A photograph of a freight train moving along tracks, with a blurred background suggesting motion. The train consists of several colorful boxcars. The image is split into two horizontal sections: the top section shows a blue sky with white clouds, and the bottom section shows the train tracks and the train itself.

# ZONING PRACTICE

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## Managing Development Along Freight Rail Corridors

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# Managing Development Along Freight Rail Corridors

By Abdul Jaffari, AICP

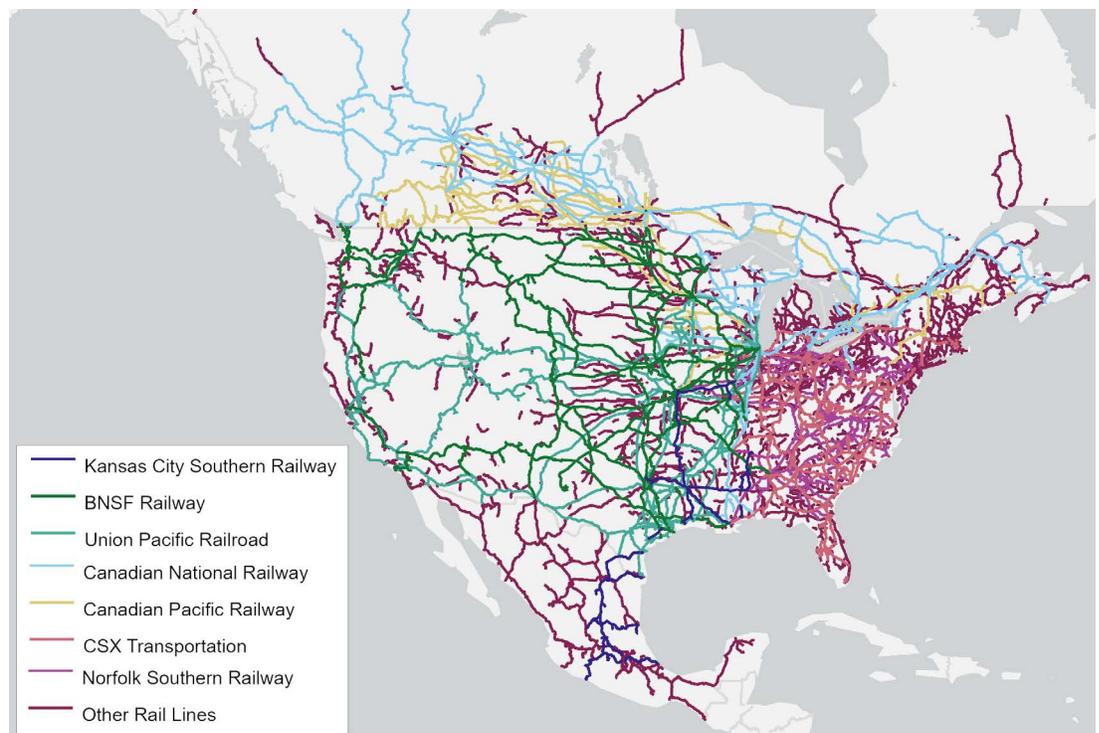
Railways have played an instrumental role in the development pattern and expansion of communities throughout North America. With increasing volumes and types of goods being transported via freight railways, there is an increased awareness across the continent of the potential risk of accidents and the physical impacts of train derailments. Despite this, current land use planning and zoning regulations often fail to consistently address development near freight rail corridors or adequately consider the needs of freight transport.

Local governments hold primary responsibility for land use planning and must understand the context and risk of developing near freight rail corridors when making planning decisions. Land use planners, elected officials, developers, landowners, and the public must

also recognize the importance of freight in the local, regional, national, and global economy to ensure safe development near rail lines. A risk-based land use planning approach allows freight rail corridors and development to coexist safely and effectively, enabling local governments to balance safety, quality of life, and growth, while meeting development goals.

This issue of *Zoning Practice* examines the key principles of a risk-based approach to managing development on lands adjacent to freight rail corridors. It begins with brief descriptions of existing guidance and policy approaches for land use planning around railway corridors before focusing on Calgary, Alberta's risk-based approach. The issue concludes with practical guidance for jurisdictions that might be considering a similar effort.

The North American freight rail network (Credit: Esri, TomTom, FAO, NOAA, USGS)



## Land Use Planning Along Railway Corridors

Freight railway infrastructures have been a part of the urban and rural landscape across North America since the 19<sup>th</sup> century and will remain so in the future. In the U.S. alone, the freight rail network spans nearly 140,000 miles, and freight railroads account for roughly 40 percent of U.S. long-distance freight volume, more than any other modes of transportation (AAR 2024). The network also contributes significantly to the economy by generating around \$80 billion annually and supporting 167,000 jobs (USDOTFRA 2024).

The Federal Highway Administration projects that the total freight shipments in the U.S. will increase to 24.1 billion tons in 2040, a 30 percent increase from 2018, resulting in more freight rail infrastructure (AAR 2020). At the same time, as cities and towns grow and change, and communities experience revitalization, there is increasing demand for infill development, particularly on lands near heavy rail corridors. There is also an increased awareness of the potential risk of accidents and the physical impact of train derailments.

**In the U.S., no single federal entity is responsible for freight planning, financing, or project implementation.**

In the U.S., no single federal entity is responsible for freight planning, financing, or project implementation. Various federal agencies oversee different aspects of the freight network, but none have authority over land use planning. Under the U.S. Constitution, land use regulation is primarily a power “reserved” for the states. Most states have delegated this authority to local municipalities and counties through planning and zoning enabling laws.

As a result, local governments are responsible for land use planning, leading to fragmented freight planning that fails to consider the fact that most freight corridors cross multiple jurisdictions. State and regional planning agencies typically lack the land use authority to bridge this gap. Additionally, federally mandated metropolitan planning organizations (MPOs) are restricted to conducting transportation planning within their designated areas, limiting their ability to address freight planning comprehensively.

Federal preemption under the [Interstate Commerce Commission Termination Act of 1996](#) (ICCTA) significantly restricts local land use and zoning regulations affecting freight rail transportation. Most local regulations on railroad operations, at-grade crossing, and facilities are preempted if they hinder freight rail operations. However, courts have narrowed this preemption in cases where certain facilities don’t qualify as transportation infrastructure or where minimal local regulations don’t significantly disrupt freight rail operations. Although some state courts have upheld limited local regulations, these exceptions are rare, and the legal framework remains unsettled (Christensen Associates et al. 2012).

The National Cooperative Freight Research Program report [Preserving and Protecting Freight Infrastructure and Routes](#) (NCFRP Report 16) provides an overview of the importance of freight transportation (Christensen Associates et al. 2012). It highlights different types of conflict between freight operations and other land uses, recommends setbacks for land uses, and explores local planning and zoning tools to address these challenges. Meanwhile, the Federal Highway Administration’s [Freight and Land Use Handbook](#) provides several compelling reasons to integrate freight into local land use and state, metropolitan, and local transportation planning processes (Hartshorn and Lamm 2012). Additionally, the



A freight train passing through downtown Reading, Pennsylvania (Credit: halbergman/iStock/Getty Images Plus)

American Planning Association's [Policy Guide on Freight](#) (2016) advocates for integrating freight into the broader transportation system and the communities it serves. It also argues that planners should consider the interaction of freight with community economic, social, and land use policies in comprehensive plans and other local and regional planning efforts.

In Canada, the Federation for Canadian Municipalities (FCM) and the Railway Association of Canada's (RAC) established the [Guidelines for New Development in Proximity to Railway Operations](#) (Proximity Guidelines) in May 2013. This document provides general guidance to municipal governments and railways in reviewing development proposals on lands next to railway facilities and includes consideration of building setbacks, noise, vibration, safety barriers, and security fencing, among other things.

### **Existing Policies and Regulations**

Local jurisdictions in the U.S. and Canada use various, distinct approaches to manage development interests adjacent to rail corridors. However, specific zoning standards or other land use policies for property along or near freight rail corridors are rare in both nations.

### **Zoning Standards in the U.S.**

Relatively few cities, towns, and counties in the U.S. have adopted explicit zoning standards for development adjacent to freight rail corridors. By default, most jurisdictions seem to rely on base district setbacks to protect adjacent development from potential harm. However, some have adopted special-purpose base or overlay districts along railway corridors or special development requirements, such as buffer zones or non-access easements, for residential subdivisions or lots adjacent to railroad rights-of-way.

**Relatively few cities, towns, and counties in the U.S. have adopted explicit zoning standards for development adjacent to freight rail corridors.**

For example, [Nevada, Iowa](#), uses a Railroad Industrial Overlay District to guide the transition of residential neighborhoods along a railroad corridor into limited industrial use ([§165.12](#)). This district restricts permitted uses to reduce traffic and limit the density of workers or customers, while also mandating a 100-foot building setback from the railroad right-of-way.

In Anaheim, California, multifamily residential lots adjacent to arterial highways or railroad rights-of-way must have a minimum setback of 50 feet ([§18.18.070.020](#)). Meanwhile, in American Canyon, California, there is a requirement to increase the depth of lots abutting state highways or railroads by 20 percent ([§19.10.050\(A\)\(3\)](#)).

In June 2023, Denver officials considered, but ultimately rejected, an ordinance that would have imposed regulations on development within 100 feet of railroads ([Bill 22-1102](#)). The [proposed ordinance](#) aimed to protect building occupants and structures near railways and ensure emergency access in the event of a railway incident. For development adjacent to freight railways, the following measures would have been required to demonstrate mitigation of railway related risks before permits could be issued:

- Emergency vehicle access analysis for the freight railway
- Evacuation plan or procedures approved by the fire department
- Structural reinforcement, such as ductile column design, enhanced column protection, and reinforced pillars
- Elevating the finish floor above the freight railroad right-of-way
- Erecting berms or walls between the structure and the freight railway
- Other mitigation measures to reduce the impact of derailment, chemical release, or fires on the structure

Earlier that same year, legislators in Virginia approved [House Bill 1674](#), which amended and reenacted [§15.2-2223](#) of the Code of Virginia. This new law requires each locality to include freight corridors in the transportation element of its comprehensive plan and could, therefore, have downstream effects on zoning along those corridors.

### **Land Use Policies and Standards in Canada**

A few Canadian municipalities have adopted policies and regulations for development adjacent to freight corridors that incorporate specific recommendations from the Proximity Guidelines.

For example, Toronto, Ontario, amended its Official Plan (i.e., comprehensive plan) to establish a city-wide planning framework to address and reduce the risk associated with new or intensified development within 30 meters (98.4 feet) of the property line from rail corridors ([By-Law 209-2022](#)). The city implemented a consistent approach to conduct rail safety and risk mitigation reviews as part of the development approval process. Applications for minor variance applications or special exception within 30 meters of rail facilities require a Rail Safety and Risk Mitigation Report, which must be peer reviewed. While rail safety is integrated into the application review process, ensuring compliance with the Official Plan, as of-right developments are exempt from these rail safety requirements (Lintern 2022).

Montreal, Quebec, [adopted](#) the Rail Proximity Guidelines into its [Land Use and Development Plan](#) (i.e., comprehensive plan), which has also been approved by the Montreal Agglomeration Council, a regional body representing all 15 cities on the Island of Montreal. Under the plan, each city should follow the Proximity Guidelines, most notably for vacant or transformative areas. While each borough within Montreal and each other independent city on the island can enact its own zoning and land use by-laws, these regulations must align with the city's comprehensive plan.

Other jurisdictions have adopted freight corridor policies with no explicit relationship to the Proximity Guidelines.



A 3D rendering of a freight corridor in Calgary with its Rail Policy's rail proximity envelope (Credit: City of Calgary)

For example, Ottawa, Ontario, prohibits residences, daycares, and schools within the 30 meters of a railway right-of-way in rural zones ([Zoning Bylaw §68](#)). Mississauga, Ontario, amended its Official Plan in 2016 to require a noise and vibration study for sensitive land uses next to rail ([By-Law Number 0266-2016](#)). Waterloo, Ontario, does not allow any building within 15 meters of a railway right-of-way ([Zoning By-Law §3.R.1](#)). And Regina, Saskatchewan, has a Railway Setback Overlay Zone that requires a minimum building setback of 300 meters from a freight rail yard, 30 meters from a main rail line, and 15 meters from a spur line ([Bylaw No. 2019-19 §8L](#)).

### **Calgary, Alberta's Rail Policy**

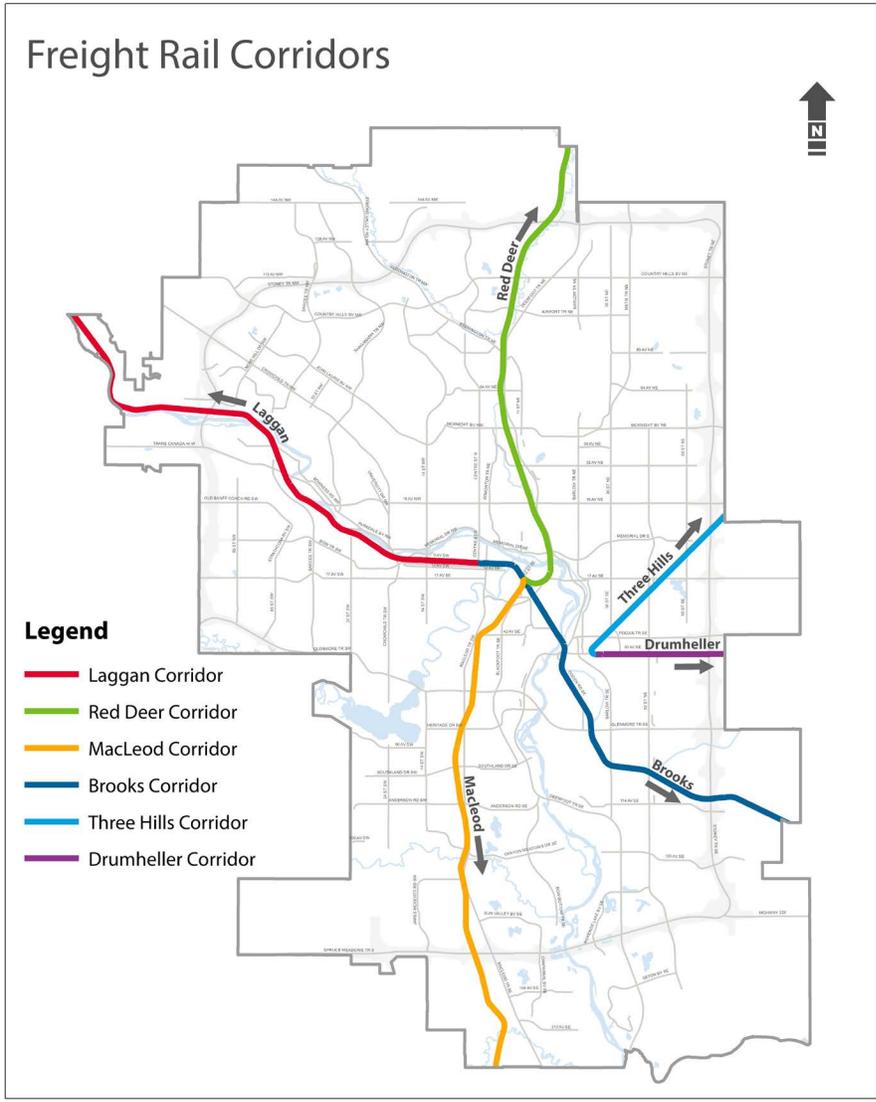
Calgary, Alberta, is a major transportation and logistics hub, connected to the North American rail network through six corridors operated by Canadian Pacific Railway (CP) and Canadian National Railway (CN). In 2018, city officials adopted the [Development Next to Freight Rail Corridors](#)

[Policy](#), the culmination of a multi-year effort to establish a consistent approach to managing risk along these corridors. The policy is unlike any other in North America and represents a potential model for other communities.

### **Formation and Implementation**

In July 2013, an unattended freight train in Lac-Mégantic, Quebec, derailed, killing 47 people, causing widespread environmental damage, and heightening concerns in Calgary about rail safety and hazardous material transport. In response, local officials formed a multi-departmental working group in 2015 and tasked it with reviewing and recommending safety measures for planning applications within 30 meters of freight rail corridors.

Initially, the working group attempted to apply the FCM/RAC Proximity Guidelines but found them overly general and not tailored to specific local contexts. Then, the group developed a [Development in Proximity to Rail: Interim Approach](#), which required site-specific risk assessments for development



proposals near rail lines. However, this requirement led to inconsistent methodologies and mitigation measures, and the city's reliance on external engineering firms to peer review each study created uncertainty and extended the time needed to review each application.

Given the challenges faced during the interim period, along with the increasing volumes and types of goods transported via freight rail, and the increased risk of potential train derailments, the city, in consultation with stakeholders, determined in 2017 that the best course of action was to gain a comprehensive understanding of the actual risks across Calgary's entire rail corridor network. This included establishing a consistent risk management approach, streamlining the approval

process, and developing Calgary-specific evidence-based policy.

The resulting Development Next to Freight Rail Corridors Policy (Rail Policy) and Development Next to Freight Rail Corridors Policy Implementation Guide (Implementation Guide) address safety and noise associated with freight rail operations and are specific to each parcel along each corridor across the city. The Rail Policy advances the vision of the city's comprehensive plan and area plans by promoting compact, complete, safe, healthy, and livable communities, while ensuring efficient use of land. It also aims to maximize the development and redevelopment potential of areas near freight railways.

In July 2018, local officials amended city's Land Use Bylaw (i.e., zoning ordinance) to establish technical rules for implementing the Rail Policy ([Bylaw Number 51P2018](#)). This amendment defined the freight rail corridor and outlined the city's authority to request additional information for both by-right (permitted) and special exception (discretionary) uses. Additionally, the amendments mandate that mitigation measures be incorporated into the development for its entire lifespan. Then in [February 2021](#), local officials updated the city's [Municipal Development Plan](#) (i.e., comprehensive plan) to require all development next to freight rail corridors to comply with the requirements of the rail policy (Part 4.5). This approach gave the policy statutory power.

### Purpose and Objectives

The Rail Policy's core aims are to protect building occupants and buildings, mitigate noise impacts from freight rail operations on residents, and remove the need for individual risk assessments for most developments by providing the planning process and landowners with a clear understanding of potential risk. It is based on an understanding of the actual risks associated with freight rail operations. This understanding was gained through the completion of the Baseline Risk

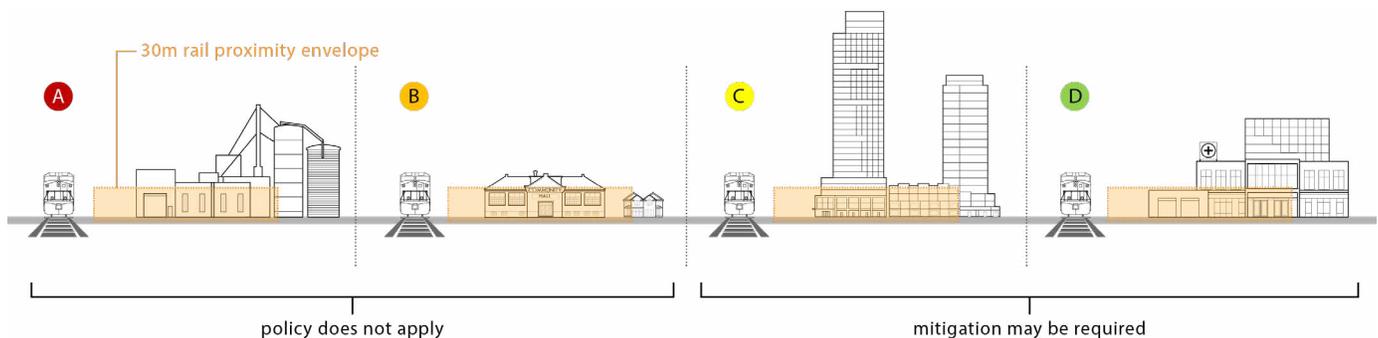
Assessment (BRA), an empirical engineering study that uniformly assessed the risk of freight rail operations to development adjacent to rail corridors.

The BRA included an analysis of all commodities hauled by rail companies, including dangerous goods, to determine the probability of fatality as a result of a derailment. This approach is tied to a nationally accepted standard, the Major Industrial Accidents Council of Canada (MIACC) [Risk-Based Land Use Planning Guidelines](#), which evaluates risk tolerance levels of fatality for different types of land uses.

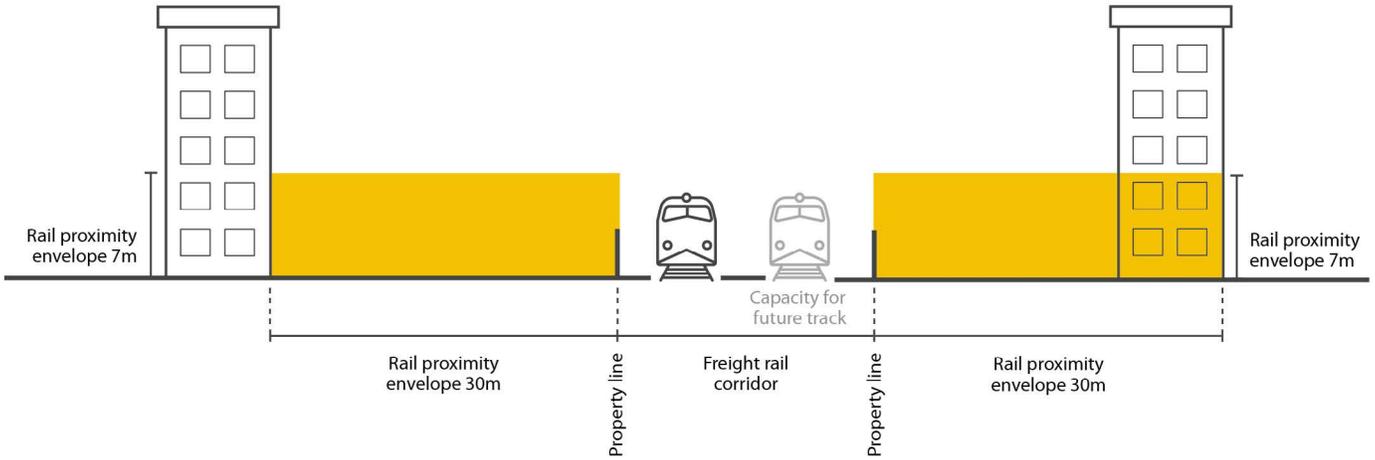
### Applicability

The Rail Policy applies to parcels that are partially or entirely within 30 meters (98.4 feet) of a freight rail corridor property line. This area is called the *rail proximity envelope*. The term *setback* is not mentioned in the policy.

Land use districts vary along the freight rail corridors and allow for a wide range of potential uses. As not all uses have the same level of risk tolerance, the safety component of the policy only applies to new (or expanded) *sensitive* and *high density uses* (which are explicitly enumerated in the policy). It does not apply to industrial and low-density residential uses.



**The relationship between land use and applicability for Calgary's Rail Policy (Credit: City of Calgary)**



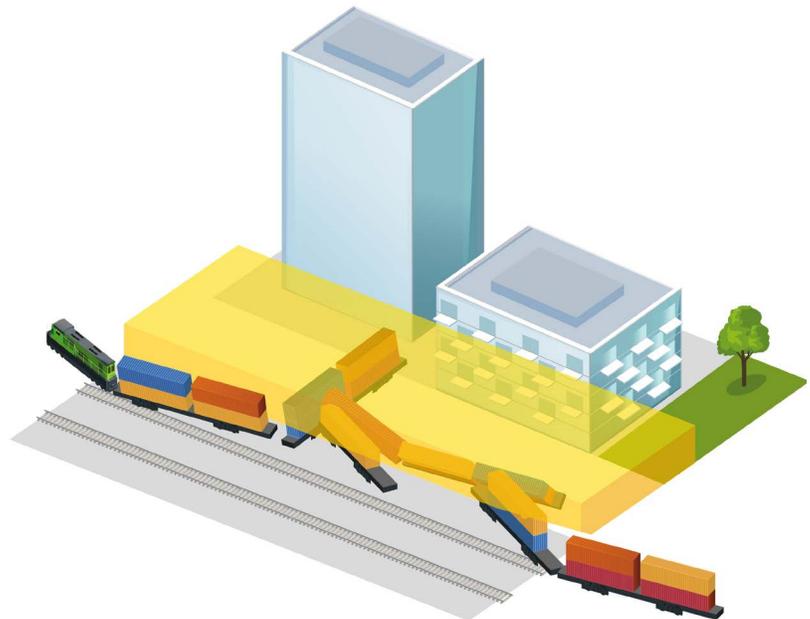
■ *Calgary's standard safety envelope (Credit: City of Calgary)*

### Safety Envelope

The Rail Policy also establishes a *safety envelope*. The standard *safety envelope* is measured 30 meters horizontally from the freight rail corridor and seven meters (23.0 feet) in height from grade. This roughly corresponds to the area that would be directly affected by a train that derails and jackknifes off the track. The longest single rail car passing through Calgary is 28.3 meters (92.8 feet) in length, and the tallest (double-stacked) train car is seven meters (23 feet). The envelope starts at the freight rail corridor property line because rail companies typically have the authority to add additional capacity up to the boundary of the right-of-way.

For existing buildings in which a change of use to a defined *sensitive use* or dwelling unit is proposed, the level of exposure is based on the existing freight tracks within the freight rail corridor. Therefore, the envelope is measured from the centerline of the nearest freight tracks to the portion of the building applying for the change of use.

For parcels that are seven meters or lower than the grade of the corridor's property line, the envelope extends beyond 30 meters. The adjusted envelope has been determined on an individual site-by-site basis and is available through an [interactive map](#).



■ *The relationship between Calgary's standard safety envelope and a worst-case derailment (Credit: City of Calgary)*

### Risk Tolerance and Building Widths

The Rail Policy establishes an acceptable risk tolerance for defined *high density* and *sensitive uses*. *High density uses*, such as multi-residential development, live-work units, offices, hotels, restaurants, medical clinics, and universities, have an acceptable probability of a train derailment leading to a fatality of one in 1,000,000. For *sensitive uses*, such as daycares, hospitals, jails, schools, and assisted living facilities, the acceptable probability is one in 3,333,333.

The Rail Policy sets maximum building widths for each parcel along all six corridors based on the number of people exposed to the potential risk of a train derailment, ease of evacuation, duration of exposure to the potential risk, and occupants' ability to self-evacuate. However, proposed developments may exceed these limits if appropriate mitigation measures are integrated into the design. Developers, landowners, city staff, and other stakeholders can view the maximum

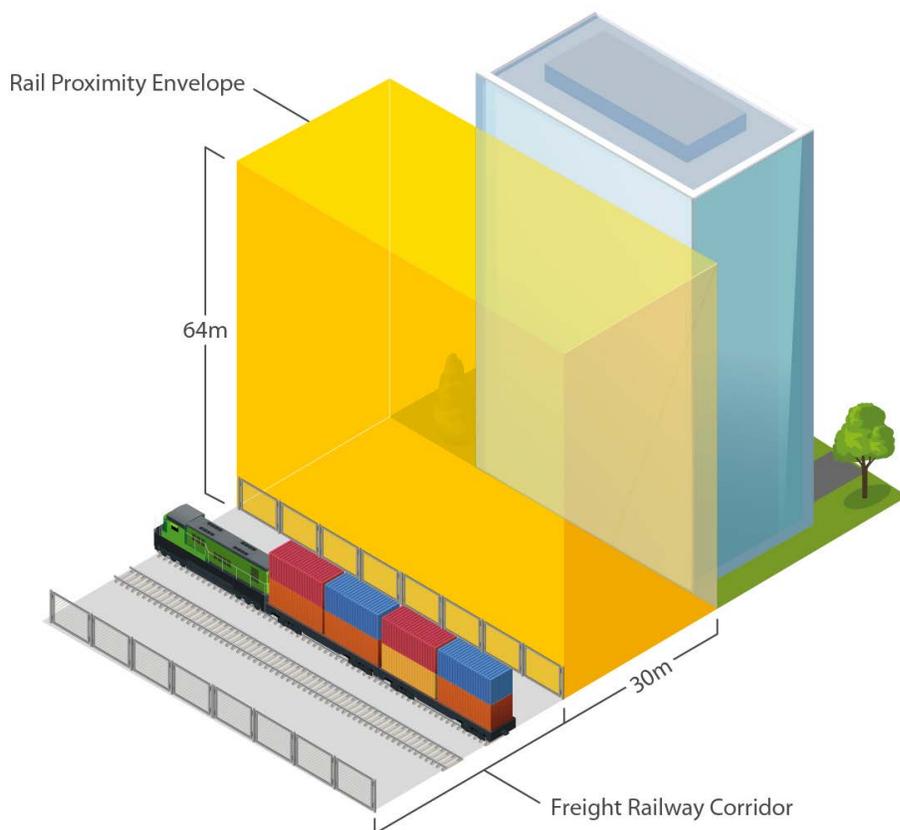
building widths (without mitigation) for each parcel on an [interactive map](#).

By limiting the building width, the amount of time the building is exposed to the risk of a train derailment is reduced. In essence, a smaller building has a lower risk of being directly impacted by a train derailment.

The concept of limiting building widths along rail corridors also aligns with urban design principles and emergency response strategies. Narrower buildings or segmented building widths enhance walkability, create more pedestrian-friendly streetscapes, and reduce the visual impact of large structures. They also increase permeability, providing more access for first responders to rail corridors during emergencies.

### Noise Mitigation

The Rail Policy acknowledges that railway operations are noisy but requires noise mitigation for defined *noise susceptible uses*, such as residences, schools,



Calgary's noise envelope extension of the rail proximity envelope (Credit: City of Calgary)

daycares, hospitals, and congregate living facilities. The Implementation Guide specifies that the *noise envelope* is measured 30 meters horizontally and 64 meters (210 feet) in height from grade. Development outside the envelope does not have to mitigate noise impact.

Applicants for *noise susceptible uses* within the envelope must complete a noise study and implement appropriate mitigation measures, such as enhanced wall and window assemblies, to demonstrate compliance with the city's noise standards (an equivalent continuous sound level of 35 dBA for bedrooms and 40 dBA for all other living areas).

The city provides a Noise Assessment Scope to the applicant, detailing the methodology and including rail data necessary for the study. This eliminates the need for individual applicants to obtain rail data from rail companies, streamlining the approval process and reducing delays.

**Requiring a single property owner to mitigate a societal risk that lies beyond their care and control or responsibility would not be appropriate.**

#### **Vibration and Chemical Hazard Release**

Due to the complex nature of vibration and chemical release, the Rail Policy encourages, but does not require, applicants and developers to mitigate vibration and chemical release caused by rail operation. In the event of a chemical hazard release caused by a derailment, the impact extends far beyond an individual parcel boundary, affecting a much larger area. Requiring a single property owner to mitigate a societal risk that lies beyond their care and control or responsibility would not be appropriate. The city provides a Vibration Assessment Scope to the applicants who choose to mitigate the impact of vibration. The Vibration Assessment Scope outlines the methodology for conducting a detailed

vibration assessment for developments near rail corridors. Its purpose is to accurately predict potential ground-borne vibration impacts and evaluate necessary mitigation measures.

The Implementation Guide outlines a number of mitigation strategies related to chemical hazard release for new and retrofit buildings. Applicants can modify HVAC systems to enable shelter-in-place during a chemical release caused by a rail incident, including installing chemical gas sensors connected to building automation systems, elevating air intakes, and enabling complete shutdown of air intake. Additional measures include installing cameras on building facades facing the rail corridor to enhance emergency response and conducting regular reviews and updates of the building's emergency response plans.

#### **Additional Requirements**

The Rail Policy stipulates that city officials may require applicants for proposed developments that exceed maximum building widths to provide additional studies, such as a site-specific risk assessment or a train impact structural review. However, based on the risk tolerance of parcels, most developments may not require additional studies.

To reduce the risk of fatality as result of trespassing, the Implementation Guide also specifies that new development must be physically separated by a fence or similar barrier, with a minimum height of 1.83 meters (six feet), along the rail corridor right-of-way boundary.

#### **Principles for a Risk-Based Approach**

Managing growth and development pressure on lands adjacent to freight rail corridors requires a risk-based land use planning approach. This approach must address the safety, noise, and vibration associated with freight rail operations, ensuring that the protection of occupants and buildings are prioritized in the development approval process. The following principles may be instructive for any jurisdiction interested in pursuing a risk-based approach to managing development along railway corridors.

### **Recognize the Importance of Freight Rail**

It is crucial to recognize the importance of freight rail in the local, regional, national, and global economy. As demand for freight rail shipments grows, the need for additional infrastructure will also increase. Development intensification and the expansion and preservation of freight rail infrastructure can coexist compatibly; one does not need to occur at the expense of the other.

### **Build Relationships With Rail Companies**

In the U.S., the Federal Railroad Administration is the primary regulatory body for rail safety, while other federal agencies oversee various aspects of the freight network; however, none have jurisdiction over land use planning. In Canada, railways are federally or provincially regulated, and municipalities have no jurisdiction over railway operations. Establishing working relationships with rail companies can facilitate understanding of their operational needs and the regulatory environment in which they operate.

### **Develop Context-Sensitive Policies and Standards**

It is important to recognize the context and risks associated with development near rail corridors. By using evidence-based planning decisions, municipalities and counties can strike the right balance between safety, quality of life, and fostering development that aligns with the growth objectives of each jurisdiction.

Understanding the actual risk associated with freight rail operations is critical to the success of any jurisdiction's effort and helps dispel the perceived risks. The mitigation strategies outlined in the Railway Proximity Guide and other referenced documents are general and may not be implementable or applicable. By determining the risk tolerance and respecting the unique context of each parcel adjacent to rail corridors, appropriate mitigation measures can be tailored accordingly. In some cases, depending on the train speed, rail traffic volume, and track geometry,

mitigation may not be required, enabling parcels to reach their full development potential without the need for additional studies.

**Accurately assessing risks can unlock the full development potential, allowing development projects to be built right up to the rail right-of-way.**

Accurately assessing risks can unlock the full development potential, allowing development projects to be built right up to the rail right-of-way. The benefit of conducting a baseline risk assessment may outweigh the cost since promoting safe development near railways can boost tax revenue, create jobs, drive economic development, and achieve growth targets.

In rural areas, where most of the development adjacent to rail consists of either low-density residential or industrial development, the concept of a safety envelope may not be applicable. However, rural jurisdictions may still need to address noise concerns for residential uses.

### **Prioritize Consistency and Predictability**

Developing a consistent approach that can be applied citywide can help streamline the approval process and provide more certainty to local officials, the development industry, landowners, and other stakeholders. Ideally, landowners and developers should understand exactly what they can build on their lands with and without mitigation.

Requiring site-specific risk assessments can result in varied mitigation strategies, some of which may make a development financially infeasible, such as the need for a crash wall along the entire length of the parcel. Additionally, if each consultant must independently contact rail companies for data, this can prolong the approval process and lead to duplicated efforts.

### Find the Right Experts

Calgary addressed safety and noise concerns by conducting a baseline risk assessment and hiring a single consultant through one request for proposals. However, the city learned that understanding these issues requires distinct expertise. Other municipalities and counties should consider issuing separate requests for proposals for safety and noise assessment. Additionally, it is recommended to hire local acoustical firms that are familiar with the local development approval process.

### Plan for Emergency Response

A risk-based land use policy for development along rail corridors provides a planning tool with a specific focus to assess and enable safe development on parcels next to the freight rail corridors. An emergency response plan, on the other hand, is a tool used by emergency agencies. It is important that development does not preclude the ability of first responders to access the rail corridor in the event of an emergency. Municipalities and counties should consider developing a separate emergency response plan to identify available public lands adjacent to rail corridors, ensuring desired access points are established before these areas are fully developed.

### Conclusions

Rail corridors and rail yards are permanent features of most jurisdictions, and they are expected to expand in the future. They are one of the most important modes of transportation and contribute significantly to the local, regional, and national economy.

As cities, towns, and counties grow and change, development interests near railways are anticipated to intensify. Neither ignoring these risks nor outright prohibiting development in these areas serves the public interest.

Employing a risk-based land use planning approach may enable municipalities and counties to balance the goals of public safety, continued economic growth, appropriate patterns of development, and transport corridor protection. If managed properly, intensification and freight rail corridors can be compatible.

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### About the Author



Abdul Jaffari, AICP, MCIP-I, MBA, is a Senior Planner with Loudoun County, Virginia. In his previous role with the City of Calgary, he authored the City's Development Next to Freight Rail Corridors Policy. With over 16 years of experience in multiple jurisdictions in both U.S and Canada, he is a seasoned municipal leader and city builder with a proven track record of delivering innovative solutions, managing complex city building projects, and fostering collaborative relationships with diverse stakeholders.

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