CITY OF VANCOUVER

CITY CLERK'S DEPARTMENT
Access to Information & Privacy Division

File No.: 04-1000-20-2022-519

January 26, 2023

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 September 29, 2022 under the ***Freedom of Information and Protection of Privacy Act (the Act)*** for:

> **The Dangerous Goods study completed after February 1, 2019 related to the Central Waterfront.**

All responsive records are attached. Some information in the records has been severed (blacked out) under s.16(1), s.17(1), and s.19(1) of the Act. You can read or download these sections here: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/96165_00.

Under section 52 of the Act, and within 30 business days of receipt of this letter, 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 (#04-1000-20-2022-519); 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
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453 W. 12th Avenue Vancouver BC V5Y 1V4

If you have any questions, please email us at foi@vancouver.ca and we will respond to you as soon as possible. Or you can call the FOI Case Manager at 604-871-6584.

Encl. (Response Package)

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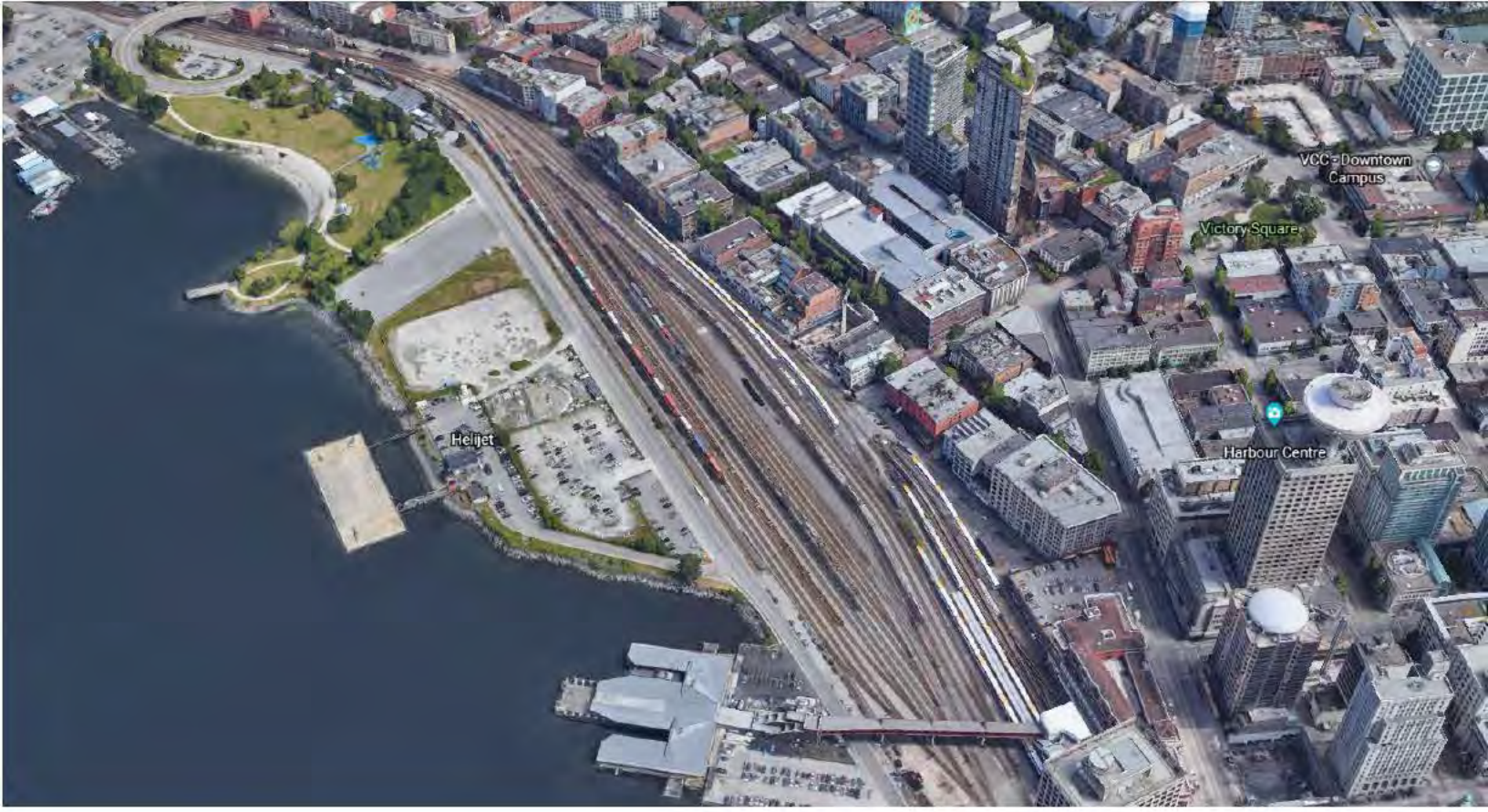

RAIL DANGEROUS GOODS MITIGATION AND MANAGEMENT STUDY

City of Vancouver

MORR TRANSPORTATION CONSULTING

Stantec

RAIL DANGEROUS GOODS MITIGATION AND MANAGEMENT STUDY

Prepared by
MORR Transportation Consulting Ltd.
Winnipeg, Manitoba

In association with
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Vancouver, British Columbia

Submitted to
City of Vancouver
Vancouver, British Columbia

February 2022

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1 INTRODUCTION

Vancouver Fraser Port Authority (VFPA) operates one of North America's busiest ports, and much of the freight traffic servicing the Port is via rail. An important element of rail transportation is the movement of dangerous goods (DG), which is highly regulated to ensure public safety when dangerous goods are being handled, stored for transport, or transported by any transportation mode.

The City of Vancouver, s.16(1), s.17(1) To achieve this goal, the City of Vancouver commissioned MORR Transportation Consulting to conduct a study that developed a robust understanding of national and international practices that could unlock land use opportunities resulting from operational and physical mitigation measures that maintain flexibility of movement and storage of dangerous goods via rail while enabling adjacent land uses. This report presents the results of the study, including the application of identified mitigating measures through a case study of the N-Yard in downtown Vancouver.

This report is organized into five chapters as follows:

Chapter 2 presents the results of a comprehensive review of existing legislation, regulations, policies, and bylaws that govern the movement of dangerous goods by rail in British Columbia.

Chapter 3 discusses the results of a review of national and international literature regarding mitigating measures that can be applied to reduce challenges and risks associated with dangerous goods movement and storage adjacent to urban land uses. The literature review was supported by a survey of jurisdictions that have successfully developed land in the vicinity of ports or rail yards.

Chapter 4 presents the results of a case study using the N-Yard, located on the South Shore of the Burrard Inlet in downtown Vancouver. The case study includes a generalized summary of operating conditions and mitigations that can be applied broadly on any rail corridor or yard in the city.

Chapter 5 presents conclusions and recommendations from the work.

2 LEGISLATIVE AND REGULATORY REVIEW

This chapter presents the results of a comprehensive review of existing legislation, regulations, policies, and bylaws that govern the movement of dangerous goods by rail in British Columbia. While some of these are federal and some are provincial, anything that applies at the federal level would also impact rail-related activities in British Columbia given that the railway of interest to this study is an inter-provincial railway – railways that cross provincial boundaries are governed by federal legislation, while railways that operate strictly within the boundaries of the province are governed by provincial legislation.

The legislation of importance to this document includes any laws that have the force of authority by virtue of their promulgation by either the federal government or British Columbia provincial government. For the purposes of this study, this refers to any enacted laws affecting the movement of goods by rail, be it dangerous goods or not. Within each piece of legislation of importance to this study there are several applicable regulations that have been issued by the federal or provincial governments to carry out the intent of the corresponding legislation enacted by those levels of government. In addition, there are by-laws, which are regulations made by a local authority.

In some instances, regulations may be supported by policies, guidelines, or standards and unless specifically defined within the regulation itself, they can be interpreted as follows:

- A policy is a high-level overall practice, rule, or recommendation embracing the general goals and acceptable procedures of government bodies or other entities on certain issues. Policies are formalized requirements that apply to a specific situation or subject and are mandatory within the context where they exist.
- Standards are a series of prescriptions established by authority, custom, or general consent as a model or example (e.g., the Grade Crossing Standards). These can be used in tort law as a measure of reasonableness (e.g., would a reasonable agency or engineer have followed the existing standards?).
- A guideline is a general recommendation on the implementation or the application of certain practice. By nature, guidelines are not mandatory or required but can provide sound information based on data-driven and objective evidence.

In addition to legal review, the chapter also presents findings with respect to current additional practice regarding the movement of dangerous goods by rail in selected cities in Canada, Australia, New Zealand, and the U.K.

The purpose of the review was to identify specific Canadian or provincial legislation and regulations that may impact land use development over or adjacent to passenger and freight rail corridors and yards. The review of additional practice expanded beyond legislation and regulations to include bylaws and policies in the selected jurisdictions.

Table 1 shows the 21 federal and provincial documents that were deemed relevant to this legislative and regulatory review. Each document was reviewed and, where applicable, key issues are summarized in this chapter.

Table 1: Relevant documents for regulatory review

Name	Source	Document Type	Identifies Relevant Issues
Transportation of Dangerous Goods Act (S.C. 1992, c. 34)	Government of Canada	Federal Legislation	
Railway Safety Act (R.S.C. 1985 c. 32/1988 c. 40)	Government of Canada	Federal Legislation	✓
Canada Transportation Act (S.C. 1996, c. 10)	Government of Canada	Federal Legislation	✓
Railway Relocation and Crossing Act (R.S.C., 1985, c. R-4)	Government of Canada	Federal Legislation	✓
Transport of Dangerous Goods Act (RSBC 1996)	British Columbia	Provincial Legislation	
Railway Safety Act (SBC 2004)	British Columbia	Provincial Legislation	✓
Railway Act (RSBC 1996)	British Columbia	Provincial Legislation	
Transportation of Dangerous Goods Regulations (SOR/2001-286)	Government of Canada	Federal Regulation	
Urban Development and Transportation Plans Regulations (C.R.C., c. 1385)	Government of Canada	Federal Regulation	
Wire Crossings and Proximities Regulations (CRC, c. 1195)	Government of Canada	Federal Regulation	✓
Joint Use of Poles Regulations (C.R.C., c. 1185)	Government of Canada	Federal Regulation	
Height of Wires of Telegraph and Telephone Lines Regulations (C.R.C., c. 1182)	Government of Canada	Federal Regulation	
Ammonium Nitrate Storage Facilities Regulations (C.R.C., c. 1145)	Government of Canada	Federal Regulation	✓
Anhydrous Ammonia Bulk Storage Regulations (C.R.C., c. 1146)	Government of Canada	Federal Regulation	✓
Flammable Liquids Bulk Storage Regulations (C.R.C., c. 1148)	Government of Canada	Federal Regulation	✓
Chlorine Tank Car Unloading Facilities Regulations (C.R.C., c. 1147)	Government of Canada	Federal Regulation	✓
Railway Safety Management System Regulations (SOR/2015-26)	Government of Canada	Federal Regulation	
Grade Crossings Regulations (SOR/2014-275)	Government of Canada	Federal Regulation	
Standards Respecting Railway Clearances (TC E-05)	Transport Canada	Federal Standard	
Standards Respecting Pipeline Crossings Under Railways (TC E-10)	Transport Canada	Federal Standard	
British Columbia Fire Code Regulation (BC Reg. 175/2006)	British Columbia	Provincial Regulation	✓
Building By-law No. 12511	City of Vancouver	Municipal by-law	✓
Guidelines for New Development in Proximity to Railway Operations	FCM/RAC	Guideline	✓

2.1 Legislation

The following pieces of legislation identify issues that may impact land use development over or adjacent to passenger and freight rail corridors and yards.

2.1.1 Railway Safety Act (R.S.C. 1985 c. 32/1988 c. 40)

The Railway Safety Act is the piece of federal legislation that promotes and provides for the safety and security of the public and personnel, and the protection of property and the environment, in railway operations. The act encourages the collaboration and participation of interested parties in improving railway safety and security; recognizes the responsibility of companies to demonstrate that they continuously manage risks related to safety matters; and facilitates a modern, flexible, and efficient regulatory scheme that ensures the continuing enhancement of railway safety and security.

While the act does not refer to the movement of dangerous goods, its contents apply to all types of railway operations, except for those specifically identified in the act (i.e., railways referred in Section 16 of the *Harbour Commissions Act*, and railways referred to in section 29 of the *Canada Marine Act*), which are not applicable to this study as they refer to purchase, lease, or operation of railways within boundaries of the harbour or lands owned by or within the jurisdiction of the harbour commission, or port authorities.

Section 24 (Non-railway Operations Affecting Railway Safety) of the *Railway Safety Act* states that:

"(1) The Governor in Council may make regulations

(a) respecting

(i) the control or prohibition of the construction or alteration, or

(ii) the control of the maintenance of buildings and other structures, not being railway works, erected or proposed to be erected above or below a line of railway, or on land adjoining the land on which the line is situated, to the extent only that is necessary to prevent those buildings or structures from constituting a threat to safe railway operations."

Railway work is defined in the Act as "a line work or any part thereof, a crossing work or any part thereof, or any combination of the foregoing."

As of writing of this report, there does not appear to be any regulation associated with Article 1 (a) of Section 24.

Relevance of this piece of legislation: *This legislation is important to this study because it oversees everything that relates to safety as it pertains to railway operations. The act has the authority to create regulations that affect issues that have a potential impact on railway safety, including land development.*

2.1.2 Railway Relocation and Crossing Act (R.S.C., 1985, c. R-4)

This federal act facilitates the relocation of railway lines or rerouting of railway traffic in urban areas and addresses financial assistance for work done for the protection, safety, and convenience of the public at railway crossings.

Section 8 of the act states the following, which may be of interest to this study:

"8 (1) For the purpose of carrying into effect a transportation plan accepted by the Agency under section 6, the Agency may, by order, subject to any requirements imposed by or under the *Railway Safety Act*, . . .

> (b) require a railway company to operate only trains carrying such class or classes of traffic over such of its lines within the transportation study area to which the transportation plan relates as may be specified by the Agency . . ."

In the context of this act, the *Agency* is the Canadian Transportation Agency, an independent, quasi-judicial tribunal and economic regulator that makes decisions on a wide range of matters involving air, rail, and marine modes of transportation under the authority of Parliament.

A *transportation plan* is defined in the act as follows: "a plan for the control of transportation within a defined area proposing as of some specific time the layout of any streets, highways, bridges, railway lines, railway crossings at level or at grade separations, bus routes, rapid transit lines, railway stations, bus terminals, rapid transit stations and wharves and airports within the defined area."

Given the parties included in this act, it would be beneficial for the City of Vancouver to consult with legal services regarding the process that may need to be followed for the Canadian Transportation Agency to act according to Section 8 above.

Relevance of this piece of legislation: *This legislation is important to this study as it identifies a mechanism whereby a municipality might explore rerouting certain types of railway traffic (i.e., dangerous goods) for the protection, safety, and convenience of the public. The City of Vancouver may wish to explore this further with their own legal counsel.*

2.1.3 British Columbia Railway Safety Act (SBC 2004)

The *British Columbia Railway Safety Act* is harmonized with the technical regulations, rules, and standards of the federal legislation.

Relevance of this piece of legislation: *This legislation was included here for completeness regarding existing legislation that impacts railway operations in B.C., although the province has decided to adopt the federal legislation.*

2.2 Regulations

The following federal regulations identify issues that may impact land use development over or adjacent to passenger and freight rail corridors and yards:

2.2.1 Wire Crossings and Proximities Regulations (CRC, c. 1195)

These regulations fall under the federal *Railway Safety Act*. The regulations apply to the construction and maintenance of lines, wires, or other conductors for the transmission of electrical energy, or for communication purposes, for which leave of the Commission is required by virtue of section 317 of the *Railway Act* or which have been or are to be constructed or maintained by consent and in accordance with these Regulations.

Section 5(4) of the regulations states that "the construction and maintenance shall also be carried out, and the line operated, in such a manner as not unduly to interfere with or obstruct the operation of any railway or line crossed or neared or to endanger the safety of the railway or line or of persons using or working on the railway or line."

Relevance of this regulation: *This regulation is relevant given the need for installation of lines, wires, or other conductors for the transmission of electricity or telecommunications when developing land. It is important to know the existing limitations regarding interactions with railway property and operations.*

2.2.2 Ammonium Nitrate Storage Facilities Regulations (C.R.C., c. 1145)

These regulations fall under the federal *Railway Safety Act.* The regulations apply to the design, location, construction, operation, and maintenance of storage facilities for ammonium nitrate and ammonium nitrate mixed fertilizers located on the right-of-way owned or leased by any railway company subject to the jurisdiction of the Canadian Transport Commission (e.g., federal railway companies). The regulations exclude certain situations as follows:

"(a) storage facilities which at no time will contain more than 3,000 pounds of ammonium nitrate or ammonium nitrate mixed fertilizers;

(b) nitro carbo nitrates or other ammonium nitrate blasting agents; the preparation, storage or use of such blasting agents or similar mixtures in or contiguous to an ammonium nitrate or ammonium nitrate mixed fertilizer storage facility is prohibited; and

(c) ammonium nitrate mixed fertilizers containing less than 60 per cent ammonium nitrate by weight if they do not contain iron oxide, chromic oxide, inorganic salts of chromium, copper or manganese, powdered metals, sulphur, potassium chloride or any other ingredient in quantities which will appreciably sensitize or otherwise increase the hazard of ammonium nitrate."

Part II (Distances) of the regulations provides details in Section 12 about the allowable horizontal distances between a storage facility and the nearest point of another building, structure, or property line as follows:

The horizontal distance should not be less than:

"(a) 300 feet from any school, hospital, hotel, motel, church, theatre, auditorium, sports arena, multi-store shopping centre, apartment or other similar multi-unit residential building, office building or department store or merchandise building of more than one storey in height or any other similar structure used for assembly, institutional, residential, business, personal service, or mercantile purposes, or any building considered by the Commission to belong to this category;

(b) 150 feet from a single family dwelling, railway passenger station, railway station-dwelling, office building or department store or merchandise building or restaurant of one storey in height, or any other similar structure used for housing, business, personal service, or mercantile purposes, or any other building considered by the Commission to belong to this category; ..."

Section 13 states that "Notwithstanding section 12, greater safety distances may be imposed on storage facilities located within densely populated areas or other areas considered by the Commission to be of special hazard."

Relevance of this regulation: *This regulation, together with the other storage regulations included here, is important to this study because it clearly explains the minimum distances required between storage facilities and the placement of buildings. Because it is likely that these facilities are not temporary but permanent, the distances identified in this regulation would present a constraint regarding the type of building that can be erected and associated distance from these storage facilities under different land development scenarios.*

2.2.3 Anhydrous Ammonia Bulk Storage Regulations (C.R.C., c. 1146)

These regulations fall under the federal *Railway Safety Act.* The regulations apply to the design, location, construction, operation, and maintenance of stationary bulk storage facilities for anhydrous ammonia.

Part II (Distances) of the regulations provides details about the allowable distances between the nearest point on the tank shell to the nearest point of the building, property line, etc.

Section 15 (5) and (6) are of relevance to this study as follows:

"(5) A storage tank with a water capacity exceeding 2,000 Imperial gallons shall be at least 300 feet from any station, office building or other similar place of public assembly on railway property.

(6) It is recommended that the distance of storage tanks with water capacities exceeding 2,000 Imperial gallons from schools, hospitals, theatres, residential areas or other similar places of public assembly be not less than 300 feet"

Relevance of this regulation: *See explanation under Ammonium Nitrate Storage Facilities Regulations.*

2.2.4 Flammable Liquids Bulk Storage Regulations (C.R.C., c. 1148)

These regulations fall under the federal *Railway Safety Act.* The regulations apply to the design, location, construction, operation, and maintenance of stationary bulk storage facilities for flammable Liquids. Figure 1, and Figure 2 show the minimum distances identified in Schedule I of the regulations for different situations.

Classification	Minimum Distance to Centre Line of Loading or Unloading Track from		Minimum Distance (Feet) to Centre Line of Loading, Unloading Rack or Terminal from —		
Flammable Liquids	Main Track (Gauge side of nearest rail)		Property line of an adjacent Property that has been or may be built upon	Grain Elevators, Warehouses containing Combustible Materials or Dangerous Commodities; Engine Houses, Railway Shops and Other Similar off site Buildings	Stations, Office Buildings and other similar Places of Public Assembly and nearest Residence
	Loading	Unloading			
Class I	50	15*	25	75	150
Class II	30	15*	15	40	75
Class III	50	25	25	75	150

* Not less than 25 feet for bottom unloading.

Figure 1: Minimum Distances Authorized for Loading or Unloading Tracks and Racks from Main Tracks, Property Lines, and Buildings (Table I, Schedule I in regulations)

Classification	Nominal Capacity Imperial Gallons	Minimum Distance (Feet) to Nearest Point of *Above Ground* Storage Tank Shell from				
Flammable Liquids	Single Storage Tank	Main Track (Gauge side of nearest rail)	Any Track Other than Main Track	Property line of any adjacent Property that has been or may be built upon	Grain Elevators, Warehouses containing combustible Materials or other Dangerous Commodities; Engine Houses, Railway Shops and Other Similar off-site Buildings	Stations, Office Buildings and Other Similar Places of Public Assembly, and nearest residence
Class I 80°F and below	0 — 5,000	30	20	10	20	40
	5,001 — 15,000	50	20	15	75	150
	15,001 — 25,000	70	20	20	100	200
	25,001 — 50,000	90	20	30	125	250
	50,001 — 100,000	120	20	50	150	300
	100,001 — 200,000	150	20	70	175	350
	Over 200,000	200	20	100	200	400
Class II Above 80°F Below 175°F		One-half the Distance Prescribed for Class I Flammable Liquids, but in no case shall the distance from any track or building be less than 20 feet, and the distance from the property line be less than 10 feet.				
Class III		One and one-half times Distance Prescribed for Class I Flammable Liquid				

Classification	Nominal Capacity Imperial Gallons	Minimum Distance (Feet) to Nearest Point of *Below Ground* storage Tank Shell
Class I Class II } Class III		One-half distance prescribed for like class of flammable liquids and like storage capacities, but in no case shall the distance from any track be less than 20 feet.

Figure 2: Minimum Distances of Storage Tanks from Main Tracks, Other Tracks, Property Lines, and Buildings (Table III Schedule I in Regulations)

Relevance of this regulation: *See explanation under Ammonium Nitrate Storage Facilities Regulations.*

2.2.5 Chlorine Tank Car Unloading Facilities Regulations (C.R.C., c. 1147)

These regulations fall under the federal *Railway Safety Act*. The regulations apply to the design, location, construction, operation, and maintenance of chlorine tank car unloading facilities.

Part II (Distances) of the regulations provides details about the allowable horizontal distances between the centre point of a chlorine unloading rack or of a tank car, when it is at the unloading position, and the nearest point of any occupied building. Section 16 states that the horizontal distance "shall be in accordance with the following:

> (a) not less than 2,000 feet from any school, hospital, hotel, motel, church, theatre, auditorium, sports arena, multi-store shopping centre, apartment or other multi-unit residential building, office building or department store or merchandise building of more than one storey in height, or any other building or enclosure considered by the Commission to belong to this category;
>
> (b) not less than 1,000 feet from any single family dwelling, railway passenger station, railway station-dwelling, one storey office building, department store, merchandise building or restaurant, or other easily evacuated or low occupancy building or enclosure considered by the Commission to belong to this category . . ."

Relevance of this regulation: *Like with the storage regulations discussed here, this regulation is important because it provides information about the design, location, construction, operation, and maintenance of chlorine tank car unloading facilities. If these facilities are already present within the railway yard or on rail property, any land development adjacent to it will be governed by these allowable distances.*

2.2.6 British Columbia Fire Code Regulation (BC Reg. 175/2006)

The purpose of this regulation is to provide the technical provisions regarding the following:

- Activities related to the construction, use or demolition of buildings and facilities.
- The condition of specific elements of buildings and facilities.
- The design or construction of specific elements of facilities related to certain hazards.
- Protection measures for the current or intended use of buildings.

One of the specific objectives of the code is defined in Division A, Section 2.2, OP Fire Protection of Buildings and Facilities as follows:

"to limit the probability that, as a result of specific circumstances related to the building or facility, the building or facility will be exposed to an unacceptable risk of damage due to fire." In particular, the code refers to activities related to construction, user, or demolition of a building or facility.

Division B, Section 3.2 (Indoor Storage) and 3.3 (outdoor storage) addresses the use of buildings for the storage of dangerous goods (among other types of products). While there are extensive details regarding internal and external arrangements such as storage height, method of storage, and space from the floor, there is limited indication regarding minimum allowable distances between these storage facilities and other buildings, except as follows (for outdoor storage):

"3.3.5.3. Clearances

1) Except as provided in Sentence (2), cylinders of Class 2.1 flammable gases or Class 2.3 toxic or corrosive gases stored outdoors shall be not less than

   a) 1.5 m from any building opening, if the aggregate capacity of expanded gas is not more than 170 m^3,

   b) 7.5 m from any building opening, if the aggregate capacity of expanded gas is more than 170 m^3 but less than 500 m^3, and

   c) 15 m from any building opening, if the aggregate capacity of expanded gas is 500 m^3 or more."

Division B, Part 4 (Flammable and Combustible Liquids), addresses the storage, handling, use, and processing of flammable liquids and combustible liquids in buildings, structures, and open areas. Section 4.2 (Container Storage and Handling) and Section 4.3 (Tank Storage) include specifications regarding the minimum allowable distances to a property line or to a building on the same property. In all cases (regardless of the class of liquid), the minimum distance is 6 m, which is less than the storage requirements in the *Railway Safety Act*.

Relevance of this regulation: *This regulation is important because it governs the design, construction, operation, and maintenance of buildings from a fire protection perspective, as well as storage of dangerous goods (and other products) inside and outside buildings. However, it appears that the Railway Safety Act regulations regarding storage of dangerous goods, as described in Sections 2.2.1, 2.2.2, 2.2.3, and 2.2.4, are more restrictive and more applicable to this study than the Fire Code as they provide clear indication regarding minimum lateral clearances between stored dangerous goods and many different building/land use types.*

2.2.7 City of Vancouver Building By-Law 12511

The Building By-law identifies the minimum standard in the City of Vancouver for buildings to which the by-law applies and establishes standards for building materials, products, and assemblies. While the by-law does not apply to rail or similar public infrastructure systems located on, or in a street or a public transit right or way, it does address dangerous goods in the following contexts:

1. To ensure that buildings provide direct access for firefighting from the outdoors.
2. For the design and fire protection of hazardous areas (buildings or parts of buildings used for the storage, handling, use, and processing of dangerous goods).
3. The design of buildings containing dangerous goods (short- or long-term storage of products)
4. Ventilation for laboratories
5. Storage and use of dangerous goods on construction sites.

Relevance of this by-law: *This by-law is important to this study because it provides minimum standards for buildings. However, the by-law is silent regarding minimum allowable distance between a railway facility and a new building.*

2.3 Policies

Both CN and CPR have a set of rules of operation requirement (policies) for dangerous goods transportation which include in depth details on how to perform inspection of the equipment, placards affixed to the car, documentation, switching, marshaling, emergency measures, special dangerous commodities and many more. In addition, Transport Canada also has published Rules Respecting Track Safety (TC E-54) to ensure the safe operation of movements on standard gauge track owned by, operated on, or used by a railway company. These are discussed here.

2.3.1 CN Rules Regarding Dangerous Goods Transportation

This section of the report summarizes the CN Rules regarding dangerous goods transportation and these rules apply to both existing and future yards.

Inspection: Before Lifting Dangerous goods (DG) cars from shipper's tracks, where applicable crews must visually inspect to ensure valves, lids and handles are closed and caps are installed.

Placarding: The placards indicate the class of the commodity as shown on the shipping documents.

a) Before lifting DG cars from shippers or interchange tracks, crew must have verification, or inspect to ensure that the required number of placards are affixed to the car. And with exception to mixed loads (DANGER placard).

b) Placards will be displayed on both sides, and both ends of the rail car, including each compartment of a compartmentalized tank.

c) Missing or damaged placards must be promptly reported to those who will arrange for replacement. DG goods cars missing placards must not be lifted.

Documentation:

a)

i. When lifting for shippers tracks or interchange tracks and while enroute, crews are responsible to be in possession of the shipping document for each loaded or residue DG car.
ii. An SRS waybill is an acceptable shipping document for any loaded or residue DG car/intermodal traffic.
iii. If the SRS waybill information for the WOPRT generated shipping document does not meet all the TDG requirements, the shipment will require a separate shipping document to accompany the car. The WOPRT will list the cars requiring separate documentation and in addition, each car will have a follower line stating ** DANGEROUS GOODS SHIPPING DOCUMENTS – REQUIRED**.
iv. The shipping document may not indicate whether the car contains a "Special Dangerous Commodity". When a loaded placarded car is lifted enroute and a consist or other means is not available to indicate that the car is not a "Special Dangerous Commodity", such car must be handled applying "Special Dangerous Commodity" speed restrictions and inspection instructions until such time as it can be verified otherwise.

b)

i. Possession of documentation by the crew is not applicable when switching in make up yards, or where cars are being switched onto trains or into classification tracks provided the required documentation is available at the responsible railway office.
ii. Where DG cars are to be placed/pulled on/from a consignee's track within a yard to a terminal area, the crew must be in possession of the shipping document for each DG car. Switch lists can be generated containing required shipping document if a separate shipping document is not provided.

c) Unless relieved of the responsibility, crews are responsible for leaving such documentation at designated locations when setting out or placing cars.

d) Whenever a car containing DG is set off, the RTC will instruct a crew member as to the disposition of the documentation.

e) After leaving a terminal, if the required documentation is lost, or it is discovered that a DG car is in their movement without the required documentation, the RTC must be notified. The crew will be provided details of the commodity in the form of a "Radio Waybill" with the applicable items shown below copied by a crew member. This information will be retained until the proper required documentation is provided to the crew (Table 2).

Table 2: Details of Commodity - Radio Waybill Details

Information Provided	
Initial/number	Origin
Shipper	Shipper street address
Destination	Consignee
Consignee street address	Car/Package type
Residue last contained	UN/NA number
Proper shipping name	Class/ Subclass
Compatibility group	Packing Group
Poison inhalation hazard	Quantity and unit of measure
Reportable quantity	Emergency 24 hr no.
ERAP Number	ERAP Phone
WB Date	Special Commodity
Marine Pollutant	Poison/Toxin
ELS permit and expiry date	DOT exemption number
Net explosive quantity	Flash Point
Emergency control temperature	Special instructions
DOT 113 – Do not hump or cut off car in motion	Fumigated unit

Train Consists:

a) Crews shall have in their possession a document indicating the position of each placarded car in their train. When the position is changed, (e.g., cars lifted or set off) or a placarded car is placed in the train, the document must be kept up to date and modified to indicate the change.
b) Any lofts or set-offs must be identified on the original document. In the case of an enroute lift, where a list of cars is provided, it must be verified for accuracy and included with the original document which must have a written insertion mark as indication of where the cars were placed in the train or transfer. The Conductor must sign the document as indication of correctness and as required by regulation or for use by emergency personal. A train consist, switch list, or other prepared document may be used to meet this requirement.
c) When lifting and a train list, switch list, or other prepared document is not provided for the car(s) lifted, the following must be recorded on the train's existing list:
    1. The car initial and number;
    2. UN number (for a car containing one commodity) or the words "Dangerous goods" for a car which contains more than one commodity. (e.g., mixed load)
d) Carloads in the Toxic Inhalation Hazard (TIH) category, are restricted to a maximum speed of 50 mph while in transit within the U.S.

A follower line on all train lists will include the information "50 mph in USA"

Switching:

a) Humping operations will be governed by the HPCS procedures outlined in Terminal Manuals.
b) Any impact suspected of being in excess of 6 mph, with or onto a DG car must be promptly reported to the appropriate supervisor for furtherance.
c) Cars in class Explosive 1.1, 1.2 or Poison gas 2.3 must not be placed under a bridge or overpass, nor in or alongside a passenger station.
d) AAR 204 and DOT 113 specification tank cars will have a follower line indicting these cars must not be:
    1. uncoupled while in motion;
    2. coupled into with more force than necessary to complete the coupling; or
    3. struck by any railway vehicle moving under its own motion.

    These cars are stenciled accordingly.

Marshalling:

a) General restrictions – Any placarded DG car must not marshalled next to:
    1. an operating locomotive; (unless all cars in the train have a placard)
    2. any occupied car; (unless all cars in the train have a placard)
    3. a car equipped with a heating or cooling device or has a source of ignition;
    4. any open top car;
        - when the lading protrudes beyond the car and may shift during transport, or
        - when the lading is higher than the top of the car and may shift during transport.
b) Marshalling Chart – Placarded DG goods cars are subject to the following marshalling group restrictions in addition to general restrictions (Figure 3).

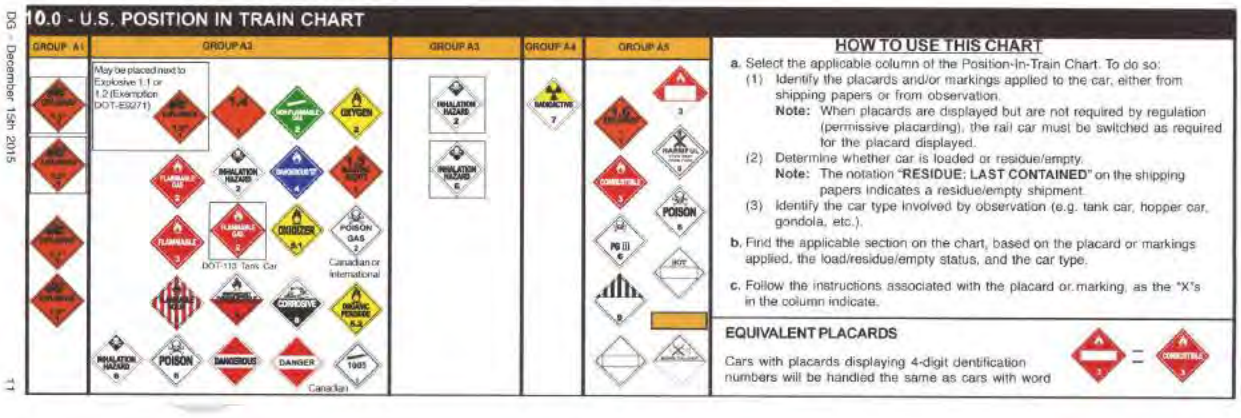


Figure 3: CN Marshalling Chart

c) Marshalling of plain veering cars
When there are plain bearings ahead, loaded DG cars must be marshalled:

1. Within the first 2000 feet on trains 4000 feet or less; or,
2. Must not be in the last 2000 feet on trains over 4000 feet

d) Marshalling of placarded trailers/containers on intermodal rail cars.
Containers/Trailers placarded as "Explosives 1.1, 1.2 or "Radioactive class 7" must be loaded/ marshalled on an intermodal railcar so it will NOT to be the first platform/car next to the locomotive, and in addition, explosives 1.1 and 1.2 must not be loaded/marshalled next to a container/trailer/car which has a mechanical heating/cooling device.

Emergency Measures:

a) A DG car discovered leaking must not be moved without authority and be kept away from switch heaters, engines, occupied passenger equipment, or any car, container, or trailer with an operating mechanical heating/cooling device.
b) When it has been determined that DG are involved in an incident, the following procedures must be followed:
    1. Protect the movement and notify the RTC, Transportation Supervisor, or Yard Coordinator where applicable;
    2. Keep clear of the incident scene and when possible, remain up wind of cars suspected of containing DG;
    3. Take immediate option to warn other employees and, if necessary, the public;
    4. Avoid any unnecessary exposure to smoke or fumes and keep all open flames and smoking material away from the incident;
    5. Determine as quickly as possible what cars are directly involved in the incident, as well as those in close proximity to them;
    6. Identify commodities involved from information contained in shipping documents;
    7. If the locomotive consist is not directly involved, and it is safe to do so, the movement should be cut as close as possible to the incident location and the remaining cars moved a safe distance;
    8. Provide the RTC, Transportation Supervisor or Yard Coordinator all pertinent information for the cars of DG involved in the incident such as:
        a. car number(s);
        b. contents;
        c. 24 hr. emergency phone numbers;
        d. condition of cars e.g., leaking, on fire etc.
    9. The RTC, Transportation Supervisor or Yard Coordinator will inform crews of emergency action to be taken to minimize the effect of the DG involved.
    10. Documentation accompanying the cars involved must remain at the scene and be made available to emergency response authorities. Employees must retain possession of documentation until received of that responsibility by a railway officer.
    11. Employees must not speculate on the cause and should only provide pertinent information.

Relevance of this policy: *The CN operating rules regarding dangerous goods transportation and handling are important as CN Locomotives are known to bring rail cars into the N-Yard. Therefore, these rules clarify how CN crew operate and handle trains that carry dangerous goods.*

2.3.2 CPR Rules Regarding Dangerous Goods Transportation

This section summarizes the CPR General Operating Instruction (GOI) Section 8 rules regarding dangerous good transportation. These operating rules apply to existing yards and any future yard. Considering that the N-Yard is operated by CPR, these rules apply to the N-Yard operation of dangerous goods.

Before lifting a dangerous goods car from a shipper's siding or interchange, the following items must be considered:

1. Comply with pre-departure Inspection Procedures
2. Ensure the car is not leaking, is equipped with serviceable roller bearings and trucks and is properly placarded
3. If the car is a tank car also ensure it has:
    a. Double shelf couplers
    b. Dome cover, or manway cover is closed
    c. Bottom outlet cap and plugs are applied
    d. Loading/unloading rack equipment is clear and secured.

Rail car carrying dangerous goods if found leaking, cannot be moved without authorization. Section 7.0 of CPR general Operating Instruction (GOI) explains how to deal with leaks and spills.

Safety Marks (e.g., Placards): Before lifting a placarded car from a siding, the following items must be checked:

a) Placards are applied to both sides and both ends of the car, container, or trailer
b) They are the same on all location
c) Clearly visible and legible from the ground
d) In good condition

Documentation: Before lifting a dangerous goods car, complete the following steps:

a) Obtain shipper supplied documents, or
b) Compressed waybill, or
c) Foreign line waybill
d) Verify the car initials and number, supping name and class
e) UN/NA number (when displayed)
f) All documents should be obtained before departing

Marshalling Chart: The chart illustrated in Figure 4 shows the CPR placarded dangerous goods cars.

Emergency Procedures: Section 7.0 in the CPR GIO explains the emergency procedures. Procedures (a) to (f) must be used for an incident involving a car, container or trailer that contains dangerous goods.

a) Protect and communicate – initial Response: Protect train in accordance with CROR
b) Assess dangerous goods hazard:
    i. Visually inspect
    ii. Identify goods involved using the train documents
    iii. Use emergency guidebook
c) Assess site hazards: If dangerous good hazard does not prevent you from approaching the derailed cars and it is necessary to approach the cars, assess the site hazards.

i. Physical: Slip, trip, fall
ii. Chemical: from derailed car
iii. Electrical: power lines
iv. Other: water, embankments, bridges

d) Rescue and secure: rescue injured and keep public away
e) Communicate the details
f) Keep all documents

Dangerous Goods Cars in Group/Class:	Must not be placed next to:		
	Group A	Group B	Group C
Group A: Explosives Classes 1.1 & 1.2 		X	X(1)
Group B: (Infrequently handled. See list below.)	X	X(2)	X
Group C: Explosives Classes 1.3 to 1.6,  Classes 2, 3, 4, and 5. 	X(1)	X	
Group D: Classes 6, 7, 8, 9, and mixed loads 	Only general marshalling restrictions (item 6.3) apply.		

Notes:
X "must not be next to" restriction
(1) not applicable to explosives in Classes 1.3 to 1.6.
(2) not applicable if the next car has the same UN number.

Group B Dangerous Goods (Infrequently handled)

UN 1008, CLASS 2.3	UN 1660, CLASS 2.3
UN 1026, CLASS 2.3	UN 1911, CLASS 2.3
UN 1051, CLASS 6.1	UN 1975, CLASS 2.3
UN 1067, CLASS 2.3	UN 2188, CLASS 2.3
UN 1076, CLASS 2.3	UN 2199, CLASS 2.3
UN 1589, CLASS 2.3	UN 2204, CLASS 2.3
UN 1614, CLASS 6.1	UN 3294, CLASS 6.1

Figure 4: CPR Marshalling Chart

Relevance of this policy: *As the N-Yard is operated by CPR, it is important to understand CPR operating rules regarding handling of dangerous goods. Therefore, this can clarify how the yard personnel will handle rail cars that carry dangerous goods and what is their emergency procedure in case of incidents.*

2.3.3 Yard Track Inspection

Transport Canada Rules Respecting Track Safety TC E-54 section 6 and 7 indicate the Yard Track inspection requirements. This part of the report summarizes some of the key information provided in TC E-54.

The maximum track speed in yard tracks is assumed to be 15 mph and four different categories are considered for the yard tracks.

Category 1 includes heavily used tracks such as:

- Through, bypass tracks and core routes.
- Lead tracks where movements are entering, leaving, or travelling through a yard carrying more than 500 cars daily.

Category 2 includes:

- Locomotive main shop lead tracks
- Main hump lead tracks
- Switching yard leads

Category 3 includes moderately used tracks including:

- Industrial leads
- Switching yard tracks and receiving and departure tracks which are used to yard or depart trains.
- Tracks carrying more than 100 cars daily.

Category 4 includes lightly used tracks including:

- Storage Tracks
- Shop Tracks
- Service Tracks
- Industrial Tracks.

Table 3 shows the frequency of visual inspection required based on the category of the yard track.

Electronic Geometry Inspections is required for Category 1 tracks annually to check the gauge and cross level of the track. This will be done using a Light Track Geometry Inspection Vehicle.

Yard track rail flaw inspections are also required for Category 1 tracks. This includes a continuous search for internal rail defects and must be completed annually in all rails of Category 1 Yard Track.

Each railway company to which these rules apply must keep a record of each inspection required to be performed under this subpart for one year after the inspection. Each railway must keep record of annual

tonnage for each subdivision and when requested, provide the previous year's annual tonnage to a Railway Safety Inspector. These records must also be available at the local geographic engineering office in Canada.

Table 3: Designated Minimum Visual Inspection Frequency Table

Category	Type	Frequency
Category 1	Track	Twice monthly
Category 2	Track	Monthly
Category 3	Track	Quarterly
Category 4	Track	Twice annually

Relevance of this policy: *One of the main causes for train incidents and derailments is poor track condition. Therefore, track inspection plays a key role on safe transportation of dangerous goods. As a result, understanding track inspection requirements and frequencies is important.*

2.4 Guidelines

In addition to existing legislation, regulations, and the Building By-Law, the Federation of Canadian Municipalities (FCM) in collaboration with the Railway Association of Canada (RAC) published guidelines for new development in proximity to railway operations. The goal of the publication is to provide guidance that can be applied to mitigate the impacts of locating new development in proximity to railway operations. The guidelines are not intended for existing locations where proximity issues already exist given the need for site specific solutions. The following are key highlights from these guidelines:

- Key Issues with Developments near Rail Corridors
- Standard Treatments
- Development Viability Assessment

2.4.1 Key Issues with Developments near Rail Corridors

There are three main challenges and risks of developments near rail corridors outlined in the FCM guidelines: safety, noise, and vibration. Table 4 shows the considerations pertaining to safety.

To mitigate these key issues, the FCM guidelines provide two alternatives:

1. In cases where it is feasible (e.g., greenfield development), the standard treatments of a setback and berm should be applied.
2. For locations where the standard treatments are not possible (e.g., infill development), a Development Viability Assessment should be conducted.

Table 4: Key Safety Issues with Developments Near Rail Corridors

Issue	Key Details
Safety	• While rail is one of the safest modes of transportation, and Canada's railways are among the safest in North America, safety remains a concern • Most accidents are non-main track collisions and derailments and occur in yards or terminals, however these tend to be less severe • The accidents with the greatest consequences, which include collisions and derailments between stations or terminals, only make up around 10 percent of all railway accidents • The frequency of accidents involving transportation of dangerous goods has been falling since 1996, despite 60 percent growth in rail transport of dangerous goods • Most fatalities involving rail result from trespassers and from vehicle occupants or pedestrians struck at crossings.

2.4.2 Standard Treatments

The standard treatments identified in the guide are depicted in Figure 3 and they include:

- Setback Distance
- Noise Mitigation
- Vibration Mitigation
- Berms and Crash Barriers
- Security Fencing, Stormwater Management, and Warning Clauses

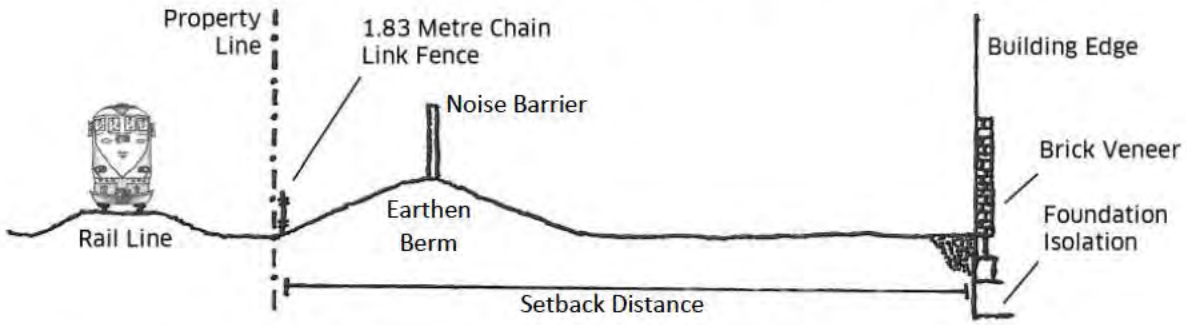


Figure 5: Standard Treatments to Mitigate the Impacts of Noise, Vibration, and Safety[1]

Details of each safety related component of the standard treatments are discussed here:

Setback Distance

Setbacks are one of the foundational components of the guidelines because they are effective at mitigating all three of the key issues. Table 5 presents the guidelines and some key considerations related to setbacks.

[1] *Extracted from Dialog (2013), 'Guidelines for New Development in Proximity to Railway Operations'.*

Table 5: Setback Distance: Guidelines and Key Considerations

Standard Recommended Setback	
Freight Rail Yard	300 metres
Principal Main Line	30 metres
Secondary Main Line	30 metres
Principal Branch Line	15 metres
Secondary Branch Line	15 metres
Spur Line	15 metres

Key Considerations
• Setbacks are important for noise and vibration dissipation and allow space for construction of a berm or safety barrier • Setback areas do not need to be vacant: appropriate uses for setback areas include roads, parks/recreation facilities, backyards, pools, unenclosed gazebos, garages/parking, and storage sheds • Setbacks are measured as straight-line distance from mutual property line • Reduced berm height permitted with greater set-back distance • Reduction of up to 5 m in setback permitted with reciprocal increase in berm height • Horizontal setback may be substantially reduced by construction of a crash wall

Berms and Crash Barriers

Berms and crash barriers are typically located within the setback area and help mitigate personal injury and property damage impacts of derailments and collisions. Table 6 describes the guidelines and key considerations for berms and crash barriers.

Table 6: Berms and Crash Barriers: Guidelines and Key Considerations

Earthen Berm Height	
Freight Rail Yard	No guideline provided
Principal Main Line	2.5 metres
Secondary Main Line	2.0 metres
Principal Branch Line	2.0 metres
Secondary Branch Line	2.0 metres
Spur Line	No minimum

Key Considerations
• Where full setbacks are possible, berm is sufficient safety barrier • Berm height is measured from the grade at the property line • Instead of a berm, a ditch or valley equivalent to the inverse of a berm can be considered • Reinforced berms, also called crash berms, are preferable to crash walls and can be used in space constrained areas where a full berm cannot be accommodated • Crash walls are designed to provide the equivalent resistance in the event of a train derailment as a standard berm • Incorporating a crash wall into a development plan requires a detailed study to determine design details to withstand the impact of four different crash scenarios (freight train glancing blow, freight train direct impact, passenger train glancing blow, and passenger train direct impact).

Security Fencing, Stormwater Management, and Warning Clauses

Beyond the foundational components of the standard treatments, attention should also be given to risks related to trespassing, drainage and stormwater flows, and sufficient stakeholder engagement. Table 7 provides the key considerations related to security fencing, stormwater management, and warning clauses.

Table 7: Security Fencing, Stormwater Management, and Warning Clauses: Key Considerations

Key Considerations
• Trespassing onto the rail corridor is a significant concern. All new residential developments should include a 1.83 m security fence • Additional security measures may be required under site-specific conditions where risk of trespassing is higher • Rail corridors have a relatively flat profile and are not designed to handle additional flows from nearby developments • Developments near rail corridors should carefully design stormwater and floodwater flows • Warning clauses in selling, purchasing, and lease agreements should indicate the proximity of the development to a rail corridor and the associated noise, vibration, and safety risks.

2.4.3 Development Viability Assessments

The intent of a development viability assessment is two-fold:

1. To assess the suitability of a given site for a proposed land use.
2. If suitable, determine alternative mitigation measures to the standard treatments that should be incorporated into the development design.

There are two possible outcomes of the development viability assessment process. The first is that a particular land use may not be suitable for the proposed development site. Residential developments near rail facilities are particularly challenging. The second is that the proposed development can proceed, subject to the inclusion of sufficient mitigation measures to address concerns related to noise, vibration, and safety.

A development viability assessment should generally include the content shown in Table 8, with additional sections for site-specific considerations included as required.

Table 8: Overview of Content for Development Viability Assessments

Section	Purpose	Key Factors to Consider
Site Details	Provide a comprehensive overview of the conditions of the subject site	• Site condition • Soil type and geology • Topography • Drainage patterns • Proximity to rail corridor
Railway Details	Evaluates the details of the railway corridor to determine potential rail-development conflicts	• Track geometry and alignment • Existence of switches or junctions • Track speed • Derailment history of the site and of similar sites • Current and future usage • Anticipated future rail corridor changes
Development Details	Provides a comprehensive description of the design and operations of the development itself	• Proximity of buildings to the rail corridor or rail infrastructure • Clearances and setbacks • Proposed collision protection features
Construction Details	Ensures that the railway corridor, infrastructure, staff, and users are adequately protected during the construction phase	• Whether access to railway corridor is required • How construction may impact railway operations • Options for maintaining security of the rail corridor • Details of planed demolition, excavation, and retaining works • Stormwater, drainage, sediment, and erosion control
Hazard and Risk Identification	Identifies, evaluates, and proposes mitigation measures for the individual risks of the development	• Consideration for safety of people • Potential structural damage resulting from a train-building collision • Ability for trespassers to enter the railway corridor

2.5 National and International Practice

A review of current practice in other jurisdictions was conducted to understand land development practices over or adjacent to passenger and freight rail corridors and yards. The selection of these jurisdictions was based on available information and guidance identified through the literature review and regulatory review and it included the following:

- Canada
  - City of Calgary
  - City of Edmonton
  - City of Saskatoon
  - City of Toronto
  - City of Montreal
- Australia
  - New South Wales

  - Queensland
- New Zealand
  - Auckland
- United Kingdom
  - London

The following summarizes key findings regarding existing regulations, bylaws, or policies applicable to land development in the vicinity of passenger and freight rail corridors and yards.

2.5.1 City of Calgary

The City of Calgary established a policy to guide development approvals for lands adjacent to railway corridors.[2] The policy applies to development lands that are at most risk of the physical impacts of train derailments. These lands have been identified as 30 metres on either side of a freight railway corridor in a zone referred to as the Rail Proximity Envelope. The envelope is the three-dimensional areas on parcels adjacent to the Freight Rail Corridor used for managing the risk of physical impact of a train derailment (safety envelope) and the noise impact (noise envelope) associated with freight rail operations. The depth of the safety envelope is measured 30 metres horizontally from the Freight Rail Corridor and 7 metres in height from grade. Appropriate measures to mitigate safety and noise risks must be incorporated into new developments and as outlined in the Implementation Guide.

The Implementation Guide outlines examples of development proposals within the rail proximity envelope. One example includes development in the city centre. The guide states that "high density residential and commercial buildings that are 121 m in width or less are allowed inside the Envelope without further studies. A sensitive use on the frontage facing the rail is not subject to the Safety Policy, but would need a noise study." The policy defines sensitive land uses as the following:

- Addiction Treatment
- Assisted Living
- Child Care Service
- Custodial Care
- Emergency Shelter
- Home Based Child Care – Class 2
- Hospital
- Jail
- Residential Care
- School Authority – School
- School – Private
- Temporary Shelter

[2] City of Calgary Development Next to Freight Rail Corridors Policy and City of Calgary Development Next to Freight Rail Corridors Policy: Implementation Guide

The depth of the safety envelope and noise envelope is typically measured from the property line of the Freight Rail Corridor but could be adjusted based on surrounding contexts. Figure 6 illustrates an example of the rail proximity envelope included in the Guide for sensitive use land.

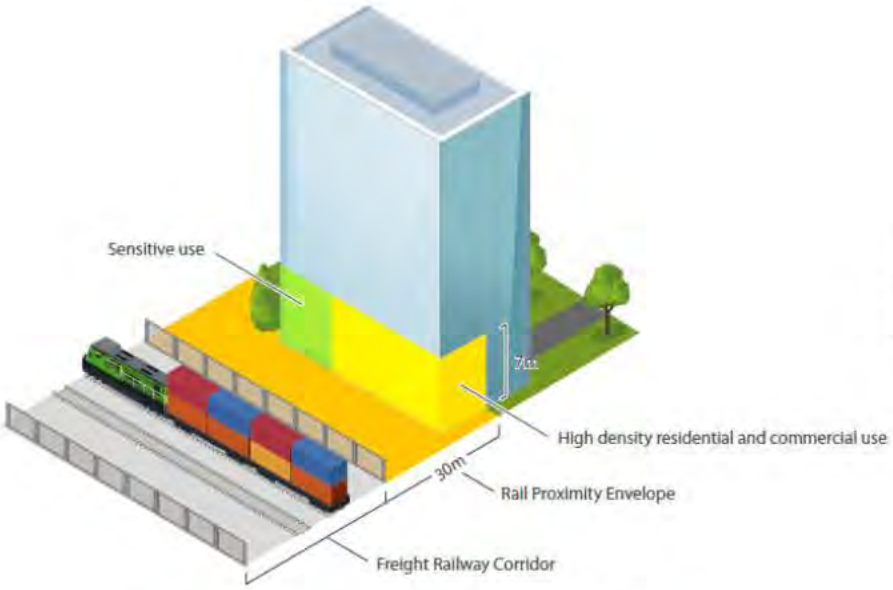


Figure 6: Example of Rail Proximity Envelope[3]

2.5.2 City of Edmonton

The City of Edmonton Zoning Bylaw 12800 contains a section pertaining to the Clareview Campus High Density Residential Zone. Section 950.4 (CCHD) of the bylaw was established "to accommodate the development of high-rise apartments with development controls designed to ensure that the development is integrated into the existing and future residential development within the Clareview Campus neighbourhood. The intent is to create a housing district of high-rise apartments, which is architecturally integrated with the low-rise apartments in area zoned CCMD and the open space corridor."

Article 3 (Development Regulations) Items *m* to *o* state the following:

"m. There shall be a minimum 1.83 m chain link Fence along the east property line of the CN right-of-way to the west of the subject Site;

n. A minimum 2.5 m high berm with 2.5:1 side slopes and a noise attenuation Fence (solid screen) shall be built parallel to the CN right-of-way so that the top of the Fence is 5.5 m above the top-of-rail; and

o. No building shall be constructed or located within 30 m of the east boundary of the CN right-of-way."

[3] Extracted from City of Calgary Development Next to Freight Rail Corridors Policy and City of Calgary Development Next to Freight Rail Corridors Policy: Implementation Guide (pg. 7).

2.5.3 City of Saskatoon

The City of Saskatoon's Official Community Plan (adopted in 2020) contains buffering policies for development adjacent to rail lines under its Neighbourhood Design and Development section (Section 3.1 (k)), stating the following: "Buffer residential uses from incompatible uses, railways, and major roadways . . ." In addition, Section 4 (Constraints to Development) states that "development in proximity to rail yards or rail lines should be consistent with the Guidelines for New Development in Proximity to Railway Operations prepared for the Federation of Canadian Municipalities and the Railway Association of Canada."

2.5.4 City of Toronto

In 2020, City of Toronto staff requested an amendment to its Official Plan and Zoning By-law 569-2013 that would apply to properties within the area influence of rail infrastructure throughout the city. According to a report submitted to Council, the City's Zoning By-laws do not include rail specific setbacks or other zoning standards to specifically address the relationship of properties to rail infrastructure. Therefore, in 2017, City Planning initiated a study on Guidelines for Development Close to Rail Corridors & Yards, which made recommendations for how to adapt the FCM/RAC Guidelines to the City's context[4].

The proposed Official Plan amendment would incorporate the requirement for applicants to submit a Rail Safety and Risk Mitigation Study as part of a complete application for development within 30 metres of rail infrastructure. The purpose of the study would be to identify how rail safety and risk mitigation measures would be addressed in the context of site-specific conditions and provide for the consideration of alternative or equivalent measures. The proposed Zoning By-law amendment would introduce a holding permission to limit (sensitive or high occupancy) land uses within 30 metres of rail infrastructure pending the completion of a Rail Safety and Risk Mitigation Study that satisfactorily demonstrates a set of rail safety and risk mitigation measures have been created for the site and supported through peer review. This holding permission would be applied only to those properties within 30 metres of a rail line and infrastructure and would apply to the as of right zoning in proximity to rail infrastructure across Toronto.

It was expected that public and stakeholder consultations regarding these amendments were to take place and a report would be brought to the Planning and Housing Committee in the Spring of 2021. Upon writing of this material, no changes were found in the bylaw (last updated March 1, 2021).

2.5.5 City of Montreal

The City of Montreal Zoning Bylaw CA29 0040 addresses provisions based on six land use groups (housing, commercial, industrial, community, recreational, agricultural, and conservation). The bylaw identifies provisions for the Housing group and the Community group with respect to the separation distance bordering a main railway line. However, these provisions are relating to noise and vibration only. However, in 2015, the City adopted the FCM/RAC Guidelines for New Development in Proximity to Railway Operations into its long-term development plan.

[4] IBI (2019), "Land Use Study: Development in Proximity to Rail Operations"

2.5.6 Queensland, Australia

The Queensland government published guidelines for developments adjacent to the railway environment[5]. The guide defines the railway environment as comprising the combination of the following:

- The area located in, below and above a railway corridor
- The area located on, below and above the 25-metre wide strip of land running along each side of a railway corridor.

In addition, the guide states that "Where a railway is located in a tunnel and any part of that tunnel is less than 25 metres below natural ground level, the width of the strip of land included in the railway environment increases to 50 metres along each side of the tunnel."

Any proposed development within the railway environment must comply with Australian standards, Queensland Rail (QR)/Department of Transportation and Main Roads (TMR) technical requirements and standard drawings. The guide presents a list of 18 related documents that contain information regarding design of foot bridges, design of buildings over or near railways, standard clearances for new structures, requirements for services under the railway corridor, and others.

The guide states that "the cost of developing in, below or above a railway corridor may be prohibitive because of the need to ensure the impacts of an incident involving dangerous goods and fire can be appropriately mitigated." However, it provides a checklist of items to be considered when undertaking a development in an area where dangerous goods move by rail. The following are the items in the checklist:

a. A pre-lodgement meeting has been held with TMR to enable the early assessment of risk and TMR has sought the input of the Railway Manager and the Queensland Fire and Rescue Service.
b. A risk assessment has been undertaken to evaluate all relevant considerations relating to fire safety and the transport of dangerous goods in the railway corridor. (A risk assessment guide is included in Appendix 1 of the guide).
c. The proposed development has been designed to minimise the impacts of fire, explosion, chemical spill, liquid fuel spill or gas emission. Measures have been incorporated in the design to:
    i. minimize or control the outbreak of fire
    ii. control smoke and/or gas release and dispersion
    iii. minimize heat build-up in structures
    iv. limit the possibility of structural components being blast damaged
    v. provide stability or contingency measures in the proposed development
    vi. provide safe emergency access and egress to and from the railway corridor and the development
    vii. ensure effective containment and cleanup of dangerous goods incidents.
d. The proposed development has been designed to withstand a minimum heat load of 60 MW. Consideration has been given, in discussion with TMR, to the prospect that the proposed development, its location in the railway corridor and the risk profile of the dangerous goods

[5] Queensland Government (nd). "Guide for Development in a Railway Environment."

transported in the corridor may mean the development will have to withstand a greater heat load. The design for the appropriate heat load has considered the following:

i. the appropriate thickness of the enclosure soffit
ii. the coating of the enclosure soffit with passive fire protection material
iii. the provision of sprinklers on the enclosure soffit above the tracks to reduce the heat generation rate and suppress fire by preventing air flow to the fuel.

e. Appropriate fire protection and alarm systems are proposed to be provided in the enclosed parts of the railway corridor.

2.5.7 New South Wales, Australia

The State Environmental Planning Policy (Infrastructure) 2007, under the Environmental Planning and Assessment Act 1979, has as one of its objectives to identify matters to be considered in the assessment of development adjacent to particular types of infrastructure, with rail being one of those. More specifically, the Infrastructure policy refers to guidelines which must be taken into account where development is proposed in, or adjacent to, specific railway corridors under clauses 85, 86, and 87 as follows:

"85 (Development immediately adjacent to rail corridors) if the development:

a. is likely to have an adverse effect on rail safety, or
b. involves the placing of a metal finish on a structure and the rail corridor concerned is used by electric trains, or
c. involves the use of a crane in air space above any rail corridor. . .

86 (Excavation in, above or adjacent to rail corridors) if the development (other than development to which clause 88 applies) that involves the penetration of the ground to a depth of at least 2m below ground level (existing) on land that is:

a. within or above a rail corridor, or
b. within 25 m (measured horizontally) of a rail corridor, or
c. within 25 m (measured horizontally) of the ground directly above an underground rail corridor."

87 (Impact of rail noise or vibration on non-rail development) refers to noise or vibration associated with development of the following purposes that is on land that is in or immediately adjacent to a rail corridor and the consent authority considers development is likely to be adversely affected by rail noise or vibration: building for residential use, a place of public worship, a hospital, an educational establishment, or childcare centre."

In response to the Infrastructure Policy, the government of New South Wales published guidelines for the Development Near Rail Corridors and Busy Roads. The purpose of the guideline is to assist in reducing the health impacts of rail and road noise and adverse air quality on sensitive adjacent development, and to assist in the planning, design, and assessment of development in, or adjacent to, rail corridors and busy roads.

Section 5 of the guide discusses potential impacts of adjacent development on roads and railway. Key highlights of interest to this study are:

- It is always advisable to undertake early consultation with the relevant infrastructure authority when planning a development next to rail infrastructure. Design and safety issues can be identified and incorporated early in the process, therefore, reducing the need for ongoing iterations, costs, and delays.
- A crane, concrete pump, or other equipment must not be used in airspace over the rail corridor without approval in writing from the rail authority. No loads should pass over overhead wiring or transmission lines located within the corridor at any time.
- In the design of buildings or structures either within or adjoining the rail corridor, the potential risks from a possible derailment should be considered. Sites within the corridor straddling rail lines, or outside the corridor adjacent to curves on highspeed tracks or at rail line junctions are at a higher risk. The need for derailment protection must be considered for the design of piers, columns, and structures within or which interface with the corridor.
- Piers, columns, buildings, and structures within or adjoining corridors must have a risk assessment undertaken, which should consider the following criteria:
    - Site condition, presence of cuttings or embankments and any other characteristics of the site.
    - Derailment history of the site.
    - The type of proposed structure to be erected, including any potential for collapse and consequent damage to trains and other infrastructure.
    - Track geometry and its likely effect on the proposed work.
    - Track speed and whether this represents a risk to the integrity of the proposed structure.
    - Type of rolling stock using the track.

2.5.8 Auckland, New Zealand

The principal statutory planning documents for Auckland are:

- Unitary Plan Operative
- Auckland Plan
- Auckland Long-Term Plan
- Auckland Regional Land Transport Plan

None of these documents identify much with respect to land development in the vicinity of railways facilities, except as follows:

- In its City Centre Master Plan, the City envisages minimized through traffic and truck/container freight movement within the city centre.
- Auckland's Unitary Plan Operative, which provides the regulatory framework for Auckland's development, is mostly silent regarding development near rail facilities, except for the following:
    - Article 27 requires that any development limit the location of buildings and other visual obstructions within the sightline areas of road/rail level crossings.
    - Article 28 discourages new road and pedestrian rail level crossings to ensure the safe, effective, and efficient operation of the region's rail network.

- Article 29 requires the control of vehicle access to sites adjacent to all road/rail level crossings to improve safety for road users on the approach to level crossings.

2.5.9 London, England

The London Plan is silent on development issues in the vicinity of railway corridors or yards. The only reference to this topic is related to noise in Policy D13 Article 3.13.6, which states that "as well as cultural venues, the Agent of Change principle should be applied to all noise-generating uses and activities including schools, places of worship, sporting venues, offices, shops, industrial sites, waste sites, safeguarded wharves, rail and other transport infrastructure." The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development.

3 ENVIRONMENTAL SCAN

This chapter presents the results of a review of national and international literature regarding mitigating measures that can be applied to reduce challenges and risks associated with dangerous goods movement and storage adjacent to urban land uses. The literature review was supported by a survey of the following jurisdictions:

- City of Tacoma
- City of Chicago
- City of Antwerp
- City of Hamburg
- City of Winnipeg
- City of Bremerhaven
- City of Felixstowe

The findings have been divided into physical measures (Section 3.1) and operational measures (Section 3.2). For each measure, the following information is provided based on the literature:

- A description of the measure
- Advantages and disadvantages
- Special Considerations
- Existing applications – shows readily-available examples of jurisdictions where measure has been applied.
- Implementation effort
- Relative cost (capital and operating).

In addition to the information provided above for each measure, some of the interviews yielded unique information that was better presented in a separate section of this memo. Section 3.3 contains the findings from these selected interviews.

Details about each of physical or operational are included in a series of templates (or tables) contained in each of the two sections. Figure 7 serves as a legend to provide guidance on how to read and understand each of the templates containing information about the physical and operational measures.

MITIGATING MEASURE:	This shows the name of the mitigating measure addressed in the template

DESCRIPTION OF THE MEASURE

A brief overview describing the mitigating measure.

ADVANTAGES	DISADVANTAGES
A list of advantages associated with the mitigating measure, based on available literature.	A list of disadvantages associated with the mitigating measure, based on available literature.

SPECIAL CONSIDERATIONS

In some cases, the literature identifies special considerations when implementing the given mitigating measure. These special considerations are listed here.

EXAMPLES OF EXISTING APPLICATIONS	IMPLEMENTATION EFFORT IN URBAN SETTING
Examples of jurisdictions where the given mitigating measure has been applied. This is not intended to be an exhaustive list. These are based on the literature.	Low — Medium — High A qualitative scale based on engineering judgement applied from knowledge extracted from the literature. This scale refers to ease of implementation of the mitigating measure in an urban setting, mainly relating to challenges due to issues such as space availability, design, required administrative coordination, maintenance issues, and others.

RELATIVE COST	References:
Capital Operating A high-level cursory estimate of the relative capital/operating cost of countermeasures based on the literature, vendor websites, trade magazines, and other websites. A symbolic scale is used: $ - Less than $50,000 $$ - Between $50,000 and $500,000 $$$ - More than $500,000	List of references used to obtain the content shown in the template.

Figure 7: Guidance for Reading Each Template

3.1 Physical Measures

The literature identified the following physical mitigating measures that can be applied to reduce challenges and risks associated with dangerous goods movement and storage adjacent to urban land uses. Details about each of these are included in tables on the following pages (in alphabetical order):

- Active protection (fire suppression systems)
- Air circulation design for covered areas such as tunnels
- Crash attenuation (sand attenuators and gravel traps)
- Crash wall
- Drainage systems
- Earthen berm
- Fire spread mitigation (nonflammable materials, firewalls)
- Gabions
- Noise-sensitive building design
- Rail grade crossing design
- Security fence
- Setbacks
- Structural protection (pillars/piers, walls, sacrificial attenuation)

MITIGATING MEASURE: Active Protection (Fire Suppression Systems)

DESCRIPTION OF THE MEASURE

Fire suppression systems are used to prevent damage to the merchandise carried, and the railway system itself (or immediately adjacent areas). The system weaves around critical risk areas to instantly flood the zone with extinguishing agent and suppress the fire.

ADVANTAGES

- Automatically detects and suppresses engine and mechanical fires
- Works quickly before a fire can damage equipment
- Easy and flexible installation
- Low operating costs

DISADVANTAGES

- Potential for accidental actuation
- Should not be used as the sole fire safety system

SPECIAL CONSIDERATIONS

- Fire suppression systems includes multiple components which may need to be tailored for each train

EXAMPLES OF EXISTING APPLICATIONS

- Moscow, Russia
- ThamesLink, UK

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	$

References:

- Rotarex Firetec (2018)
- Wagner (2018)
- Gillespie et. al. (2017)

MITIGATING MEASURE: Air Circulation Design

DESCRIPTION OF THE MEASURE

Air circulation design for covered areas such as tunnels is primarily used to provide safe evacuation conditions for passengers in case of fire. The circulation serves to transport toxic gases, smoke and heat out of the walkway and tunnels. Typically, 100% reversible fans are used for longitudinal ventilation along the tunnel, however jet fans can also be used.

ADVANTAGES

- Can use recycled air to maintain moderate temperatures
- Reversible fans can be used for smoke control

DISADVANTAGES

- Jet fans can have difficulty balancing airflow and may require complicated control strategies
- Design must be custom made to tunnel parameters

SPECIAL CONSIDERATIONS

- Circulation design can vary depending on tunnel parameters. The length of the tunnel, number of trains per vent section, station smoke control, and non-incident tunnel trains can all impact the design and should be considered extensively.

EXAMPLES OF EXISTING APPLICATIONS

- Air circulation design is implemented at many locations through Canada and internationally.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	$$

References:

- FlaktGroup (2021)
- WSP Parsons Brinckerhoff (2017)

MITIGATING MEASURE: Crash Attenuation

DESCRIPTION OF THE MEASURE

There are different types of crash attenuation devices. Two types are of interest to this study: Fitch barriers or "sand attenuators" and gravel traps.

Sand attenuators are used primarily at bridge abutments, cantilever posts, gore areas and at barrier wall-ends. They absorb the energy of a crash and reduce collateral damage to other vehicles and injuries to traveling motorists.

Gravel traps consist of a gravel-filled zone used to slow down and trap errant vehicles.

ADVANTAGES

Sand Attenuators

- Simple to move and install.
- Certified to meet the crashworthy requirements of NCHRP 350.
- Available in different configurations and weights.

Gravel Traps

- Simple to install
- Provides high friction resistance

DISADVANTAGES

Sand Attenuators

- Allow the vehicle to pass through rather than redirecting
- Site may require re-grading if too steep

Gravel Traps

- High maintenance.
- Require lots of space for desired effects. It may require a separate roadway to be constructed off the main facility.
- It is difficult to remove the stopped vehicle from the arrestor bed due to the extreme invasion of gravel in the axles.

SPECIAL CONSIDERATIONS

Sand Attenuators

- Must be arranged so the weights of the sand barrels are increasing with the direction of movement.

Gravel Traps

- A mechanical arrestor ramp can be installed on flat ground, containing a series of stainless steel catch-nets that absorb the energy of a large vehicle collision and stop the vehicle.
- A traditional approach also uses arrestor beds surfaced with sand, river gravel, or crushed gravel.

EXAMPLES OF EXISTING APPLICATIONS

- Both measures have several installations across the country information is not readily available regarding railway applications.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	$$

References:

- PSS (2018)
- Speier, G (nd)

MITIGATING MEASURE: Crash Walls

DESCRIPTION OF THE MEASURE

Crash walls are concrete structures designed to provide similar physical resistance to a derailed train as an earthen berm. A crash wall is designed to deflect an oncoming car or locomotive, rather than absorb the impact, as a berm does; therefore, crash walls are often referred to as deflection walls.

ADVANTAGES

- Can be used to decrease setbacks by building taller walls.
- No need for slope decreases footprint as compared to earthen berm.
- Can be designed to perform other functions, such as security fencing and sound attenuation.
- Have minimal ROW requirements as well as minimal or no routine maintenance.

DISADVANTAGES

- More expensive than an earthen berm.
- Typically provide little protection against explosions, fire, or dangerous goods release.
- Crash walls will deflect a train back toward the track, contrasting an earthen berm's tendency to absorb the impact and stop the movement.
- Depending on the height and length, it can produce undesirable visual impacts, particularly when adjacent to residential land.
- Relatively high cost.

SPECIAL CONSIDERATIONS

- Must be designed to meet the site-specific requirements of the rail development, including the rail line classification, max speed, and geotechnical conditions.
- Can be combined with an earthen berm to form a crash berm. Crash berms are more effective at absorbing impacts than crash walls and are highly cost effective in physically constrained sites.

EXAMPLES OF EXISTING APPLICATIONS

- Toronto

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$

References:

- Dialog (2013)
- AECOM (2014)
- Johnson Sustronk Weinstein + Associates (Derailment Protection Report - Blauson Assets Management Ltd. 2020)
- BC Ministry of Transportation and Highways (1997)

MITIGATING MEASURE: Drainage Systems

DESCRIPTION OF THE MEASURE

Properly designed drainage systems improve safety outcomes in two ways: First, clearing water from the ground decreases risk of an incident due to adverse water conditions causing track instability. Second, a drainage system can evacuate an accidental spill of dangerous liquid. Spill management systems incorporate additional measures to drainage systems to manage releases of dangerous liquids.

ADVANTAGES

- Drainage systems reduce risk in multiple ways

DISADVANTAGES

- Upgrading drainage systems to be prepared for a release of dangerous liquid, rather than just water, is a significant investment.

SPECIAL CONSIDERATIONS

- Spill management systems can include siphons that can assist in avoiding flame propagation in the underground portion of the system in the event of a flammable liquid spill.
- Spill management systems can include site containment systems that prevent dangerous liquids from leaving the site via runoff or rainwater drainage systems.

EXAMPLES OF EXISTING APPLICATIONS

- Victoria, Australia
- Melbourne, Australia

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$$

References:

- Technical Safety BC (Railway Safety Program: Safety Handbook 2018)
- CP (Customer Safety Handbook 2020)
- Van der Vlies & van der Heijden (Urban planning and rail transport risks: Coping with deadlocks in Dutch urban development projects 2013)
- Environment Protection Authority Victoria (Liquid storage and handling guidelines 2018)
- City of Melbourne (Docklands Design and Construction Standards 2013)

MITIGATING MEASURE: Earthen Berms

DESCRIPTION OF THE MEASURE

Earthen berms provide a physical safety barrier between a rail facility and nearby developments that can reduce or eliminate potential property damage and/or injury from a rail incident. Berms are constructed parallel to rail right-of-way and are mounded so that a rail car travelling into the berm will dig into the earth and have its movement stopped.

ADVANTAGES

- Can provide significant physical protection when combined with appropriate setback.
- Their natural appearance allows them to blend in with their surrounding in an aesthetically pleasing manner.
- Lower capital cost if ROW and fill material is available on site.

DISADVANTAGES

- Provide little protection against explosions, fire, or dangerous goods release.
- Require 'sufficient' right-of-way (ROW).

SPECIAL CONSIDERATIONS

- Berms are typically only required on primary and secondary branch lines, but not on spur lines.
- Standard berm height is 2.0 m-2.5 m depending on rail corridor type, and standard slope is 2.5:1 or less.
- Berms are not required when the railway is in a cut of equivalent depth.
- Can be combined with a crash wall to form a crash berm (Additional information provided under Crash Walls).

EXAMPLES OF EXISTING APPLICATIONS

- Information not readily available

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$

References:

- Dialog (Guidelines for New Development in Proximity to Railway Operations 2013)
- Earth Tech Canada Inc. (Final Report - Proximity Guidelines and Best Practices 2007)
- BC Ministry of Transportation and Highways (1997)

MITIGATING MEASURE: Fire Spread Mitigation

DESCRIPTION OF THE MEASURE

Fire spread mitigation can be in the form of firewalls and/or non-flammable materials. A firewall is a special type of fire separation assembly typically made up of non-combustible materials. It must be capable of withstanding the impact of fire and contain it to one side of the wall until the fire burns itself out or is extinguished. The intent is that even in a severe fire, a firewall will remain standing to prevent the spread of the fire.

As for non-flammable materials, the purpose is to reduce the flame time, the drip flame time, and the burn length. Materials used ideally would stop flaming after the flame source is removed, or has falling from the specimen to the floor, and exhibit minimal damage the further from the source.

ADVANTAGES	DISADVANTAGES
• Contains the affected area • Delays the collapse of structural members	• Can be expensive in terms of cost and installation • Does not directly extinguish the fire

SPECIAL CONSIDERATIONS

- Non-flammable materials used should be environmentally friendly and ideally non-toxic, however these materials can be more expensive in terms of manufacturing

EXAMPLES OF EXISTING APPLICATIONS

- Have several installations across the country, information is not readily available regarding railway applications.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$

References:

- University of Westminster (2009)
- Blaine et al. (2020)

MITIGATING MEASURE: Gabions

DESCRIPTION OF THE MEASURE

Gabions are structures consisting of rocks or boulders contained within a steel woven wire cage. Gabions use their weight to provide protection for various types of structures, including those around rail yards; their function is like that of a crash wall or earthen berm.

ADVANTAGES

- Installing gabions is a low-cost alternative to reinforced structures such as crash walls.
- Gabions function well as retaining walls due to their porosity, which prevents pore-water pressure buildup.

DISADVANTAGES

- Due to the weight of the rocks used, some settlement into the soil is unavoidable.
- Cannot be built as high as concrete walls but 5 m high is feasible.
- Not necessarily aesthetically pleasing.
- Despite protection from gabions, structures may be required to be reinforced regardless.
- Not a sufficient replacement for setbacks.

SPECIAL CONSIDERATIONS

- Gabions must be properly designed to withstand any impacts expected from a potential derailment incident.
- Gabions are frequently used as a retaining wall as the gaps between rocks eliminate water buildup
- The functions served by gabions (structure protection, retaining walls) can be performed by other products, such as guard rails and earthen berms (protection) or modular concrete blocks (protection and retaining walls). Depending on the model used, modular concrete blocks may lack the drainage properties of gabions, and any crash barrier must be designed to withstand the expected forces of an impact, potentially raising the closer to that of a crash wall.

EXAMPLES OF EXISTING APPLICATIONS

- New South Wales

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	$

References:

- NSW Department of Planning (Development Near Rail Corridors nad Busy Roads - Interim Guideline 2008)
- Indian Roads Congress (Guidelines for Design and Installation of Gabion Structures 2018)
- Block Moulds (n.d.)

MITIGATING MEASURE: Noise-Sensitive Building Design

DESCRIPTION OF THE MEASURE

By constructing buildings with the correct orientation and room layout, noise impacts from rail operations can be reduced inside the affected buildings. Examples include locating noise-sensitive rooms on the side of the building opposite the noise source, minimizing the number of doors and windows on the side of the building nearest the noise source, and designing wall and windows to prevent noise transmission from the outside.

ADVANTAGES

- Can be applied to reduce noise impacts throughout all buildings, including high-rises.

DISADVANTAGES

- Cannot be applied retroactively.

SPECIAL CONSIDERATIONS

- Noise mitigation provides no safety benefits but are important to consider in all urban rail yard contexts.
- Various mitigation measures that may reduce noise in buildings but are primarily intended to perform risk mitigation of other factors (e.g., derailments, dangerous goods releases), are listed as separate items. These measures include crash walls, fire spread mitigation, active fire suppression, and structural protection.

EXAMPLES OF EXISTING APPLICATIONS

- Information not readily available.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	N/A

References:

- Dialog (Guidelines for New Development in Proximity to Railway Operations 2013)

MITIGATING MEASURE: Rail Grade Crossing Design

DESCRIPTION OF THE MEASURE

Highway-rail grade crossings are a safety issue for rail as the interaction between rail and road operations increases the likelihood of an incident. While the ultimate safety treatment for addressing rail/road interactions is grade separation, improving crossing design for at-grade crossing locations can decrease collision risk. Potential design improvements to rail at-grade crossings include:

- Improved signage and warning devices
- Improving road design to eliminate humped (low-profile) crossings
- Improved sightlines
- Removing unnecessary crossings

ADVANTAGES

- Improves general safety outcomes, in addition to safety from dangerous goods transport by rail and truck.

DISADVANTAGES

- Can be very expensive, depending on the treatment type (although never as expensive as grade separation)

SPECIAL CONSIDERATIONS

- Rail grade crossings present an additional risk in that there is a chance that an incident can include dangerous goods transported by road in addition to by rail.
- Active warning devices are warranted where there is higher than normal usage by heavy trucks or trucks carrying dangerous or hazardous materials.

EXAMPLES OF EXISTING APPLICATIONS

- Proper rail grade crossing design is implemented at many locations through Canada and internationally.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$$	$$

References:

- Warner et al. (Public Guidance for Managing Hazardous Material Transportation in Texas 2009)
- Ogden & Cooper (Highway-Rail Crossing Handbook, 3rd Edition 2019)
- Transport Canada (Grade Crossings - Handbook 2016)

MITIGATING MEASURE: Security Fencing

DESCRIPTION OF THE MEASURE

Fencing around railway corridors can reduce incidents of trespassing, which will improve safety outcomes and reduce incidents of emergency whistling. Trespassing on railway property continues to be a major safety issue in Canada – about 100 injuries and fatalities every year, regardless of the level of pedestrian or cyclist activity at these sites.

ADVANTAGES

- Can provide a decrease in trespassing incidents in known problem areas, such as those surrounding parks, trails, open space, community centres, and schools.
- Protects public for entry, particularly in high traffic areas, although trespassing is a possibility in high and low traffic conditions.

DISADVANTAGES

- Can reduce, but not eliminate, trespassing incidents.

SPECIAL CONSIDERATIONS

- Security fencing is typically chain link fence, but other materials can be substituted given approval by the railway and municipality.
- Standard required height of chain link fence is 1.83 m.
- A noise barrier or crash wall can serve the purpose of security fencing.
- Fencing solutions to prevent intrusion of windborne debris such as snow and sand have been studied, with the finding that porous fences allow debris smaller than the pore size to flow through, but that solid fences, if not specifically designed for a particular context, can trap debris on the inside, as well as the outside of the fence, causing undesirable accumulation.

EXAMPLES OF EXISTING APPLICATIONS

- Various locations across Canada.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	$$

References:

- Dialog (Guidelines for New Development in Proximity to Railway Operations 2013)
- Earth Tech Canada Inc. (Final Report - Proximity Guidelines and Best Practices 2007)
- Bruno, et al. (2018)

MITIGATING MEASURE: Setbacks

DESCRIPTION OF THE MEASURE

Setbacks from railway corridors or yards permit emissions, vibrations, and noise from rail operations to dissipate and provides a safety barrier.

ADVANTAGES	DISADVANTAGES
• Setbacks decrease the need for other mitigation measures	• Setbacks are not always practically compatible with dense developments due to spatial constraints • Setbacks do not eliminate the need for additional mitigating measures

SPECIAL CONSIDERATIONS

- Reduced setbacks can be considered in conjunction with alternative safety mitigation measures.
- The recommended setback from a freight yard is 300 m, while the recommended setback from a rail mainline corridor is 30m. Setbacks are measured from the rail property line.
- Horizontal setbacks can be accompanied by vertical clearances to form a 'Rail Proximity Envelope'. The City of Calgary has set the required height of the envelope to be 7 m.
- Some assessments reduce required horizontal setbacks by building taller walls, and summing the vertical and horizontal setbacks to arrive at the total setback amount (e.g., 20 m horizontal setback + 10 m high wall = 30 m total setback)

EXAMPLES OF EXISTING APPLICATIONS

- Town of Canmore
- City of Edmonton
- City of London
- City of Ottawa

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	N/A

References:

- Dialog (Guidelines for New Development in Proximity to Railway Operations 2013)
- Porter, et al. (Spatio-Parametric Rail Risk Assessment for Developments Near Freight Rail 2017)
- Earth Tech Canada Inc. (Final Report - Proximity Guidelines and Best Practices 2007)
- IBI Group (Land Use Study: Development in Proximity to Rail Operations 2019)
- Hatch Ltd. (2019)

MITIGATING MEASURE: Structural Protection

DESCRIPTION OF THE MEASURE

Structural protection such as deflection walls or crash walls are reinforced concrete structures provided for the protection of piers and abutments within the vicinity of railway tracks. The purpose of these walls is to prevent head on collisions from derailed trains on the primary structural support elements as a direct collision of a train on a primary pier may lead to total collapse of bridge.

ADVANTAGES	DISADVANTAGES
• Avoid catastrophic failures due to collisions. • Minimize probability of injury to passengers.	• Expensive to implement. • Difficult and costly to retrofit

SPECIAL CONSIDERATIONS

- The crash wall should be in accordance with the latest Transport Canada code or in accordance with standards of the rail company the bridge is over, whichever specified load is greater.

EXAMPLES OF EXISTING APPLICATIONS

- Throughout Australia

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$-$$$	$

References:

- Anand (2018)
- Rapattoni (2014)

3.2 Operational Measures

The literature identified the following operational mitigating measures that can be applied to reduce challenges and risks associated with dangerous goods movement and storage adjacent to urban land uses. Details about each of these are included in tables on the following pages (in alphabetical order).

- Corridor Risk Assessments
- Dangerous Goods Storage Practices
- Development Viability Assessment
- Emergency Response Planning
- Positive Train Control
- Rail Car Tracking
- Risk-Based Land Use Planning
- Spatial Risk Assessment
- Spill Management Plan

MITIGATING MEASURE: Corridor Risk Assessments

DESCRIPTION OF THE MEASURE

Corridor risk assessments are performed by railways on their corridors to determine the level of risk from a variety of sources, including dangerous goods, and to evaluate various technologies for their suitability for risk reduction along the corridor. Mathematical assessment techniques are used to evaluate risk and the influence of potential mitigating measures on that risk.

ADVANTAGES

- Mathematical assessment provides an objective assessment of risk.
- Can be used to identify mitigating measures.

DISADVANTAGES

- Should be renewed on a set schedule (e.g., every 3 years) to ensure currency.

SPECIAL CONSIDERATIONS

- Corridor risk assessments can be used to identify risk 'hot spots' on a corridor to allow for targeted risk mitigation measures.
- CN's corridor risk assessment process analyzes 28 corridor characteristics, including train volume, speed, track alignment, rail type, rail grade crossings, and geotechnical features. These factors are analyzed in how they impact the frequency of a cause of derailment and the likelihood of a derailment when a cause is present.

EXAMPLES OF EXISTING APPLICATIONS

- Information not readily available.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	N/A

References:

- CN (2019 Leadership in Safety 2019)
- Saat & Lin (Shared Rail Corridor Adjacent Track Accident Risk Analysis 2014)

MITIGATING MEASURE: Dangerous Goods Storage Practices

DESCRIPTION OF THE MEASURE

To ensure safety in rail yards where dangerous goods are stored, a variety of storage practices must be followed. These measures include:

- Storage clearances for incompatible freight
- Rules for loading and unloading dangerous goods
- Rules for placement of dangerous goods rail cars in marshaling operations

ADVANTAGES

- Many storage requirements are already regulated.
- Correct procedures can reduce risk of derailment and non-derailment incidents.

DISADVANTAGES

- Use of enclosures represents an operational burden.

SPECIAL CONSIDERATIONS

- Incompatible freight may be required to be stored 3 to 5 m apart, depending on the nature of the incompatibility.
- Use of enclosures for freight that has specific fire suppression requirements is recommended.
- While reducing the transport and storage of dangerous goods in a rail facility will decrease the risk due to dangerous goods, requirements for maximum storage duration are typically not in place; some jurisdictions allow administrators to limit time that dangerous goods may be stored in a facility.

EXAMPLES OF EXISTING APPLICATIONS

- Information not readily available.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$	N/A

References:

- Batarliene (Risk analysis and assessment for transportation of dangerous freight 2008)
- Batarliene (Improving Safety of Transportation of Dangerous Goods by Railway Transport 2020)
- Bagheri & Fu (Effective placement of dangerous goods cars in rail yard marshaling operation 2010)
- Government of Nova Scotia (Dangerous Goods Management Regulations 2017)

MITIGATING MEASURE: Development Viability Assessment

DESCRIPTION OF THE MEASURE

A Development Viability Assessment is a procedure in which the site of a proposed residential development in a constrained area near an existing rail corridor is evaluated to determine potential conflicts due to the proximity of the rail corridor and impacts of the proposed development on rail operations on the corridor. It consists, at a minimum, of evaluating details of the site, affected railway, proposed development, and construction methods and staging, as well as hazards and risks associated with each of these components.

ADVANTAGES

- Can identify issues and potential mitigation measures before problems are experienced.
- Can identify non-standard mitigation measures that can enable a development to proceed when standard mitigation measures are not feasible.

DISADVANTAGES

- None identified.

SPECIAL CONSIDERATIONS

- An assessment allows municipal planners to better evaluate proposals for residential developments in areas where standard mitigation measures cannot be accommodated.
- An assessment should be carried out by a qualified planner or engineer in consultation with the affected railway.
- Example DVAs in the Greater Toronto Area evaluate the following factors:
  - Land value and availability (physical constraints of the site)
  - Sensitivity of land uses to risk from rail incidents
  - Track geometry, presence of junctions, and speed
  - Expected train types (e.g., passenger, freight, mixed, dangerous goods)
  - Potential public benefit of site development
  - Historical track incidents (rail operations and trespassing incidents)

EXAMPLES OF EXISTING APPLICATIONS

- Toronto
- Etobicoke

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	N/A

References:

- Dialog (Guidelines for New Development in Proximity to Railway Operations 2013)
- Hatch Ltd. (Rail Safety and Development Viability Assessment - 6 Dawes Road, Toronto 2019)
- Hatch Ltd. (2020)

MITIGATING MEASURE: Emergency Response Planning

DESCRIPTION OF THE MEASURE

Emergency response planning allows jurisdictions to be prepared for any potential dangerous goods incidents that may occur in their jurisdiction. Emergency response planning allows jurisdictions to:

- Have personnel available and ready for response
- Have procedures in place to deal with incidents
- Coordinate with the relevant parties (rail companies, etc.)

All organizations should have an emergency response program in place given that customers and stakeholders see it as an indication of reliable business operation. This means that it is good practice for a road authority, particularly in the context of this study, to have such a document in place, whether it is hosted by the Fire Department or another department within the agency.

ADVANTAGES

- Current regulations require many parties to have Emergency Response Assistance Plan (ERAP) in place.

DISADVANTAGES

- Emergency response planning does not decrease the likelihood of an incident.

SPECIAL CONSIDERATIONS

- An emergency response plan typically considers the following:
  - Risk assessment
  - Potential losses
  - Potential emergencies
  - Comprehensive emergency preparedness policy and response program
  - Business continuity and business recovery plan
  - Lessons learned from incidents
  - Improvement on response capability

EXAMPLES OF EXISTING APPLICATIONS

- Information not readily available.

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$$

References:

- Transport Canada (Emergency response assistance plans 2021)
- CN (Railroad Emergency Preparedness Guide 2020)
- CP (Community Emergency Planning Guide 2017)
- Canadian Centre for Occupational Health and Safety (2020)
- Public Safety Canada (2010)

MITIGATING MEASURE: Positive Train Control

DESCRIPTION OF THE MEASURE

Positive Train Control Signal systems provide continuous monitoring of train positions in relation to each other and automatically maintain safe separations and speeds as well as prevent certain unauthorized train movements on a given track segment. Positive train control prevents trains from making certain movements but does not automatically perform any movements.

ADVANTAGES

- Provide increased security from incidents caused by accident or malicious action.
- Can prevent incidents from happening due to various types of operator error.

DISADVANTAGES

- Requires extensive investment in infrastructure and employee training.
- Use in United States is driven by congressional mandate, with no similar Canadian legislation.

SPECIAL CONSIDERATIONS

- These systems are mandated in the U.S. to be in place on rail routes that either serve both passenger and freight rail or are used to transport toxic-by-inhalation hazardous materials.
- Analysis indicates that 5.6% of rail occurrences in Canada from 2011-2015 could have been prevented by positive train control.
- Costs can be up to $1 million per track mile in dense urban areas, with a range of $123,000 to $192,000 per track mile for typical applications.
- Is a form of Enhanced Train Control, which can include measures from a warning system to a full positive control system.

EXAMPLES OF EXISTING APPLICATIONS

- United States (Select rail corridors)

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$$	$$

References:

- Warner, et al. (Public Guidance for Managing Hazardous Material Transportation in Texas 2009)
- CN (2019 Leadership in Safety 2019)
- Train Control Working Group (Train Control Working Group Final Report 2016)

MITIGATING MEASURE: Rail Car Tracking

DESCRIPTION OF THE MEASURE

Rail car tracking uses electronic means to monitor the movements of select rail cars when in sensitive areas such as dense urban development.

ADVANTAGES

- Can provide warning of potential intentional damage through monitoring of standstill time.
- Can be used to perform automatic alerts.

DISADVANTAGES

- Does not perform actions to prevent rail incidents, only provides warnings.

SPECIAL CONSIDERATIONS

- Is typically applied only to sensitive goods such as cars transporting toxic-by-inhalation goods
- Is a form of Enhanced Train Control.

EXAMPLES OF EXISTING APPLICATIONS

- Texas

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$$	$

References:

- Warner et al. (Public Guidance for Managing Hazardous Material Transportation in Texas 2009)
- Train Control Working Group (Train Control Working Group Final Report 2016)

MITIGATING MEASURE: Risk-Based Land Use Planning

DESCRIPTION OF THE MEASURE

Risk-based land use planning determines how suitable a site is for a given use based on quantified assessments of risk. By calculating risk, an objective assessment of the impacts of a development can be performed.

ADVANTAGES

- Quantified assessment of risk allows mitigation measures to be calibrated to risk level.
- Quantified risk for mitigation measures can be used to perform a cost-benefit analysis to support the planning initiative.

DISADVANTAGES

- To be useful, accurate quantifications of risk and risk reduction from mitigation measures must be available.

SPECIAL CONSIDERATIONS

- For application of quantified risk assessment, the acceptable level of risk must be defined, including both defining both the metric to be used and the value of that metric.
- To gain stakeholder buy-in, reductions in risk from mitigation measures can be used to show no change in risk if the right mitigation measures are selected.
- Has been applied in Norway, where the acceptable level of risk has been a 1% increase from the base level in the likelihood of death, with the base level being 1 in 10^{-4} per year.
- Has been applied in Toronto as part of a development viability assessment. Risk was calculated separately for a variety of potential incident types (e.g., Main Line Derailment – Explosive), with risk calculated as the product of the expected frequency and severity of an incident type, each rated from 1 to 5. Risk values greater than 5 had mitigation measures applied to reduce risk from particular incident types.

EXAMPLES OF EXISTING APPLICATIONS

- Norway
- Toronto

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	N/A

References:

- Van der Vlies & van der Heijden (Urban planning and rail transport risks: Coping with deadlocks in Dutch urban development projects 2013)
- MIACC (Risk-Based Land Use Planning Guidelines 1995)
- Glickman & Erkut (Assessment of hazardous material risks for rail yard safety 2007)
- (Hatch Ltd. 2019)

MITIGATING MEASURE: Spatial Risk Assessment

DESCRIPTION OF THE MEASURE

Spatial risk assessment can use one of several methodologies, but all methods use data analysis to quantify risk as it applies to locations throughout regions or proximities to rail lines or other sources of dangerous goods transport or storage. Spatial risk assessment provides another layer of analysis to risk-based land use planning in that risks are expressed as applying to specific distances to rail lines, rather than as a generalized probability of incident.

ADVANTAGES

- Mathematical assessment provides an objective assessment of risk.
- Spatial approach to risk can be used to identify and calibrate mitigating measures.

DISADVANTAGES

- May generate recommendations (e.g., required setback distances) that conflict with values from other analyses.

SPECIAL CONSIDERATIONS

- Can be applied as a 'spatio-parametric risk assessment', which uses a combination of data analysis, expert judgement, and modelling and simulation to assess the risk of a dangerous goods incident impact human safety based on a person's proximity to a rail line that is used for dangerous goods transport. Explosion and dispersion modelling are used to determine the potential impacts of a dangerous goods incidents.
- Can be applied as in the 'City Eyes on Dangerous Goods' product, which uses cell phone location data and dangerous goods transportation data to find risky 'hot spots' where high populations and quantities of dangerous goods coincide in time and space. This system can then target mitigation measures to these hot spots.

EXAMPLES OF EXISTING APPLICATIONS

- Beijing

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	N/A

References:

- Porter et al. (Spatio-Parametric Rail Risk Assessment for Developments Near Freight Rail 2017)
- Wang et al. (No Longer Sleeping with a Bomb: A Duet System for Protecting Urban Safety from Dangerous Goods 2017)

MITIGATING MEASURE: Spill Management Plan

DESCRIPTION OF THE MEASURE

A spill management plan should document guidelines and processes for responding to an accidental release of a dangerous good into the environment. Typical spill management plans should:

- Document potential hazards and their impacts
- Analyse the risk of an incident
- Outline responsibilities, communications protocols, and processes for containment, evacuation, and remediation

In British Columbia, the Environmental Management Act regulates owners of a pipeline, rail, or highway transporter that has possession, charge, or control of liquid petroleum products at 10,000 litres (for rail and highway transporters) or any quantity for pipelines. These entities must demonstrate they are prepared to respond to a spill of their substances.

ADVANTAGES

- Can be adapted to specific context.

DISADVANTAGES

- Does not perform actions to prevent rail incidents, only helps mitigate their impact.

SPECIAL CONSIDERATIONS

- The BC Ministry of Environment is responsible for coordinating the government's response to major accidental spills. Spill management plans for BC jurisdictions should align with the British Columbia Hazardous Material Response Plan.
- Information required in the plans includes: hazard assessment, spill response planning map, incident command system, waste management, human health and safety, spill response, and others.

EXAMPLES OF EXISTING APPLICATIONS

- Melbourne
- British Columbia

IMPLEMENTATION EFFORT IN URBAN SETTING

RELATIVE COST

Capital	Operating
$-$$	$

References:

- City of Melbourne (Docklands Design and Construction Standards 2013)
- BC Government (B.C. Guidelines for Industrial Emergency Response Plans 2002)
- BC Government (British Columbia Hazardous Material Response Plan 2013)
- BC Government (2018).

3.3 Jurisdictional Interviews

To support the literature review, interviews were conducted with select jurisdictions that have a similar context to the City of Vancouver, or who may have developed land near rail corridors and rail yards. While some of the interviews provided insight into specific mitigation measures, five jurisdictions pointed to more strategic activities or unique challenges that are important to this study:

- Hamburg, Germany
- Winnipeg, Manitoba
- Chicago, Illinois
- Antwerp, Belgium
- Tacoma, Washington

The results of these interviews are presented here.

Hamburg, Germany

With one of the busiest ports in Europe and associated rail infrastructure to support the movement of goods into and out of Europe, Hamburg experiences similar challenges to Vancouver with respect to port and industrial land uses in close proximity to residential, retail, office and other land uses.

Population (2020)	1,845,229
Area (km²)	755
Port Container Traffic (20-foot equivalent units)	8,700,000

Hamburg City Planning staff noted that there are no existing policies or processes specific to development of sites near rail lines or rail yards. Instead, their approach to dealing with challenges related to rail-adjacent development focusses on higher level planning and stakeholder engagement strategies. They have a long tradition of converting land into different functions, including harbor sides and rail. A key issue is demonstrating that there is an opportunity for sustainable or ecological development in the land that will be rezoned.

City staff emphasized the importance of early framework planning processes to define the desired development parameters and outline all needs and demands for the site. For success in Hamburg, it was critical that stakeholder engagement was integrated with framework planning to ensure all perspectives are integrated into one planning document.

This type of advocacy and engagement emerged as a key theme in the conversation with Hamburg staff. Because federal and rail stakeholders often do not have a clear understanding of the local context, Hamburg has dealt with long and difficult negotiations to find win-win scenarios. For example, part of the engagement process involves highlighting the land owner's social responsibility to the community given that railway organizations typically have no knowledge about what is going on outside of their property. As a result, everyone benefits when they learn about the role that their land plays within the greater context.

Through this type of engagement process, Hamburg has successfully purchased rail property that will be redeveloped into residential land uses in 2027. This was possible despite railway companies having significant political influence combined with a revival in rail transportation in Germany due to increased desire for sustainable transportation options.

Key Learnings

- Early-stage, high-level planning processes help to successfully complete development projects in challenging contexts.
- While it can be a long process, persistent and consistent engagement and negotiation with government and rail stakeholders can lead to solutions that work for everyone.
- Having political champions can be of great assistance in the process.

Winnipeg, Manitoba

The City of Winnipeg has recent experience in developing land near rail lines that carry dangerous goods through a project at 'The Forks.' The Railside Project includes a mix of office and retail space along with about 1,200 multi-family residential units, that will be constructed on a site adjacent to CN's main line. Given the Canadian context of this development, project staff were invited to provide an overview of regulations and any mitigation measures that were implemented.

Population (2016)	705,244
Area (km^2)	464
Port Container Traffic (20-foot equivalent units)	N/A

The project staff noted a number of challenges encountered during the development planning process:

- The existing Federation of Canadian Municipalities (FCM) guidelines primarily provide guidance for residential developments
- The FCM guidelines do not contemplate a wide variety of track design scenarios, and so the guidelines were not directly applicable to the raised tracks present at 'The Forks'
- The set-back requirements in the FCM guidelines would have been difficult to achieve since they are measured from the property line.
- The City of Winnipeg did not have their own specific policies or bylaws related to development near rail lines and rail yards
- Typical mitigation measures such as berms, crash walls, or jersey barriers can be very costly to implement.

In order to balance safety, noise, and vibration considerations while creating a feasible development plan, the project staff reported using the following strategies:

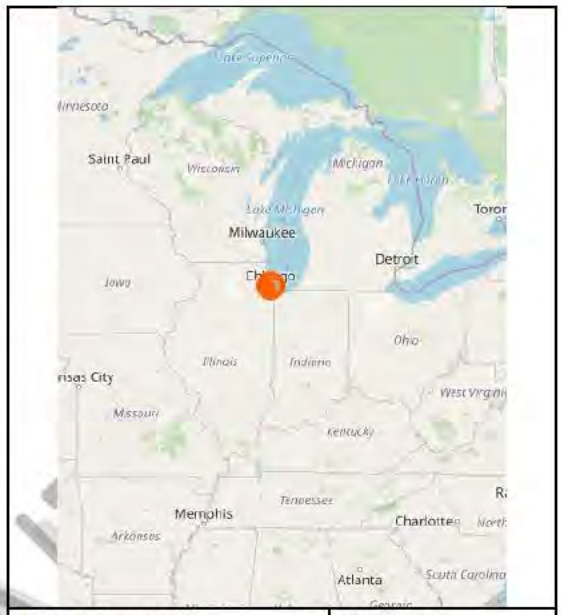
- Given that rail expansion was not possible at the site, the set-back distance was measured from the edge of the rail line, rather than from the property line
- Train speeds, derailment history, and other local factors were reviewed, which allowed for increased flexibility in the interpretation and application of the FCM guidelines
- While input was collected from the rail company, efforts were focused on satisfying organizations with authority over development approvals. In Manitoba, rail companies do not have jurisdiction over the development process.

Key Learnings

- Guidelines are of significant importance; however, care should be taken to interpret and apply them to fit the local context.

Chicago, Illinois

Chicago is one of the largest freight railway hubs in the United States, and is located on the south-west of Lake Michigan. Chicago is of interest as a case study due to these factors, and because of some potential upcoming developments. For example, the One Central development proposes to build more than 9,000 homes, in addition to retail, office, hotel, event and parking land uses. Should the project be approved, it would be constructed on a platform overtop of about 31 acres of existing rail yards, with a new transit hub to connect the development site to the wider transit network. While there is very limited freight rail in proximity to this development, factors common to rail adjacent development in general, such as noise and vibration, remain relevant.



Population (2021)	2,746,388
Area (km²)	607
Port Container Traffic (20-foot equivalent units)	N/A

The City of Chicago does not have any specific bylaws or policies related to development near rail yards or rail lines. As a result, they rely on individual developers to identify and address all risks and challenges associated with development in the vicinity of these land use types. This leads to developers having to work directly with the rail companies to determine requirements. Generally, if the railway company is satisfied, the City will not impose any additional requirements on the development. However, when it comes to rail safety, because rail safety is under federal jurisdiction, the City does not typically address or comment on rail safety considerations as part of the development approval process.

Staff also noted that in Chicago, the freight rail lines that would carry dangerous goods are generally within the City's industrial corridors. As such, the majority of the rail lines and rail yards located in downtown areas are for commuter rail, and would not be used for the transportation of dangerous goods.

Key Learnings

- The City relies on the federal government to address any rail safety issues associated with any proposed development.
- The City relies on developers to enter into negotiations that will satisfy the railways throughout the development process.

Antwerp, Belgium

Like Hamburg, Antwerp ranks as one of the busiest ports in the world, and has rail infrastructure to support the movement of goods into and out of Europe. Historically, the City of Antwerp was the terminal for the rail line, however in recent years work has been done to convert former rail yards to other land uses, or to move rail infrastructure into tunnels. One ongoing development of note is the Kiewit development near a main passenger rail station. The development includes a mix of office, residential, restaurant, and retail uses.

Population (2017)	520,504
Area (km²)	205
Port Container Traffic (20-foot equivalent units)	12,000,000

Related to this development, staff noted a number of challenges:

- In Belgium, there is a national railway company that is federally regulated
- There was initially strong public opposition to the project
- The City does not have their own policies related to mitigating risks of rail-adjacent development

In supporting the delivery of this project and other similar ones, staff noted a number of success factors:

- Set-backs in line with the federal guidelines were incorporated into the development plan
- Windows on the rail side of the development do not open, primarily for safety so that people cannot fall or jump out
- The City took the lead in the development process to create consensus among all stakeholders and local residents. For example, a requirement was added that the ground floor within the development had to be publicly accessible. The developer was also responsible to pay for the public domain around the buildings
- The City has hired someone into a stakeholder management role who holds regular meetings with key stakeholders including the rail company, public transportation, large companies, city department staff and others to collaboratively solve issues.
- Patience and flexibility in working with stakeholders. It took five years to move from the initial stages of planning to the start of construction on the first building.

Key Learnings

- City leadership in complex development contexts is critical for successful project delivery.
- Sharing responsibility for issues and consistency in stakeholder relations are key components of collaborative problem solving.

Tacoma, Washington

Tacoma is of interest for a case study due to its location on the west coast of North America, significant port activity, and a heavy rail line carrying dangerous goods that travels adjacent to the downtown area of the City. In addition, City staff shared that work has been ongoing for many years to redevelop a 200 metre wide strip of land bounded by a heavy rail yard and public two-lane road on one side, and the ocean on the other. The rail line and yard are part of the mainline track that connects to the Port of Tacoma. The land itself was purchased by the City.

Population (2020)	219,346
Area (km^2)	162
Port Container Traffic (20-foot equivalent units)*	3,300,000

At this time, some redevelopment has occurred, and it is ongoing, even in the absence of any City specific policies or bylaws related to development near rail. The main challenges reported by staff related to development in this context included:

- Planning for access to developments because the rail line (in combination with a steep hill) effectively cuts the properties off from the rest of the downtown area
- In the United States, railway companies have been given significant power over their own land and operations, which can be a barrier to effective collaboration
- Effectively marketing properties to balance the advantages of ocean-front property with the disadvantages of proximity to heavy rail

Staff also noted some strategies and approaches they have leveraged for development in this area:

- There are no specific setbacks for developments; the assumption is that the rail company should have obtained enough land for the safe operation of their trains.
- No safety concerns had been received by the City related to the developments
- Triple pane windows have been used in building designs to help mitigate noise concerns. While this is not a City requirement, many developers have incorporated it into their designs
- They default to the International Building Code, and staff were not aware of anything related to rail adjacent development in that code.
- In their context, the rail company has no power to direct what can be done with private property.
- Staff noted it is not entirely the responsibility of the development to mitigate safety or other related issues, however with the extent of power given to rail companies in the United States it is challenging to encourage them to take action
- Staff also noted that there has been a shift in peoples' willingness to live or work near more industrial land uses. For example, mixed use developments are increasingly common, with the associated noise from restaurants or businesses more acceptable to many people.

Key Learnings

- While some basic mitigation measures might be incorporated into the development, the City assigns responsibility for rail safety to the railway company.

*total for the Northwest Seaport Alliance, which includes both the Port of Tacoma and Port of Seattle

4 CASE STUDY

There are a few large yard tracks in Waterfront area and N-yard is one of them. N-Yard consists of 20 tracks located on the east side of Waterfront Station on the Canadian Pacific Railway (CPR) Cascade subdivision Mile 129. CPR's N-Yard services Vancouver Harbour and is an integral and vital component in the City's economy. The property is owned by Carrera Management Corporation and CPR has an agreement to continue operations.

From the east, the N-Yard is fed by the CPR mainline track and two lead tracks in the CPR rail corridor. The mainline track splits into three tracks and services the West Coast Express station platforms at Waterfront Station. The two yard tracks split into 16 yard storage and sorting tracks. Figure 8 shows the location of this site and the adjacent roads.

Figure 8: N-Yard Location

As can be seen in Figure 8, the following major facilities are in the vicinity of this yard:

- Granville Square is to the west
- Waterfront Station is to the southwest
- Helijet facility is to the north
- Seabus terminal is to the northwest
- CRAB Park is to the northeast
- Commercial buildings are to the south

There are two tail tracks that lead in underneath Granville Square as part of the west ladder of N-Yard. These tracks are used for switching train cars from the west side to the various tracks within the N-Yard.

s.19(1)

Table 9 shows the track length and track capacities in the N-Yard.

Table 9: Existing Track Capacity[6]

Track ID	Track Length (PI to PI) m (ft)	Storage ft
N20	858 (2,815)	2,473
N19	870 (2,854)	2,512
N18	760 (2,493)	2,151
N17	632 (2,073)	1,731
N16	591 (1,939)	1,597
N15	596 (1,955)	1,613
N14	548 (1,798)	1,456
N13	497 (1,631)	1,289
N12	444 (1,457)	1,115
N11	417 (1,368)	1,026
N10	392 (1,286)	944
N9	337 (1,106)	764
N8	284 (932)	590
N7	236 (774)	432
N6	237 (778)	436
N3	655 (2,149)	1,807
N2	626 (2,054)	1,712
N1	1079 (3,540)	3,198
Total	**10,059 (33,002)**	**26,846**

CPR General Operating Instructions (GOI) Section 5 Item 1.1 applies to all trains and terminal transfers originating at any location in Vancouver Terminal. This item stipulates that a train or transfer carrying one or more full carloads, container loads, or trailer loads of special dangerous commodities must, within one mile of the location, perform a pull-by or standing inspection from the front of the train up to and including 8 axles behind the last full carload, container load, or trailer load of a special dangerous commodity.

Mainline track speed is 25 mph for freight and 30 mph for passenger trains. Yard speed is expected to be 10 mph or less. The mainline is controlled by a Centralized Traffic Control System (CTC).

[6] Central Waterfront Transit Hub Study Report, August 2008

4.1 Dangerous Goods Transported by CPR within BC

The CPR website[7] provides information about dangerous goods shipments in different provinces in Canada. According to the 2020 information, 11.2% of loaded shipments on CPR tracks carry dangerous goods in British Columbia and the corresponding percentage for Canada is 13%. Their remaining loaded shipments are non-regulated products.

Figure 9 shows the percentage of the total tonnage shipped by CPR in B.C. for the top 10 dangerous goods. Diesel fuel is one of the leading dangerous goods shipped locally, comprising 25.4% of total dangerous goods. Petroleum crude oil, freight all kinds (FAK), and liquefied petroleum gases are the next leading dangerous goods comprising 13.1%, 11.1% and 10.5% respectively. The term FAK is used for shipments that have mixed loads (up to 25 products) or compartments (up to 4 products) and carry more than one type of dangerous goods. The rest of the commodities each comprise less than 10%.

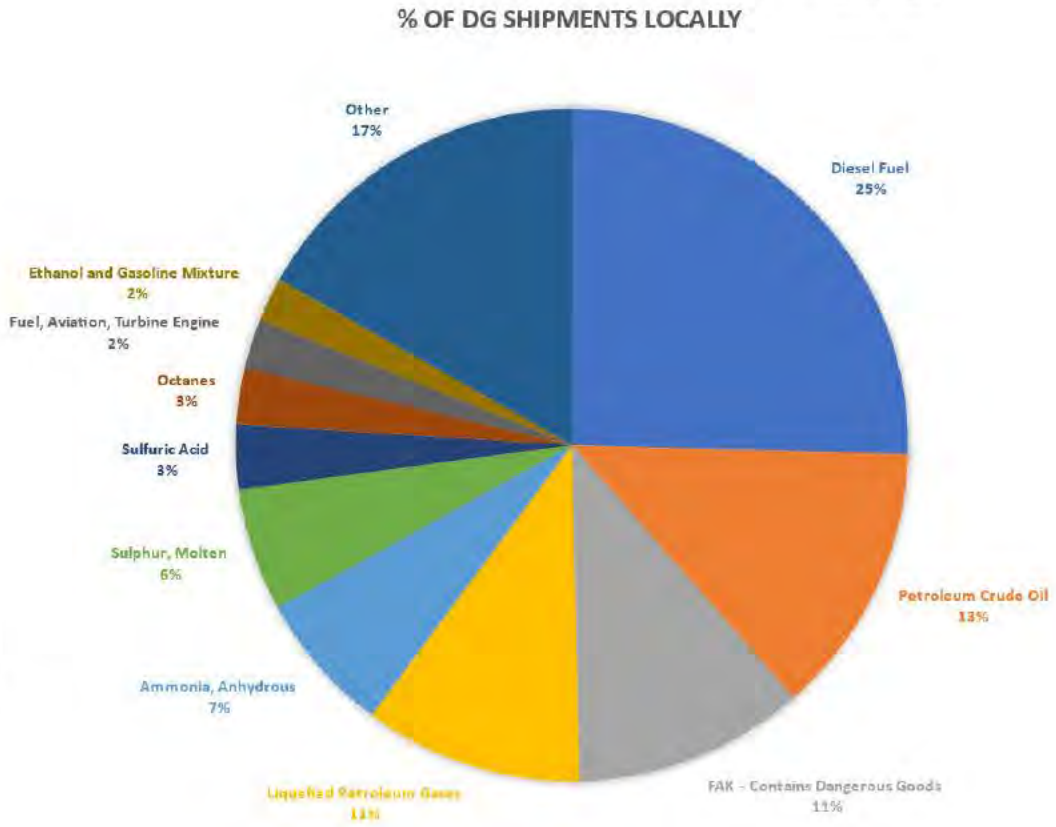


Figure 9: Dangerous Goods Shipments by Commodity in B.C. - 2020

The information provided in Figure 9 only represents the total movements of dangerous goods by CPR in B.C. and does not indicate explicitly what percentage of the shipment may be moved through the N-Yard, therefore, the proportion and type of goods being shipped in the yard may vary from those shown for the

[7] Accessed online on 2022.01.04 at https://www.CPR.ca/en/safety/transporting-dangerous-goods/notification-list-Canada

entire province. No information regarding the rail operation and shipments in N-Yard was available when this case study was conducted.

CPR quarterly earnings reports[8] indicate the revenues gained per commodity. According to the 2021 quarterly reports, the energy, chemicals, and plastics group revenues decreased by 21% in 2021 Q1 in comparison to 2020 Q1 while the revenue in this group increased by 8.2% in 2021 Q2 in comparison to 2020 Q2. This may indicate the fluctuating nature of the amount of dangerous goods being transported in different times of the year.

4.2 Clearance Envelope

Transport Canada Standards Respecting Railway Clearances (TC E-05) identify the minimum required clearances for railways and every structure over or beside a railway track. Railways have their own standards with regards to structural protection adjacent to their rail track. Both CN and CPR standards follow the TC E-05 minimum clearance required, but as well indicate their own crash wall protection requirements for the adjacent structures.

Figure 10 shows the required minimum clearances for the track with or without a service road based on TC E-05. As shown, the face of an adjacent abutment or pier should be a minimum of 5.486 m (18 ft) away from the track center. If there is an adjacent service road beside the track, the minimum required distance from the face of an abutment or pier to the track center should be a minimum of 7.925 m (26 ft).

The minimum required vertical clearance is also illustrated in Figure 10. The vertical clearances are measured from the top of rail (TOR). As can be seen in the envelope, a minimum clearance of 7.010 m (23 ft) from the TOR to the overhead construction is required.

According to the TC E-05, all existing structures, bridges, snowsheds, overhead timber bridges and tunnels which met previous clearance requirements but encroach within the clearance limits prescribed, shall not be considered as having less than standard clearances and shall be permitted to remain until the restrictive feature is modified or replaced.

If the clearances mentioned above are not met, they could be permitted in the following circumstances:

- on a track at a main shop, diesel or car shop;
- doorways in buildings;
- ramps, platforms, and similar structures to facilitate loading, unloading, servicing, and maintenance;
- permanent structures to provide for or support locomotive and car wash facilities;
- temporary restrictions necessary to facilitate construction or repair of overhead structures, in which case the train crews are to be notified.

Where circumstances do not permit the standard clearances prescribed above, exceptions may be authorized by the railway Chief Engineer.

[8] Accessed online at https://investor.cpr.ca/financials/default.aspx

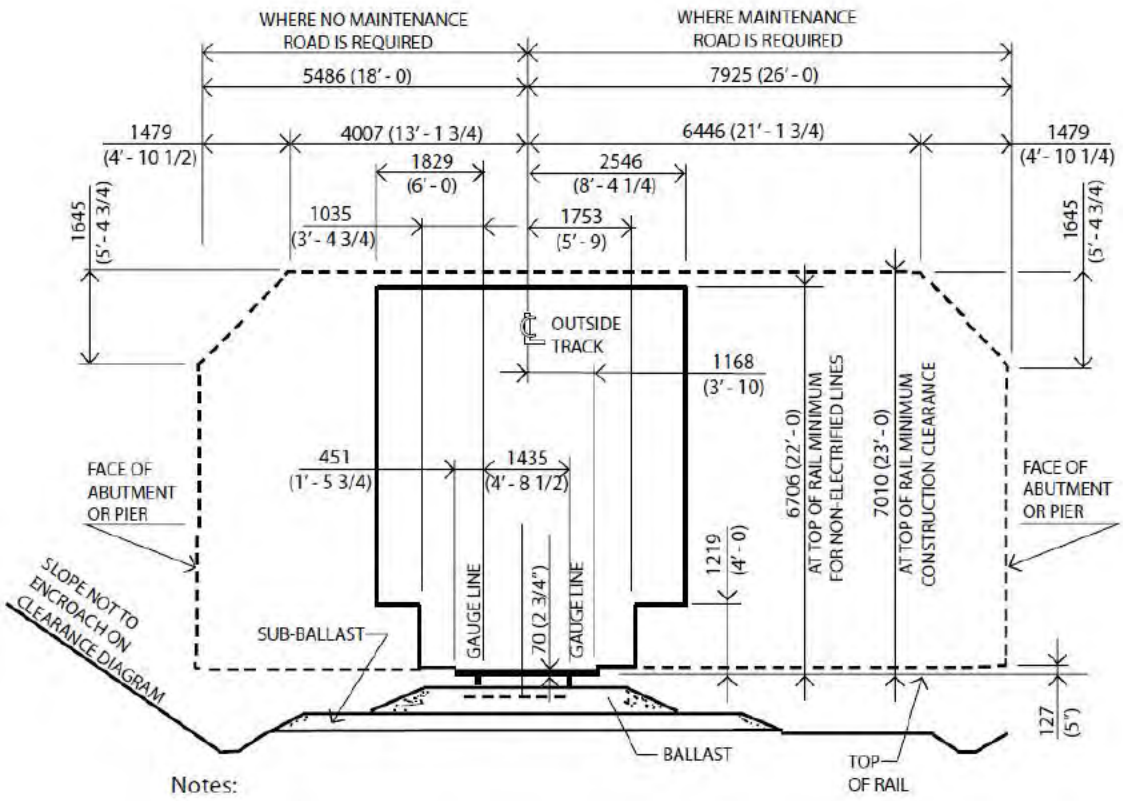


Figure 10: Required Clearance Envelope for Railways

As an example, according to CPR standards, to limit damage by the redirection and deflection of railroad equipment, all structures (except overhead bridges) adjacent to the railway with a clear distance of less than 15 m from the centreline of the nearest existing or proposed track shall be protected by a reinforced concrete crash wall. For the overheard bridges, the lateral clearances for all new bridge structures shall be in accordance with TC E-05.

According to the CPR standards, crash wall design shall be incorporated into all abutments, piers, and walls of all new overhead bridge structures except as follows:

a) Crash walls may be omitted for piers and abutments of heavy construction (i.e., with a cross-sectional area equal to or greater than that required for the crash wall and the larger of its dimensions is parallel to the track).

b) Crash walls may be omitted where lateral clearance is equal to or greater than 8 m from the centreline of track. In making this determination, mitigating factors such as horizontal and vertical alignment of the track, embankment height, and a risk assessment of the consequences of serious damage in the case of a collision shall be taken into consideration.

When a new track is constructed and the minimum clearances are not met, crash walls are required to protect the adjacent structure and the piers from possible derailments. Crash walls are concrete structures

that can absorb train derailment forces and their design depends on different variables including train speed, weight, and the angle of impact. According to a design guideline which was prepared by the Federation of Canadian Municipalities (FCM) and the Railway Association of Canada in 2013[9], several other factors such as flexibility of the structure and the amount of deflection allowed should be considered in crash wall design.

Figure 11 shows the plan view of an example of crash wall application for protecting the overhead structure's piers. In this example, the clearance envelope was not sufficient, and a crash wall was proposed to protect the face of pier. Figure 12 shows the section view of the clearance envelope and the crash wall that is presented in Figure 11.

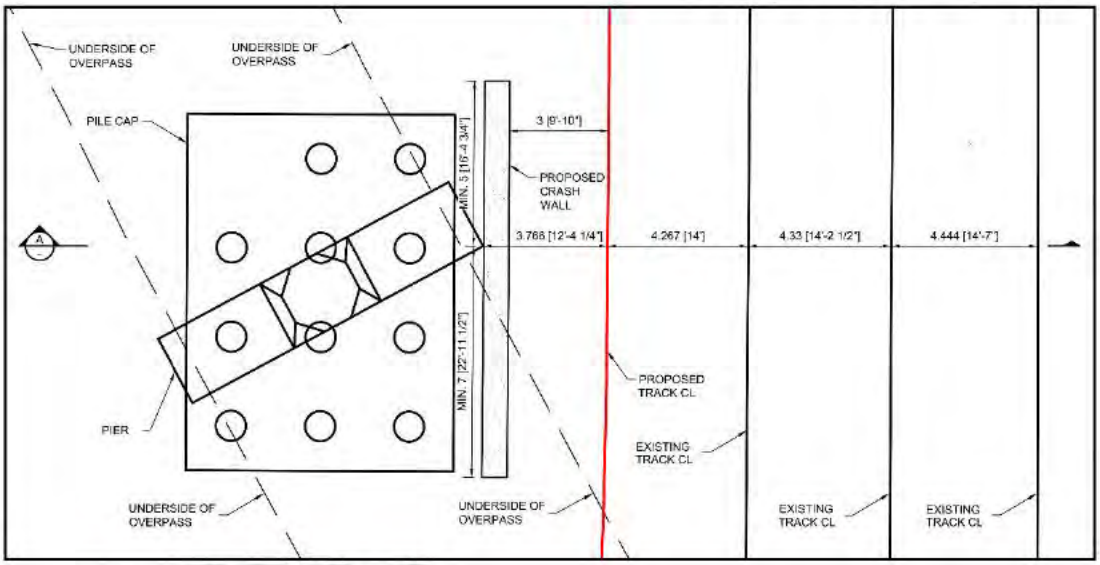


Figure 11: Sample Application of Crash Wall and Clearance Envelope – Plan View

[9] Accessed online at https://www.proximityissues.ca/wpcontent/uploads/2017/09/2013_05_29_Guidelines_NewDevelopment_E.pdf

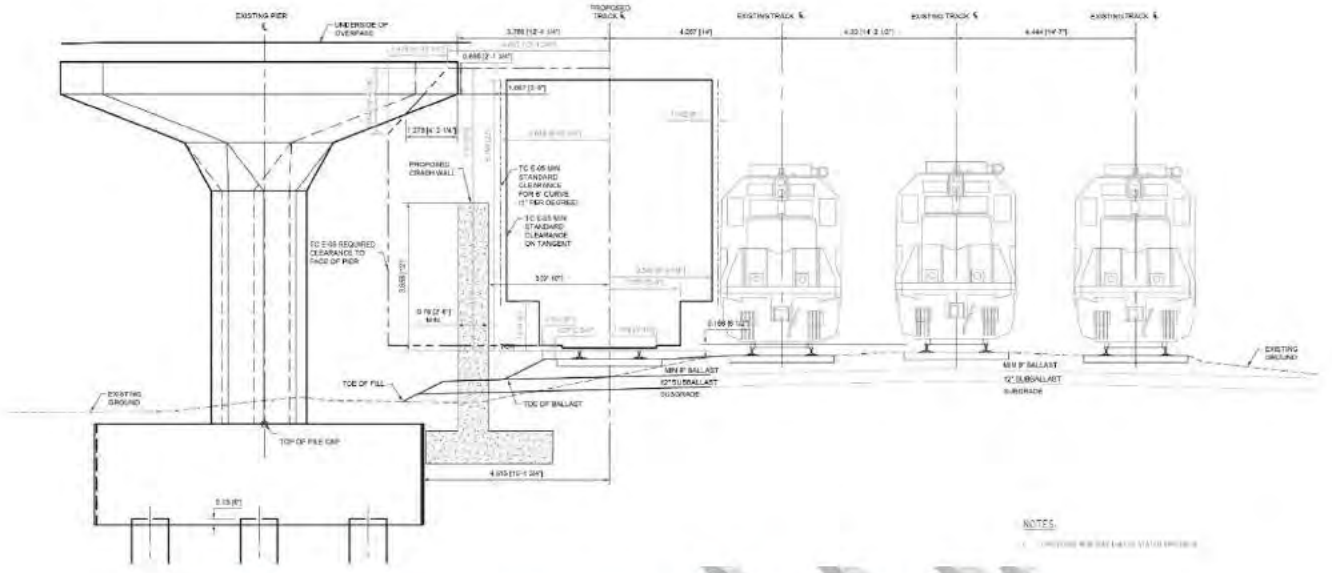


Figure 12: Sample Application of Crash Wall and Clearance Envelope – Section View

4.3 N-Yard Site Visit

While a detailed track inspection at the N-Yard was planned as part of this project, CPR did not grant permission to enter the site. In addition, CPR did not provide any specific information regarding the operation of railcars in the N-Yard site, or the percentage of dangerous goods carried to this site. Therefore, readily available public information was collected and used for preparation of this case study.

The site was inspected from public areas in the vicinity of the N-Yard on Tuesday December 14th, 2021, from 8:00 AM to 4:00 PM. The number and type of the railcars inside the yard, and the arrivals and departures were counted. Table 10 shows a summary of the number of rail cars arriving and leaving the site during the site visit.

Table 10: N-Yard Arrival and Departure Log

Time	Arrival/Departure	Number & Type of Cars	Description
10:14 AM	Departure	27 Grain Cars left	CPR Locomotive
12:42 PM	Arrival	25 Rail Tank Cars arrived	Dangerous Goods
12:53 PM	Departure	2 CPR Locomotives left	Locomotive with No Rail Cars
14:17 PM	Arrival	2 CN Locomotives arrived	Locomotive with No Rail Cars
14:22 PM	Arrival	CPR brought 34 double stack container cars	Cosco, CMA CGM, China Shipping, TKI, OOCL were among containers
14:32 PM	Departure	2 CPR Locomotives left	
14:41 PM	Departure	CN took 35 double stack container cars	Cosco, CMA CGM, China Shipping, TKI, OOCL were among containers

Figure 13 shows a view of the N-Yard site at 8:30 AM on Tuesday December 14, 2021. At that time, most of the rail cars in the yard were grain cars and container carrying rail cars. Only one rail tank car was observed in the middle of the yard.

Figure 13: N-Yard – 8:30 AM

Figure 14 shows the railcars that were left in the N-Yard track. Different brands including APL, Evergreen, CMA CGM, CAI, China Shipping, Magellan, OOCL, Seaco, Tex, Triton, Touax and UES were observed. Several grain cars with different brands including CN, CPR, CITX and Richardson were also in the yard.

Figure 14: Pictures of Container Carrying Cars in the Yard

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Figure 15: Rail Tank Cars Stored in the Yard

Figure 16 shows the west end of the N-Yard where the tracks merge and go under a parking building and Granville Square. Based on the clearance envelope information provided in Section 4.2, it appears that the tracks are very close to the piers and no crash wall has been built to protect the piers from possible derailments. Therefore, the approximate available clearances and the lack of crash wall do not meet the requirements of the TC E-05 standard. However, the TC E-05 standard was issued on May 14, 1992, and the Granville Square was completed in 1973, and predates the current regulation. Granville Square was part of a broader plan called "Project 200" to develop entirely over the railway alignments.

Figure 16: West Side of N-Yard

Figure 17 shows a large-scale view of the passenger tracks and yard tracks in the south side of the yard. The Skytrain Expo line tracks are illustrated in red, tracks being used by the West Coast Express (WCE) are illustrated in green and the CPR freight yard tracks are illustrated in cyan. The passenger tracks provide service to the SkyTrain and WCE. According to TransLink website, a total of five WCE trains arrive at Waterfront station in the morning and five WCE trains depart in the evening.

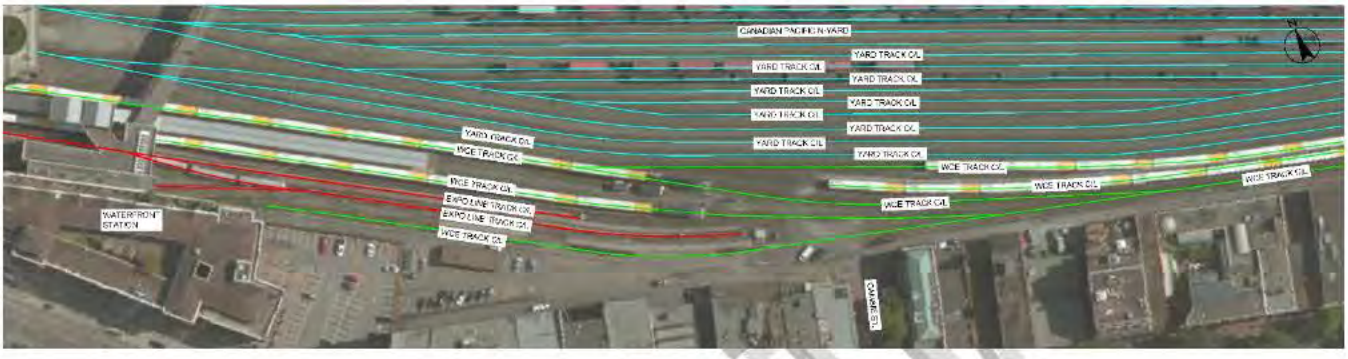

Figure 17: WCE, Expo Line & Yard Tracks

Figure 18 shows the track centrelines and the distance from the first freight track to the adjacent buildings.

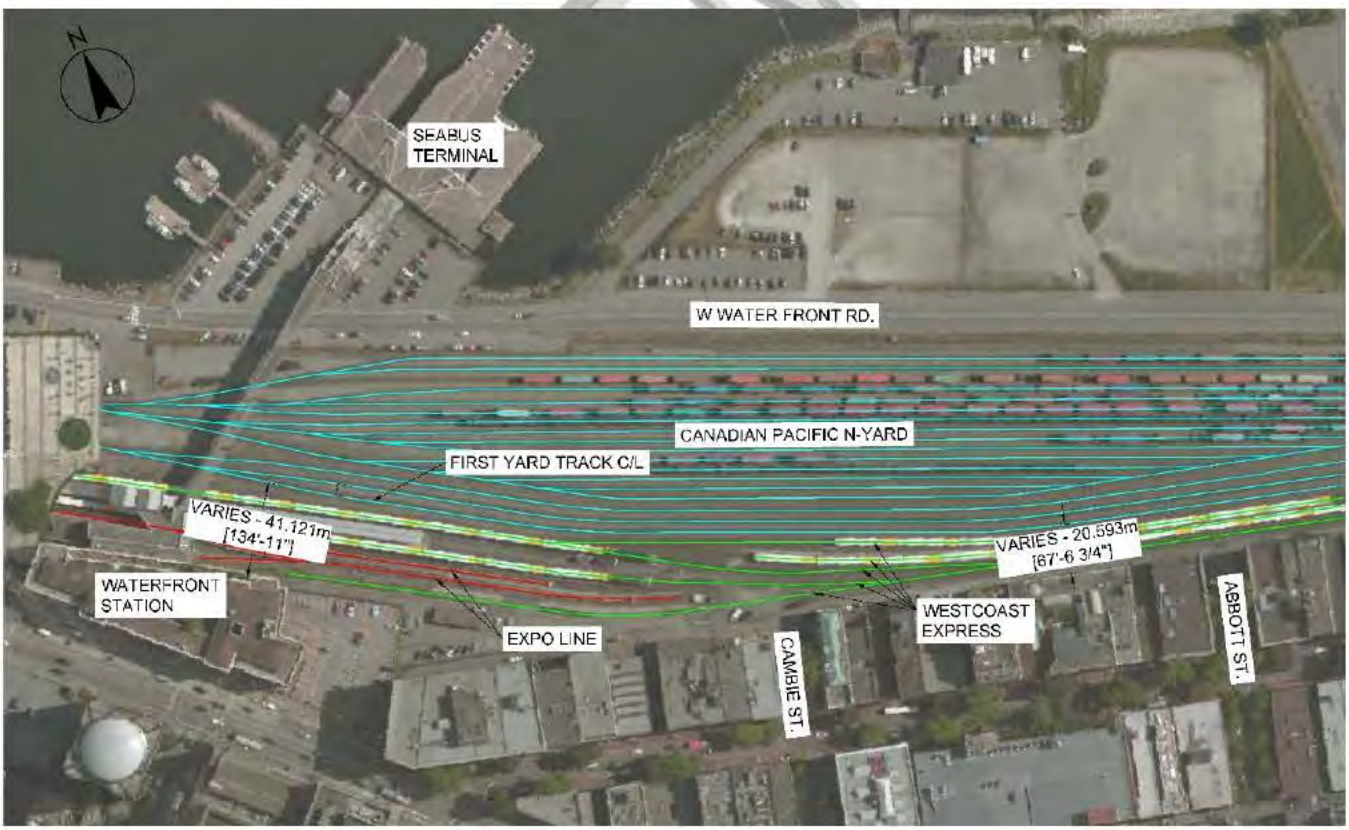

Figure 18: Yard Layout and Distance to Adjacent Property – West Side

As discussed in Section 2.4.2, the standard recommended setback distance for a freight rail yard is 300 m. While no specific guideline was found for the City of Vancouver, the City of Calgary, Edmonton, and Toronto guidelines were used as reference. According to the City of Calgary guidelines, a 30 m horizontal distance is required between the freight rail corridor and adjacent high density residential and commercial buildings. The City of Toronto has also proposed an Official Plan amendment that incorporates the requirement for applicants to submit a Rail Safety and Risk Mitigation Study as part of a complete application for development within 30 m of rail infrastructure. The City of Edmonton zoning bylaw 12800 requires installation of a minimum 1.83 m chain link fence along rail right-of-way and indicates that no building shall be constructed or located within 30 m of the boundary of the CN right-of-way.

The distance between the centreline of the first freight track and the Waterfront station building is 41.121 m [134'-11"] which meets the minimum 30 m distance required by City of Calgary, City of Edmonton, and City of Toronto guidelines. On the east side of the yard, as shown in Figure 19, the distance between the adjacent buildings and the first freight track varies between 12.209 m [40'-0 ¾"] and 33.488 m [111' – 10 ½ "] which does not meet the 30 m distance. s.19(1)
s.19(1) The 25 rail tank cars that arrived during the site visit were stored on the second freight track which gives further distance from the adjacent properties.

Figure 19: Yard Layout and Distance to Adjacent Property – East Side

4.4 Summary

Publicly available information regarding CPR N-Yard was reviewed, and the vicinity of this site was inspected on December 14th, 2021. In addition, CPR and CN rules regarding the transportation of dangerous goods and Transport Canada rules regarding yard track inspection and clearance envelope requirements were reviewed. Seven recommendations resulted from this analysis. These are included in Chapter 5.

5 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to develop an understanding of national and international practices that may be able to unlock land use opportunities resulting from operational and physical mitigation measures that maintain flexibility of movement and storage of dangerous goods via rail while enabling adjacent land uses. The following conclusions and recommendations result from the work.

5.1 Legislative and Regulatory Review

Given that the movement of dangerous goods is highly regulated, understanding the regulatory framework applicable to the movement of these goods and its impact on land development opportunities was important.

A comprehensive review of existing legislation, regulations, policies, and bylaws that govern the movement of dangerous goods by rail in British Columbia was conducted. This review identified nine pieces of legislation, regulation, or guidelines relevant to land development and dangerous goods movement by rail in Vancouver:

- Railway Safety Act (R.S.C. 1985 c. 32/1988 c. 40)
- Railway Relocation and Crossing Act (R.S.C., 1985, c. R-4)
- British Columbia Railway Safety Act (SBC 2004)
- Wire Crossings and Proximities Regulations (CRC, c. 1195)
- Ammonium Nitrate Storage Facilities Regulations (C.R.C., c. 1145)
- Anhydrous Ammonia Bulk Storage Regulations (C.R.C., c. 1146)
- Flammable Liquids Bulk Storage Regulations (C.R.C., c. 1148)
- Chlorine Tank Car Unloading Facilities Regulations (C.R.C., c. 1147)
- Federation of Canadian Municipalities and Railway Association of Canada guidelines for new development in proximity to railway operations

Overall, while the above refer to issues of relevance to this study, they are silent on development-specific issues beyond distances from storage facilities containing dangerous goods. One piece of legislation that may be worth exploring further is the Railway Relocation and Crossing Act (R.S.C., 1985, c. R-4) as it may present a mechanism to explore rerouting certain types of railway traffic (e.g., dangerous goods) for the protection, safety, and convenience of the public.

From the jurisdictional review, it is evident that not many jurisdictions have developed a policy or even guidance regarding land development near rail corridors or rail yards. However, while some jurisdictions have adopted FCM's Guidelines for New Development in Proximity to Railway Operations, those that have not yet formally adopted the guidelines, do identify a minimum clearance or setback of 30 m measured horizontally from the Freight Rail Corridor to a structure. This is one of the recommendations in FCM's guide. The City of Toronto has recommended the introduction of a bylaw for a holding permission to limit (sensitive or high occupancy) land uses within 30 metres of rail infrastructure pending the completion of a

Rail Safety and Risk Mitigation Study that satisfactorily demonstrates a set of rail safety and risk mitigation measures have been created for the site.

If the City of Vancouver is not prepared to create a set of guidelines for development near rail infrastructure and is not planning on adopting FCM's guidelines, it is important to consider the requirement of a Rail Safety and Risk Mitigation Study as part of a complete application for development within a certain distance of rail infrastructure – as previously stated, in cities like Toronto, this distance is 30 m. The purpose of such study would be to identify how rail safety and risk mitigation measures would be addressed in the context of site-specific conditions and provide for the consideration of alternative or equivalent measures. The study would need to satisfactorily demonstrate that a set of rail safety and risk mitigation measures have been created for the site and it must be supported through peer review.

Specific Recommendations:

- Explore Railway Relocation and Crossing Act (R.S.C., 1985, c. R-4) as a potential mechanism to reroute certain types of railway traffic.
- Consider introducing guidelines for development near railway operations, adopting FCM's Guidelines for New Development in Proximity to Railway Operations, or adapting FCM's guidelines to fit Vancouver's characteristics and needs.
- Consider implementing requirement for a Rail Safety and Risk Mitigation Study as part of a complete application for development within a certain distance of rail infrastructure (e.g., 30 meters)

5.2 Environmental Scan

A review of national and international literature regarding mitigating measures that can be applied to reduce challenges and risks associated with dangerous goods movement and storage adjacent to urban land uses was conducted. The literature review was supported by a survey of the following jurisdictions:

- City of Tacoma
- City of Chicago
- City of Antwerp
- City of Hamburg
- City of Winnipeg
- City of Bremerhaven
- City of Felixstowe

A total of 13 physical and nine operational mitigating measures were identified in the literature, as shown below.

Physical measures

- Active protection (fire suppression systems)
- Air circulation design for covered areas such as tunnels

- Crash attenuation (sand attenuators and gravel traps)
- Crash wall
- Drainage systems
- Earthen berm
- Fire spread mitigation (nonflammable materials, firewalls)
- Gabions
- Noise-sensitive building design
- Rail grade crossing design
- Security fence
- Setbacks
- Structural protection (pillars/piers, walls, sacrificial attenuation)

Operational measures

- Corridor Risk Assessments
- Dangerous Goods Storage Practices
- Development Viability Assessment
- Emergency Response Planning
- Positive Train Control
- Rail Car Tracking
- Risk-Based Land Use Planning
- Spatial Risk Assessment
- Spill Management Plan

In general, most mitigating measures were found to require a medium to high implementation effort in a city like Vancouver. In some instances, the challenge was associated with space requirements, while in others, it was associated with cost. These two categories of challenge did not intersect in a prohibitive way for any measures, as those measure requiring large amounts of space (setbacks, earthen berms), are typically inexpensive to install in the right context.

The jurisdictional interviews revealed that land development in the vicinity of railway corridors or yards can be extremely complex, and it can take several years of discussions and negotiation before agreements that work for all stakeholders can be obtained. Some key lessons for Vancouver to consider as they move forward with land development opportunities in the vicinity of rail are:

- Early-stage, high-level planning processes can help to successfully complete development projects in challenging contexts.
- While it can be a long process, persistent and consistent engagement and negotiation with government and rail stakeholders can lead to solutions that work for everyone.
- City leadership in complex development contexts is critical for successful project delivery.
- Having political champions can be of great assistance in the land development process.

- Relying on developers to enter into negotiations that will satisfy the railways throughout the development process can sometimes be beneficial.
- Consistency in stakeholder relations is important for strengthening collaborative problem solving.

Specific Recommendations:

- In constrained urban settings, Development Viability Assessments provide an opportunity for context sensitive development in complex environments near railways.
- Consider ways of building on existing relationships with railway companies, provincial and federal governments, development companies, and other stakeholders.

5.3 Case Study

A case study using the N-Yard, located on the South Shore of the Burrard Inlet in downtown Vancouver, was conducted as part of this work. The following conclusions and recommendations result from the data analysis and site vicinity visit:

- The clearance envelope requirements identified in the Transport Canada Standards Respecting Railway Clearances (TC E-05) were discussed in this report and field measurements are required to evaluate the clearance envelope of the tracks. Considering that the tracks on the west side of the yard go under the Granville Square parking building, Google earth measurements were used to estimate the track clearance. This showed that industrial track clearance (diagram 4 in TC E-05) is met while the required clearance for the structure beside the track might not be met. Since Granville Square was built many years before TC E-05, according to section 4.1 of TC E-05, this cannot be considered as having less than standard clearances and shall be permitted to remain until the restrictive feature is modified or replaced. The overhead pedestrian walkway column clearance may need to be field verified for TC-05 compliance.
- s.19(1) [redacted]
- Regular inspection requirements indicated in Transport Canada Rules Respecting Track Safety TC E-54 should be followed by CPR to keep the yard tracks in good operating condition. These include the regular walking track inspection, turnout and special trackwork inspection, Electronic Geometry Inspection, and rail internal flaw inspections.
- Information regarding the CPR Management and operating conditions of the yard was not available when this report was prepared. Proper operation and maintenance of the yard is essential to minimize and mitigate risks in the form of safe operating procedures, yard management and maintenance.

- The City of Vancouver Emergency Planning Official (EPO) must request information regarding the Dangerous Good transportation from CPR. Several pieces of information including number of trains, percentage of cars transporting dangerous goods can be requested.
- Any design for new structures or facilities in the vicinity of the tracks should follow the horizontal and vertical clearance envelop requirements as per Transport Canada Standards Respecting Railway Clearances (TC E-05).
- Setbacks should be considered in new developments to limit the rail operation related vibrations and noise and provide additional safety for the adjacent properties.

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