 levels in that zone, the ventilation for that zone at each time step shall be determined by multiplying the zone's design ventilation rate with the scheduled occupancy fraction.

2.6. Other Considerations

Depending on the stage of the project when the energy model is developed, there may be the need to make a number of assumptions, of which many can have a significant impact on the performance of the building. While it is up to the design team and energy modeller to make reasonable assumptions based on past experience or engineering judgement, the items noted below are explicitly listed as they are often misrepresented in energy models.

2.6.1 Heat or Energy Recovery Ventilators

Heat or energy recovery ventilators shall be modelled according to design, even in instances where there exists software limitations. Appropriate workarounds or external engineering calculations are expected to be performed to accurately assess the performance of the as-designed systems. This includes the use of preheat coils and/or other frost control strategies.

When modelling a heat recovery system, the energy modeller must use Sensible Recovery Efficiency (SRE), and determine if an adjustment to efficiency is required to properly account for fan heat in the system. The modeller must do one of the following:

a) Use SRE of the specified product and model fan location and power as per the Heat Recovery Ventilator ( ) design directly in the software; or,
b) If the software cannot model exact fan placement and/or fan power as per the HRV's design, adjust the SRE efficiency so that it incorporates the benefit of fan heat directly in the SRE value for any fans that contribute heat to the supply air stream. Model the fans without power and account for their energy use elsewhere in the software or externally to the software.

Note: SRE is a measure of the heat exchanger's efficiency, i.e. removing the impact of case heat loss, air leakage, fan heat, etc., and is defined in CAN-CSA C439-2014. While the impact of such items do improve the heat exchanged to the supply air of the HRV, they do so at the expense of indoor air quality or heat from the space in which the HRV is located, with the exception of fans.

Heat or energy recovery ventilators that use frost control strategies whose effects are not included in the rated sensible recovery efficiency shall be modelled as designed. If no frost control strategy is specified by the mechanical designer or equipment manufacturer, ~~which limit the amount of ventilation supplied to the space (i.e. exhaust only defrost) shall be modelled to include an electric preheat coil before the heat or energy recovery ventilator that heats the air to the minimum temperature before frost control is employed, as indicated by the manufacturer. For example, if the minimum temperature prior to frost control being deployed is -5°C,~~ then an electric preheat coil shall heat the incoming air to -5°C prior to it entering into the heat or energy

recovery ventilator. The purpose of this approach is to not reward designs that reduce ventilation to the space due to their lack of efficiency.

For more detail on these requirements, refer to Chapter 3 of BC Housing's Guide to Low Thermal Energy Demand in Large Buildings referenced in Section 6.

2.6.2 Terminal Equipment Fans

Terminal equipment fans shall be modelled according to design. Specifically, ensure that fan power and fan control (i.e. cycling, always on, multi or variable speed) of terminal equipment represent the design and design intent as accurately as possible.

2.6.3 Variable Air Volume (VAV) and Fan-Powered Boxes

Modellers must ensure that minimum flow rates and control sequences of VAV terminals and Fan Powered Boxes are modelled according to the design, and if not available at the time of modelling, according to expected operation based on maintaining ventilation and other air change requirements as appropriate. Note that default values for minimum flows of VAV terminals are often unreasonably low in most energy modelling software.

2.6.4 Exhaust Fans

Suite exhaust fans that are not part of the ventilation system (for example, kitchen exhaust or bathroom exhaust not connected to an HRV or similar), shall have a runtime of 2 hours/day. ~~All other exhaust fans, including heat recovery units, shall be modelled to reflect the design intent as accurately as possible.~~

Note: make-up air for suite exhaust fan use under this section is considered to be accounted for as part of the overall infiltration of the building, as per Section 2.4.1. No additional intake of outdoor air is required to satisfy the requirements of this section.
Terminal equipment fans shall be modelled according to design. Specifically, ensure that fan power and fan control (i.e. cycling, always on, multi or variable speed) of terminal equipment represent the design and design intent as accurately as possible.

All other exhaust fans, including heat recovery units, shall be modelled to reflect the design intent as accurately as possible. For heat recovery units designed to operate at a higher rate on manual occupant control, such as for bathroom exhaust on a timer, this higher rate shall have a runtime of at least 2 hours/day.

2.6.5 Other Fans

All other building fans (for example parkade supply and exhaust fans, transfer fans) shall be modelled to reflect the design intent as accurately as possible.

2.7. Small and/or Slim Building Forms Adjustment Factors

Projects with small and/or slim building forms that yield a high Vertical façade to Floor Area Ratio (VFAR) or high Enclosure to Floor Area Ratio (EFAR) may find it difficult to meet absolute floor area-based performance metrics due to the significantly increased infiltration and conduction heat losses per unit floor area when compared with more conventional Part 3 building forms. This set of adjustment factors has been developed to provide these buildings a reasonable compliance path that result in similar building envelope characteristics as those with conventional building forms.

2.7.1 Eligibility

The adjustment calculations described in this section may only be applied to buildings which meet at least one of the following criteria to the satisfaction of the AHJ:

1. Small buildings of 1 or 2 storeys (each storey with at least 50% wall area above-grade) may claim the Small Building Adjustment described in section 2.7.2.,

2. A building with a VFAR greater than or equal to 0.65 (calculated according to Equation 7) may claim the VFAR Adjustment described in section 2.7.2.,
3. The high VFAR of the building form must be as a result of site limitations such as, but not limited to: site dimensions, sidewalk setback requirements, neighbouring building setback requirements, infill lot constraints, etc. These limitations should be described in the energy model report.

Equation 8: Vertical Façade to Floor Area Ratio

$$VFAR = \frac{A_{AGW}}{MFA}$$

Where:

A_{AGW} = modelled area [m^2] of above-ground wall (including windows) defined in section 2.4.1.
MFA = Modelled Floor Area – See Section 1.3 Definitions

2.7.2 Adjustment Factors

To allow compliance for small and/or slim buildings required to meet intensity performance limits, adjustment factors defined in this section may be applied to the results of the energy model.

Adjustment factors shall be calculated according to the equations below. The Small Building Adjustment is capped at a maximum of 30 and a minimum of 0. The VFAR Adjustment is capped at a maximum of 20 and a minimum of 0. The Form Adjustment may be subtracted from the modelled TEDI and TEUI results when demonstrating compliance with absolute performance limits.

Equation 9: Small Building Adjustment

$$Small\ Building\ Adjustment = 15 \times (3 - \#\ storeys) \times \left(\frac{600}{MFA}\right)$$

Equation 10: VFAR Adjustment

$$VFAR\ Adjustment = 40 \times (VFAR - 0.65)$$

Equation 11: Form Adjustment

$$Form\ Adjustment\ = (Small\ Building\ Adjustment + VFAR\ Adjustment) \times (2 - \frac{3000}{HDD})$$

Where:

# storeys = the number storeys with at least 50% of the exterior wall area (according to the A_{AGW} definition) exposed to outdoor air
HDD = Heating Degree Days (18°C base temperature) for the project location as stated in Division B - Appendix C, Table C-2 Climatic Design Data of the applicable building code.

Example 1 – A small, single storey, standalone convenience store building located in Vancouver has 1000 m^2 modelled floor area and 455 m^2 exterior wall area.

Small Building Adjustment = 15 × (3-1) × (600/1000)
= 18.0 kWh/m^2a

VFAR = 455/1000
= 0.455

The building is not eligible for VFAR adjustment (< 0.65).

Form Adjustment = 18.0 × (2 – 3000/2925)
= 17.5 kWh/m^2a

Example 2 – A slim 5-storey residential building on an infill lot in Vancouver has 2500 m^2 modelled floor area, and 1900 m^2 exterior wall area.

The Building is not eligible for the Small Building Adjustment (# storeys > 2).

VFAR = 1900/2500
= 0.76

VFAR Adjustment = 40 × (0.76-0.65)
= 4.4 kWh/m^2a

Form Adjustment = 4.4 × (2 – 3000/2925)
= 4.3 kWh/m^2a

~~2.7 Projects Not Sub-Metering Hot Water for Space Heating~~

~~Research indicates that multi-unit residential projects that do not sub-meter hot water for space heating at the suite level typically use 15% additional heating energy or more when compared to sub-metered suites. To account for this increase in heating energy use, projects where suite hot water for space heating is not sub-metered must add 15% to their modelled residential heating energy end-use. This increase would be reflected in the TEUI only (i.e. TEDI results would remain as a direct output from the model, with no additional 15% added).~~

3 Calculating Envelope Heat Loss

Typical building envelope thermal bridging elements that can have a significant impact on heat loss that have historically been underestimated include: balcony slabs, cladding attachments, window wall slab by-pass and slab connection details, interior insulated assemblies with significant lateral heat flow paths such as interior insulated poured-in-place concrete or interior insulation inside of window wall or curtain wall systems, and others. With the recent addition of industry resources that support more efficient and accurate calculations of building envelope heat loss, assemblies and associated thermal bridging elements must be accurately quantified, according to the requirements below.

3.1 Opaque Assemblies

The overall thermal transmittance of opaque building assemblies shall account for the heat loss of both the clear field performance, as well as the heat loss from interface details. Additional heat losses from interface details are to be incorporated in the modelled assembly U-values, according to the provisions below.

3.1.1. Acceptable Approaches

Overall opaque assembly U-values must be determined using the Enhanced Thermal Performance Spreadsheet (available from BC Hydro New Construction Program), performance data for clear fields and interface details from the Building Envelope Thermal Bridging Guide (BETBG), and the calculation methodology as outlined in 3.4 of the BETBG. A detailed example is provided in Section 5 of the BETBG.

If clear fields or interface details matching the proposed opaque assemblies are not available in the BETBG, overall U-values may be determined using any of the following approaches:

a) Using the performance data for clear field and interface details from other reliable resources such as ASHRAE 90.1-2010, Appendix A, ISO 14683 Thermal bridges in building construction – Linear thermal transmittance – Simplified Methods and default values, with the methodology described in the BETBG;
b) Performance of spandrel panels may be determined using the Reference Procedure for Simulating Spandrel U-Factors, developed for Fenestration BC;
c) Calculations, carried out using the data and procedures described in the ASHRAE Handbook – Fundamentals;
d) Two or three dimensional thermal modelling; or,
e) Laboratory tests performed in accordance with ASTM C 1363, "Thermal Performance of Building materials and Envelope Assemblies by Means of a Hot Box Apparatus," using an average temperature of 24 +/-1°C and a temperature difference of 22 +/-1°C.

3.1.2. Thermal Bridges to be Included

Except where it can be proven to be insignificant (see below), the calculation of the overall thermal transmittance of opaque building envelope assemblies shall include the following thermal bridging effect elements:

a) Closely spaced repetitive structural members, such as studs and joists, and of ancillary members, such as lintels, headers, sills and plates,
b) Major structural penetrations, such as floor slabs, beams, girders, columns, curbs or structural penetrations on roofs and ornamentation or appendages that substantially or completely penetrate the insulation layer,
c) The interface junctions between building envelope assembles such as: roof to wall junctions and glazing to wall or roof junctions,

d) Cladding structural attachments including shelf angles, girts, channels, clips, fasteners and brick ties,
e) The edge of walls or floors that intersect the building enclosure that substantially or completely penetrate the insulation layer.

3.1.3. Thermal Bridges that may be Excluded

The following items need not be taken into account in the calculation of the overall thermal transmittance of opaque building envelope assemblies:

a) Mechanical penetrations such as pipes, ducts, equipment with through-the-wall venting, packaged terminal air conditioners or heat pumps.
b) The impact of remaining small unaccounted for thermal bridges can be ignored if the expected cumulative heat transfer through these thermal bridges is so low that the effect does not change the overall thermal transmittance of the above grade opaque building envelope by more than 10%.

3.2 Fenestration and Doors

The methods listed in this section shall be used to determine the thermal transmittance and solar heat gain coefficient (SHGC) values of fenestration products to used in building energy model. These methods reference the following industry standards:

- ANSI/NFRC 100 Procedure for Determining Fenestration Product U-Values
- ANSI/NFRC 200 – Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
- CSA A440.2/CSA A440.3 Fenestration energy performance/User guide to CSA A440.2
- Wherever the ANSI/NFRC methods are referenced in this section, CSA A440.2/CSA A440.3 methods also apply

Methods A and B are for fenestration products that fall under the scope of ANSI/NFRC 100 and 200, and thus all products have certified thermal transmittance and SHGC values tested or simulated at ANSI/NFRC 100 Table 4-3 standard sizes from accredited laboratories or professionals.

Method C is for fenestration products that may be custom made or imported and do not have ANSI/NFRC 100 and 200 certification, or products that require additional modelling outside the scope of ANSI/NFRC 100 and 200 (e.g. due to thermal impacts of structural elements, etc).

The thermal performance values used in an energy model may be derived using a combination of these methods as suited to the project's fenestration components and configurations.

Method A: Standardized Size Method

This method allows certified thermal transmittance and SHGC values to be used in the building energy model, regardless of actual product sizes or configurations within the project.

Note: This method will not be permitted once industry tools (e.g. tools approved by National Fenestration Rating Council or Fenestration Canada) enabling Method B are released (expected in Fall 2024).

Method B: Standard Size Scaling Method

This method allows for certified thermal transmittance and SHGC values to be scaled or extrapolated to the actual product size used in a project. The scaled values shall be calculated using the methodology in Appendix A of ANSI/NRFC 100 and 200, specifically A.1 "Determination of SHGC and VT at Non-Standard Sizes" and A.2 "Determination of U-Factor at Non-Standard Sizes using Aspect Ratio Calculation". Calculated values may be derived using industry approved tools (e.g. tools approved by the National Fenestration Rating Council or Fenestration Canada) to provide thermal values for energy modelling, and shall be analyzed using the certified Canadian Standards Association (CSA) or National Fenestration Ratings Council (NRFC)'s Certified Products Directory (CPD) number based on the standard size values to validate and compare to the installed products.

Note: Good engineering practice shall apply when considering the impacts of structural components that are not included in the NFRC certification scope (which only includes built-in structural elements). Other structural components (e.g. metal reinforcing, couplers, etc.) may impact the overall thermal performance. Thermal modelling or engineering calculations to determine the thermal performance of fenestration configurations that include elements outside of the NFRC certification scope may be requested at the discretion of the Registered Professional of Record (RPR). Such calculations shall be completed according to current NFRC policies and procedures. In such cases, follow Method C for the areas or fenestration configurations under consideration.

Method C: Custom Fenestration Modelling Method

This method allows modelling of the fenestration products' thermal transmittance and SHGC values using the actual sizes and configuration of fenestration products used in the project. Thermal modelling shall be done by an NFRC certified thermal simulator, and include the installed sizes, configurations and all structural elements related to the fenestration system. A thermal simulation report provided by the certified simulator shall include the following information:

- Physical and legal address of building(s)
- A list of each fenestration product type, quantity, size, and area, along with the corresponding U-value and SHGC
- The sizes and configurations of the simulated products as shown by frame elevations and/or shop drawings
- A table of the area-weighting calculations performed to determine the overall average U-values (reported to two decimal places)
- A description of each framing system used, including manufacturer name, series, and model numbers, as well as frame material and any internal reinforcing used
- A complete description of the glazing (e.g. glass type, low-E coatings, air gap size and gas)
- Isotherms for each unique framing member as well as all reinforcing metal in mullions and perimeter frames
- If applicable, the NFRC or CSA A440.2 certified test data for any certified product that was included in the calculation, as a mix of both certified and uncertified product is acceptable.

~~The overall thermal transmittance of fenestration and doors shall be determined in accordance with NFRC 100, "Determining Fenestration Product U-factors", with the following limitations:~~

~~a) The thermal transmittance for fenestration shall be based on the actual area of the windows and not the standard NFRC 100 size for the applicable product type. It is acceptable to area-weight the modelled fenestration U-value based on the relative proportions of fixed and operable windows and window sizes. It is also acceptable to simplify the calculations by assuming the worst case by using the highest window U-value for all fenestration specified on the project.~~

b) ~~If the fenestration or door product is not covered by NFRC 100, the overall thermal transmittance shall be based on calculations carried out using the procedures described in the ASHRAE Handbook – Fundamentals, or Laboratory tests performed in accordance with ASTM C 1363, "Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus," using an indoor air temperature of 21 +/ 1°C and an outdoor air temperature of -18 +/- 1°C measured at the mid-height of the fenestration or door.~~

4 Overheating in ~~Passively Cooled~~ Buildings

Overheating is already a concern for ~~non-mechanically cooled~~ many buildings, due to large amounts of glass, minimal exterior shading, ~~and~~ few natural ventilation strategies, urban heat island effect, and warmer future climate. Improving the building envelope to meet the applicable performance requirements may lead to increasing overheating if they are not addressed through design strategies that limit heat gain and promote passive cooling. The following requirements are intended to mitigate this effect, as well as ensure any benefit a project might seek from passive solar gains is balanced with considerations of summertime overheating. As noted in Section 1.1, the actual thermal performance of the building will depend on many factors, and these requirements are not intended as a guarantee of thermal comfort.

4.1 Overheating Analysis for Passively and Partially Cooled Buildings

For buildings that do not incorporate full mechanical cooling, it must be demonstrated that interior dry bulb or operative temperatures of occupied spaces do not exceed the 80% acceptability limits for naturally conditioned spaces, as outlined in ASHRAE Standard 55-2020 ~~2010~~ Thermal Environmental Conditions for Human Occupancy Section ~~5.3~~ 5.4, for more than the number of hours indicated in VBBL Subsection 6.6.2.1. ~~200 hours~~ per year for any zone. ~~(~~For projects located in Vancouver, refer to Table 4 below for acceptability limits~~)~~.

For buildings or spaces with vulnerable groups (for example, seniors housing, shelter and supportive housing, daycares, schools, healthcare facilities, etc.) refer to VBBL Subsection 6.6.2.1. on the limit of hours exceeding the 80% acceptability limit.~~ is recommended that projects work with owners and user groups to determine if mechanical cooling may be required to achieve their thermal comfort needs. Where pursuing passive cooling, it is recommended that projects target a more stringent threshold of not exceeding the 80% acceptability limits for more than 20 hours per year.~~

For buildings located outside of Vancouver, refer to the applicable requirements or policies of the AHJ for the limit of hours exceeding the 80% acceptability limits, if any.

Note that this analysis of hours exceeding the 80% acceptability limits has been adapted from ASHRAE 55's Adaptive Model and deviates from it by applying to buildings with partial mechanical cooling, such as systems designed with supply of cooled ventilation air, residential suites with cooling provided to only one room, or where cooling systems are not designed to maintain space temperatures according to NECB space types. For residential suites with cooling is provided only to a select room or rooms within the suite, it is acceptable to model the suite as one zone with the installed cooling capacity serving the entire zone.

4.2 Overheating Analysis for Actively Cooled Buildings

Buildings that incorporate mechanical cooling may overly rely on mechanical cooling for thermal comfort with little consideration for passive cooling strategies. These buildings may not be resilient to warmer weather and can pose a risk to occupants in the event of equipment failure or power outages, especially as future climate projections indicate higher numbers of summer days >25°C and increased extreme temperatures in the Vancouver region.

To quantify the building's resiliency to future warming and to encourage passive cooling design, buildings provided with active cooling are to be evaluated for the number of hours exceeding the 80% acceptability limits for naturally conditioned spaces, as outlined in ASHRAE 55 Section 5.4. Model the building using the methodology outlined in Section 4.3, with mechanical cooling systems (e.g. cooling coils, chilled beams, radiant cooling systems, and any other terminal system using chilled water or refrigerant

to remove heat from the space) disabled. The overheating hours evaluated using this methodology are referred to as "Passive Overheating Hours"; the number of passive overheating hours in the critical spaces in a building are to be reported with energy modelling results. For requirements or limits on Passive Overheating Hours and which spaces they apply to, refer to the AHJ and applicable codes and policies.

4.3. Methodology and Assumptions for Overheating Analysis

Measures such as solar shading, minimizing internal gains, dynamic glass, effective methods of natural ventilation, etc. shall be validated through engineering calculations (i.e. computer modelling or similar). Calculations must be based on hourly weather data using the GW2.0 (global warming +2.0°C scenario) version of the NRC TMY weather file required in Section 1.5, or a warmer alternate weather file accepted by the AHJ. The GW2.0 weather files are available from City of Vancouver or the NRC websites; see also Section 1.5.

Table 2: Monthly Acceptability Limits for Vancouver based on NRC TMY GW 2.0 weather file

Month	80% Acceptability Limit for Vancouver based on NRC TMY GW 2.0 weather file
April	N/A (Mean temperature too low)
May	25.5 ~~25.2~~ °C
June	26.5 ~~26.1~~ °C
July	27.5 ~~26.9~~ °C
August	28.4 ~~26.9~~ °C
September	26.5 ~~25.2~~ °C
October	25.2 °C ~~N/A (Mean temperature too low)~~
November	N/A (Mean temperature too low)

~~Notes:~~
~~[1] Acceptability limits for other locations must be derived from the weather file for that location.~~

Note: Compliance with the limits must be demonstrated to the satisfaction of the AHJ. This could be achieved by submitting a summary of the modelled temperatures in each zone, or by summarizing the results in select zones, chosen to create a representative picture of the building, and including any areas of high concern (for example, west-facing suites on upper floors).

The temperature limits in Table 4 apply only to projects located in the City of Vancouver. Limits for other locations' weather files may be derived from the weather files for that location as per the AHJ, and be determined using the following equation from ASHRAE 55 Section 5.4.2.2:

Equation 12: ASHRAE 55 Upper 80% Acceptability Limit

$$Upper\ 80\%\ acceptability\ limit\ (°C) = 0.31\overline{t_{pma(out)}} + 21.3$$

Where:

$t_{pma(out)}$ is the average air temperature for the month

4.3.1 Operable Window Effective Opening Area

When modelling natural ventilation for passive cooling, the effective operable window area must be calculated based on the dimensions of the opening, insect screens, opening operation type, and any limitations to degree of opening, such as window limiters. For example, effective operable area of a top hung window is calculated as the hatched areas in Figure 1. Effective operable area can not exceed 100% of the operable window area. Insect screens are to be accounted for in the effective operable area. Unless otherwise known, insect screens are assumed to be present for all operable windows and have a free-area of 70%, reducing the effective operable area by 30%.

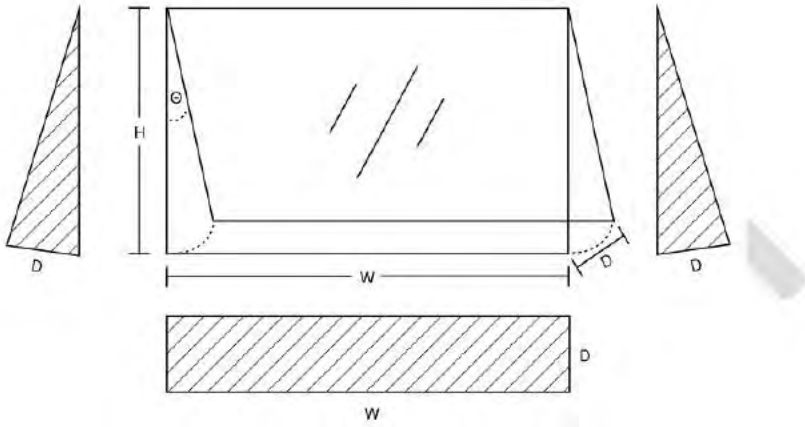

Figure 1: Operable Window Effective Opening Area

4.3.2 Standard Occupant Behaviour Assumptions

Where manual cooling measures such as exterior shading and operable windows are to be modelled for overheating analysis, the following standardized occupant behaviour shall be used. Temperatures noted below should be operative temperatures, unless operative temperatures are not available in the modelling software, in which case dry bulb temperatures are acceptable.

1. Operable windows are opened when indoor air temperature is >24°C.
2. Operable windows are closed when outdoor air temperature > indoor air temperature.
3. Patio doors are not used for passive cooling.
4. Interior blinds/shades are not to be modelled.
5. Operable exterior shades are deployed when indoor air temperature is >24°C.
6. Operation of bathroom exhausts, and boost modes for ventilation systems for the purpose of reducing space temperature is only permitted when there is a documented plan to educate occupants on how to use these features for this purpose. The use of range hoods for passive cooling is not permitted.

The above standard behavioural assumptions are provided as a baseline for consistency in overheating analysis. The project team should consider other factors that may affect occupant behaviour and yield a more conservative result, such as exposure to a busy street that may reduce the likelihood that an occupant may open windows due to noise and air quality concerns.

5 Mixed Use and Other Building Types

5.1 Mixed-Use Buildings

Buildings consisting of different occupancies with different absolute TEUI, TEDI, and GHGI targets shall create whole-building targets by area-weighting the TEUI, TEDI, and GHGI requirements accordingly.

For buildings consisting of different occupancies that have different fundamental requirements (i.e. part of the building has absolute TEUI, TEDI, and GHGI target and part of the building has a reference building target with or without TEUI and/or GHGI reduction requirements), the following methodology shall be used to determine the overall building requirements:

a) Develop a reference building only for the portion(s) of the building that do not have an absolute performance target. Note that the reference building may be based on either ASHRAE 90.1 or NECB as permitted by the applicable policy or code requirements.
   If the reference building envelope performance values already account the effects of building envelope thermal bridging (e.g. NECB 2017 or 2020), the reference envelope values may not be derated further. If the reference building envelope performance values do not include the effects of building envelope thermal bridging (e.g. NECB 2011 or 2015), the reference building may also use a de-rated R-value according to the methodology outlined in the white paper "Accounting for thermal bridging at interface details – a methodology for de-rating prescriptive opaque envelope requirements in energy codes", available from the BC Hydro New Construction Program.
b) Extract the TEUI, TEDI, and GHGI for that reference building.
c) If required (such as projects subject to Vancouver's 2017 Green Buildings Policy for Rezonings), reduce the TEUI according to the percentage savings required.
d) The total building TEUI, TEDI, and GHGI requirement shall be based on an area-weighted average between the resulting targets for the reference building, and the requirements for the rest of the building.
e) In addition to the total building targets, the portions of the building that have a TEDI target must still meet their combined TEDI target. Similarly, the portions of the building that have an absolute GHGI target must still meet their combined GHGI target.

5.2 Other Building Types

For other building types that do not have absolute performance limits and instead have a reference building target, follow the modelling requirements and methodologies laid out in ASHRAE 90.1, or NECB Part 8. The proposed building must account for overall thermal performance as described in Section 3 of these guidelines, and as a result the reference building may use a de-rated R-value according to the methodology outlined in the white paper "Accounting for thermal bridging at interface details – a methodology for de-rating prescriptive opaque envelope requirements in energy codes" available from the BC Hydro New Construction Program. Where the reference building envelope performance values already include the effects of the Building Envelope Thermal Bridging Guide (e.g. NECB 2017, 2020), no de-rating is applied.

5.3 GHGI Targets Compared to a Fossil Fuel Baseline

This section only applies to projects with Groups A, B, or F major occupancies which are subject to VBBL compliance requirements with either an ASHRAE 90.1 or NECB Part 8 reference model. Where the "reference building modelled using only fossil-fuel systems" (the "GHGI Reference") described in VBBL Table 10.2.2.5.A1 differs from the ASHRAE 90.1 or NECB reference model (used to determine TEUI and TEDI requirements) the approach described in this section may be used as an alternative to an hourly simulation of the "GHGI reference" model to determine the GHGI requirement.

The GHGI described in VBBL Table 10.2.2.5.A1 for "all other occupancies", prior to the % reduction requirement, may be calculated from the ASHRAE 90.1 or NECB reference building results with the natural gas emissions factor used for all space heating, ventilation heating, and domestic hot water end uses as a simplified alternative to requiring additional energy modelling. A full energy GHGI reference model may still be used if desired.

Example – A warehouse building subject to VBBL table 10.2.2.5.A1 with 2000 m^2 modelled floor area uses a rooftop heat pump system to provide space heating and gas-fired boiler to provide domestic hot water heating. The building's NECB Part 8 reference design therefore uses a packaged unitary rooftop heat pump conditioning system.
The reference model space heating use is 65,000 kWh electricity, DHW is 11,000 kWh natural gas and other end uses in the building account for 120,000 kWh electricity total.

As an alternative to modelling the same reference building, but requiring a change in system configuration and efficiencies to the equivalent NECB gas-fired rooftop system for the purposes of VBBL table 10.2.2.5.A1, the same NECB reference building results are used with the space heating emissions factors changed to calculate the project's GHGI requirement.

Under this methodology the project GHGI requirement per table 10.2.2.5.A1, including the 50% reduction, is the following:

GHGI = 0.50 × ((65000 + 11000) × 0.180 + 120000 × 0.011) / 2000
= 3.7 kg CO2e/ m^2a

5.4 Infiltration for other building types

Infiltration rates for NECB or ASHRAE 90.1 reference buildings shall be calculated using the methodology of that code/standard to convert from tested whole building leakage rate to model infiltration rate.

Portions of proposed models comparing to NECB or ASHRAE 90.1 reference models shall use the same infiltration calculation methodology as the reference. An example is shown below, where the NECB conversion rate is the using the default exponent.

Table 3. Infiltration Example for a Building with Mixed Requirements

Building Area	Basis of Requirements	Whole Building Tested or Targeted Air Leakage (L/s·m² of total enclosure at 75 Pa)	Total Enclosure Area (m²)	Façade Area (m²)	Conversion Factor from Tested to Operating	Conversion Reference	Modelled Infiltration (L/s·m² façade)
Office	VBBL TEDI/TEUI	1.50	5000	3000	0.112	CoV EMG	0.28
School	NECB 2020		5000	3000	0.197	NECB 2020	0.49

6 Additional Resources

a) 2014 Building America House Simulation Protocols, NREL, 2014
b) Accounting for thermal bridging at interface details – a methodology for de-rating prescriptive opaque envelope requirements in energy codes, BC Hydro, 2015
c) ASHRAE Handbook of Fundamentals, ASHRAE, 2013
d) ASHRAE Standard 90.1-2019 ~~2010~~ – Energy Standard for Buildings Except Low-Rise Residential Buildings
e) ASHRAE Standard 55-2020 Thermal Environmental Conditions for Human Occupancy
f) Commercial Buildings Building Envelope Thermal Bridging Guide, Version 1.1, BC Hydro, 2016
g) Energy Modelling Guidelines and Procedures, CONMET, 2014
h) EnergyStar Multifamily High Rise Program, Simulation Guidelines, Version 1.0, Revision 03, January 2015
i) Infiltration Modelling Guidelines for Commercial Building Energy Analysis, PNNL, 2009
j) National Energy Code of Canada for Buildings (NECB), NRC, 2020 ~~2011~~
k) New Construction Program's Energy Modelling Guideline, BC Hydro, March 2016
l) TM54 – Evaluating Operational Energy Performance of Buildings at the Design Stage, CIBSE, 2014
m) Guide to Low Thermal Energy Demand in Large Buildings, BC Housing, March 2018
n) Reference Procedure for Simulating Spandrel U-Values, Fenestration BC, September 2017
o) Illustrated Guide to Achieving Airtight Buildings, BC Housing, September 2017
p) Passive Cooling Study for Multi-Unit Residential Buildings, City of Vancouver, April 2017
q) Joint Professional Practice Guidelines – Whole Building Energy Modelling Services, version 1.0, Architectural Institute of British Columbia and Engineers & Geoscientists British Columbia, 2018
r) The Climate Registry - 2023 Default Emissions Factors, June 2023
s) City of Vancouver Guidelines – Airtightness Testing – Process and Requirements for New Buildings, City of Vancouver, September 2023
t) "Building Enclosure Airtightness Testing in Washington State – Lessons Learned about Air Barrier Systems and Large Building Testing Procedures", RDH Building Science, 2014
u) Guide to Low Thermal Energy Demand in Large Buildings, BC Housing, 2018, https://www.bchousing.org/publications/Low-Thermal-Energy-Demand-Large-Buildings.pdf

Public Review

Vancouver Building By-law (VBBL)

Proposed change to 10.2.1.5. Compliance Pathways

Topic: 10.2.1.5. Residential Buildings Compliance Pathways Clarity

Code change number: 24-0015

Code reference: 10.2.1.5. Residential Buildings of 1 to 3 Storeys and Houses (excluding Hotels/Motels)

Description of the proposed change

This update proposes clarity and cleanup items to buildings subject to Article 10.2.1.5., specifically;

- by simplifying or removing outdated or ineffective language
- by separating the 2 compliance pathways (prescriptive and performance) and
- by simplifying the language that differentiates the two paths

Justification

1) **Cleanup and Housekeeping** – based on feedback and changes in building practices, a number of edits are proposed to improve the readability and simplicity of code items.

2) **Article 10.2.1.5. clarity**: when multiple compliance pathways were added, they used the presence of fireplaces as the differentiating language to determine what pathway was followed. This complexity has been removed.

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

Underlined Black Text – Proposed modification to Vancouver Building By-law content

10.2.1.5. Residential Buildings of 1 to 3 Storeys, and Houses (excluding Hotels/Motels)

1) A *building* shall comply with the requirements of either Sentence (2) or Sentence (3), where it
   a) is entirely of Group C *major occupancy* except subsidiary *occupancies*,

i. Less than 4 storeys in *building height and* less than 600m^2 in *building area*, or
ii. containing not more than 2 principle *dwelling units* and their subsidiary structures with conditioned space, and

b) does not include a Hotel or Motel use.

(See Note A-10.2.1.5.(1)(a)(ii))

2) A *building* conforming with the criteria of Sentence (1) shall comply with the following "Performance Path" requirements:

a) shall be designed in compliance with ~~i)~~ the energy and carbon emissions performance of Article 10.2.2.4., ~~and Sentences 10.2.2.15.(1) through (4) where domestic gas-fired fireplaces are provided, or~~

~~ii) Article 10.2.2.15. where domestic gas-fired fireplaces are provided.~~

b) shall be designed with building envelope opaque elements with thermal performance in compliance with Article 10.2.2.6.,

c) shall be designed with exterior closures and fenestration with thermal performance in compliance with 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) shall comply with Article 10.2.2.19. where ancillary equipment and gas piping is provided,

~~k) [UTV Deleted],~~ (renumbering to be confirmed at end of process)

~~l) shall provide documentation in compliance with Article 10.2.2.20.,~~

m) shall provide airtightness testing in compliance with Article 10.2.2.21., and

n) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.22..

3) Except as permitted in Sentence (2), a *building* conforming with the criteria of Sentence (1) shall comply with the following "Prescriptive Path" requirements:

a) shall be designed in compliance with the carbon emissions performance of Sentence 10.2.2.4.(4). and 10.2.2.4.(5).

b) shall be designed with building envelope opaque elements with thermal performance in compliance with Article 10.2.2.6.,

c) shall be designed with exterior closures and fenestration with thermal performance in compliance with 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) shall provide airtightness testing in compliance with Article 10.2.2.21., and

m) except for *residential buildings* with not more than 2 principal *dwelling units*, may provide exterior heated spaces in compliance with Article 10.2.2.22.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Create Article 10.2.2.4.

Topic: - Align new article 10.2.2.4. with the Zero Carbon Step Code (BCBC 9.37) and BC Step Code (BC 9.36.6)

Code change number: 24-0016

Code reference: 10.2.2.4. Energy and Emissions Performance (for Buildings subject to Article 10.2.1.5.)

Description of the proposed change

- Create an entirely new Article (10.2.2.4.) to host energy and emissions requirements specific to 10.2.1.5. buildings (low-rise residential buildings)
- This replaces the performance (EnerGuide modelling reference and emissions requirements) in Article 10.2.2.5.
- References the new "City of Vancouver 1-3 storey Residential Energy Modelling Guidelines" which went through significant industry consultation in Summer 2023, to supplement Energuide modelling.
- Align this new article with the Zero Carbon Step Code (BCBC 9.37) and BC Step Code (BC 9.36.6)
- Large Home GHG requirement has moved to 10.2.2.4. The Notes for Large Home GHG have moved accordingly from A-10.2.2.20 to A-10.2.2.4

Justification

This code language proposal seeks to maximize the benefits of alignment with the top tier (EL-4) of the Zero Carbon Step Code, while maintaining some unique to Vancouver (UTV) elements that have been successful historically.

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

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10.2.2.4. Energy and Emissions Performance (for Buildings subject to Article 10.2.1.5.)

1) For a *building* required to comply with this Article, 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,

b) version 9 or newer of the Passive House Planning Package, prepared by a Certified Passive House Designer, or Certified Passive House Consultant. (See Note A-10.2.2.5.(4).), or

c) the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines

2) 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 (3), a thermal energy demand intensity (TEDI) ≤ 20 kWh/(m²•year)

Table 10.2.2.4.A.

Mechanical Energy Use Intensity in Part 9 Residential Buildings and Houses

Forming part of Sentence 10.2.2.4.(2)(a)

Amount of the Building's Conditioned Space Served by Space-Cooling Equipment	Floor Area of Conditioned Space (m^2)					
	≤ 50	51 to 75	76 to 120	121 to 165	166 to 210	> 210
	Mechanical Energy Use Intensity (MEUI) (kWh/m^2-a)					
Not more than 50%	90	80	60	48	40	40
More than 50%	125	108	78	58	48	45

3) The thermal energy demand intensity requirements may be calculated using the 'Adjusted TEDI' formula (see Note A-10.2.2.4.(3)):

$TEDI_{adjusted} = TEDI_{20} + (TEDI_{higher} - TEDI_{step})(HDD_{actual} - HDD_{lowest})/500$

4) A *building* required to comply with this Article shall be designed and constructed to one of the following carbon emissions compliance options in Table 10.2.2.4.B:

Table 10.2.2.4.B
Greenhouse Gas Emissions Compliance Pathways
Forming part of Sentence 10.2.2.4.(1)

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 for this option is demonstrated by meeting both the GHGI and the GHG emission requirements for each house.

5) A *building* required to comply with this Article that contains more than 325 m^2 of *conditioned space*, and does not consist of more than *one principal dwelling unit*, shall provide a calculation to demonstrate that the proposed home has a maximum greenhouse gas (GHG) limit of 2,000 $kgCO_{2e}$/ year (see Note A-10.2.2.4.(5))

10.2.2.5. Building Energy and Emissions Performance

1) Except as permitted by Sentence (4), for a *building* required to comply with this Article, any energy modelling shall comply with:

a) the applicable requirements of Part 8 of the NECB, and the City of Vancouver Energy Modelling Guidelines.

2) Except as permitted in Sentences (3), (4) 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.A1.

3) [Deleted]

4) *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.(4).)

5) Compliance with the TEUI and TEDI limits in Table 10.2.2.5.A1 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.A1
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(2)

Occupancy Classification (1)	Total Energy Use Intensity (kWh/m^2a)	Thermal Energy Demand Intensity (kWh/m^2a)	Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)
~~Group C occupancies complying with 10.2.1.5.(2)(a)(i)~~	~~See Table 10.2.2.5.A2~~	~~20~~	~~3~~
Group C *occupancies* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	1.8
Group C *occupancies* in *buildings* over 6 *Storeys*, except Hotel and Motel	120	30	1.8
Hotel and Motel *occupancies*	140	20	2.0
Group D and E *occupancies*, except Office	120	20	2.0
Office *occupancies*	100	20	1.5
All other *occupancies*	(1)		85% lower than GHGI of the reference building modelled using only fossil-fuel systems

Notes to Table 10.2.2.5.A1:

(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.A2~~
~~Mechanical Energy Use Intensity in Buildings under 4 storeys for Group C Major Occupancies except Hotel and Motel~~

~~Conditioned Floor Area~~	~~Mechanical Energy Use Intensity (MEUI) (kWh/m^2a)~~
~~≤ 50 m^2~~	~~125~~
~~≤ 75 m^2~~	~~108~~
~~≤ 120 m^2~~	~~78~~

~~≤ 165 m²~~	~~58~~
~~≤ 210 m²~~	~~48~~
~~> 210 m²~~	~~45~~

~~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/m²a)~~	~~Thermal Energy Demand Intensity (kWh/m²a)~~	~~Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)~~
~~Group C *occupancies*~~	~~100~~	~~15~~	~~N/A~~

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/m²a)	Thermal Energy Demand Intensity (kWh/m²a)	Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)
Group C *occupancies* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	1.8
Group C *occupancies* in *buildings* over 6 *Storeys,* except Hotel and Motel	130	40	1.8
Hotel and Motel *occupancies*	170	30	2.0
Business and Personal Services or Mercantile *occupancies*, except Office	170	30	2.0
Office *occupancies*	130	30	1.5

DIVISION B – SECTION 1.3 Referenced Documents and Organizations

CoV	v1.0	City of Vancouver Embodied Carbon Guidelines	10.4.1.2.(1)
CoV	2017	City of Vancouver Energy Modelling Guidelines	10.2.2.5.

CoV	2023	City of Vancouver Energy Modelling Guidelines for 1 to 3 Storey Residential Buildings	10.2.2.4.

APPENDIX

A-10.2.2.4.(3) Adjusted Thermal Energy Demand Intensity (TEDI)

Refer to the latest BC Energy Step Code documentation and guidence for calculating the Adjusted TEDI

A-~~10.2.2.20~~ 10.2.2.4.(5) 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."

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Various Articles with 10.2.2.6. to 10.2.2.20.

Topic: The proposed set of changes include housekeeping and cleanup items, as well as new or removed requirements to 8 existing prescriptive Articles that, with the exception of Article 10.2.2.15, pertain only to buildings subject to Article 10.2.1.5.

Code change number: 24-0017

Code reference:

10.2.2.6. Building Envelope Opaque Elements

10.2.2.7. Building Envelope Windows, Skylights, Doors and Other Glazed Products

10.2.2.12. Domestic Hot Water Heaters

10.2.2.13. Domestic Boilers

10.2.2.14. Domestic Heat Pumps, Furnaces or Make Up Air Units

10.2.2.15. Domestic Gas-Fired Fireplaces

10.2.2.17. Domestic Heat Recovery Ventilators

10.2.2.20. Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation

New Section 10.2.2.19. Ancillary Equipment

Description of the proposed change

The proposed set of changes include housekeeping and cleanup items, as well as new or removed requirements to 8 existing prescriptive Articles that, with the exception of Article 10.2.2.15, pertain only to buildings subject to Article 10.2.1.5.

These proposed changes include:

- Clarity for performance path minimums and prescriptive path requirements,
- Simplifying or removing outdated or ineffective language,
- A relaxation for RSI insulation values for roof decks (10.2.2.6)
- A requirement for high albedo roof materials (10.2.2.6)
- Removal of the natural gas option for heating and hot water systems (10.2.2.12, 10.2.2.13 and 10.2.2.14)

- A prescriptive limit for number of gas fireplaces in a building (10.2.2.15)
- And entirely new requirements (10.2.2.19) are being proposed, including:
  - Prescriptive requirements for indoor and outdoor pools, and snowmelt systems to be electric
  - Add requirements that no gas piping 'rough-ins' for the purpose of facilitating additional gas appliances and gas loads or ease the replacement of electric appliances with gas appliances post-occupancy
- Relocated administrative documentation requirements (10.2.2.20)
- Appendix notes have been added or updated with more detailed maintenance accessibility requirements

Justification

1) **Removal of the natural gas option for heating and hot water systems** – is being proposed for clarity of expectations for mechanical contractors and designers. Currently the GHG limits under the performance path may allow gas space and hot water heating with specific modelling tweaks. Given the City's desire (via alignment with the highest tier of the Zero Carbon Step Code (ZCSC)) for clear outcomes to achieve climate targets, and the readily available technology for electric space and hot water heating, this is recommended.
2) **A relaxation for RSI insulation values for roof decks** – under the prescriptive path it references R40 flat and vaulted roof insulation. The feedback received from industry was this was prohibitively restrictive especially for decks. It was agreed that decks could be relaxed to R24 (RSI 4.3) effective for greatly improved buildability with minimal loss to building performance
3) **A prescriptive limit for number of gas fireplaces in a building** – the existing requirements for fireplaces includes a 60,000 BTU total limit for fireplaces under the prescriptive path. This was noted as challenging to enforce and unclear for industry. It is proposed to expand this to a prescriptive limit of 2 gas fireplaces per building.
4) **Move administrative requirements** – there are a number of administrative items in Part 10, which in the effort to align with the BCBC, this approach begins to move requirements for checklists and inspections (for example) to Div C, namely Article 10.2.2.20

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

Underlined Black Text – Proposed modification to Vancouver Building By-law content

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 be 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 Sentences 10.2.2.6.(1)

Building Assembly	Assembly Minimum Thermal Resistance (RSI - m^2K/W)	
	~~Complying with Article 10.2.2.5.~~ Performance Path (per Sentence 10.2.1.5.(2))	~~Not subject to Article 10.2.2.5.~~ Prescriptive Path (per Sentence 10.2.1.5.(3))
Roof assemblies	4.30	7.00
Decks(1)		
Area > $10m^2$	4.30	7.00
Area < $10m^2$	4.30	
~~All buildings~~		
Attic Space(3)	8.50	
Walls (including frame crawl space walls)(4)	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)	4.20	
Suspended Floors (concrete slab)	4.20	
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.50	
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below)(5)	2.50	

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 "Houses" shall represent *buildings* containing not more than 2 principle *dwelling units*.~~

(1) The term "Decks" shall represent flat roof assemblies, intended for pedestrian access, installed over livinig spaces.

~~(2) The conditioned area of 110 m^2 pertains to the entire building and not only the suite.~~

~~(3) The thermal resistance rating of attic space insulation may be reduced to value required for frame walls for a distance of 1200 mm from the exterior wall. A minimum nominal RSI of 3.52 m^{2}K/W is required above the top plate in the attic space.~~ 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

(4) 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.

(5) 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.

3) 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.)

4) 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 (SRI) of 78, when tested in accordance with ASTM E908, and a minimum emissivity of 0.9 (in the 8-13 micron band), when tested in accordance with ASTM E408. (See Note A-10.2.2.6.(4).)

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 (W/(m^{2}K))	
	~~Complying with Article 10.2.2.5.~~ Performance Path (per Sentence 10.2.1.5.(2))	~~Not subject to Article 10.2.2.5.~~ Prescriptive Path (per Sentence 10.2.1.5.(3))
Windows, sliding, and folding doors with glazing		
Window-to-wall ratio ≥ 30%, and One Family Dwelling with conditioned space ≥ 325 m^2	1.44	Average of 1.04 or lower and no individual window can be above U1.22(2)
All Other	1.44	1.22
Curtainwall and Window Wall Assemblies		

Window-to-wall ratio ≥ 30%, and One Family Dwelling with conditioned space ≥ 325 m^2	1.44	Average of 1.04 or lower and no individual window can be above U1.22[(2)]
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).)

10.2.2.12. Domestic Hot Water Heaters

1) In a *building* required to comply with this Article, water heating appliances shall

a) be powered only by electricity, ~~electrically operated except as permitted by Sentence (2),~~

b) comply with the following standards:

~~a~~i) CSA C191, “Performance of electric storage tank water heaters for domestic hot water service”, or

~~b~~ii) CAN/CSA-C745 “Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters, or

~~c~~iii) CAN/CSA-P.9 Combined space- and water-heating systems

~~2) *Buildings* that are complying with Article 10.2.2.5 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),~~ iIn a *building* required to comply with this Article, domestic boilers providing heat, or heat and domestic hot water, shall be powered only by electricity ~~electric~~ and be tested using CAN/CSA-C22.2 No 165, "Testing Method for Electric Boilers"~~,~~,

~~2) *Buildings* that are complying with Article 10.2.2.5 may provide gas-fired appliances have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, and 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 ~~electrically-operated~~ and ~~have been~~ 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

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	SEER = 14 EER = 11

		(Including General Instruction No 2)	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 that comply with Article 10.2.2.5 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".~~

5) *Heat pumps* used to provide space heating shall be of the variable or multi stage compressor type.

6) *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.

7) 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.

8) Heat pumps, furnaces and makeup air units shall be readily accessible for maintenance, 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 shall be equipped with~~

a) shall be equipped with

i) intermittent pilot ignition (IPI) systems,

~~b~~ii) on-demand ignition systems that automatically shut off within ~~i)~~ 7 days of appliance non-use in a single detached house or duplex *building*, or ~~ii)~~ 6 hours of appliance non-use in a multifamily dwelling, or

~~c~~iii) match ignition,

b) shall be direct vented (Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted), and

c) shall be on a timer.

2) The number of domestic gas-fired fireplaces must not exceed a total of two per *building*, with a combined total rated output not exceeding 17.59 kW (60,000 Btu per hour)

~~2) In a *building* required to comply with this Article, domestic gas-fired fireplaces shall be direct vented (Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted).~~

~~3) In a *building* required to comply with this Article, domestic gas-fired fireplaces must be on a timer.~~

4) Deleted: ~~Where exterior gas fireplaces are provided as an 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.~~

~~5) In a *building* required to comply with this Article, there shall be no more than two gas fireplaces where the combined total rated input of all gas fireplaces installed shall not exceed 17.59 kW (60,000 Btu per hour).~~

3) In a building required to comply with this Article, gas-fired fireplaces are not permitted as the primary heating *appliance*.

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, components of mechanical ventilation systems not specifically described in this Subsection shall be designed, constructed and installed in accordance with good engineering practice and as described in the ASHRAE Handbooks and Standards, HRAI Digest, TECA Ventilation Guideline, Hydronics Institute Manuals or the SMACNA manuals.~~

3) In a *building* required to comply with this Article, a heat recovery ventilator (HRV) 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 Ventilator Performance Requirements

~~Building's Conditioned Space (m^2)~~ Compliance Path	Sensible Heat Recovery Efficiency (SRE) at 0^o Celsius[1]
~~≤110 m2~~ Performance Path (complying with Sentence 10.2.1.5.(2))	65%
~~>110 m2~~ Prescriptive Path (complying with Sentence 10.2.1.5.(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 designed and tested to meet the CSA International Standard CAN/CSA-F326-M91, "Residential Mechanical Ventilation Systems",~~

c) 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,

~~d) supply outdoor air directly to the principal living area, to each bedroom, and to any *floor area* without a bedroom, including similar rooms within *secondary suites* and *lock-off units*, directly or indirectly, through a central recirculation system with a continuously operating fan,~~

~~e) be designed to run continuously to comply with the minimum ventilation rates of Table 9.32.3.5 of Division B,~~

f) not be connected to kitchen and bathroom exhaust fans,

~~g) except for mechanical ducts cast into concrete structure, have exterior connected supply-air ducts and exhaust ducts insulated to not less than RSI 0.75 (R 4.25) and shall have an effective vapour barrier,~~

h) have balanced HRV supply and exhaust air flows within plus or minus 20% of the actual normal operating exhaust capacity, and

i) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM. ~~and~~

~~j) be located in an accessible locaation within the *dwelling unit*, that can be readily accessed for maintenance, and~~

~~i) designed and installed to operate with an acceptable level of weather and freeze protection,~~

~~ii) in a duplex or single detached house and their contained *ancillary residential units*, be within a *conditioned space* and provided with direct access from at least one of the *dwelling units* that it serves, and~~

~~iii) have a minimum headroom clearance of 2 m with sufficient room to replace or maintain the heat recovery ventilator.~~

4) In a *building* required to comply with this Article, the HRV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the Chief Building Official.

~~5) In a *building* required to comply with this Article, a contractor trained in the installation of energy recovery ventilators (ERV) may install an ERV in lieu of a heat recovery ventilator (HRV).~~

5) An HRV shall be located in a readily accessible location within the *dwelling unit*, and
   a) 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,
   b) designed and installed to operate with an acceptable level of weather and freeze protection,
   c) in a duplex or single detached house and their contained *ancillary residential units*, be within a *conditioned space* and provided with direct access from at least one of the *dwelling units* that it serves, and
   d) have a minimum headroom clearance of 2 m with sufficient room to perform routine maintenance.

   (see Note A-10.2.2.17)

10.2.2.19 Ancillary Equipment and Gas Piping

1) In a *building* required to comply with this Article,
   a) snow melt systems
      i) shall be powered only by electricity, and
      ii) shall be on a timer
   b) interior and exterior recreational pools and hot tubs
      i) shall be powered only by electricity, and
      ii) shall be provided with a cover

2) A *building* required to comply with this Article shall not be provided with gas piping that is not connected to an appliance.

10.2.2.20. [Items Relocated] ~~Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation~~

~~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 to the Chief Building Official acceptable documentation, in the form of~~

~~a) a PHPP file from a Certified Passive House Consultant or Designer,~~

~~b) an EnerGuide Rating System Audit,~~

~~c) equivalent energy modelling documentation, acceptable to the Chief Building Official.~~

~~2) In a building required to comply with this article, at the time of mid-construction inspection, the owner shall provide to the Chief Building Official acceptable documentation, in the form of~~

~~a) a mid-construction checklist, and~~

~~b) a blower door test result that achieves an acceptable level of performance~~

~~3) In a building required to comply with this Article, that contains more than 325 m2 of conditioned space, and does not contain more than one principal dwelling unit, the owner shall provide a calculation utilizing the EnerGuide rating system to demonstrate that the proposed home has a greenhouse gas (GHG) footprint that is no more than two (2) metric tonnes annually (see Note A-10.2.2.20.(3)).~~

Notes to Part 10

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.

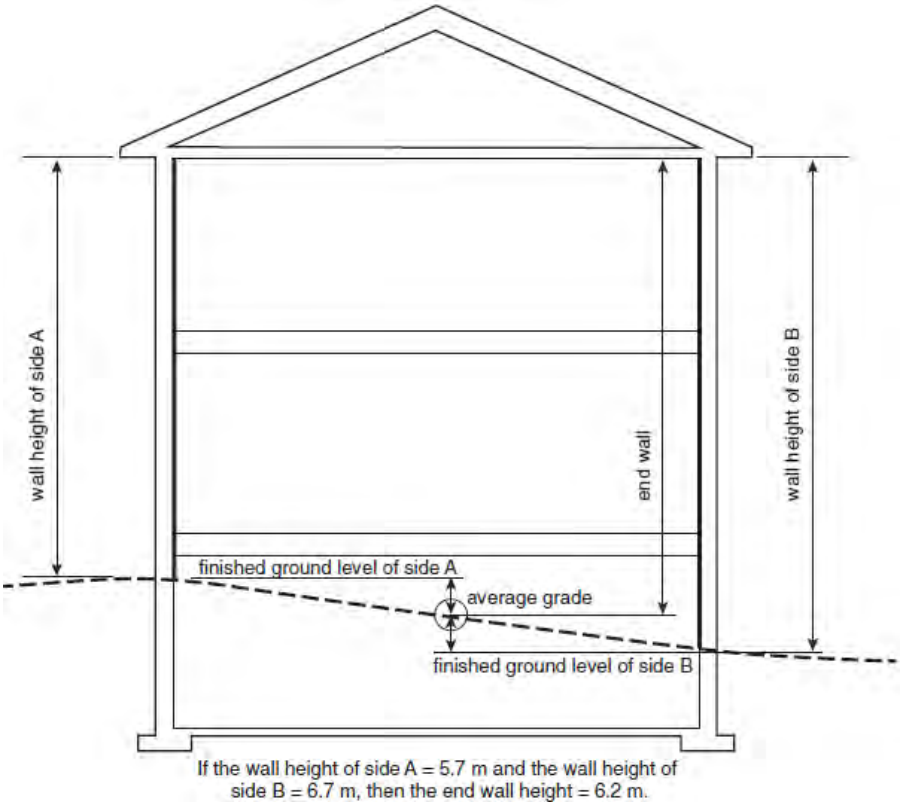


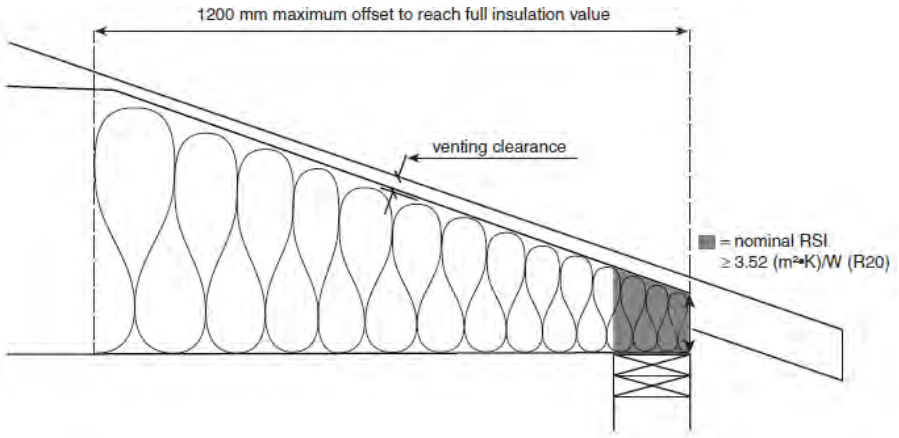
Figure A-10.2.2.6.-A

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.(4) 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.

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.

Design and Installation of Ventilation Systems

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

~~Sentence 10.2.2.17.(5) identifies that~~ 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 to ensure 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Lighting Trade-offs

Topic: Lighting Trade-offs

Code change number: 24-0018

Code reference: 10.2.2.2. ASHRAE 90.1, and 10.2.2.3. NECB

Description of the proposed change

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 taking into account the existing over-lit spaces (through previous trade-off applications) can result in total building/tenancy LPD limits being exceeded by excessive amounts.

Justification

A building/tenancy, through the use of lighting trade-offs and multiple renovations, can produce lighting power levels greatly exceeding the maximum allowable for a new building/tenancy, by either ASHRAE 90.1 or NECB . The problem stems from the standard practice that partially renovating a building's/tenancy's lighting does not require the accounting of the existing lighting within areas not being renovated. As a result, over-lit spaces are not considered when under-lit spaces are renovated with new lighting added to reach their individual space allowance.

Proposed VBBL content

Legend

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10.2.2.2. ASHRAE 90.1

l) lighting Space by Space Method application, per ASHRAE 90.1, Section 9.6.1.d., 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).),

10.2.2.3. NECB

i) lighting Trade-off Path application, per NECB, Section 4.3., 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-10.2.2.3.(1)(i).),

Notes to Part 10

A-10.2.2.2.(2)(I) and A-10.2.2.3.(1)(i) 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 taking into account the existing over-lit spaces (through previous trade-off applications) can result in total building/tenancy LPD limits being exceeded by excessive amounts.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Commissioning

Topic: Commissioning

Code change number: 24-0019

Code reference: New 10.2.2.18 (with supporting adjustments/statements within Part 5, Part 6, Part 11, and the Elect Bylaw)

Description of the proposed change

Adding commissioning of building operations equipment and associated systems (including controls) for new Part 3 buildings of 10.2.1.2 and 10.2.1.3 buildings, and new work in existing Part 3 buildings of 11.7.1.2 and 11.7.1.3 buildings. The commissioning requirement is located in Part 10 and is referenced in Part 5 (Environmental Separation), Part 6 (HVAC), Section 11.7, and the Electrical Bylaw (Electrical systems).

Justification

In our fight against climate change, the CoV and the building industry have incorporated many energy and emissions reduction policies and requirements resulting in improved building systems design and construction, yet operationally, these systems are still not required to be commissioned for optimal performance resulting in wasted energy and increased emissions.

Since the 1980s, mechanical contractors have been responsible for 'commissioning' their own work. In practice that means the basic functional performance testing, adjusting and balancing of individual HVAC equipment. Now, with more complex HVAC equipment and sophisticated controls equipment and strategies to operate inter-dependent HVAC systems, a significant gap has materialized due to the lack of coordination and unclear roles and responsibilities split between different trades who are only responsible for their part of the contract. As such, many buildings designed based on current code requirements for energy efficient and low carbon performance are not likely to meet the design intent. A commissioning requirement in VBBL based on referenced industry standards will help ensure that qualified professionals are carrying out an appropriate level of commissioning oversight to help buildings deliver on energy and carbon performance targets throughout the buildings' life cycle.

Commissioning requirements have been in place since 2017 for over 200 large new construction projects following rezoning under the conditions of the Green Buildings Policy for Rezonings. These projects account for approximately 50% of large new construction in Vancouver. There is sufficient industry capacity to expand and deliver commissioning services for all 10.2.1.2. and 10.2.1.3 buildings.

Proposed VBBL content

Legend

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10.2.2.18. Building Equipment and Systems Commissioning (excluding Part 9 buildings) (See Note A-10.2.2.18.(1)).

1) In a *building* required to comply with this Article, the *building* equipment, controls, meters, submeters, and systems shall follow a *commissioning* process led by a *Commissioning Authority* in accordance with:

a) ASHRAE Standard 202-2018, 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.

2) In a building required to comply with this Article, acceptable documentation for compliance shall include a commissioning plan and a commissioning report completed by the *Commissioning Authority,* or other documentation to the satisfaction of the *Chief Building Official*.

Supported by new sentences and clauses per;

Part 5 (Environmental Separation – General):

Section 5.1.2.2 Building Envelope Professional Requirements

Sentence 5.1.2.2.(4) The *Building Envelope Professional* shall support the *commissioning* of building envelope systems in compliance with Article 10.2.2.18.

Part 6 (HVAC systems):

Section 6.2.1.1. Good Engineering Practice

Sentence 6.2.1.1.(3) Heating, ventilating and air-conditioning equipment, controls, meters, submeters and systems, including mechanical refrigeration equipment, shall be *commissioned* in compliance with Article 10.2.2.18.,

Part 10 (for Part 3 buildings of 10.2.1.2 and 10.2.1.3 only):

Clause 10.2.1.2.(1)(i) shall *commission* equipment, controls, meters, submeters and systems in compliance with Article 10.2.2.18.,

Clause 10.2.1.3.(1)(i) shall *commission* equipment, controls, meters, submeters and systems in compliance with Article 10.2.2.18.,

…while removing existing commissioning requirements from referenced standard ASHRAE 90.1;

Clause 10.2.2.2.(2)(c) no requirement for commissioning per ASHRAE 90.1 Section 4.2.5.2.

Electrical Bylaw (Electrical systems):

7.3.6 Energy Efficiency

Where a building is constructed, commissioned, retro-commissioned, renovated, upgraded, or otherwise altered from the existing condition other than for the purposes of repair, an owner shall comply with the Energy Efficiency provisions in Part 10, or Section 11.7 as applicable, of the applicable Building By-law only insofar as those provisions pertain to the installation of new electrical equipment, devices, conductors, and all associated electrical components, thereof.

Add definitions to Div A Section 1.4 –

1.4.1.2 Defined Terms

*Commissioning (*or *commissioning process)* means a systematic verification, documentation, and training process applied to all activities during the design, construction, static verification, start-up, and functional performance testing of equipment and systems in a *building* to ensure that the *building* operates in conformity with the owner's project requirements and the basis of design in accordance with the contract documents.

Commissioning authority means a qualified individual identified by an owner to lead the commissioning team in the planning and implementation of the commissioning process. The commissioning authority may be an owner or a third party. The commissioning authority may also be a commissioning provider. The commissioning authority shall be qualified based on the following:

- 10 or more years of demonstrated experience in commissioning with a minimum of 5 projects of a similar scale and scope, or
- 4 or more years of demonstrated experience in commissioning with a professional commissioning designation provided by an organization who has an accredited commissioning training program, 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.

Commissioning agent means an individual or entity who is part of the commissioning team and is responsible for implementing the *commissioning* tasks required within their respective contracts to verify that elements of the building project meet stated requirements.

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.

Add to "Notes to Part 10"

Note A-10.2.2.18.(1). The intention of 10.2.2.18 is to apply only to Part 3 buildings, and to exclude Part 9 buildings regardless of major occupancy classification. BC Housing projects that follow the commissioning requirements of the BC Housing Building Commissioning Guidelines are deemed equivalent to 10.2.2.18 requirements.

For building projects with simple building systems, the commissioning authority and project team should follow guidance from the referenced standards to adapt the scale of the commissioning process and activities to suit.

Section 11.7 (Articles 11.7.1.2. and 11.7.1.3.)

11.7.1.2. Buildings Without Residential or Commercial Components

1) Alterations to energy systems or components of a *building*, except those included in Articles 11.7.1.3 through 11.7.1.5, shall comply with

a) the *alteration* requirements of

i) Clause 11.7.1.1.(3)(a) except as required by Clause (ii), or

ii) Clause 11.7.1.1.(3)(b) where the building was designed or upgraded to NECB, and,

b) the airtightness performance requirements of ASHRAE/NECB for reconstruction projects,

c) Articles 10.2.2.8 through 10.2.2.17. as applicable,

d) the commissioning requirements of Article 10.2.2.18 for new equipment and new systems including controls, meters, submeters, and

e) Articles 10.2.2.19 through 10.2.2.22. as applicable.

11.7.1.3. Residential Buildings of 4 Storeys or More, and Commercial Buildings (including Hotels and Motels)

1) Alterations to energy systems or components of a *building* containing Group C, D, or E *Major Occupancies*, except those included in Articles 11.7.1.4 through 11.7.1.5., shall comply with

a) the *alteration* requirements of Clause 11.7.1.1.(3)(b),

b) Articles 10.2.2.8 through 10.2.2.17. as applicable,

c) the commissioning requirements of Article 10.2.2.18 for new equipment and new systems including controls, meters, submeters,

d) Articles 10.2.2.19. and 10.2.2.20. as applicable,

e) the airtightness performance requirements of Article 10.2.2.21. for reconstruction projects, and

f) Article 10.2.2.22. as applicable.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to (Sub)metering Requirements

Topic: (Sub)metering requirements

Code change number: 24-0020

Code reference: 10.2.2.2, 10.2.2.3., 10.2.2.9.

Description of the proposed change

Consolidate (sub)metering requirements, potentially from 4 locations into a single location (10.2.2.9.). Incorporate feedback and lessons learned from energy system sub-metering requirement from the Green Buildings Policy for Rezonings.

Justification

Buildings are subject to (sub)metering requirements from numerous sources, requiring inconsistent levels of compliance. Some require the installation of (sub)metering while others only need to facilitate for future provision. Some require (sub)metering of specific systems (receptacles) while others do not.

10.2.2.9. is already being referenced by all buildings therefore the ideal location for consolidation.

Monitoring requirements can be streamlined as well since Lighting systems are now so efficient there is no need to continue monitoring their power consumption. Consultation with DEIs and SUS confirm no need for lighting monitoring. Need is limited to… “Provision for monitoring electrical and gas for; 1) Major Occupancies, 2) HVAC/Mech equipment, 3) Building Total (Main Meter)” only.

Feedback from projects required to sub-meter as part of rezoning conditions indicate that often metering are designed and constructed to fulfill the rezoning requirement. However, commissioning of the meters is often done poorly, especially if the owner is not planning monitor sub-metered energy data for building optimization. As such, the rezoning requirement for energy system submetering may lead to additional costs that add little value.

This proposed change to require facilitation (instead of installation) of metering allows electrical infrastructure to be designed to enable sub-metering of all buildings in the future, but minimizes costs for owners who do not have current plans to collect and use submeter energy data.

Proposed VBBL content

Legend

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Add VBBL (Clause 10.2.2.2.(2)(j)

j) no requirement to comply with Electrical Energy Monitoring provision of ASHRAE 90.1, Section 8.4.3.1.

Add VBBL (Clause 10.2.2.3.(1)(j)

j) no requirement to comply with Monitoring provision of NECB, Article 7.2.1.1.,

VBBL (Article 10.2.2.9.)

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:

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

(See Note A-10.2.2.9.(2).)

New Note A-10.2.2.9(1)

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.

New Note A-10.2.2.9.(2)

Monitoring of 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 elecgrical 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Building and Dwelling Airtightness

Topic: Airtightness

Code change number: 24-0021

Code reference: Div B Part 10.2.2.21 Building and Dwelling Unit Airtightness Testing for 10.2.1.3. building types, and whole building airtightness for 10.2.1.2 building types, and 10.2.1.5. building types

Description of the proposed change

1) Add ASTM E3158-18 to list of reference standards to provide more guidance for projects, to align with BCBC and NECB 2020
2) Update Maximum Tested Air Leakage Rate for 10.2.1.3 buildings to align with NECB 2020
3) Update 10.2.2.21 tables to separate requirements for 10.2.1.5. and 10.2.1.2 buildings
4) Streamline requirement for 10.2.2.21 for buildings following 10.2.1.2. by removing similar requirements in referenced by ASHRAE and NECB

Justification

1) BCBC 2018 has been revised as of May 1, 2023 to include ASTM E-3158-18 as a reference standard for projects to meet building envelope airtightness testing requirements. This standard is not currently referenced in VBBL and provides additional useful guidance for industry. This standard is also referenced in NECB 2020.

2) NECB 2020 has introduced a new prescriptive building envelope requirement to test the air barrier system in accordance with ASTM E-3158 to a normalized air leakage rate not greater than 1.50 L/s/m2 at a differential pressure of 75Pa. The current VBBL requirement is 2.0 L/s/m2 at 75Pa and is proposed to align with NECB 2020.

   Based on data from air leakage tests collected at building occupancy, 75% of applicable projects are already testing below 1.50 L/s/m2 at 75 Pa. Industry feedback

indicates that this target is not difficult to achieve for a majority of projects under current typical envelope sealing practices and it does not indicate an unfeasible level of air tightness. Many current COV and BC Energy Step Code projects are already accomplishing this target.

3) (for 10.2.1.5. buildings) it is proposed to align with BC Step Code (BCBC 9.36.7. and Table 9.36.7.4.) and the AL-1 Step.

For 10.2.1.5. buildings, it is recommended that the City of Vancouver continue with the existing 2.5 ACH@50Pa requirement, given challenges with buildability of especially smaller and denser housing typologies, and broad builder skillsets to achieve lower airtightness values that higher BC Step Code levels require. It also aligns with the optional NLA and NLR values in AL-1 step, to provide valuable flexibility for small and dense typologies.

4) 10.2.1.2 buildings can choose between 10.2.2.2 (ASHRAE) or 10.2.2.3 (NECB) for energy compliance. Per the new BCBC, ASHRAE 90.1-2019 and NECB 2020 will also be referenced within the 2025 VBBL, where these updated standards now include whole building air leakage testing metrics, however the ASHRAE 90.1 requirement and differs slightly from NECB. For simplification purposes, the by-law proposes to exclude the air leakage testing requirements from both ASHRAE and NECB, and instead requires 10.2.1.2 buildings to follow the same air tightness testing metrics, compliance and documentation requirements of 10.2.2.21.

Buildings under 10.2.1.2. have the option to meet energy requirements based on 10.2.2.2. (ASHRAE 90.1) or 10.2.2.3. (NECB). ASHRAE 90.1-2019 and NECB 2020 (the updated versions being adopted for 2025 VBBL) introduces new airtightness testing requirements not found in previous versions referenced by VBBL 2019. This proposed change is to align both ASHRAE and NECB projects with the requirements of 10.2.2.21, and disregard the similar but potentially conflicting requirements of ASHRAE or NECB. This creates simplicity for all Part 3 projects to have a single set of limits to follow, and the same process should non-compliance occur.

For information, the ASHRAE 90.1-2019 5.4 Mandatory Provisions requires whole-building pressurization test not to exceed 2.0L/s/m2 at 75Pa limit, with an exemption from whole building testing based on building geometry (but requires portions of the building to be tested), or for buildings that opt to perform air barrier design and installation verification instead. This differs from the NECB 2020 requirement through the prescriptive path for air barrier system to comply with the normalized air leakage rate not greater than 1.5 L/s/m2 at 75 Pa (NECB 2020 Div B Sentence

3.2.4.2.(1)). However, this is a requirement only for projects following the prescriptive path and is not required for projects using the trade-off or performance paths, which creates multiple options for projects to consider. A single airtightness requirement for all Part 3 new construction under VBBL 10.2.2.21 resolves this lack of consistency and creates alignment for all new construction.

Proposed VBBL content

Legend

Black Text – 2019 Vancouver Building By-law content

Black Underlined Text – Proposed modification to Vancouver Building By-law content

10.2.2.21. Building and Dwelling Unit Airtightness Testing

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, ~~or~~

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 inspections, maximum tested air leakage rates in conformance with:

a) Table 10.2.2.21.A, for *buildings* subject to Article 10.2.1.5.,

b) Table 10.2.2.21.B, for *buildings* subject to Article 10.2.1.2 or Article10.2.1.3., or

c) 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 10.2.1.5.
Forming part of Clause 10.2.2.21.(2)(a)

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 $L/s/m^2$ at 75 pascals
Individual Dwelling Units	1.23 $L/s/m^2$ at 50 pascals

Table 10.2.2.21. DELETED

Add whole building airtightness testing requirement for 10.2.1.2 buildings

Clause 10.2.1.2.(1)(j) shall provide airtightness testing in compliance with Article 10.2.2.21.,

Remove similar but potentially conflicting requirements in 10.2.2.2

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

d) no requirement to comply with whole building air leakage testing of ASHRAE 90.1, Section 5.4.3.1.1.,

Remove similar but potentially conflicting requirements in 10.2.2.3

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

g) no requirement to comply with whole building air leakage testing of NECB, Article 3.2.4.2.,

Add to **Div B Acceptable Solutions Section 1.3 Referenced Documents and Organizations, Table 1.3.1.2:**

Issuing Agency	Document Number	Title of Document	By-law reference
ASTM	E 3158-18	Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building	10.2.2.21.(1)

New note A.10.2.1.2.(1)(a)

A-10.2.1.2.(1)(a)
For projects complying with 10.2.1.2.(1)(a), note that whole building air leakage testing requirements of 10.2.2.21 supercede similar requirements in ASHRAE 90.1 or NECB.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Low Carbon Materials and Construction

Topic: Low Carbon Materials and Construction

Code change number: 24-0022

Code reference: 10.4. Low Carbon Materials and Construction

Description of the proposed change

- Exemptions: Introduce an exemption for buildings with a floor area of less than 1,800 m2.
- Reduction Target Modification: Adjust the whole-building embodied carbon impacts limit from double of a baseline (i.e. 200% of a baseline) to require a minimum 10% reduction (i.e. 90% of a baseline).

Justification

Operations of buildings in Vancouver are responsible for more than 50% of the city's total carbon emissions, amounting to 1.38 million tonnes in 2019. Additionally, an estimated 179,500 tonnes of carbon emissions annually are attributed to the manufacture, transport, use, and disposal of construction materials such as cement and steel. Although these emissions, known as embodied carbon, predominantly occur outside the city limits, Vancouver can play a crucial role in mitigating them. Efficient building design, material selection, and land use development are key methods for effectively reducing embodied carbon emissions.

Big Move 5 (Low-Carbon Construction Materials) of the Climate Emergency Action Plan (CEAP), ratified in October 2020, targets a 40% reduction in new buildings' embodied carbon by 2030 compared to 2018. The Embodied Carbon Strategy (Appendix K to CEAP) outlines four major actions to achieve this target, including the implementation of new building regulations to limit embodied carbon.

The initial embodied carbon regulations were approved in 2022 and subsequently integrated into the Building By-law by October 2023. These regulations mandated reporting and established an easy-to-achieve limit for the embodied carbon of all new Part 3 buildings (set at 200% of a standardized baseline in accordance with the CoV Embodied Carbon Guidelines).

Concurrently, additional modifications slated for 2025 were also approved in principle. These forthcoming amendments include requirements for a 10% or 20% reduction in embodied carbon, as well as a new mandate for responsible material sourcing. Staff were tasked with conducting further reviews of these proposed changes and to present final recommendations to Council in 2024.

The initial requirements implemented in 2023 helped to enhancing industry capacity and understanding of embodied carbon reduction challenges and solutions. The proposed modifications for 2025 are informed by insights from industry feedback, project case studies, and data derived from assessments conducted in accordance with the newly released CoV Embodied Carbon Guidelines of October 2023.

These adjustments, described below, aim to keep the requirements effective, practical, and aligned with the best practices in reducing embodied carbon emissions.

- Exemption for Small Projects: Exempt projects with a floor area under 1,800 m2 to reduce regulatory burden on smaller-scale developments and streamline compliance efforts.
- Continued Reporting Requirement: Maintain the requirement for embodied carbon assessment and reporting to ensure continued industry capacity building and identification of reduction opportunities.
- Reduced Embodied Carbon Limit: Implementing a reduction in the embodied carbon limit, mandating a 10% reduction in whole-building embodied carbon emissions.
- Industry Leadership Credits: In the proposed 2025 changes approved in principle in 2022, responsible material sourcing criteria were proposed to be a mandatory requirement in the By-law. These requirements are moved to the Embodied Carbon Guidelines as optional embodied carbon reduction credits, referred to as Industry Leadership Credits. This transition aims to allow time to enhance industry capacity, incentivize best practices, and foster innovation. Projects can choose to get up to 5% of the total 10% reduction requirements through these embodied carbon reduction credits given for optional reporting of a selection of the following, regardless of whether embodied carbon reduction is achieved in the optional scopes reported. The full details of the Industry Leadership Credits and submission requirements will be available in Version 2 of the Embodied Carbon Guidelines. These optional credits include reporting of:
    - Embodied carbon of optional building elements (including MEP, interior, and site work)
    - Project-specific estimates for life cycle stages beyond production (including construction site emissions and building elements' lifespan)
    - Use of products with sustainability, transparency, or health certifications (including certified wood)
    - Use of circularity practices (including salvaging and design for deconstruction)

Additional prescriptive and prescriptive-like compliance paths were explored but were not added in this version of the Bylaw. The alternative paths explored included use of combustible construction or encapsulated mass timber construction, use

Of low-carbon structural materials, specifically low-carbon concrete, and reuse of the existing structure. The decision to not add these paths were based on the feedback received through industry expert group consultations. The industry experts advised the staff to keep the code language simple, refrain from prescriptive pathways that are not proven to consistently achieve the intended reductions and which already have simple pathways available in the existing structure, and continue requiring embodied carbon assessment to inform carbon and cost savings in building design, prepare the industry for future reduction requirements, and inform future policy and reduction targets.

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Division A

2.2.1.1. Objectives

OE2 Greenhouse Gas Emissions

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, 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 as a result of manufacturing, transportation, construction, replacement, or disposal of the building or building components, and the energy consumed in the lifecycle of those components

Division B

1.3.1.2. Applicable Editions

Issuing Agency	Document Number	Title of Document	By-law Reference
CoV	~~v1.0~~2.0	City of Vancouver Embodied Carbon Guidelines	10.4.1.2.(1)

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 where

a) the *floor area* of a new *building* or an *addition* is less than 1,800 m^2.

10.4.1.2 Low Carbon Materials and Construction

1) A *building* shall be designed and constructed to ~~achieve~~ reduce whole-building embodied carbon ~~impacts of not more than double that of a functionally equivalent baseline~~ by at least 10% compared to an *acceptable* benchmark, as determined in compliance with the City of Vancouver Embodied Carbon Guidelines, or as acceptable to the *Chief Building Official*.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to carbon requirements

Topic: BC Zero Carbon Step Code and Carbon Requirements

Code change number: 24-0023

Code reference: 10.2.2.5. Building Energy and Emissions Performance for buildings complying with 10.2.1.2. and 10.2.1.3.

Description of the proposed change

1) Alignment with the top step of the BC Zero Carbon Step Code for major occupancies Group C, D, & E (Buildings complying with 10.2.1.3)
2) Update carbon reduction requirements for major occupancies Groups A, B and F (Buildings complying with 10.2.1.2)
3) Delete unnecessary compliance pathway 10.2.2.5.(3), delete Table 10.2.2.5.B
4) Adopt updated Energy Modelling Guidelines

Justification

The stepping down of GHGI in new buildings has been a key implementation strategy of the Zero Emissions Building Plan (ZEBP) since its approval by Council in 2016. In May 2022, Council approved in principle for VBBL to be updated in 2025 to halve the GHGI values for buildings under 10.2.1.3 (residential, commercial, hotel/motel, and office) to effectively require electrification of water heating, which is the last step of the Zero Emissions Building Plan, and including the impact of refrigerant leakage (GHGI-R) within the whole building GHGI limit. This change would have been functionally equivalent to what is now considered EL-4 or the “Zero Carbon Performance” step of the new provincial Zero Carbon Step Code (ZCSC). This direction was provided as part of approval of the report “Climate Emergency – By-law and Policy Updates applicable to New Buildings” (May 2022).

In May 2023, after the release of the province-wide Zero Carbon Step Code, Council directed staff to report on adopting the top step (EL-4) of the ZCSC into VBBL, as part of the Member’s Motion A2 “Ensuring Healthier Climate-Smart Homes”. This proposed change reflects Council’s direction in 2022 and 2023 and increases alignment with the provincial framework, simplifying requirements for the local industry.

For historical context, VBBL carbon limits in between 2018 to 2021 were approximately equivalent to ZCSC EL-2 or the "Moderate Carbon Performance" step. Between 2021 to 2025, VBBL carbon limits are a mix of EL-2 and EL-3 based on different building occupancies. The proposed change to adopt the top step (EL-4 or Zero Carbon Performance) is a continuation of the stepped approach to carbon reduction for new buildings in Vancouver originally laid out in the 2016 ZEBP.

Regulation of refrigerant impacts within the whole building carbon limit (originally approved in principle in May 2022) is proposed to be delayed as there have been changes in federal regulation around the use of refrigerants with high global warming potential (GWP) and slower than expected adoption of lower GWP refrigerants. Staff continue to research and engage with local industry and other regulatory bodies to determine next steps in reducing the risks of global warming from refrigerant leakage.

For buildings covered under 10.2.1.3 (care, assembly, and industrial occupancies), the current proposal to update the carbon performance limit from 50% to 85% reduction require electric hot water heating. This update builds on requirements approved in May 2022 and enacted in 2023 and is also the final step in regulating carbon performance of these building types. Under this regulation process loads, which are all energy uses aside from lighting, space and hot water heating, are not part of this regulation. This means that gas use (such as commercial cooking, industrial processes, healthcare or laboratory research, etc.) not being regulated in Vancouver buildings.

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Numbering per description above:

1) and 2) – Modifications per table:

Table 10.2.2.5.A1
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(2)

Occupancy Classification (1)	Total Energy Use Intensity (kWh/m^2a)	Thermal Energy Demand Intensity (kWh/m^2a)	Greenhouse Gas Intensity ($kgCO_{2e}/m^2a$)
ROW DELETED			
Group C *occupancies* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	1.8

Group C *occupancies* in *buildings* over 6 *Storeys*, except Hotel and Motel	120	30	1.8
Hotel and Motel *occupancies*	140	20	2.0
Group D and E *occupancies*, except Office	120	20	2.0
Office *occupancies*	100	20	1.5
All other *occupancies*	(1)		85% lower than GHGI of the reference building modelled using only fossil-fuel systems

Notes to Table 10.2.2.5.A1:

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.C
Maximum Energy Use and Emissions Intensities
Forming part of Sentence 10.2.2.5.(5)

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* in *buildings* up to 6 *Storeys*, except Hotel and Motel	110	25	1.8
Group C *occupancies* in *buildings* over 6 *Storeys,* except Hotel and Motel	130	40	1.8
Hotel and Motel *occupancies*	170	30	2.0
Business and Personal Services or Mercantile *occupancies*, except Office	170	30	2.0
Office *occupancies*	130	30	1.5

3) Delete unnecessary compliance pathway 10.2.2.5.(3), delete Table 10.2.2.5.B

10.2.2.5. Building Energy and Emissions Performance

3) [UTV Deleted] ~~Compliance with the GHGI limits in Table 10.2.2.5.A1 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.~~

Table 10.2.2.5.B [UTV Deleted]

~~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~~	~~Thermal Energy Demand Intensity~~	~~Greenhouse Gas Intensity~~

	~~(kWh/m^2 a)~~	~~(kWh/m^{2}a)~~	~~(kgCO_{2e}/m^{2}a)~~
~~Group C *occupancies*~~	~~100~~	~~15~~	~~N/A~~

4) Update reference to the City of Vancouver Energy Modelling Guidelines in Div B 1.3 Table 1.3.1.2

Issuing Agency	Document Number	Title of Document	By-law Reference
COV	~~2017~~ V3.0	City of Vancouver Energy Modelling Guidelines	10.2.2.5

Public Review

Vancouver Building By-law (VBBL)

Proposed change to Updates to Part 11

Topic: Updates to Part 11 to reflect proposed changes to Part 10 (10.2.1.5.)

Code change number: 24-0024

Code reference: 11.7.1.5. Residential Buildings of 1 to 3 Storeys, and Houses (excluding Hotels/Motels)

Description of the proposed change

- Update Part 11 (Section 11.7) to reflect proposed changes to Part 10 (10.2.1.5.)
- Majority of changes reflect housekeeping and code clarity
- A Sentence (3) has been added for Reconstruction projects, as they have unique requirements as effectively a new house, relative to other alteration projects. This includes separate requirements for HRV's, airtightness and electric heating & hot water

Justification

- Ensure consistency in new building and alteration language
- Added clarity for Reconstruction project requirements by adding an additional Sentence (3).
- Natural gas appliances continue to be allowed as a 'relaxation' to new building electric equipment requirements for a number of reasons: 1) it has not yet been engaged on to require electric replacement equipment in existing buildings 2) it is unclear the financial and infrastructure related implications of requiring electric replacement equipment. This is a major part of upcoming retrofit regulation development as part of the Zero Emissions Building Retrofit Plan.

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11.7.1.5. Residential Buildings of 1 to 3 Storeys, and Houses (excluding Hotels/Motels)

1) Except as otherwise required by Sentence (3), ~~Sentence (2) and Sentence 11.7.1.1.(7), Table 11.2.1.4.(2) or in this Subsection~~, a*lterations* to energy systems or components of a *building* described in Sentence 10.2.1.5.(1), shall comply with

a) the building envelope opaque elements with thermal performance requirements of Article 10.2.2.6, except 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 Article 10.2.2.15. ~~Sentences 10.2.2.15.(1) to (4)~~ and Article 10.2.2.16.,

~~g) the heat recovery ventilators requirements of Article 10.2.2.17., except a system that non-reconstruction *projects* may provide continuous exhaust ventilation in accordance with Section 9.32.,~~

~~h) Article 10.2.2.20. for all alterations, except Sentence (3) shall apply to reconstruction projects only;~~

~~i) Article 10.2.2.21. except an airtightness performance of 3.5 ACH may be used for reconstruction projects, and~~

g) the ancillary equipment requirements of Article 10.2.2.19

j) Article 10.2.2.22. as applicable.

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 11.7.1.5 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 11.7.1.5. – Permitted minimum standards (with equivalent emissions reduction trade-offs selected and approved)	
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, Curtainwall, sliding or folding doors with glazing	Shall achieve a maximum nominal USI of 1.44 W/m^2K

3) *Alterations* designated as reconstruction (see Note A-11.2.1.2.), shall comply with:

a) energy and emissions requirements following either the Performance Path in Sentence 10.2.1.5.(2) or the prescriptive path in Sentence 10.2.1.5.(3),

b) domestic hot water requirements of Article 10.2.2.12.,

c) space-heating appliance performance requirements of Articles 10.2.2.13. and 10.2.2.14,

d) the heat recovery ventilator performance requirements of Article 10.2.2.17.

e) the gas piping requirements of Article 10.2.2.19, and

f) the applicable airtightness requirements of Article 10.2.2.21. except an airtightness performance of 3.5 ACH may be achieved.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to add a new Sentence Div. B, 3.3.1.13.(11)

Topic: After-hours Elevator Lobby Egress

Code change number: 24-0025

Code reference: Div. B, 3.3.1.13.(11)

Description of the proposed change

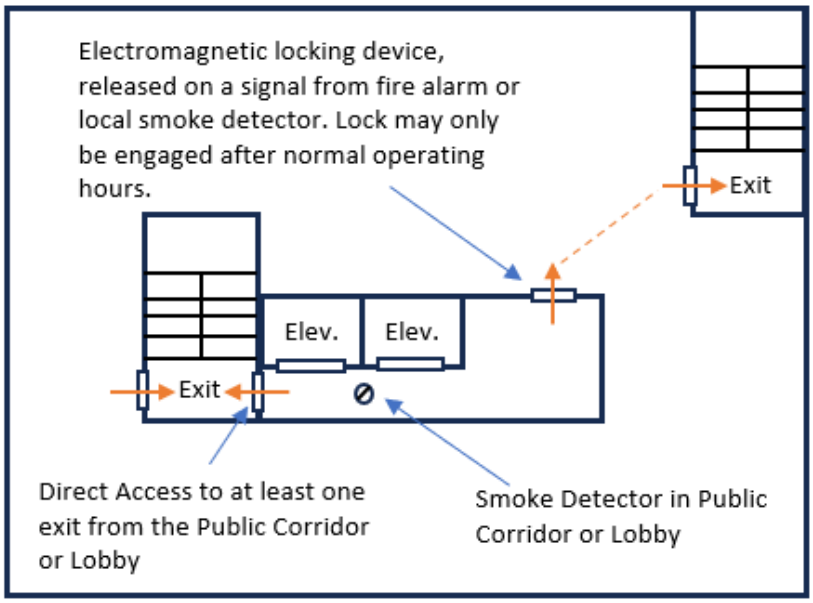
It is a common alternative solution request to provide electromagnetic locking in public corridors and lobbies to secure the main entry of larger suites during hours where occupants are not expected (not just after business hours as staff may still be present), where the suite entry door provide a means of egress to reach an exit located within the suite. This would reduce access to a single exit from the public corridor or lobby. Alternative solution to address this condition are usually varied, add complexity or delay to otherwise simple building permits.

Justification

This proposal is a variation of the permission in Sentence 3.3.1.13.(7) which was recently revised in the NBCC 2020 to make clear than an electromagnetic locking device may be incorporate into any door in a means of egress.

As electromagenetic locking device are required to comply with Sentence 3.4.6.16.(5), which require release of the door after 15 seconds the owner's security objective cannot be fulfilled.

This proposal is intended to permit an electromagnetic lock device on a public corridor or lobby, provided that direct access is provided to at least one stair, and that automatic release of the electromagnetic locking devices at the suite entry and all other locking devices leading to the exit.



These provisions are generally consistent with the existing provisions for electromagnetic locking devices, except that a reliance is placed on automatic device to release the locks. To reduce the risk of unacceptable delay, locking devices are only to be engaged once occupants have left the storey

The fundamental objective that egress is not unacceptably delayed remains, and must be reviewed by the responsible registered professional for compatibility with the building egress systems.

Proposed VBBL content

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3.3.1.13. Doors and Door Hardware

[…]

7) Except as permitted by Sentence (11), a ~~A~~ door in an *access to exit* is permitted to be equipped with an electromagnetic lock conforming Sentences 3.4.6.16.(5) or (6). (See Note A-3.3.1.13.(7).)

[…]

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 auxiliary 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).)

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 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.

Public Review

Vancouver Building By-law (VBBL)

Proposed change to revise Sentence 3.4.6.16.(8)

Topic: Electromagnetic locking device provisions on frequently used entry doors

Code change number: 24-0026

Code reference: Division B, 3.4.6.16.(8) (formerly 3.4.6.16.(7))

Description of the proposed change

Previous versions of the VBBL have included additional provisions for the integration of electromagnetic locking hardware into frequently used main entry doors, which allow for the use of motion sensors and pressure sensors to release the electromagnetic locks on an exit door.

Justification

The proposed changes modify the application of the permission from exit doors to egress doors to expand its applicability. This is in-line with commonly submitted alternative solutions to apply this to egress doors.

Recent changes to the provisions of Sentence 3.4.6.16.(5) in the provincial and national building codes have made it clear that electromagnetic locking devices may be installed in any egress doors, provided the provisions of this Article is satisfied.

These provisions do not fundamentally change any currently applicable requirements, and only introduce expand options for release mechanisms for electromagnetic locking devices. The fundamental objective that egress must not be unacceptably delayed, and the egress arrangement must be reviewed by the responsible registered professional for compatibility with the overall building egress systems.

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3.4.6.16. Door Release Hardware

[…]

8) As an alternative to the requirements of Clauses (e), (f) and (g) in Sentence (5) ~~(4)~~, acceptable door release hardware for an electromagnetic lock shall be located in close proximity to the egress ~~*exit*~~ 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) ~~(7)~~.)