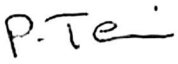
FCR (Park Lawn) LP and CPPIB Park Lawn Canada Inc.

2150 Lake Shore Boulevard West

Rail Safety and Development Viability Assessment

Issue and Revision Record					
Rev	**Date**	**Originator** (Print) (Signature)	**Checker** (Print) (Signature)	**Approver** (Print) (Signature)	**Description**
A	May 15, 2020	Jamie Kennedy HATCH	Paul Tewari HATCH	Andrew Middleton HATCH	
	Signatures:				Combined Zoning By-Law Amendment (ZBA), Draft Plan of Subdivision (DPS), Official Plan Amendment (OPA)

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Rail Safety and Development Viability Assessment

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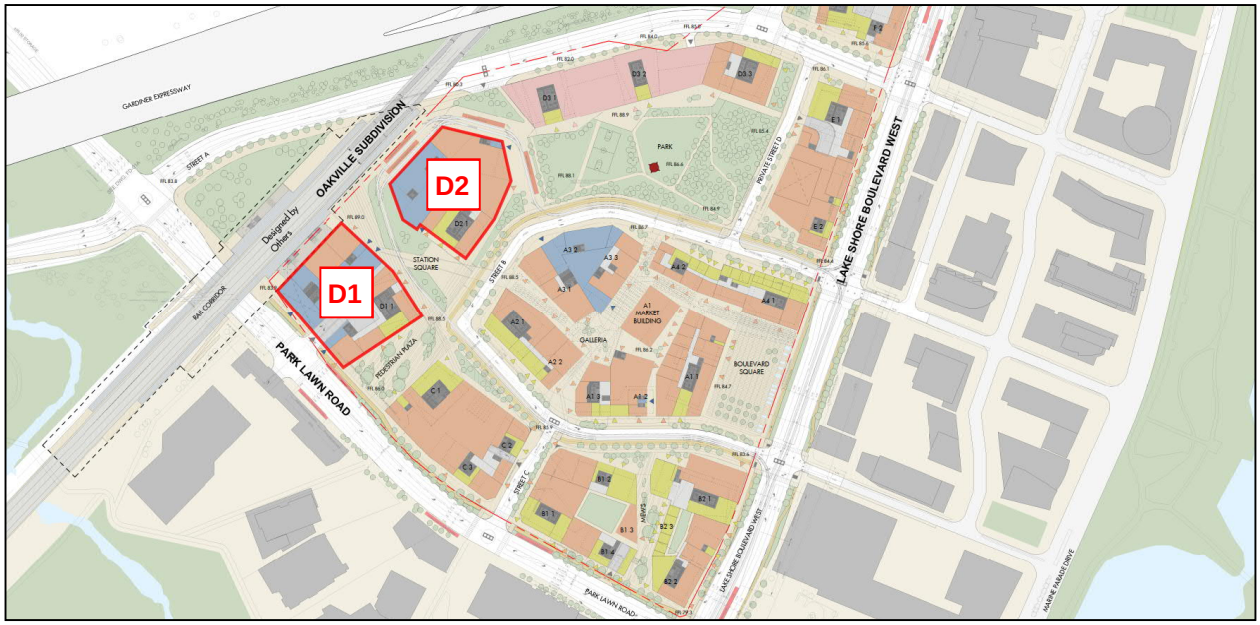
1. Executive Summary

Hatch Ltd. ('Hatch') has been retained by FCR (Park Lawn) LP and CPPIB Park Lawn Canada Inc. ('the Owners') to provide a Rail Safety and Development Viability Assessment report for 2150 Lake Shore Boulevard West in support of combined Zoning By-Law Amendment Application (ZBA), Draft Plan of Subdivision Application (DPS), and Official Plan Amendment (OPA) resubmission to realize an important transit-oriented community anchored by Park Lawn GO Station. The Master Plan includes a multi-phase, mixed-use development, consisting of commercial, residential and retail where the Metrolinx GO line, TTC streetcar, and bus service all converge at the station. The Metrolinx-owned Oakville Subdivision adjacent to the site operates daily passenger service on the Lakeshore West GO line.

The 27.7 acre / 11.2 hectare site is located on the northeast corner of Park Lawn Road and Lake Shore Boulevard West, municipally known as 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road site ("the site" or "2150 Lake Shore").

While the overall site will accommodate fifteen new towers, only two building blocks are proposed within 30m of the rail corridor. These are proposed as Block D1 and Block D2 (highlighted in red in Figure 1-1), immediately adjacent to the Oakville Subdivision (Mile 5.80). The Oakville Subdivision is a Principal Main Line track with daily Lakeshore West GO Line service. Metrolinx is currently undertaking major infrastructure upgrades and service improvements, resulting in a future condition with all-day, two-way service through the GO Expansion Program and Network Electrification Project.

Figure 1-1: Site Plan



(Source: Allies and Morrison)

The purpose of this report is to present the rail corridor conditions in relation to the subject site, identify the risks to the development and its occupants, and make recommendations for mitigating these risks while achieving a development plan that is well integrated with higher-order transit.

The Rail Safety and Development Viability Assessment presents the rail safety recommendations as a proof-of-concept, for submission to the municipality and the rail operator for comment and review. It is

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also understood that these recommendations will have to be further verified and resubmitted for review during the subsequent detailed planning stage.

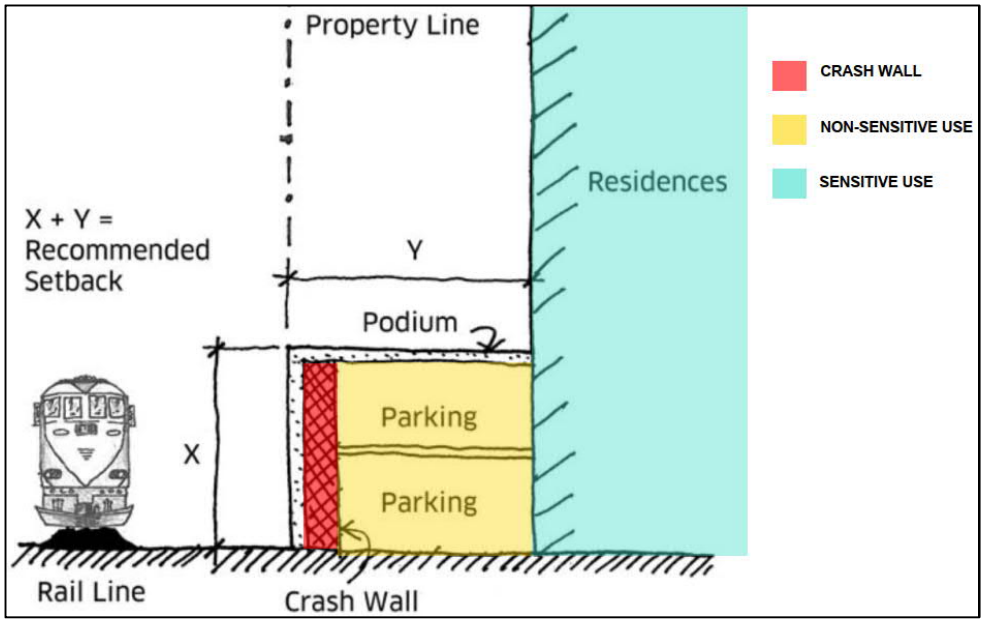
The standard measure prescribes a minimum horizontal setback of 30m with an earthen berm which is not practical here. The future site will encourage interaction with the rail corridor which is contradictory to the existing guidelines. An alternative approach has been taken to achieve a site that is risk mitigated and provides an equivalent level of protection as the standard approach.

It is recommended that the Property owner implement a safety barrier that is at minimum 4.0m high, measured from the top-of-rail, to protect for both passenger and (possible) freight traffic on the adjacent tracks. The proposed height of the safety barrier will be constructed in accordance with the AECOM Crash Wall Design Guidance and submitted to the rail operator for review during the detailed design phase.

Using the alternative approach to achieve rail safety, a Development Viability Assessment (DVA) per the FCM/RAC Guidelines[1] was undertaken to evaluate the risk mitigation measures that are appropriate given that the standard berm and setback are not technically or practically feasible. The intention is to recommend alternative mitigation measures that are both viable for the site and provide equivalent or better risk mitigation than the standard measure.

Figure 1-2 below is the basic illustration that summarizes the FCM/RAC guidelines' alternative approach to measuring setbacks, through a combination of horizontal and vertical setbacks when combined with a safety barrier. The non-sensitive use space within the setback areas acts a buffer between the crash wall and the closest sensitive use.

Figure 1-2*:* FCM/RAC Alternative setback measurement



(Source: FCM/RAC Guidelines)

[1] The Federation of Canadian Municipalities (FCM) and The Railway Association of Canada (RAC) – Guidelines for New Development in Proximity to Railway Operations

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Mitigation Measures at 2150 Lake Shore Boulevard West

Metrolinx has indicated that the setback can be measured from the edge of the active rail corridor, or edge of platform. This was confirmed during the initial engagement with the rail operator in June 2019 and then again by Metrolinx in March 2020. This correspondence and confirmation are included in *Appendix C*.

Through our assessment, the following are the alternative rail safety mitigation measures being recommended as appropriate for the Project, and to principally protect against the risk of a train derailment:

Block D1

- A crash wall at a minimum height of 4.0 m, measured from the top-of-rail, designed to the 'heavy construction' criteria as per the AECOM *Development of Crash Wall Design Loads from Theoretical Train Impacts* at a minimum thickness of 0.45m (450mm);
- A horizontal setback of 18m to the face of the building D1, measured from the edge of the platform of the closest active track;
- A vertical setback of 9m to the closest sensitive use at building D1, measured from top-of-rail
- A 27m setback to the closest sensitive use at building D1, achieved through a combination of horizontal and vertical measures;
- The crash wall design will incorporate wall returns and/or extensions, where appropriate;

Block D2

- A crash wall at a minimum height of 4.0m, measured from the top-of-rail, designed to the 'heavy construction' criteria as per the AECOM *Development of Crash Wall Design Loads from Theoretical Train Impacts* at a minimum thickness of 0.45m (450mm);
- A horizontal setback of 18m to the closest face of the building D2, measured from the edge of the platform of the closest active track;
- A vertical setback of 9m to the closest sensitive use at building D2, measured from top-of-rail
- A 27m setback to the closest sensitive use at building D2, achieved through a combination of horizontal and vertical measures;
- The crash wall design will incorporate wall returns and/or extensions, where appropriate;

Park Lawn GO Station

- The GO Station building will be located within the setback area (at Block D1) to facilitate access to the rail corridor (see Figure 1-3)
    - Note: Metrolinx indicated that station buildings are considered passive, transient spaces and do not fit the FCM/RAC Guidelines' criteria of sensitive use. A non-sensitive use classification is therefore appropriate for station buildings and associated activities
    - The crash wall will be located between the station building and Block D1 (see Figure 1-3)
- TTC streetcar tracks are located within the setback area at Block D2 (see Figure 1-4)

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    - The crash wall will be located between the TTC tracks and Block D2 (see Figure 1-4)

- Increased GO platform height – the new requirements for GO stations will result in an increase in the height of the platforms to, approximately 500mm higher than the current standard. This increase in height will not only act as an obstacle to slow and contain a derailed train within the rail corridor, but will also more safely allow passenger boarding and egress from the frequently stopping trains;
- Jordan guard rails will be used on the bridge overpass as a means of derailment protection; a report commissioned by Hatch showed that Jordan guard rails can reduce the overall severity of derailment and help to contain derailed trains within the railway;

The proposed horizontal setback of 18m and vertical setback of 9m combines for a total setback of 27m to the closest sensitive use spaces within Blocks D1 and D2. The use of crash walls / deflection walls within the setback area integrated into the low occupancy podium is supported by the FCM/RAC Guidelines.

The crash wall at Block D1 will be integrated into the station building along the southern most wall and extend along the face of D1.

The crash wall will be integrated into the podium of Block D2.

In both cases, the crash wall will be structurally isolated from any part of Block D1 or D2.

When considering the above factors, the rail safety mitigation strategy is considered to provide an equivalent level of protection as the standard 30m setback and berm.

Track expansion is not planned here in the future and is unlikely given the physical land constraints and lack of developable land for the rail operator. Park Lawn GO will accommodate passenger platforms on the north and south sides of the rail corridor; however, this report is only intended to address the development south of the rail corridor.

While the FCM/RAC Guidelines recommend that setbacks be measured from the mutual property line to protect rail operations and future expansion, a station not only encourages interaction with the railway but also limits future expansion capabilities once complete. Metrolinx has provided written approval that the setback be measured from the edge of platform rather than the property line.

An alternative approach to meeting the total setback is recognized at 2150 Lake Shore Boulevard West. The recommendations within this report are contingent on an appropriately designed safety barrier that meets the specifications of the AECOM Crash Wall Design Guidelines. A detailed Energy Balance Analysis has been conducted as part of this study to inform the detailed design of the crash wall to withstand a number of train impact scenarios. See Appendix B for the Energy Balance Approach and design load calculations.

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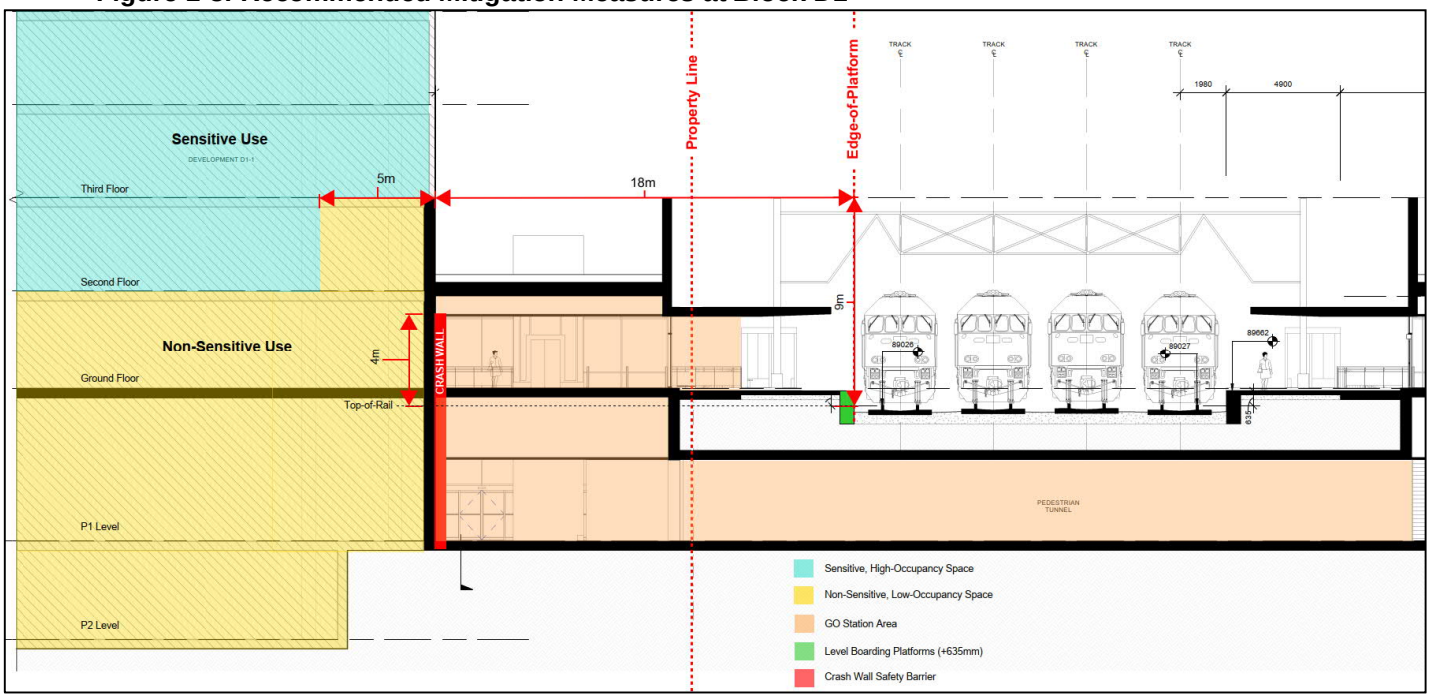
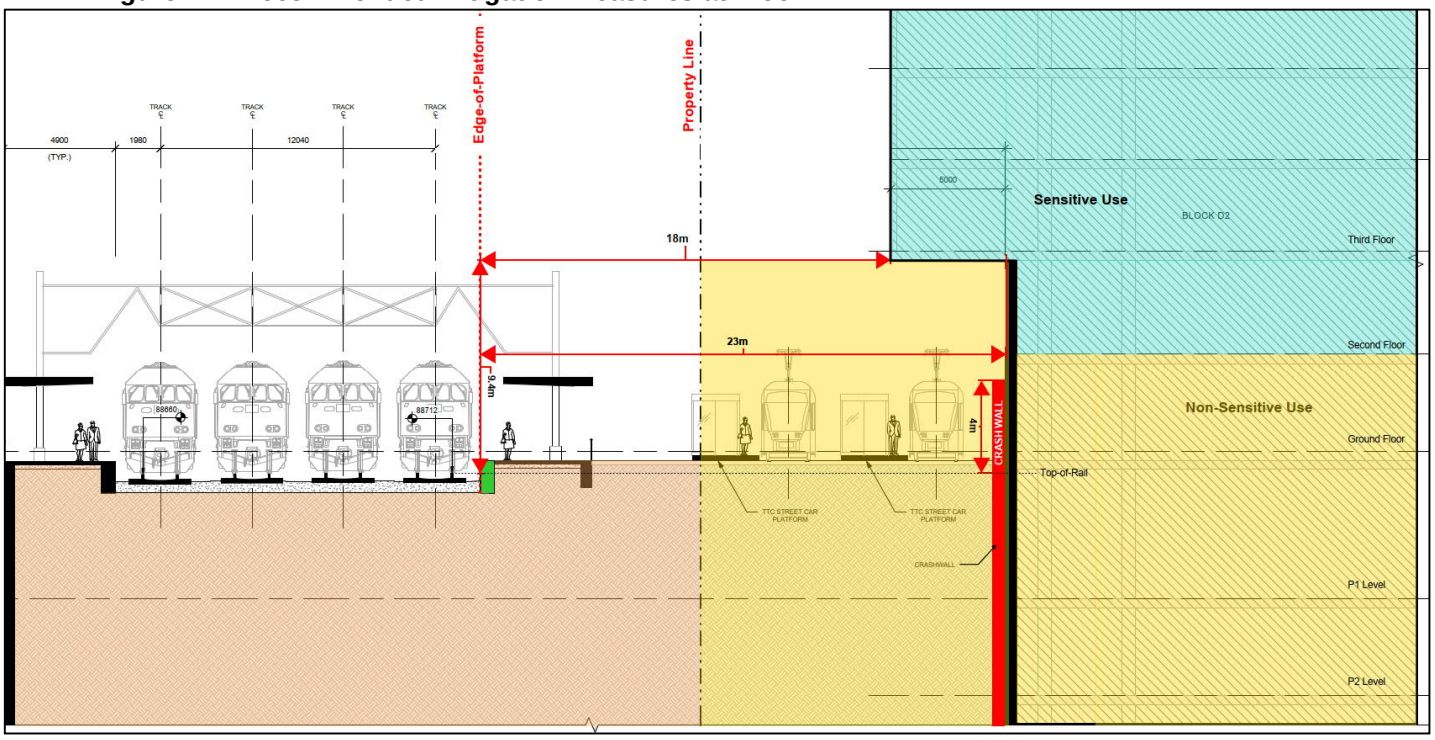
Figure 1-3: Recommended Mitigation Measures at Block D1



(Source: Hatch)

Figure 1-4: Recommended Mitigation Measures at Block D2



(Source: Hatch)

At all times, a total setback of 27m (measured to the closest sensitive use) is achieved. This, in combination with a higher crash wall, provides an equivalent level of safety as the standard 30m measure and earthen berm and meets the stated requirements of the rail operator.

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The reduced horizontal setback is premised on the FCM/RAC guidelines that dictate:

> "Horizontal setback requirements may be substantially reduced with the construction of a crash wall. *For example*, where a crash all is incorporated into a low-occupancy podium below a residential tower, the setback distance may be measured as a combination of horizontal and vertical distances, as long as the horizontal and vertical value add up to the recommended setback."

Within the ground floor of both D1 and D2, low-occupancy, non-sensitive uses are planned, including building lobbies, retail, common areas, hallways, washrooms, maintenance, mechanical rooms and back-of-house. Note: the 'Glossary' in the FCM/RAC Guidelines indicates that retail space can be located within a low-occupancy podium.

Rail safety is a key objective for the development approval process at 2150 Lake Shore Boulevard West. The risks to people and property posed by railway operations and activities must be considered and appropriately mitigated. This report responds to these requirements within the context of existing regulations, guidance and procedures, as well as taking into consideration specific site conditions, future infrastructure, and service conditions on the adjacent tracks. In the future, when the rail corridor is improved and the recommended mitigation measures are applied at the site, the level of risk exposed to the development will be improved to the lowest risk category of 'acceptable'. See *Appendix D – Risk Assessment Matrix* for the detailed assessment. Tolerable risk does not mean that a major event cannot happen, but it does mean that the odds of it happening are so small that it would represent over-engineering and over-building to protect for such risks.

2. Guidelines and Design Criteria

All new development proposals within proximity of the rail corridor(s) must satisfy rail safety requirements set out by the City of Toronto Terms of Reference, as part of their development approval process, and relevant railway owners, i.e. Metrolinx. Both the City of Toronto and Metrolinx have independent criteria, based principally on the FCM/RAC Guidelines, both allowing for site-specific approaches to determining appropriate rail safety requirements.

The City of Toronto published a report in 2019 – *Land Use Study: Development in Proximity to Railway Operations* – which reiterates the standards set out in the FCM/RAC guidelines but does indicate that reduced setbacks have been achieved when the applicant is able to effectively demonstrate the safety mitigation measures performs as well or better than the standard mitigation measures set out by the 2013 FCM/RAC guidelines.

2.1 FCM/RAC Proximity Initiative

The Federation of Canadian Municipalities (FCM) and Railway Association of Canada (RAC) signed a memorandum of understanding in 2003 establishing the FCM/RAC Proximity Initiative. Their goals for this Memorandum of Understanding (MOU) were to build awareness, develop a set of guidelines for development adjacent to railways, and to provide dispute resolutions. This initiative was meant to promote better communication and understanding between the railways and stakeholders to resolve proximity issues in an effective manner. The FCM and RAC collaborated to produce a set of proximity guidelines and best practices for development near railways, and the most recent and comprehensive edition was published in May 2013.

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The FCM/RAC Guidelines outline the following design principles for mitigation design to protect sensitive use (herein referred to in this document as “high-occupancy uses”):

1. Standard mitigation measures are desired as a minimum requirement.
2. In instances where standard mitigation measures are not viable, alternative development solutions may be introduced in keeping with the Development Viability Assessment process. (See Figure 2-1)
3. All mitigation measures should be designed to the highest possible urban design standards. Mitigation solutions, as developed through the Development Viability Assessment process, should not create an onerous, highly engineered condition that overwhelms the aesthetic quality of an environment.

High-occupancy, sensitive uses are defined as *“uses where routine or normal activities occurring at reasonable expected times would experience adverse effects from the externalities, such as noise and vibration, generated from the operation of a railway.”*

Low-occupancy, non-sensitive uses are defined as *“uses such as parking, retail, or the common elements of a condominium,”* i.e. a low-occupancy podium will never contain residential uses.

The guidelines being reviewed as part of the Development Viability Assessment process include:

- FCM/RAC Guidelines for New Development in Proximity to Railway Operations (2013)
- City of Toronto – Land Use Study: Development in Proximity to Rail Operations (2019)
- Metrolinx GO Transit Adjacent Development Guidelines (2013)
- AECOM Submission Guidelines for Crash Walls (July 29, 2014) and Development of Crash Wall Design Loads from Theoretical Train Impact

The assessment uses the FCM/RAC Guidelines as the principle benchmark in determining the setback (vertical / horizontal) and crash wall as a safety measure. Nonetheless, all derailment scenarios identified in the FCM/RAC Guidelines and the AECOM Guidelines are analyzed.

2.2 Metrolinx Guidelines

Metrolinx released Adjacent Development Guidelines for development projects, adjacent to railway corridors Metrolinx owns, on April 1, 2013. The guidelines were developed by the Railway Corridors Management Office within the Railway Corridors Division of GO Transit, which reviews and comments on developments within 300m of a GO Transit rail corridor to safeguard the integrity of the railway corridor and ensure developments proceed in a safe manner, including construction activities and maintenance/operations of the railway and projected expansion-related real estate needs. The Railway Corridors Management Office is intended to be the first point of contact for all parties wishing to carry out new construction, repairs, maintenance, or demolition activities on any property adjacent to a GO Transit railway corridor.

Due to a conflict (FCM/RAC Guidelines use rail corridor approach, whereas the Metrolinx Guidelines use land-use approach to determine the setback, vertical and horizontal setbacks) between the Metrolinx Guidelines and the FCM/RAC Guidelines, for the purpose of this report, the FCM/RAC Guidelines is used as the governing document in determining the required setback.

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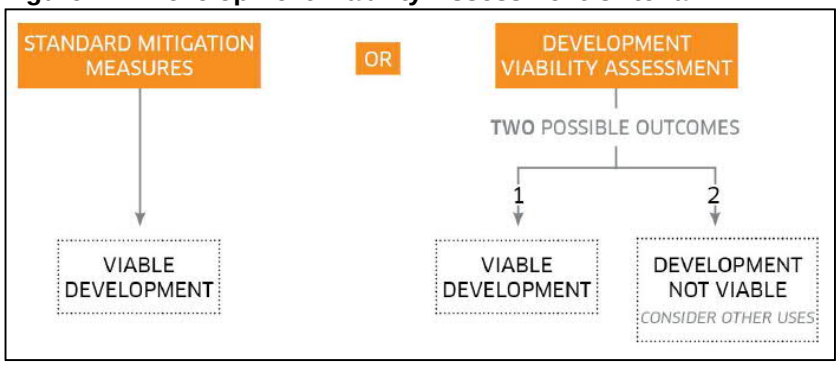
It is important to note that the Metrolinx Guidelines issued on April 1, 2013 is valid for five years (as noted in the Metrolinx Guidelines) and has expired. Metrolinx has confirmed that until an updated version is issued, the current version of the document will continue to govern.

2.3 Development Viability Assessment (DVA)

The development site at 2150 Lake Shore Boulevard West is an example of a common challenge faced by many urban sites throughout Toronto, where the standard mitigation measures of setback and berm are not technically or practically feasible due to site conditions or constraints. The FCM/RAC Guidelines recognize this challenge and requires that in these scenarios, a DVA should be undertaken by the proponent to evaluate the conditions specific to the site, determine its suitability for development, and suggest alternative safety measures such as crash walls or crash berms. A DVA will allow municipal planners to better evaluate proposals for sensitive-use development in areas where standard mitigation cannot be accommodated due to site constraints.

Figure 2-1: Development Viability Assessment Criteria



(Source: FCM/RAC Guidelines)

The assessment should evaluate any potential impacts on the operation of the railway as a result of the new development. As well, the assessment should take into consideration details of the proposed development site, including topography, soil conditions, and proximity to the railway corridor; details of the railway corridor, including track geometry or alignment, the existence of junctions, and track speed; details of the proposed development, including the proposed collision protection in the event of a train derailment and an identification of the potential hazards and risks associated with development on that particular site.

2.4 Energy Balance Analysis

Within the AECOM Crash Wall Guidelines, two methods for determining crash wall design load requirements are outlined:

Method 1:

- The wall shall be designed for a minimum point load of 2700kN applied horizontally and normal to the face at any point along the way;
- The point load shall be applied at a height of 6 feet (1.8m) *above the top of rail* for walls up to 25 feet (7.6m) from the centre line of the track, or a height 6 feet (1.8m) *above the adjacent groundline* for walls farther than 25 feet (7.6m) from the centre line of the track.

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- This method may be applied where track speeds do not exceed 50mph (80km/hr) for freight or 70mph (112km/hr) for passenger trains; where speeds exceed these limits, Method 2 shall be used.

  Method 2:

  An energy balance approach considering collision by glancing blow and single car rotation may be used to determine the design load for a wall at a distance d_{CL} from the centerline of track in feet (m). The closest existing or future/proposed track is to be used. The four cases to be considered:

- Freight Train Load Case 1 – Glancing Blow: nine cars weighing 143 tons (129 700 kg) each, impacting the wall at an angle, θ_G. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.
- Freight Train Load Case 2 - Single Car Impact: single car weighing 143 tons (129 700 kg) impacting the wall as it undergoes rotation about its center. Where d_{CL} is greater than 28 feet (8.5 m), this load case need not be considered.
- Passenger Train Load Case 3 - Glancing Blow: eight cars weighing 74 tons (67120 kg) each impacting the wall at an angle, θ_G. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.
- Passenger Train Load Case 4 - Single Car Impact: single car weighing 74 tons (67120 kg) impacting the wall as it undergoes rotation about its center. Where d_{CL} is greater than 42'-6" (13 m), this load case need not be considered.

This report is based on the analysis undertaken using Method 2 – "Energy Balance Approach," to which the parameters for train load, distance from track centerline and angle of impact are key factors in determining the appropriate crash wall design load requirement.

Given that the track speeds for passenger trains are above 70mph, Method 2 must be used. A full set of calculations and Energy Balance report are included in Appendix B.

Using the calculations provided for Method 2, a speed of 120km/h (75mph) and a distance of 18m to the crash wall from the edge of platform, it was found that there is no impact on the wall from a derailed train at this distance. A derailed train would lose all momentum before reaching the way when the crash wall is 18m horizontally setback from the edge-of-platform (or 19.55m from the centreline of the closest track).

The sensitivity analysis reveals that the critical velocity is only 10 km/h higher than the maximum speed of Metrolinx passenger trains. Thus, a train derailing at a speed of 130.1 km/h (80mph) has a high probability of reaching the property line from the closest track E4. If a train traveling at the critical velocity and critical rolling resistance hit the wall, the force was found to be 36.98 kN. At an unlikely derailment speed of 142 km/h or 88.3 mph, the impact force approaches 2,700 kN.

The Structural Engineer, in consultation with the rail operator, is to decide on the applicable load factors for Ultimate Limit State and Extreme Event Limit State load combinations as well as the wall thickness which is required to be not less than a minimum of 0.45 m.

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3. Land Use and Proposed Development

The following section provides an overview of the site-specific conditions that apply to the property in the context of rail safety.

The Master Plan included a new Park Lawn GO Station, related TTC transit improvements, a fine-grained network of new streets and connections, a range of new open spaces including a new public park, and a diverse mix of residential, retail, service, entertainment and employment uses. At that time, the Master Plan contemplated a range of built form typologies including low, mid and high-rise buildings, fifteen towers ranging in height from 22 to 71 storeys.

3.1 Development Site Conditions Along the Rail Corridor

The development is situated south of the Oakville Subdivision at Mile 5.80. The Oakville Subdivision is a Principal Main Line track. Daily Lakeshore West GO passenger train service and VIA Rail passenger trains operate on the Oakville Subdivision. Canadian National Railway (CN) maintains operational rights but freight activity is non-existent and remains unscheduled.

The rail corridor is currently elevated above the development site, however, in the future, the development will be at-grade with the platform level immediately south of the rail corridor. To plan for this possibility, the crash wall height is measured from top-of-rail and not the adjacent ground level to ensure adequate protection of the building is maintained in the future condition.

A small parcel of land sits immediately to the north, owned by the City of Toronto. No development is currently planned north of the existing rail corridor. A small station may be constructed here in the future to serve the north platform of Park Lawn GO Station but is not considered in this report.

The existing rail corridor contains 4 mainline tracks. The official track speed is 75mph for passenger trains and 60mph for (unscheduled) freight trains. There are 2 crossovers near to the site within rail

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corridor, one on the east side of the Gardiner Expressway and one 750m west of the site near Mimico GO Station. The crossover to the east is not considered an immediate risk to the development site as a train would have to travel through the tunnel underneath the Gardiner before reaching the site. The crossover to the west is sufficient distance away from the site that a train derailment in this location would not directly impact 2150 Lake Shore Blvd. West or Park Lawn GO Station.

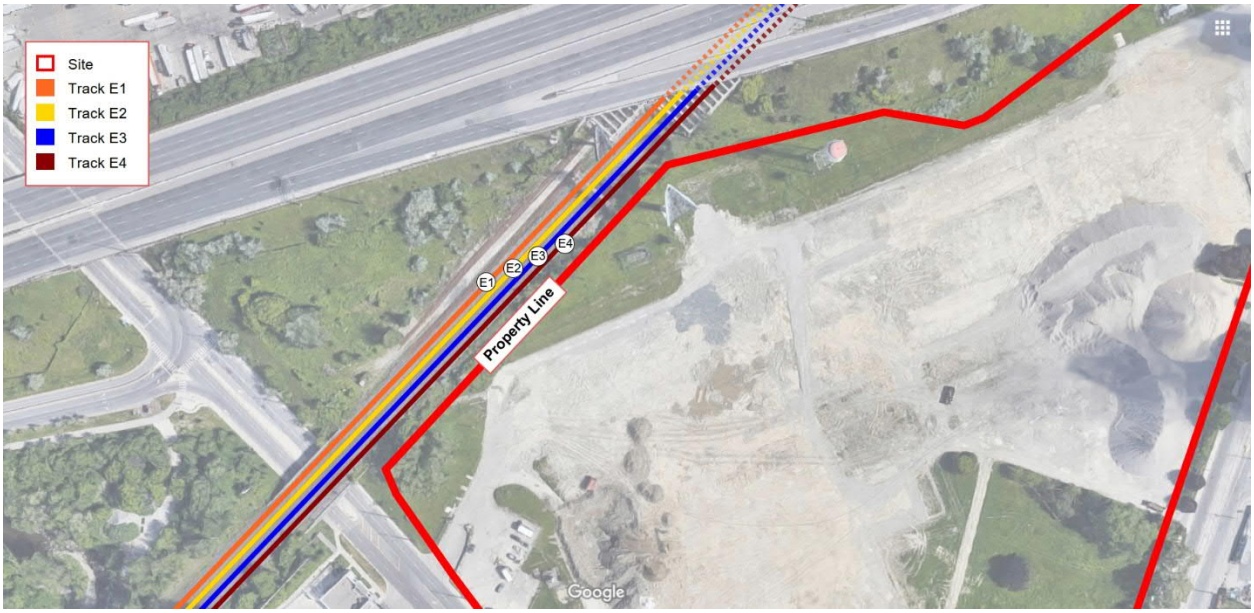
Mimico GO station is located approximately 1.2km west of Park Lawn GO and is in the early planning stages that will result in a mixed-use development and intensification at the station.

Exhibition GO Station is located approximately 3km east of the site and is expected to undergo capital improvements before 2030 to accommodate increasing passenger service and a rapidly growing residential and workforce nearby.

While there is a high volume of passenger train service that will increase through the GO Expansion program, the absence of freight traffic and dangerous goods movement, combined with level boarding and a setback approaching the standard distance, all contribute to a lower overall risk at the site which, as indicated above, can be mitigated through the implementation of a crash wall.

Figure 3-1 below provides a general overview of the track alignment relative to the site.

Figure 3-1 – Satellite Aerial of Site Conditions along the Oakville Subdivision



(Source: Google)

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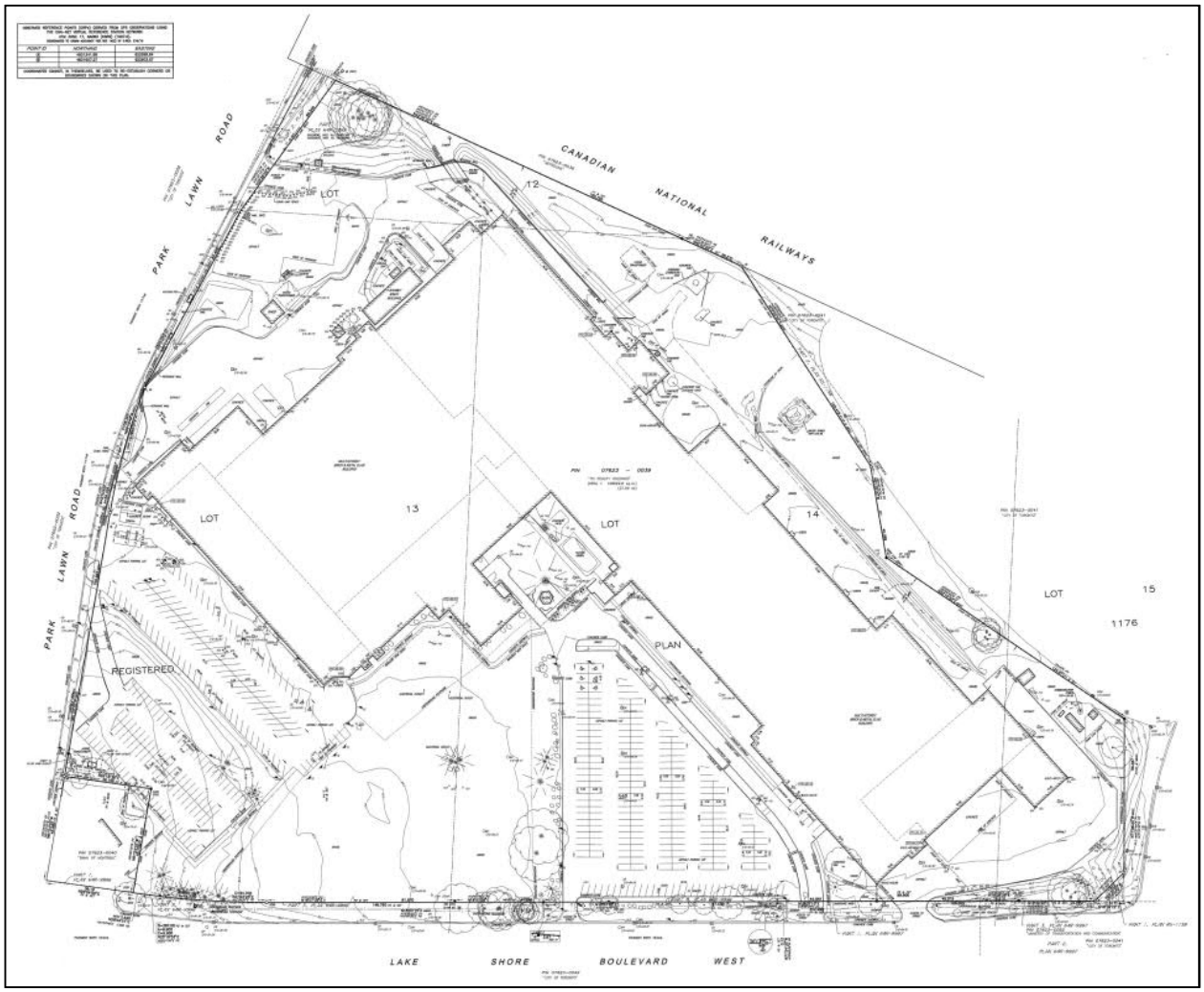
Figure 3-2: Survey of 2150 Lake Shore Boulevard West



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3.2 Current and Future Operating Environment within the Rail Corridor

The study area for rail corridor conditions is between Mimico GO Station to the west and Exhibition GO Station to the east.

Current Operating Environment

The existing rail corridor contains 4 mainline tracks as part of the Oakville Subdivision. The tracks run in an east-west direction. At the east end of the site, the rail corridor passes underneath the Gardiner Expressway.

Approximately 1.2km west of the site is Mimico GO Station. Daily passenger service on the Lakeshore West lines operates frequently and is expected to increase in the future.

A chain link fence runs along the southern property line separating the site from the rail corridor. There are no existing maintenance access points to the rail corridor within the vicinity of the site.

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Table 3-1 – Current and Future Operating Environment within the Oakville Subdivision

Conditions	2150 Lake Shore Boulevard West
Rail Corridor	• Oakville Subdivision
Classification	• Principle Main Line
No. of Tracks	• 4 existing *mainline* tracks • 0 proposed future mainline track (no expansion planned)
Speed	• *Current:* Passenger - 75mph • *Current:* Freight - 60mph
	• *Future:* Passenger – 75mph • *Future:* Freight – 60mph
Alignment	• Straight • Multiple switches in the immediate vicinity (see Figure 3-3)
Elevation	• The rail corridor is currently elevated above the adjacent site • In the future, the adjacent ground level will be raised to the existing track level
Traffic: Current	• Lakeshore West GO Line service – approx.125 passenger trains per day • VIA Rail – approx. 20 passenger trains per day • Freight – CN has operational rights but does not operate in this corridor. *Estimate is based on Metrolinx publicly available train schedules
Traffic: Future	• Increase Lakeshore West GO service: 15-min, all-day, two-way service between Toronto (Union Station) • Total trains per day will exceed 125 • Freight – CN to maintain operational rights, but operating ability will decline because of planned service enhancement
Station Location	• Mimico Station approximately 1km to the west of the site.
Proposed Development	• Multi-tower, mixed-use residential development (xx-xx storeys) • New retail / commercial units integrated into the podium • Sensitive use residential units located beyond the minimum recommended 30m total setback • Non-sensitive uses located within the setback area (ie. parking, storage, retail, lobby, amenity space) • Crash wall located along the face of development Blocks D1 and D2

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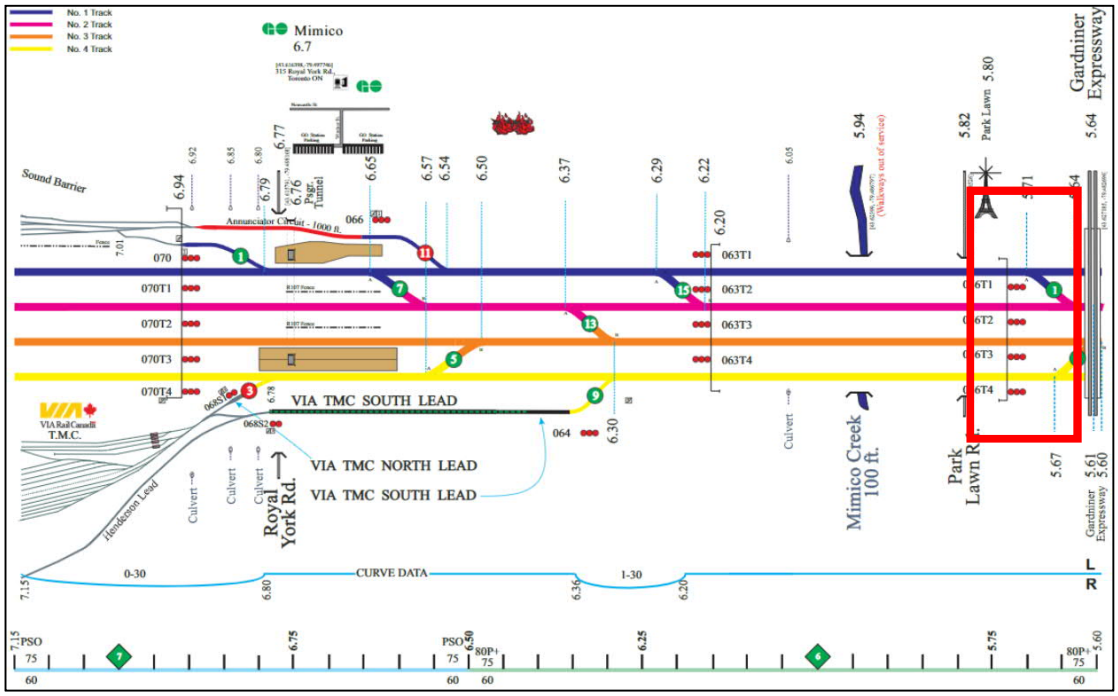
Figure 3-3: Metrolinx Track Diagram (2150 Lake Shore Blvd. W. in red)



Future Operating Environment

No track expansion is planned in the future. As such, the proposed mitigation strategy is based on the existing track alignment. The crash wall design and specifications are based on the distance from the existing Track E4 (see Figure 3-3 above). The design loads consider all the criteria set out in the FCM/RAC Guidelines, AECOM Guidelines and additional analysis carried out by Hatch as part of the Energy Balance Analysis to apply Metrolinx train specifications to the overall calculation.

Furthermore, the GO Expansion currently underway will result in a significant increase in the frequency of passenger train service through this corridor. However, the increase in passenger train service will further inhibit freight train movement through this corridor as the local area continues to de-industrialize.

Additionally, the Electrification Project is part of Metrolinx's strategy to increase the service level of the GO network as well as increase operational efficiency and emission free service and will impact the Oakville Subdivision in the future.

One aspect that may require design and construction coordination with the development site is the overhead catenary system that will be introduced as part of the Electrification Project. While sufficient setback has been maintained to allow for future electrification work within the rail corridor, some coordination may be required at the site during implementation. *Reference – GO Rail Network Electrification Transit Project Assessment Process Environmental Project Report (October 2017)***.**

While an increase in the overall volume of train traffic is anticipated in the future, the increase in traffic is expected to be passenger train traffic. However, Metrolinx has an exceptional operating and safety record compared to freight operators. Electrification of the rail corridor will result in a quieter, safer environment. The electrification will result in a moderate reduction in the overall noise, a significant improvement in the air quality, a lowered risk of explosion, and the additional infrastructure in the corridor will act as a further buffer between active trains and the adjacent buildings.

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4. Risk Assessment and Mitigation for 2150 Lake Shore Boulevard West

The following sections are focused on assessing the level of risk posed by the rail corridors onto the Project by considering all potential derailment scenarios. Then, appropriate mitigation measures are recommended to improve the risk profile to a level that is acceptable by all stakeholders and will provide an equivalent level of safety as the established practices for development adjacent to rail corridors (i.e. the FCM/RAC Guidelines).

Current and future potential derailment scenarios and their impact are identified and assessed on its level of frequency and severity to determine the scenario's risk category (i.e. from lowest to highest risk, the categories are: acceptable, tolerable and intolerable) and finally its mitigation strategy. See *Appendix D – Risk Assessment Matrix* for the detailed definitions of the assessment framework.

4.1 Current Potential Derailment Scenarios and Impact

The risk assessment has identified a total of fourteen (14) potential derailment scenarios posed by the Oakville Subdivision onto the subject Property. Of these scenarios, eight (8) scenarios have been assessed as low risk, meaning the risk is acceptable and no further mitigation is required. The other remaining six (6) scenarios are assessed as medium risk, or "tolerable risk," meaning there is room for improvement in its mitigation strategy to further reduce the overall risk level that one that is considered acceptable as reasonably practicable.

Table 4-1 – Current Assessed Risk with Existing Conditions

Current *Assessed Risk with* ***Existing Conditions***				
Hazard	Frequency	Severity	Residual Risk Level	Risk Classification
1. Main Line Derailment – Explosive *Derailment of* ***freight*** *train carrying flammable or hazardous materials*	1	5	5	Acceptable
2. Main Line Derailment – Inert *Derailment of* ***freight*** *train alongside the site boundary*	1	5	5	Acceptable
3. Main Line Derailment – Inert *Derailment of* ***passenger*** *train alongside the site boundary*	2	5	10	Tolerable
4. Main Line Derailment – Peripheral *Derailment of* ***freight*** *train at speed from east or west of the property, travelling towards the property*	1	5	5	Acceptable
5. Main Line Derailment – Peripheral *Derailment of* ***passenger*** *train at speed from east or west of the property, travelling towards the property*	2	4	8	Tolerable
6. Train Travelling Faster than Zone Speed for Type of Train *Derailment of* ***freight*** *train at speed greater than max. line speed through a curve with property on the inside of the curve*	1	5	5	Acceptable
7. Train Travelling Faster than Zone Speed for Type of Train *Derailment of* ***passenger*** *train at speed greater than max. line speed through a curve with property on the inside of the curve*	1	5	5	Acceptable
8. Dangerous Goods Leak/Release *From a loaded* ***freight*** *train due to a failure of, or damage to the railcar carrying said goods*	1	4	4	Acceptable

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Current** Assessed Risk with **Existing Conditions				
9. Airborne Train Derailment *Top level of sea-can (double stack intermodal) **freight** car becomes airborne in a derailment*	1	4	4	Acceptable
10. Crew Member Incapacitated *Controller of the train loses consciousness or ability to use train controls while train is in motion*	2	5	10	Tolerable
11. Runaway Rolling Stock - Explosive *Unattended railcar(s) loaded with dangerous goods begin moving by gravity without an active prime mover*	1	4	4	Acceptable
12. Runaway Rolling Stock - Inert *Unattended railcars, unloaded or loaded with non-hazardous goods begin moving by gravity without an active prime mover*	2	3	6	Tolerable
13. Movement Exceeds Limits of Authority *Unauthorized movement by a train placing the train in a position that could be struck by another train*	2	3	6	Tolerable
14. Trespassing onto Railroad *Trespassing onto railroad by unauthorized member*	3	3	9	Tolerable

Total Assessed Risk Score = 86

The risk assessment was conducted with the understanding that the Oakville Subdivision is predominantly passenger trains. With over 100 passenger train trips per day operated by Metrolinx, passenger traffic is projected to increase above current levels.

Freight traffic is expected to continue to be inactive in the corridor. Hazardous and flammable materials are not scheduled to be transported in this corridor, but rights to schedule such trains are present and so the possibility for unscheduled trains with hazardous and flammable materials still exists.

4.2 Risk Profile by Operating Environment

The following section assesses the rail corridor based on historical rail transportation occurrence data from the Transportation Safety Board (TSB). The following assessment is based on accidents/incidents reported (and investigated) within 5 miles of the development site on the Oakville Subdivision between 2004 to 2019. The following table outlines the number of adverse events occurring within 5 miles of the site between 2004-2019 and is sorted by rail operator.

Table 4-2: 15-Year Accident Record within 2-mile radius of 2150 Lake Shore Blvd. West

	Rail Operator		
Accident Type	Metrolinx (GO)	CN Rail	Total
Main Track Train Derailment	-	1	1
Non-Main Line Track Derailment	5	8	13
Non-Main Line Track Collision	-	1	1
Movement Exceeds Limits of Authority	-	2	2
Signal Less Restrictive than Required	-	3	3
Trespasser	-	2	2
Crossing	1	-	1

(Source: Transportation Safety Board)

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4.2.1 Derailments and Adverse Events

Figure 4-1 below identifies train incidents by the location and associated rail operator within a 1-mile radius of the site. As is evident by the absence of main track derailments and collisions involving Metrolinx trains, Metrolinx maintains a very safe operating environment.

Figure 4-1: Reported train incidents within a 1-mile radius

All CN-related incidents occurred prior to Metrolinx ownership and incidents involving this rail operator have not been recorded since Metrolinx took over the line.

4.2.2 Site-Specific Risk Considerations

Operational environmental factors that demonstrate a medium risk profile at the subject Property include:

- **Low Level of Scheduled Freight Operation** – CN maintains the rights to operate through Oakville Subdivision. However due to high volume of passenger trains (and anticipated increase in passenger train volume), freight train operational window is limited. Under an assumption that there is one freight train per day through the rail corridor, passenger train service is accounted for more than 99% of the rail traffic at this site.
- **Park Lawn GO Station** – Park Lawn GO Station will be situated along the northern boundary of the site. Level boarding is planned for this station increasing the platform height from 0.127m to 0.585m. The additional platform height will not only result in safer movements on and off the trains, it will also improve the likelihood a train will be contained within the rail corridor in the event of a derailment. While there will be significant increase in the total volume of traffic, the nature of these movements will be entirely different from today. Most trains will be stopping at Park Lawn. This will result in hundreds of trains accelerating and decelerating past the subject site daily as opposed to operating normal track design speeds.
- **Jordan Guard Rails –** The station platform is planned to extend the length of the bridge crossing Park Lawn Avenue. Bridge crossings require Jordan guard rails to prevent trains from leaving the track in the event of a derailment. The presence of guard rails don't prevent a derailment but they do act as a safety measure to minimize the severity of a catastrophic event.

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- **Mimico GO Station** – Similar to Park Lawn Station, the presence of Mimico Station contributes to an overall reduction in the total risk level at 2150 Lake Shore Boulevard West. Mimico GO Station is located approximately 1.2 km southwest of the site. Trains are slowing down and operating well below track design speeds as they approach and depart from Union Station.
- **Gardiner Expressway Tunnel** – at the north end of the site, the rail corridor passes underneath the Gardiner Expressway in a tunnel that is approximately 190m in length. A retaining wall envelops the tunnel and supports the highway above. The tunnel itself provides an additional level of protection from westbound trains.
- **Track Alignment** - the tracks run tangent along the northern boundary of the property and are straight in alignment at least 1km in either direction of the planned station.
- **Future Electrification Program** – it is anticipated that Metrolinx will install positive train control (PTC) system to GO network in order to "automatically reduce the speed, or stop a train depending on the conditions on the track ahead (GO Rail Network Electrification TPAP). This should reduce risks related to exceeding speed limit and movement exceeding limit of authority.

The combination of the discussed factors above and the implementation of a safety barrier can be reasonably considered to improve the safety and hazard level on the development site that may arise from the railway operation.

4.3 Mitigation Measures

The FCM/RAC Guidelines recommend a combination of setbacks and safety barriers to principally mitigate against the risk of a train derailment and achieve rail safety. Consistent with the guidelines, the Project will apply a combination of horizontal and vertical setback distances and a safety barrier system in the form of a crash wall to achieve rail safety. The below described are the recommended mitigation measured being applied in the Project's site design:

4.3.1 Application of Setback

Setback Measurement

Setbacks between the rail corridor and the sensitive uses proposed within the development building are a preferred mitigation measure to act as a physical buffer zone that allows occupants of the development to escape from the setback area in the event of a derailment, especially if the event results in smoke and/or fire. The resulting setback area is then defined as a 'non-sensitive use' zone, and to make productive use of this space 'low-occupancy uses' are permitted as per the FCM/RAC Guidelines. This includes, but is not limited to, parking, certain types of retail, common elements of a building such as a lobby, outdoor recreational spaces and facilities, storage, back-of-house, non-emergency egress corridors and/or service areas.

Park Lawn GO Station will be located in the setback area for Block D1. An 18m setback, measured from the edge of the platform is recommended, with an 8m vertical setback for a combined total setback of 27m. The height of the crash wall is recommended to be increased from the minimum 2.135m to 4.0m to address this reduction in overall setback (see Figure 4-2 below).

The TTC streetcar loop and Park Lawn Station platforms will be located in the setback areas for Block D2. A 23m horizontal setback to the crash wall at the ground floor will be achieved. Block 2 cantilevers above the crash wall at Floor 3, reducing the horizontal setback to the face of the building to 18m. However, at

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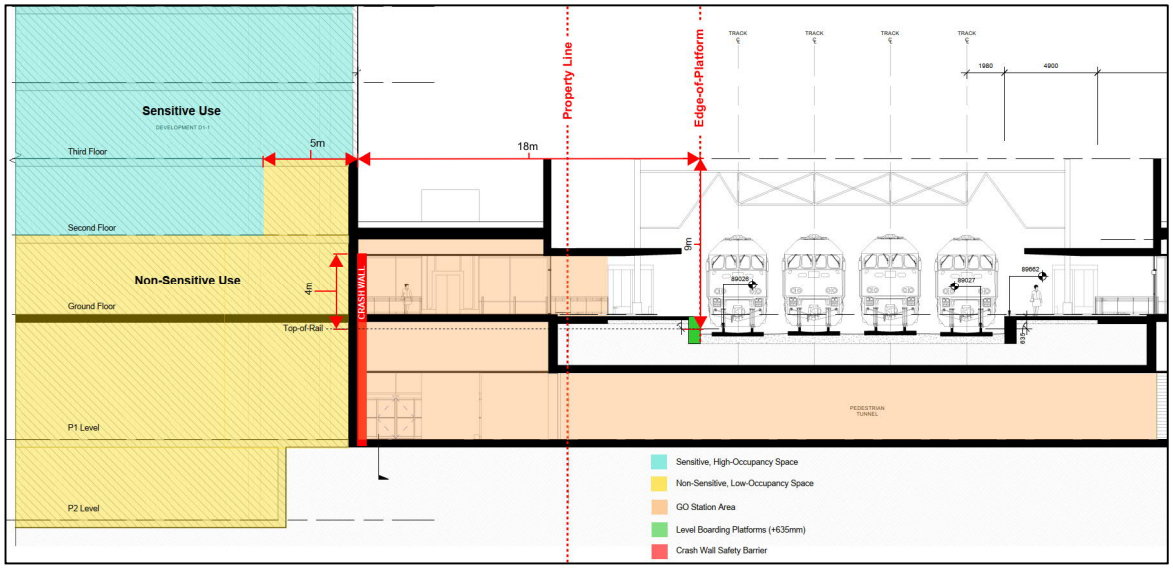
this height, the 9m vertical setback, combined with the 18m horizontal setback results in a total setback of 27m. Again, the height of the crash wall is recommended to be increased from the minimum 2.135m to 4.0m to address the reduction in overall setback (see Figure 4-3 below).

Setbacks are typically measured from the mutual property line (between the rail corridor and the development site). Per the FCM/RAC Guidelines, this is to *"ensure the entire right-of-way is protected for potential rail expansion in the future."*

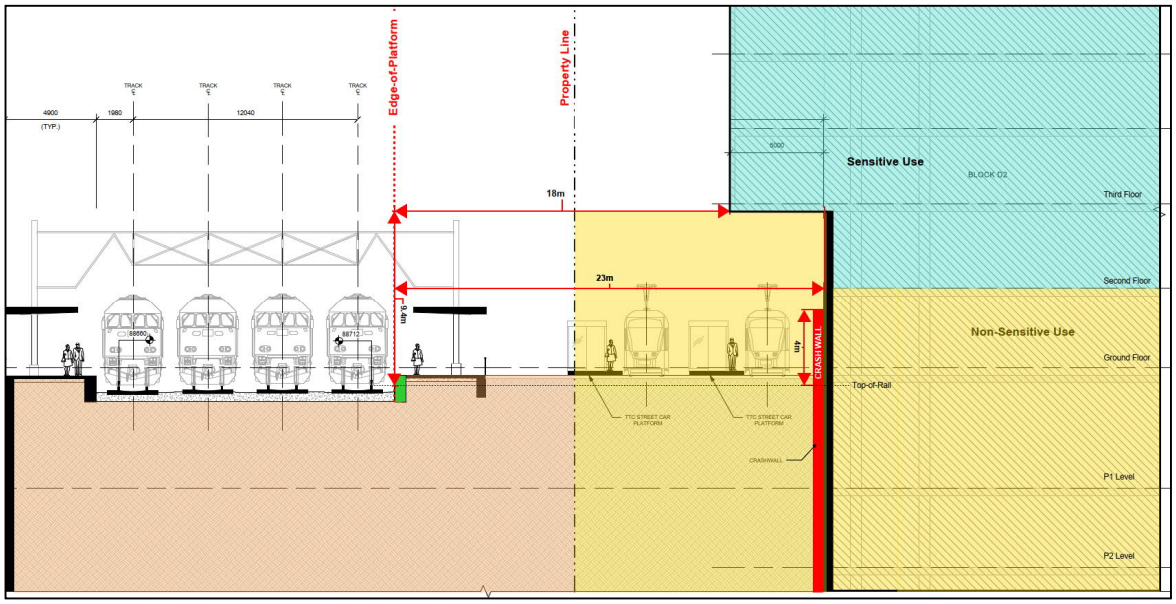
However, for the development site at 2150 Lake Shore Boulevard West, the setback is measured from the edge of the platform, previously approved by Metrolinx. This approval is indicated in Appendix C.

Figure 4-2:Setback at Block D1



(Source: Hatch)

Figure 4-3: Setback at Block D2



(Source: Hatch)

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4.3.2 Application of Sensitive / Non-Sensitive Uses

Sensitive Uses (or, 'High-Occupancy')

The setback recommendations above are intended to separate the rail corridor from sensitive uses proposed in the development building. Sensitive uses can be understood as 'high occupancy' uses. High-occupancy uses are defined as *"uses where routine or normal activities occurring at reasonable expected times would experience adverse effects from the externalities, such as noise and vibration, generated from the operation of a railway."* At 2150 Lake Shore Boulevard West, the commercial units proposed from Floor 3 and above are considered high-occupancy uses and are setback from the rail corridor 27m through a combined horizontal and vertical distance.

Non-Sensitive Uses (or, 'Low-Occupancy')

Productive use of the space within the setback area is allowed for non-sensitive, or 'low-occupancy' uses. Low-occupancy, non-sensitive uses are defined in the guidelines as "*parking, retail, or the common elements of a building"* (i.e. indoor/outdoor recreational spaces and amenities, work-sharing space, storage/lockers, certain fitness facilities, back-of-house, non-emergency egress corridors).

The setback area for the planned development includes the GO station facilities and TTC streetcar tracks, as well as the 'Station Square' (see Figure 1-1), a passive public space, as well as low-occupancy retail that will be integrated into the station and development blocks.

4.3.3 Application of Safety Barrier

The FCM/RAC Guidelines recommend the use of safety barriers to absorb the energy impact of a derailed train. In many settings an earthen berm is an appropriate type of safety barrier. On urban sites like the subject property, a crash wall is preferred as an alternative form of safety barrier.

In the case of 2150 Lake Shore Boulevard West, a crash wall will act as the primary mitigation in protecting the development from a train derailment.

The following sections are more detailed recommendations related to the safety barrier design in the context of the site conditions.

Crash Wall Specifications

The crash wall should be a minimum of 4.0m above top-of-rail where adjacent to a track. At the east and west ends, the crash wall return may follow the grade to remain 4.0m above the grade. The following list of recommendations outlines the requirements as set out by the existing guidelines:

- Crash wall to be design in accordance with the AECOM *Development of Crash Wall Design Loads from Theoretical Train Impacts;*
- The crash wall is recommended to be built to a minimum thickness of 450mm (0.45m);
- The crash wall height is recommended to be increased from the minimum 2.135m to a total height of 4.0m high, measured from top-of-rail; and
- The crash wall is required to be structurally isolated from Block D1 and D2 and will be subject to review by the rail operator during the detailed design stage.

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A detailed Energy Balance Analysis was conducted to determine the specific load impact forces that the wall must be designed to withstand in a derailment scenario. The Energy Balance report is contained in Appendix B.

Crash Wall Openings

The existing sets of guidelines do not adequately address rail safety mitigation measures at transit stations. Typically, interaction with the rail corridor is discouraged. However, transit stations encourage interaction with the rail corridor.

To achieve a development that is in line with Metrolinx's transit-oriented development strategy and station delivery model, the site owner will explore the feasibility of providing openings in the crash wall to facilitate interaction between the GO Station and the development site. The openings will allow for a seamless transition between the commercial office building and Park Lawn GO Station.

Given the point loads determined by the Energy Balance approach, a derailed train is expected to lose most of its momentum and energy before it reaches the crash wall.

Openings in the crash wall will be presented to the rail operator during the subsequent design stage. The structural engineer will provide evidence that the wall will be able to withstand the anticipated impact loads from a derailed train. Additional measures may be required to address concerns about smoke, fire, and flying debris in the event of a derailment.

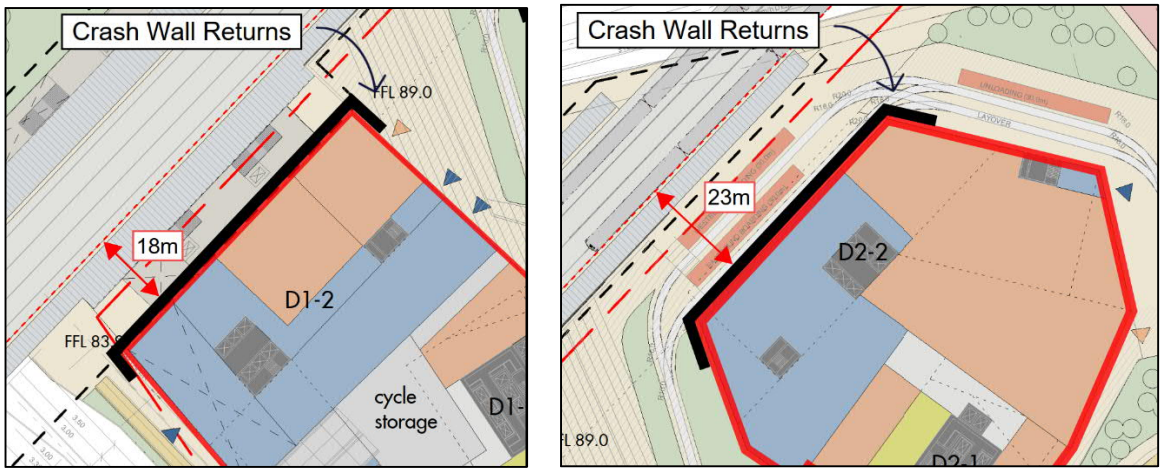
Safety Barrier Returns

Similar to the design of the crash wall, returns are recommended at the east and west end of the development, where appropriate. The location and extent of the returns will be further discussed during the detailed design phase. There may be instances where existing infrastructure limits the need for returns. However, at this time, we acknowledge that wall returns are a common requirement in the construction of crash walls.

Crash wall returns are recommended to be 3 - 6m in length to protect from a potential derailment of east or west bound trains. The returns will be built to the same specifications as the crash wall, if deemed necessary during the peer review.

Figure 4-4 below identifies the approximate locations of the proposed wall returns.

Figure 4-4: Crash Wall Returns



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Structural Considerations

Our recommendation is that the crash wall be structurally independent and isolated from the superstructure and vibrationally isolated to the substructure supporting the sensitive uses above (i.e. an isolation gap / expansion joint between the crash wall and the podium).

A full Constructability Report will be provided at the subsequent stage when detailed design and construction programming begins as part of a full Site Plan Control application.

Recommendation:

The AECOM Crash Wall Design Guidelines dictate that, "crash walls greater than 25 feet (7.6m) from the centreline of track shall be a minimum of 7 feet (2.135m) above the adjacent groundline"[2].

The crash wall is recommended to be increased to a height of 4.0m to meet the requirements of the rail operator to allow for a reduced setback.

4.4 Future Potential Derailment Scenarios and Impact

In the future condition, when mitigation measures herein are applied as recommended, the risk levels of all fourteen (14) identified potential derailment scenarios are lowered to an acceptable/tolerable level of risk. In other words, the property has been made equivocally safe to what the standard measure would offer.

Table 4-3: Future Assessed Risk with Protective Measures Applied

Future *Assessed Risk with* ***Protective Measures Applied***					
Hazard	Frequency	Severity	Residual Risk Level	Risk Classification	Have Future Conditions been Improved, Unchanged or Worsened?
1. Main Line Derailment – Explosive	1	4	4	Acceptable	Improved (+) *Residual risk levels have improved from 5 to 4*
2. Main Line Derailment – Inert (Freight)	1	4	4	Acceptable	Improved (+) *Residual risk levels have improved from 5 to 4*
3. Main Line Derailment – Inert (Passenger)	2	3	6	Tolerable	Improved (+) *Residual risk levels have improved from 10 to 6*
4. Main Line Derailment – Peripheral (Freight)	1	3	3	Acceptable	Improved (+) *Residual risk levels have improved from 5 to 3*
5. Main Line Derailment – Peripheral (Passenger)	1	4	4	Acceptable	Improved (+) *Residual risk levels have improved from 8 to 4*
6. Train Travelling Faster than Zone Speed for Type of Train (freight)	1	4	4	Acceptable	Improved (+) *Residual risk levels have improved from 5 to 4*
7. Train Travelling Faster than Zone Speed for Type of Train (passenger)	1	4	4	Acceptable	Improved (+) *Residual risk levels have improved from 5 to 4*
8. Dangerous Goods Leak/Release	1	3	3	Acceptable	Improved (+) *Residual risk levels have improved from 4 to 3*

[2] AECOM. Development of Crash Wall Design Loads from Theoretical Train Impact. 2014

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Future** Assessed Risk with **Protective Measures Applied					
9. Freight Car Becomes Airborne in a Derailment	1	2	2	Acceptable	Improved (+) *Residual risk levels have improved from 4 to 2*
10. Crew Member Incapacitated	2	2	4	Acceptable	Improved (+) *Residual risk levels have improved from 10 to 4*
11. Runaway Rolling Stock - Explosive	1	3	3	Acceptable	Improved (+) *Residual risk levels have improved from 4 to 3*
12. Runaway Rolling Stock - Inert	2	2	4	Acceptable	Improved (+) *Residual risk levels have improved from 6 to 4*
13. Movement Exceeds Limits of Authority	2	2	4	Acceptable	Improved (+) *Residual risk levels have improved from 6 to 4*
14. Trespassing onto Railroad	1	3	3	Acceptable	Improved (+) *Residual risk levels have improved from 9 to 3*

Total Assessed Risk Score = 52

Of the previous six (6) identified medium-risk scenarios where there is room for improvement in its mitigation strategy under current conditions, they have all been improved and made safer under future conditions once the recommended, principal mitigation measure of a crash wall that withstands the worst-case scenario is applied.

5. Additional Risks and Considerations

While the focus of this study is on rail safety and appropriate mitigation, there are other potential risks to both the public and rail operations that are typically addressed through the application of standard setbacks. The following risks must be identified and properly mitigated at the subsequent planning stage, the Site Plan Application, where the detailed design will formalize the recommendations put forward in this report and the following supporting studies:

- Noise and Vibration
- Stormwater Management
- Geotechnical Investigation
- Air Quality
- Smoke and Fire Protection

At the ZBA stage, the intention of this report is to provide the rail operator, Metrolinx, and the City of Toronto an opportunity to assess the risk mitigation strategy proposed for the site. The primary intention of the ZBA is to determine appropriate land use, building massing criteria, and property setbacks. As such, the following studies are recommended to be carried out to inform the detailed design and subsequent submission of the future DVA during the Site Plan Application.

5.1 Noise and Vibration

A separate noise and vibration study for 2150 Lake Shore Boulevard West will be prepared by RDWI Inc. as part of the planning submission. The FCM/RAC Guidelines specify a set of criteria to assess localized sound, however, the City of Toronto currently uses a more strict assessment process. The FCM/RAC recommendations are highlighted in Figure 5-1 below.

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Figure 5-1: Noise and vibration requirements for rail adjacent development

AC.1.6 // RECOMMENDED NOISE CRITERIA - RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO FREIGHT RAIL SHUNTING YARDS

TIME OF DAY	ONE HOUR Leq (dBA) OR L_{LM} (dBAI)	
	Class 1 Area	Class 2 Area
0700 - 1900	50	50
1900 - 2300	47	45
2300 - 0700	45	45

*These criteria are applicable to any usable portion of the lot or dwelling.

**Class 1 and 2 Areas refer to the typical acoustical environment that can be expected within the development zone. Class 1 Areas are acoustic environments dominated by an urban hum, and Class 2 Areas have the acoustic qualities of both Class 1 and Class 3 Areas (which are rural) For more information, refer to Section 2 of the LU-131 Guidelines issued by the Ontario Ministry of the Environment.

(Source: FCM/RAC Guidelines)

The Applicant must demonstrate they have met the minimum requirements as dictated by the City of Toronto, using criteria developed by the Ontario Ministry of the Environment and Climate Change (MOECC).

We defer to the recommendations and conclusions contained within the Noise and Vibration Assessment to mitigate all associated rail corridor risks of this type.

5.2 Stormwater Management and Drainage

Stormwater draining can be an issue for any new development. Maintaining current drainage patterns for the rail corridor is important, to ensure the stability of the tracks. The grading of the rail corridor is intended to maintain existing longitudinal drainage patterns. The rail corridor is not designed to handle additional flows from neighboring properties. As such, the development must not discharge or direct stormwater, roof water, or floodwater onto the railway corridor. This is addressed in the FCM/RAC Guidelines:

> *Stormwater management and drainage infrastructure associated with a development […] should not adversely impact on the function, operation, or maintenance of the corridor, or should not adversely affect area development.*[3]

A Stormwater Management Report is recommended to ensure that the new development and station do not adversely impact the rail corridor.

Proposed Alteration to Existing Site

The development site is currently vacant. The surface is flat and made of earthen material. No formal drainage system exists at the current site.

A stormwater management report will be conducted by the property owner to ensure that stormwater runoff is captured and directed into the municipal storm sewers. This will inform the subsequent detailed design stage.

Stormwater runoff at the site will not result in any significant amount of water discharged onto the rail corridor as a direct result of the elevation differences between the two properties.

[3] Federation of Canadian Municipalities, Railway Association of Canada. Guidelines for New Development in Proximity to Railway Operations. 2013.

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All drainage will be directed to municipal infrastructure and no impact to the rail corridor is anticipated as a result of the development.

Drainage Recommendations

A Stormwater Management report is recommended and should include mitigation measures to address all stormwater and drainage at the site. We defer to the recommendations within this study to inform the detailed design and ensure the rail corridor is not adversely impacted by stormwater discharge.

A drainage system built into the station platform and surrounding "Station Square" is recommended to capture stormwater runoff at the site. It will also provide a means to capture any fuel or oil spilled in a derailment scenario.

5.3 Air Quality

Air Quality, including odours and emissions, is a potential concern for development adjacent to rail corridors. In the case of Metrolinx and GO Expansion, the majority of passenger rail operations are planned to be electric. In the current condition, the diesel trains operating through the corridor may have an adverse impact on residents.

Inoperable windows and centralized heating and cooling systems can help offset some of the potential air quality concerns that may arise when next to an active rail corridor.

In the future, the electrification of the tracks will decommission a significant number of diesel locomotives, meaning there is potential for improved air quality in the future. Arguably, automobile emissions play a larger role in the local air quality in Etobicoke than the rail corridor operations.

An Air Quality report is recommended and should include mitigation measures to address air quality concerns at the development site.

5.4 Smoke and Fire Protection

In the absence of a standard horizontal setback, the building design at the upper levels of the building and associated podium must account for the risk of rising smoke and/or fire due to a train collision or derailment below. The crash wall will act as the primary mitigating factor to protect the development from a fire within the rail corridor. Inoperable windows can be incorporated into the building design to protect against any potential smoke and/or air quality concerns within the Oakville Subdivision.

The risk of explosive impact is low.

6. Conclusions and Recommendations

This Rail Safety and Development Viability Assessment has been undertaken within the context of existing regulations, guidance and procedures while taking into consideration the specific site conditions and constraints at 2150 Lake Shore Boulevard West.

Importantly, this assessment has been prepared to support the 'proof of concept' stage. All detailed design matters will be addressed in full during the subsequent Site Plan Application and the Rail Safety report that will be submitted as a part of that application.

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The assessment follows each applicable guidelines' recommended approach of determining suitable, alternative mitigating measures that would still provide an equivalent or better risk mitigation than the standard measure and enable development viability on an underutilized site.

Rail safety is a key objective for the development at 2150 Lake Shore Boulevard West, and it is well understood that the risks to people and property posed by railway operations and activities must be considered and, as appropriate, mitigated. The key intent needs to be an appropriate mitigation of all potential derailment risk to a level that is acceptable to all stakeholders and will provide an equivalent level of safety as the established practices for development adjacent to rail corridors (i.e. the FCM/RAC Guidelines).

Through the implementation of the recommendations contained herein, the goal of providing an equivalent level of protection is achieved, as per the established practices for development adjacent to rail corridors, as required by the municipality and rail operator.

7. Appendices

Appendix A – Guidelines and References

Appendix B – Energy Balance Analysis

Appendix C – Metrolinx Correspondence

Appendix D – Risk Assessment Matrix

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7.1 Appendix A – Guidelines and References

1. FCM/RAC Guidelines for New Development in Proximity to Railway Operations (May 2013)
2. Metrolinx – GO Transit Adjacent Development Guidelines (April 1, 2013)
3. City of Toronto. Land Use Study: Development in Proximity to Rail Operations (May 2019)
4. AECOM Submission Guidelines for Crash Walls (July 29, 2014)
5. Development of Crash Wall Design Loads from Theoretical Train Impact by Gaylene Layden, P.Eng, Bridge Engineer AECOM (2014)
6. City of Toronto – Land Use Study: Development in Proximity to Rail Operations (March 2019)

   https://www.toronto.ca/wp-content/uploads/2019/05/960c-City-Planning-Final-Report-City-Wide-Land-Use-Study-Development-in-Proximity-to-Rail-Operations-Phase-2-March-21-2019.pdf
7. Transportation Safety Board – Occurrence Database

   http://www.tsb.gc.ca/eng/stats/rail/data-5.asp
8. Bombardier Bi-Level IX Coach – Crumple Capacity Information (responded email from Bombardier on March 4, 2019)
9. Motive Power MP54AC Tier 4 Commuter Locomotive Specifications
10. GO Rail Network Electrification Transit Project Assessment Process Environmental Project Report (October 2017)

    http://www.metrolinx.com/en/electrification/docs/EPR_Volume%205_For%20Web_Revised_Jan2018_20180212_R2.pdf
11. Bi-level coach locomotive weight - https://transit.toronto.on.ca/archives/maps/GoTransit/GO-quick-facts-2013-06.pdf
12. MP54 locomotive specifications sheet: - https://www.wabtec.com/uploads/outlinedrawings/MP54AC-Commuter-Locomotive.pdf

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7.2 Appendix B – Energy Balance Analysis

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Project Report May 2020

Energy Balance Analysis

Park Lawn GO Station

Issue and Revision Record					
Rev	**Date**	**Originator** (Print) (Signature)	**Checker** (Print) (Signature)	**Approver** (Print) (Signature)	**Description**
A	May 15 2020	Shivani Nathoo HATCH	David Anders HATCH	Behrang Dadfar HATCH	
	Signatures:				Combined Zoning By-Law Amendment (ZBA), Draft Plan of Subdivision (DPS), Official Plan Amendment (OPA)

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Energy Balance Analysis
Energy Calculations Guidance Memo

May 15, 2020

To:	2150 Lake Shore Boulevard West Park Lawn GO Station	From:	Shivani Nathoo, Smart Grid and Asset Management EIT Hatch Ltd.
cc:	Behrang Dadfar David Anders		

1.0 Introduction

The Energy Balance contained herein was carried out based on the planned track configuration at the upcoming Park Lawn Go Station.

Figure 1-1: Site plan

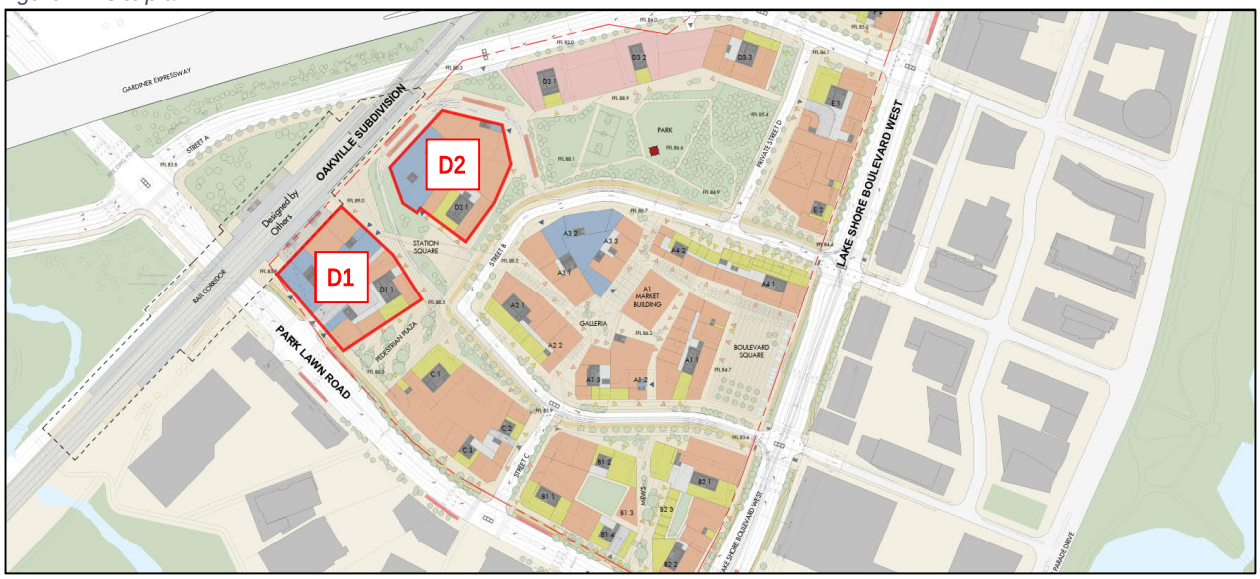
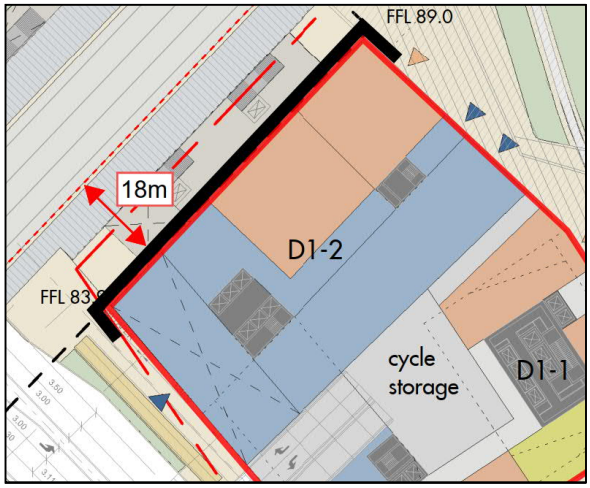


Figure 1-2: Distance from edge of platform to crash wall for Block D1 and Block D2



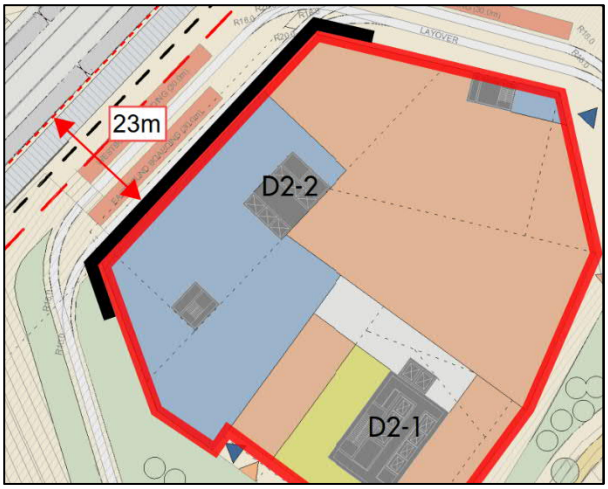


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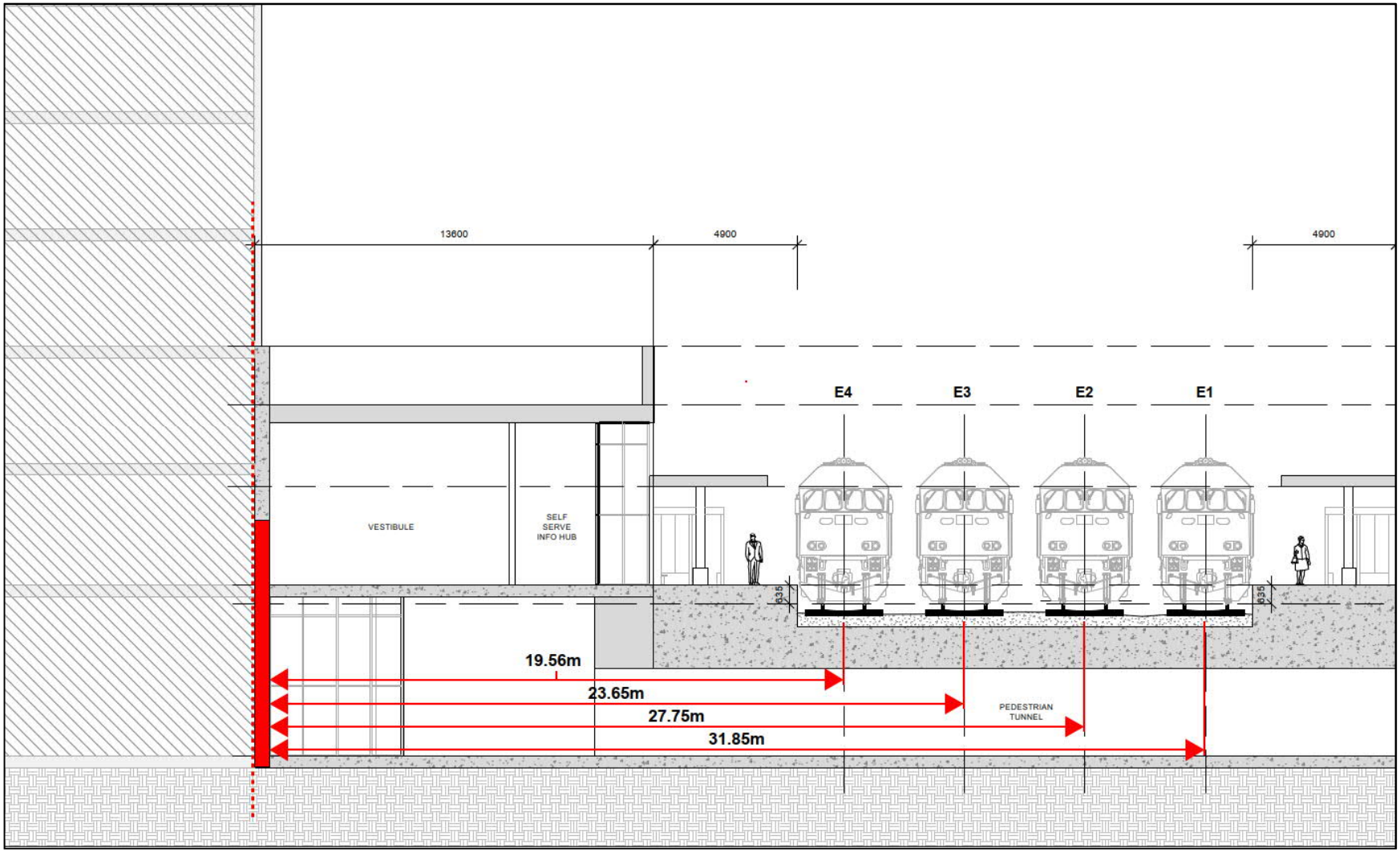
Figure 1-3: Distance from centreline of tracks to the face of the crash wall



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2.0 Methodology

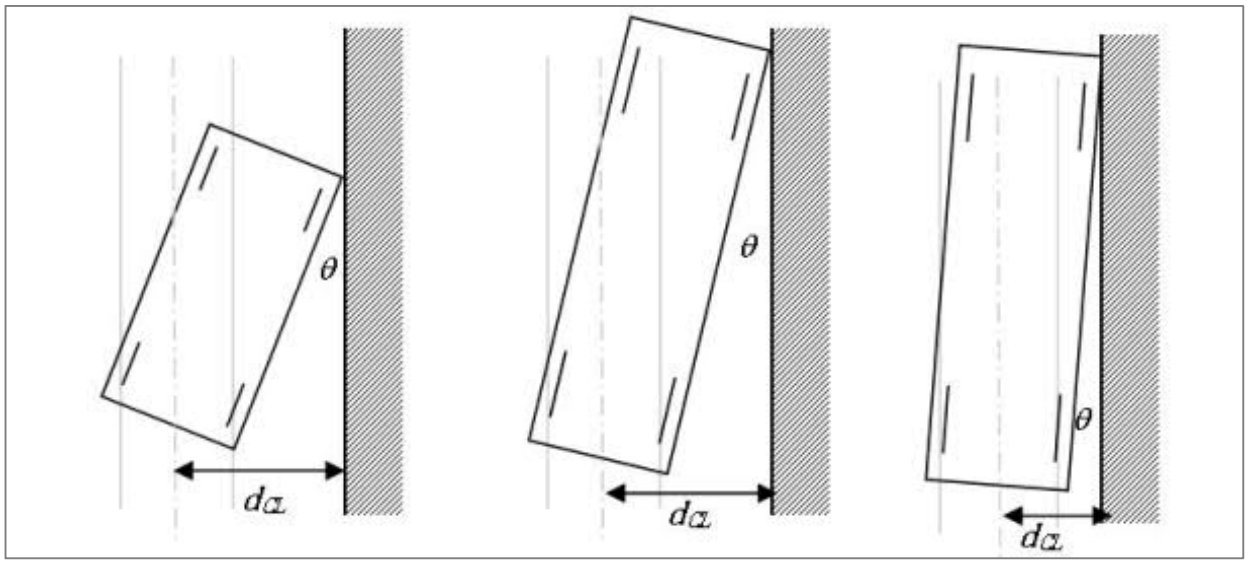
As illustrated in Section 2.2 of the Rail Safety Report, the existing condition and future condition with future track represent different distances and grades and will both be considered, and the corresponding proposed access path profile is achieved.

In determining the energy impact to the protective barrier, the following reference documents are used to develop the approach:

- **"FCM/RAC"** - Guidelines for New Development in Proximity to Railway Operations (May 2013) – 1 method The Federation of Canada Municipalities and the Railway Association of Canada
- **"AECOM"** - Submission Guidelines for Crash Walls (July 29, 2014), the "Guideline". – 2 methods "Development of Crash Wall Design Loads from Theoretical Train Impact", by Gaylene Layden

The FCM/RAC guideline was the overriding governing guideline and referred to existing AECOM guidelines at the time for much of the methodology. AECOM then released updated guidelines with inputs from Metrolinx, AREMA, CP and CN rail. The similarities and differences between the previous FCM/RAC guidelines and the updated AECOM guidelines are presented in the table below. The FCM/RAC guidelines represent a more extreme scenario using heavier trains/cars and not accounting for the reduction in velocity of derailed train as it travels on gravel towards the crash wall. The AECOM guidelines address these shortcomings and use updated (lighter) weights as well as rolling resistance losses. Bombardier responded to our requests to provide updated crumple zone capacities for the cars they designed for Metrolinx, which was used in the energy balance calculations for passenger rail.

Figure 2-1: Diagram indicating a glancing blow impact with a variety of different angles of impact



(Source: AECOM Crash Wall Design Guidance)

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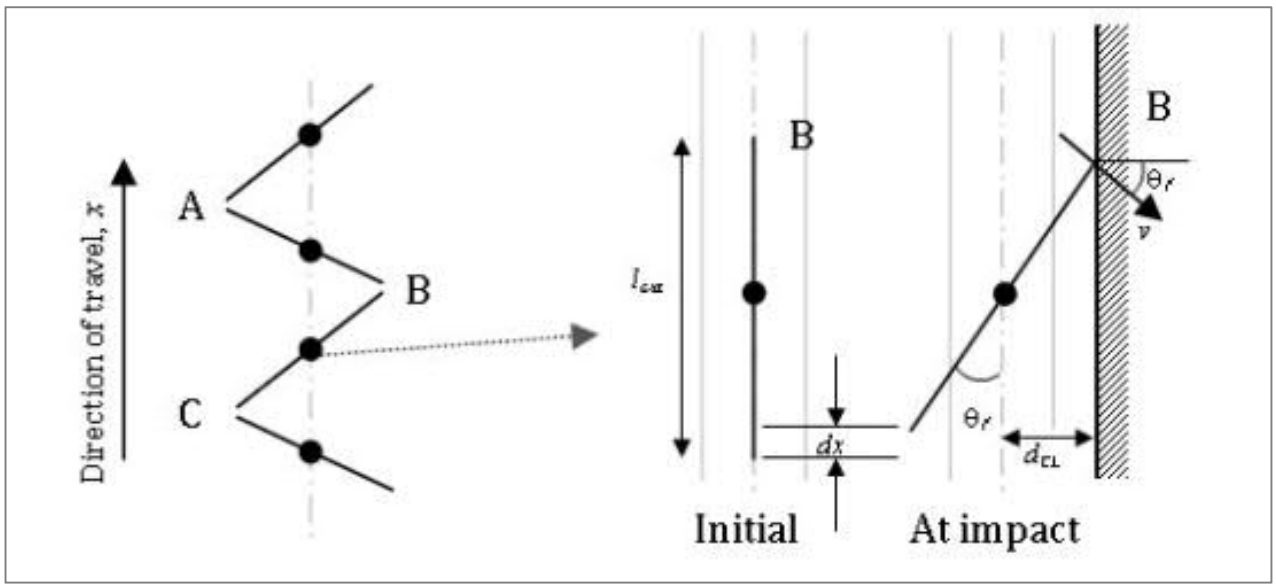
Figure 2-2: Geometry of direct (accordion style) impact



(Source: AECOM Crash Wall Design Guidance)

Table 2-1: Comparison of guidelines and Hatch's recommendations

Load Cases	**FCM/RAC Guidelines (2013)**	**AECOM – Method 2 (2014)** **"Energy Balance"**	**Hatch – Recommended Scenario** ***(Modified Weights with AECOM – Method 2 "Energy Balance")***
Load Case 1 – Glancing Blow, Freight			
Train Details	3 x locomotives weighing 200,000 kg each + 6 x cars weighing 143,000 kg each	9 x cars, weighing 129,700 kg each	9 x cars, weighing 143,000 kg each
Angle of Impact (θ_G)	10°	3.5° (suggested)	3.5°
Load Case 2 – Direct Impact, Freight			
Train Details	1 x car weighing 143,000 kg	1 x car, weighing 129,700 kg each	1 x car, weighing 143,000 kg
Angle of Impact (θ_G)	90°	Defined by $\theta_F = \text{asin}\left(\frac{dCL}{8.5}\right)$ based on the d_{CL} of each track from E0 to E6	AECOM specifies that distances from the centre line (d_{CL}) greater than 8.5 m should not be considered. Thus, no impact angles are determined; the car can rotate about its axis to and past 90º without reaching the crash wall.

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Load Case 3 – Glancing Blow, Passenger			
Train Details	2 x locomotives weighing 148,000 kg each + 6 x cars weighing 74,000 kg each	8 x cars weighing 67,120 kg each	8 x cars weighing 74,000 kg each OR 1 x locomotive weighing 132,000 kg and 12 cars weighing 74,000 kg, given by Metrolinx to model the Metrolinx locomotive weight and number of passenger carsThe results will indicate which combination yields the higher loadings.
Angle of Impact (θ_G)	10°	3.5° (suggested)	3.5°
Load Case 4 – Direct Impact, Passenger			
Train Details	1 x car weighing 74,000 kg	1 x car, weighing 67,120 kg each	1 x car weighing 74,000 kg
Angle of Impact (θ_G)	90°	Defined by $\theta_F = \text{asin}\left(\frac{dCL}{13.0}\right)$ based on the d_{CL} of each track from E0 to E6, this gives applicable values for tracks E0 and E1 of 28.84° and 54.3° respectively.	No Impact Angles Determined.
Velocity	- "…specified track speeds for Passenger and freight applicable within the corridor. " - "The speed of a derailed train or car impacting the wall *is equal to the specified track speed*" (FCM/RAC)	Velocity Adjusted for based on track velocity, rolling resistance, grade, angle of impact. $G = \frac{Groundline\ at\ wall - Base\ of\ Rail}{d_{CL}/_{sin\theta_G}}$ R = 0.25 Glancing Blow (3M): $v_G = \sqrt{v_0^2 + 2a\left(\frac{d_{CL}-1.625}{\sin\theta_G}\right)}\ [m/s]$ Single Car, Direct Impact: Freight: $v_A = \frac{2.3\theta_f}{\sqrt{1-\cos\theta_f}}$ Passenger: $v_A = \frac{2.9\theta_f}{\sqrt{1-\cos\theta_f}}$	FCM does not consider dynamic losses. AECOM guidelines do consider dynamic losses related to ground surface rolling resistance and elevation where applicable. The AECOM methodology will be followed: Method 2 – Energy Balance Maximum allowable track velocity Freight: 130 km/h (80 mph) Passenger: 130 km/h (80 mph) **G = 0 (existing)** **G = 0.635 m (Future)** **R = 0.225** **(10% decrease due to smoother surface characteristics)**

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3.0 Assumptions

- All calculations and figures are reported in S.I. units.
- The current calculations herein rely on freight train information as outlined in industry standards and guidelines, including AREMA and the AECOM guide for crash wall design.
- Maximum speed for GO passenger trains is 75 mph (120 km/h)
- Maximum speed for VIA passenger trains is 80 mph (128 km/h)
- The passenger train weight used in the FCM/RAC Guidelines
- The AECOM guidelines recommend not considering load cases where the distance from centre lines of track are greater than 13 m for glancing blows (Load cases 1, 3) and greater than 8.5 m for single car impacts (Load cases 2, 4).
- Although the recommended number of cars to be considered as per the AECOM guidelines in Load Cases 3 and 4 may provide an equivalent load, Hatch notes that the number of passenger trains and locomotives do not entirely reflect the actual number of locomotives and passenger cars. During peak times and rush hours, Metrolinx GO trains will likely consist of one (1) MP54 locomotive weighing 132,000 kg and up to twelve (12) bi-level coaches weighing 74,000 kg.
    - The FCM/RAC guidelines recommend that the weight of a passenger car is 74,000 kg
    - The actual weight of a Metrolinx bi-level coach is less than the weight prescribed by the FCM/RAC guidelines. However, when the passenger cars are assumed to be at full capacity and the average weight of an adult is assumed, the total weight of the car and passenger combined approaches the weight used for passenger cars in the FCM/RAC guidelines. As such, the guidelines-recommended weight of 74,000 kg is used in our analysis and is considered to be both conservative and to accurately represent a realistic scenario involving Metrolinx passenger railcars.
- The roll-over of locomotives and passenger cars is a possible occurrence in the existing condition due to the grades involved depending on their centre of gravity. This has not been considered in the energy simulations.
- The acceleration does not take into account air resistance, and thus, the actual deceleration is likely to be greater than that which is stated

4.0 Energy Balance Simulation - Results

Future Condition

Given the unique configuration of this site, 2 simulation scenarios are proposed in order to establish best, and expected results. The main variables are whether or not the train manages to go over the platform, and the friction coefficient of the platform surface. The two scenarios are summarized as follows:

Scenario A: This scenario establishes a base case by assuming a flat surface from the centre line of the closest track with a traditional railyard gravel surface which causes/results in a rolling resistance of 0.25 for derailed trains as per the AECOM guidelines.

Scenario B: This scenario establishes a worst-case scenario whereby the derailed train climbs onto the platform and continues to move towards the crash wall. This takes into account the energy lost by the platform elevation, and a lower rolling resistance of 0.225.

If no collision occurs, a sensitivity analysis is performed to determine the critical rolling resistance which will lead to an impact so as to better inform on the design characteristics of the surface of the station platform and its friction coefficient.

Limitation: This simulation does not take into account the mechanical losses experienced by each axle and the bottom of the train as it climbs onto the platform.

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The force of highest magnitude from each of the four load cases is indicated and governs the final design of the recommended rail safety mitigation measure(s) for the development.

Table 4-1: Summary of Energy Balance results & design criteria

Parameter	Recommended Criteria *(If energy balance approach not used)* Method 1	Scenario A As per AECOM guidelines, without platform lip.	Scenario B: Train climbs onto station platform, and continues towards property line
Distance from centreline of closest future track, T1 (m)	30	19.55	19.55
Derailment Speed	Variable	130 km/h (80 mph)	130 km/h (80 mph)
Impact Force (kN) (AECOM guidelines)	N/A	0.00 No Impact	0.00 No Impact
Impact Force (kN) Hatch – Severe Scenario *(1 locomotive + 12 cars)*	N/A	0.00 No Impact	0.00 No Impact
Critical Rolling Resistance for Glancing Blow Impact at the property line (R) *(Sensitivity Analysis – The rolling resistance required for the train to reach the property line and to exceed 2,700 kN)* (3.5° Angle, at 130 km/h)	N/A	R- 0.226359544 (at 0 grade)	R = 0.224376638 (to reach the property line with 0.635m platform)
		R = 0.1832699 *(to exceed 2,700 kN at the property line at a derailment velocity of 130 km/h)*	*R = 0.1812870* *(to exceed 2,700 kN at the property line at a derailment velocity of 130 km/h)*
Critical Velocity for Glancing Blow Impact *(Sensitivity Analysis - Velocity a train needs to be travelling at to reach*	N/A	136.6 km/h (84.88 mph) (Passenger Car, Load Case 3 – Glancing Blow)	130.1 km/h (80.84 mph) (Passenger Car, Load Case 3 – Glancing Blow)

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Locations A, B in glancing blow fashion if derailed) (3.5° Angle, 0 grade, Reduced Rolling Resistance of 0.25 for case A, and 0.2 for Case B		147.9 km/h (91.34mph) (To cause a 2,700 kN impact at the property line)	142 km/h (88.23 mph) (To cause a 2,700 kN impact at the property line)
For Crash Wall			
Surface Friction Coefficient (μ)	≤ 0.45		
Point Load (kN) Applied perpendicular and normal to the face of the wall	2,700	No Impact	**≥36.98** **(Worst case scenario - at critical rolling resistance and critical velocity)**
Force along length of wall (Horizontal component, kN)	N/A	No Impact	16.64
Point Load Height above the top of the rail (m)	1.8		
Wall Thickness (m)	0.76	≥0.45 (for walls farther than 7.6m from property line)	≥0.45 (for walls farther than 7.6m from property line)
Wall Height (m)	3.6 (above the top-of-rail if immediately adjacent to tracks, otherwise above the adjacent ground line)	≥2.135 (above the top-of-rail)	≥2.135 (above the adjacent groundline)

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5.0 Conclusion & Recommendations

Hatch has performed the energy balance calculations as per the recommended methodology outline in the AECOM/AREMA guidelines. The Energy Balance Analysis follows the prescribed Method 2 of AECOM's Crash Wall Design Guidelines to determine the maximum amount of energy dissipated under each derailment scenario. The analysis then informed the recommended minimum requirements according to which the crash wall should be designed.

In addition to the forces generated in all the scenarios studied in the energy balance recommended by AECOM/AREMA guidelines, a more severe scenario featuring 1 locomotive and 12 passenger cars is also considered as standard practice at Hatch to reflect actual GO Train operations and maximum allowable loads.

The guidelines may be modified to reflect site-specific conditions. In this case, the elevated track platform as well as a smoother surface has been factored in the simulations compared to the parameters of a traditional rail corridor.

The energy balance simulations yield the following results for the two case scenarios:

Scenario A: With a distance of centreline of track to property line of 19.55 m, no glancing blow impact was observed with standard parameters. No single car impacts were observed, given that the distance is greater than half the length of a passenger car of 26 m; the latter is unable to reach the property line by rotation along its centre axis on the track).

Scenario B: No impacts were observed with standard parameters when considering the increased elevation of the station platform, and the reduced rolling resistance of the platform surface. However, the sensitivity analysis reveals that the critical velocity is approximately 10 km/h higher than maximum allowable GO passenger trains and only 3km/h higher than the maximum allowable speed of VIA rail passenger trains. Thus, a train derailing at a speed of 130.1 km/h has a high probability of reaching the property line from the closest track E4.

At an unlikely derailment speed of 142 km/h or 88.2 mph (over speeding), the impact force reaches 2,700 kN, the upper level impact specified in Method 1. Conversely, if the maximum derailment velocity of 130 km/h (80 mph) is maintained, the rolling resistance would have to be 0.181 or lower to cause an impact of 2,700 kN at the property line), this value thus sets the minimum limit for surface rolling resistance to be achieved for train wheels on the platform surface.

The critical velocity and critical rolling resistance demonstrate that impacts may occur, predominantly in Load Case 3 scenarios with a maximum point load of 36.98 kN when both critical values are met.

However, it can be noted that certain infrastructural features within the set-back area play a key role in lowering the probability of a derailed train reaching the property line. Features such as the sharp platform elevation itself, any accessibility ramps with handrails, the self-serve info hub and vestibule will act as obstructions and intermediate barriers to prevent a derailed train at the critical velocity and critical rolling resistance from reaching the property line. Furthermore, the geometry of the site reduces the probability of a train to derail from the closest track and reach the property line with a derailment angle of 3.5°, given the relatively narrow portion of the track that the buildings D1 and D2 occupy compared to the overall track distance.

Given the uncertainties involved, Hatch recommends a crash wall be designed to protect the sensitive use portion of the property from a minimum impact force of 36.98kN. The Structural Engineer is to decide about the applicable load factors for Ultimate Limit State and Extreme Event Limit State load combinations as well as the wall

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thickness which is required to be not less than a minimum of 0.45 m with a height of 2.135 m above the adjacent groundline.

6.0 References

1. FCM/RAC Guidelines for New Development in Proximity to Railway Operations (May 2013)
2. Metrolinx – GO Transit Adjacent Development Guidelines (April 1, 2013)
3. AECOM Submission Guidelines for Crash Walls (July 29, 2014)
4. Motive Power MP54AC Tier 4 Commuter Locomotive Specifications
5. Bi-level coach locomotive weight -https://transit.toronto.on.ca/archives/maps/GoTransit/GO-quick-facts-2013-06.pdf
6. MP54 locomotive specifications sheet: -https://www.wabtec.com/uploads/outlinedrawings/MP54AC-Commuter-Locomotive.pdf

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7.3 Appendix C – Metrolinx Correspondence

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METROLINX

City of Toronto, Etobicoke York District
2 Civic Centre Ct.
Etobicoke, ON
M9C 5A3

Attention: Sabrina Salatino, Senior Planner *via email: Sabrina.Salatino@toronto.ca*

09/04/2020

Re: Applications: 19 239170 WET 03 OZ
2150-2194 Lake Shore Boulevard West & 23 Park Lawn Road
City of Toronto, Etobicoke York District

Dear Ms. Salatino,

Metrolinx is pleased to provide comments regarding the October 22nd, 2019 Official Plan Amendment application for the proposed master planned community/GO-Station development at 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road (the "Subject Lands"). The Subject Lands are located immediately adjacent to Metrolinx's Lakeshore West rail corridor (Metrolinx Oakville Subdivision).

For information, please refer to Appendix I, which outlines Metrolinx's standard conditions for development in proximity to Metrolinx owned Principal Main Line tracks.

Please note that the comments stipulated in this letter only relate to Metrolinx concerns regarding the subject application and the applicant shall work with the City of Toronto to fulfil any other requirements.

PROPOSED PARK LAWN GO STATION

The applicant has proposed a development including a proposed new Park Lawn GO Station on the Subject Lands, which is currently under review by Metrolinx. As per Metrolinx's Market Driven Strategy, Metrolinx welcomes transit oriented community proposals at, or adjacent to Metrolinx's rail corridors and GO stations. Such projects have the potential to attract more riders to the GO network and enable access to transit by foot. However, it should be noted that no agreement to develop the proposed GO Station is in place at this time, and the proposed GO station has not received Metrolinx approval. As such, the references in the Official Plan Amendment to a proposed GO station are being included at the applicant's risk.

OFFICIAL PLAN AMENDMENT APPLICATION (19 239170 WET 03 OZ)

Metrolinx has reviewed the subject Official Plan Amendment application and our comments are set out below:

1. Notwithstanding the comments above pertaining to the proposed GO station, Metrolinx has no objections to the proposed Official Plan Amendment as currently prepared.

2. Metrolinx is in receipt of the Rail Safety Strategy prepared by Hatch Ltd. Due to current prevailing policies, Metrolinx requires a minimum 25 metre setback for 'sensitive use' for developments in proximity to Principal Main Line rail corridors that can be achieved through horizontal and vertical distances when combined with a higher-order safety barrier such as a crash wall.
    i. Given the potential integration between the proposed Park Lawn GO Station and the private development, the setback may be measured from the active rail corridor.
    ii. Non-sensitive uses such as quick retail, convenience amenities, and fast casual restaurants are only permitted within the setback or transitory area between the station and private development space if rail derailment protection is situated between the rail corridor and these non-sensitive uses. However, if any of the above non-sensitive uses are included as part of a potential future GO station, these will be at Metrolinx's sole discretion and approval. Any such train derailment protection measures shall be on constructed the developer's lands.
    iii. Should the proposed development contemplate an overbuild structure above the transit corridor, an agreement with Metrolinx to construct in Metrolinx's air space above the transit corridor will be required, including a minimum vertical clearance from the top of rail of 15.25 metres to accommodate Metrolinx transit infrastructure.

Moving forward, the applicant should continue to engage Metrolinx, and as required, our Technical Advisor, throughout the project planning process to ensure that Metrolinx's concerns are appropriately addressed. To assist these future stages of project planning, Metrolinx has provided the below list of standard considerations for any forthcoming Zoning By-Law Amendment and Site Plan Application on the Subject Lands to the City of Toronto.

FUTURE ZONING BY-LAW AMENDMENT APPLICATION

The following are Metrolinx comments to be addressed during the zoning by-law amendment process.

1. As part of site specific zoning, a rail safety setback shall be designated and sensitive uses shall not be permitted within the setback area. The site specific zoning shall be updated with language consistent with the following:

   Rail Safety Setback:
   All residential and commercial spaces shall be set back 30 metres from the railway right-of-way unless a setback reduction is granted through consultation with Metrolinx. Sensitive uses shall not be permitted on developer lands within the intervening setback area.

2. A safety barrier is to be provided in conjunction with the setback (standard form is an earthen berm). While the intervening space between the active rail corridor and the private development may be occupied by a potential the future Metrolinx Station/Facility, rail corridor exposure remains a relevant issue. As such, the provision of crash walls or alternative safety barriers, such as free-standing caissons, columns or bollards shall be explored to ensure adequate rail safety protection is provided.

3. Further to the Official Plan Amendment comments, the applicant shall submit a detailed Rail Safety and Risk Mitigation Report, as required by the City of Toronto, to justify deviations from established rail safety requirements and to demonstrate that safety can be suitably maintained when sensitive development is proposed with direct exposure to railway corridors. The Rail Safety and Risk Mitigation Report shall be submitted for review and satisfaction of Metrolinx and our Technical Advisor.

4. The applicant's underground structure is to be constructed at the mutual property line. As such, additional details are requested on the railway loading implications under normal operating circumstances as well as in the case of a derailment.

5. A vegetation setback, to be measured from the edge of the active rail corridor, shall be provided and shall meet all Corridor Maintenance and Electrification standards.

6. The applicant shall engage a qualified consultant to prepare a Noise and Vibration Study for review and satisfaction of Metrolinx and our Technical Advisor.

7. The applicant shall engage a qualified consultant to prepare an Air Quality Assessment for review and satisfaction of Metrolinx and our Technical Advisor.

8. With respect to electrification, the applicant's lead engineer shall provide a letter acknowledging that the proposed development will satisfy the following standards for infrastructure near the rail right-of-way:

    - Electric Traction Enabling Works (MX-ELEC TRAC EW-SPEC-2016-REV1)
    - Enabling Works ET Standard (MX-ELEC TRACT EW-DW-2016-REV1)
    - Structures Passing Over Electrified Corridors (MX-ELEC STR-SPEC-2017-Rev3.0)
    - Interim Standards for the Selection of New Electronic Devices and Cables in Metrolinx Facilities (MX-ELEC EMI-SPEC-2017)

FUTURE SITE PLAN CONTROL APPLICATION

Regarding the subject development application, it is requested that at the time of Site Plan Control the following conditions be included as Metrolinx Pre-Approval Conditions (NOAC). It should be noted that some of the information identified is also detailed in Appendix I.

1. The applicant shall engage a qualified consultant to prepare and submit a final stormwater management report for review and satisfaction of Metrolinx and our Technical Advisor. Additionally, the applicant shall provide assurance that any safety barrier(s) will not alter the existing drainage pattern affecting Metrolinx land.

2. The proposed safety barrier design shall be submitted to Metrolinx's Technical Advisor for review and satisfaction.

3. The applicant shall satisfy all Metrolinx rail safety requirements and the applicant shall enter into an "Adjacent Development Agreement" with Metrolinx stipulating how applicable concerns will be addressed. The Agreement will include an environmental easement for operational emissions, to be registered on title against all residential dwellings within 300 metres of the rail corridor and in favour of Metrolinx (see Appendix II).

4. If entry into, above and/or below the rail corridor is determined to be unavoidable, the applicant must enter into a crane swing and/or tieback agreement with Metrolinx.

5. The applicant's solicitor shall submit a letter of undertaking to Metrolinx stipulating that the following warning clause will be inserted into all development agreements, offers to purchase and Agreements of Purchase and Sale or Lease of each dwelling unit within 300 metres of the railway right-of-way:

    Warning: Metrolinx, carrying on business as GO Transit and UP Express, and its assigns and successors in interest has or have a right-of-way within 300 metres from the land and the subject hereof. There may be alterations to or expansions of the rail facilities on such right-of-way in the future including the possibility

that GO Transit or any railway entering into an agreement with GO Transit to sure the right-of-way or their assigns or successors as aforesaid may expand their operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwelling(s). Metrolinx will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid right-of-way.

6. Appropriate permits will be required for any works occurring within or immediately adjacent to the rail corridor (to be administered through Metrolinx's Technical Advisor).

It is kindly requested that Metrolinx be circulated future revisions of the subject applications, and future Zoning By-Law Amendment and Site Plan Control application(s) for review and commenting purposes. Should you have any questions regarding the above, please contact me at 416-202-0267 or email me at Kelvin.Ng1@metrolinx.com.

Sincerely,

Kelvin Ng, M.E.S.
Third Party Projects Officer, Third Party Projects Review
Metrolinx
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Alexandra Goldstein, Third Party Projects Officer, Third Party Projects Review, Metrolinx

Meghan Wong, Director, Transit Oriented Development, Infrastructure Ontario + Metrolinx

Scott Hays, Development Coordinator, Transit Oriented Development, Infrastructure Ontario + Metrolinx

Appendices:

Appendix I: Metrolinx Conditions for Development in Proximity to Principal Main-Line Tracks

Appendix II: Metrolinx Environmental Easement 2019

Park Lawn GO Station TOD
Project No. 195701
Request for Information (RFI)

To Be Completed By The Developer Or Their Representative	
Request #	H361249-RFI-0003_00
Title/Subject:	Park Lawn GO_Rail Adjacency
Raised By:	Jamie Kennedy – Hatch
Date Raised:	March 10, 2020
Type of Request: (check applicable box)	☒ Information ☒Clarification ☐Meeting
Source of Query	
Reference Document:	
Meeting:	
Other:	

Request/Query (One Request / Query Per Sheet)

Hi,

I am looking to obtain in writing confirmation of a couple of considerations related to rail-adjacent development for the proposed Parklawn GO Station and adjacent development at 2150 Lake Shore Blvd. West.

I was hoping to confirm:

1. Where we can measure the setback from.
    a. Per the FCM/RAC Guidelines, the setback is typically measured from the mutual property line.
    b. Early discussion with Metrolinx (July 2019) indicated that the setback could be measured from the edge of the platform from the closest active track. (Brandon Gaffoor / Megan Wong)

2. The total setback that would be supported by Metrolinx.
    a. Per the FCM/RAC Guidelines, the standard setback is 30m horizontal measure with the inclusion of an earthen berm.
    b. Marginal reductions in the total setback can be achieved by increasing the height of the safety barrier (crash wall)

3. Whether the crash wall can be located within the station area, outside of the developer's property (the crash wall can be located anywhere between in the setback area, per the FCM/RAC Guidelines)

Given that the nature of this development encourages interaction with the active rail corridor (through the GO Station), it would seem appropriate to measure the setbacks from the closest edge-of-platform. This is not a standard rail-adjacent development where you'd seek to limit interaction with the rail corridor.

Our understanding is that station areas are considered non-sensitive use spaces and can be included in the setback area. Residences, daycares, and schools are examples of uses that are considered sensitive and it is recommended that these specific types of use are not included within the setback area.

All standard mitigation measures will be enacted to ensure maximum level of safety and comfort for the adjacent development. Standard technical reports including noise/vibration, air quality and stormwater management will be conducted to support the rail safety report.

Please let me know if you have any questions. Thank you.

To Be Completed By Metrolinx	
Response #	**H361249-RFI-0003_00_R**
Response	
1. The rail corridor setback may be measured from the edge of active rail corridor. This boundary will be defined as the station design progresses. 2. A 30 metres rail corridor setback is the established requirement for high-occupant sensitive uses and a reduction to the setback (up to 5 metres) may be contemplated when a higher order safety barrier is considered. 3. Any higher order safety barrier shall be constructed on the developer's land.	
Date of Response:	April 9, 2020

7.4 Appendix D – Risk Assessment Matrix

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Risk Assessment Matrix Framework

	TSB Class:	Class 1	Class 2	Class 3	Class 4	Class 5
		Catasptrophic	Critical	Serious	Marginal	Negligible
		5	4	3	2	1
Frequent	5	25	20	15	10	5
Probable	4	20	16	12	8	4
Occasional	3	15	12	9	6	3
Remote	2	10	8	6	4	2
Improbable	1	5	4	3	2	1

Risk Scoring for Each Instance

Frequency x Severity		Risk Category	Mitigation Strategy
Low	1 to 5	Broadly Acceptable	Risk is acceptable. No further mitigation required.
Medium	6 to 10	Tolerable	Risk is considered tolerable if agreed that the risk is reduced to a level considered as l
High	11 to 25	Intolerable	Risk shall be eliminated/reduce.

Overall Corridor Risk Classification

	Weighted Ratio	Max Score	Weighted Max Score (non-cumulative)	Score Range (cumulative)
Low	0.2	350	70	70
Medium	0.2	350	70	140
High	0.6	350	210	350

*Max score of 350 (14 scenarios x 25)
*Weighted ratio is the same as the individual case (i.e. 5/25 = 20%)

Frequency Criteria

Rating		Qualitative Interpretation
Improbable	1	Unlikely to occur, but possible. It can be assumed the event is unlikely to occur.
Remote	2	Likely to occur sometime in the rail system lifecycle. It can reasonably be expected to occur several times.
Occasional	3	Likely to occur several times. The event can be expected to occur several times.
Probable	4	Will occur several times. The event can be expected to occur frequently.
Frequent	5	The event will be continually experienced

*** Assessment based on TSB data recorded since 2004.

Definition of Safety Hazard Severity Criteria

Hazard Rating		Consequence to Personnel or General Public	Consequence to the Environment
Negligible	1	Non-reportable injury	None
Marginal	2	Single minor injury	Reversible minor environmental impact
Serious	3	Single permanent partial or temporary total disabling injury; Multiple minor injuries.	Reversible moderate environmental impact
Critical	4	Single fatality;Single instances of permanent total disability;Multiple instances of permanent partial or temporary total disabling injuries.	Reversible significant environmental impact
Catastrophic	5	Multiple fatalities;Multiple instances of permanent total disability	Irreversible significant environmental impact

Going-in Assumptions and Existing Conditions

1) The Kingston Sub/USRC is a predominantly passenger rail corridor, with over 100 passenger train trips per day operated by Metrolinx and VIA Rail Canada combined. Passenger traffic is projected to increase substantially above current levels. Hazardous and flamable materials are not scheduled to be transported in this corridor, but rights to schedule such trains are present and unscheduled trains with hazardous and flamable materials may operate. Traffic in the future may only be realistic in overnight periods due to the high passenger train traffic volumes during other periods.
2) Dangerous goods and freight remain unscheduled at this time.
3) There is no history of main line derailments in this area.
4) Track slope for Track 1 to 6 is consistent with Proposed Track E0 which is at -0.144% from west to east
5) There are 3 switches adjacent to the project site between Track 1, 2 and 3.
6) Tracks average elevation is zero (data from Track E0, assume same for all until obtain factual information from Metrolinx)
7) Additionally, Metrolinx likely will not allow double stack freight train to go through Union Station.
8) Although data from all Metrolinx own corridors were reviewed, only USRC data from TSB are accounted for in this analysis.

		Current Initial Risks		Summary Comparison of Existing and Future Risks		
No.	Harzard	Context	Consequence	Current Residual Risk Level	Future Residual Risk Level	Future vs. Existing (Worsen, Unchanged, Improved)
0	Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W			86	52	Improved
1	Main Line Derailment - Explosive (Freight)	Derailment of freight train carrying flammable or hazardous materials.	On collision with proposed buildings on site, rail cars with flammable/hazardous materials ignite, explode or are released adjacent to or within the building, causing injuries and/or fatalities to occupants.	5	4	Improved
2	Main Line Derailment - Inert (Freight)	Derailment of freight train alongside the site boundary	Transfer of derailment loads/forces to the auxillary and principal building structures causes moderate to significant damage and possible collapse.	5	4	Improved
3	Main Line Derailment - Inert (Passenger)	Derailment of passenger train alongside the site boundary	Transfer of derailment loads/forces to the auxillary and principal building structures causes moderate to significant damage and possible collapse.	10	6	Improved

		Current Initial Risks		Summary Comparison of Existing and Future Risks		
No.	Harzard	Context	Consequence	Current Residual Risk Level	Future Residual Risk Level	Future vs. Existing (Worsen, Unchanged, Improved)
0	Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W			86	52	Improved
4	Main Line Derailment - Peripheral (Freight)	Derailment of freight train at speed from east or west of the development, traveling towards the development	Derailed freight cars enter the site from an angle (i.e. either from east or west approaches), colliding with the side of the building on the site.	5	3	Improved
5	Main Line Derailment - Peripheral (Passenger)	Derailment of passenger train at speed from east or west of the development, traveling towards the development	Derailed passenger cars enter the site from an angle (i.e. either from east or west approaches), colliding with the side of the building on the site.	8	4	Improved
6	Train Traveling Faster than Zone Speed for Freight Train	Derailment of freight train at speed greater than maximum line speed through a curve with development on the inside of the curve.	Freight train enters curve, centripetal forces push train off track to the south side, possibly tipping over, and falls off the berm and create collision.	5	4	Improved

		Current Initial Risks		Summary Comparison of Existing and Future Risks		
No.	Harzard	Context	Consequence	Current Residual Risk Level	Future Residual Risk Level	Future vs. Existing (Worsen, Unchanged, Improved)
0	Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W			86	52	Improved
7	Train Traveling Faster than Zone Speed for Passenger Train	Derailment of a passenger train at speed greater than maximum line speed through a curve with development on the inside of the curve.	Passenger train enters curve, centripetal forces push train off track to the south side, possibly tipping over, and falls off the berm and and create collision.	5	4	Improved
8	Dangerous Goods Leak/Release	Release of dangerous goods from a loaded freight train due to a failure of or damage to the railcar carrying said goods.	Risk to human health and/or life from the dangerous goods release into the local area environment.	4	3	Improved
9	Top level of sea-can (double stack intermodal) freight car becomes airborne in a derailment	Top level of sea-can (double stack intermodal) freight car becomes airborne in a derailment.	Airborne freight container that has left the railcar collides with a building in the development.	4	2	Improved

		Current Initial Risks		Summary Comparison of Existing and Future Risks		
No.	Harzard	Context	Consequence	Current Residual Risk Level	Future Residual Risk Level	Future vs. Existing (Worsen, Unchanged, Improved)
0	Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W			86	52	Improved
10	Crew Member Incapacitated	Controller of the train loses consciousness or ability to use train controls while train the is in motion.	Collision with another train or derailment due to excessive speed.	10	4	Improved
11	Runaway Rolling Stock - Explosive	Unattended railcar(s) loaded with dangerous goods begin moving by gravity without an active prime mover.	Uncontrolled move takes place with no ability to respond to signal indications, could collide with other trains on the line or derail due to excessive speed through a curve, causing an explosion.	4	3	Improved

		Current Initial Risks		Summary Comparison of Existing and Future Risks		
No.	Harzard	Context	Consequence	Current Residual Risk Level	Future Residual Risk Level	Future vs. Existing (Worsen, Unchanged, Improved)
0	Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W			86	52	Improved
12	Runaway Rolling Stock - Inert	Unattended railcars, unloaded or loaded with goods that are non-hazardous begin moving by gravity without an active prime mover.	Uncontrolled move takes place with no ability to respond to signal indications, could collide with other trains on the line or derail due to excessive speed.	6	4	Improved
13	Movement Exceeds Limits of Authority	Unauthorized movement by a train placing the train in a position that could be struck by another train.	Collision between two trains, potentially at high speeds, or a diverging route turnout may be taken at excessive speed, derailing the train.	6	4	Improved
14	Trespassing onto railroad	Trespassing onto railroad	Interference with railway operations, vandalism, and danger to the trespasser(s) from moving trains.	9	3	Improved

		Current Residual Risks with Existing Conditions					
No.	Harzard	Current Condition	Affected Tracks:	Frequency	Severity	Current Residual Risk Level	Current Risk Classification
0		Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W				86	Medium
1	Main Line Derailment - Explosive (Freight)	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In case of a freight train derailment containing dangerous / flammable goods, any occupants at the site would be unprotected. There is a risk the train would travel down the slope and cause damage to either the building or its occupants. This type of event is unlikely but is considered possible - the affect would result in permanent disability and/or death with the high possibility of environmental contamination. A westbound train derailing before the site would likely be stopped within or completely contained by the tunnel under the Gardiner. A train derailment of an eastbound moving train before the site would potentially fall off the Park Lawn Ave. bridge potentially avoiding impact at the property. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	5	5	Acceptable
2	Main Line Derailment - Inert (Freight)	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a derailment along the property line whereby energy is transferred to auxillary buildings, significant damage could occur without mitigation. There is a risk the train would travel down the slope and cause damage to either the building or its occupants. This type of event is unlikely but is considered possible - the affect would result in permanent disability and/or death with the high possibility of environmental contamination. A westbound train derailing before the site would likely be stopped within or completely contained by the tunnel under the Gardiner. A train derailment of an eastbound moving train before the site would potentially fall off the Park Lawn Ave. bridge potentially avoiding impact at the property. However, a train derailing at the site may have catastrophic impacts. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	5	5	Acceptable
3	Main Line Derailment - Inert (Passenger)	Corridor elevation is higher than the project site with slope toward the project site. Access to the corridor is secured with chain link fence at the bottom of the slope. Similar to the above conditions, a derailment of a passenger train in the vicinity of the site would pose a significant threat to buildings or occupants within the site. There is a high likelihood that the train would roll down the slope towards the property. While Metrolinx has an excellent record maintaining and operating their passenger train service, there have been a few main line train derailments within the vicinity of the site, according to TSB data. While these events occurred west of the site nearer to the Mimico yard, in the presence of multi-track switches, this type of event can reasonably be expected to occur (with varying levels of severity) over the course the lifecycle of the rail corridor. In it's current condition, significant, irreversible damage would likely occur in the event of a derailment. Significant loss of life and damage to buildings woul dbe expected without any intervention.	All tracks	2	5	10	Tolerable

		Current Residual Risks with Existing Conditions					
No.	Harzard	Current Condition	Affected Tracks:	Frequency	Severity	Current Residual Risk Level	Current Risk Classification
0		Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W				86	Medium
4	Main Line Derailment - Peripheral (Freight)	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a derailed train travelling at an angle into the site would result in significant damage and/or loss of life. While this type of event in the current condition is possible, it is considered unlikely - the risk score reflects this probability. However, in the event of this type of derailment, multiple fatalities and significant environmental impact could occur. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	5	5	Acceptable
5	Main Line Derailment - Peripheral (Passenger)	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a derailed passenger train travelling at an angle into the site would result in significant damage and/or loss of life. While this type of event in the current condition is possible and, due to the frequency of passenger trains, likely to occur at some point in the rail system lifecycle. Importantly, this type of event is more likely to occur from an eastbound train than a westbound train due to the tunnel under the Gardiner. However, eastbound trains must also travel over the Park Lawn bridge so the likelihood that it would be able to travel diagonally into the site is further reduced - the risk score reflects this probability. However, in the event of this type of derailment, multiple fatalities and significant environmental impact could occur. While Metrolinx has an excellent record maintaining and operating their passenger train service, there have been a few main line train derailments within the vicinity of the site, according to TSB data. While these events occurred west of the site nearer to the Mimico yard, in the presence of multi-track switches, this type of event can reasonably be expected to occur (with varying levels of severity) over the course the lifecycle of the rail corridor.	All tracks	2	4	8	Tolerable
6	Train Traveling Faster than Zone Speed for Freight Train	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a freight train travelling above the maximum design speed and derailing through any track curvature would result in significant damage and/or loss of life. While this type of event in the current condition is possible, it is considered unlikely - the risk score reflects this probability. It is particularly unlikely because there are no curves in the local vicinity of the site. However, in the event of this type of derailment, multiple fatalities and significant environmental impact could occur. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	5	5	Acceptable

		Current Residual Risks with Existing Conditions					
No.	Harzard	Current Condition	Affected Tracks:	Frequency	Severity	Current Residual Risk Level	Current Risk Classification
0		Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W				86	Medium
7	Train Traveling Faster than Zone Speed for Passenger Train	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a passenger train travelling above the maximum design speed and derailing through any track curvature would result in significant damage and/or loss of life. While this type of event in the current condition is possible, it is considered unlikely - the risk score reflects this probability. It is particularly unlikely because there are no curves in the local vicinity of the site. However, in the event of this type of derailment, multiple fatalities and significant environmental impact could occur. While Metrolinx has an excellent record maintaining and operating their passenger train service, there have been a few main line train derailments within the vicinity of the site, according to TSB data. While these events occurred west of the site nearer to the Mimico yard, in the presence of multi-track switches, this type of event can reasonably be expected to occur (with varying levels of severity) over the course the lifecycle of the rail corridor.	All tracks	1	5	5	Acceptable
8	Dangerous Goods Leak/Release	Corridor elevation is higher than the project site with a slope toward the project site. Access to the corridor is secured with chain link fence at the bottom of the slope. Probability is very low as the Oakville Subdivision at Park Lawn Avenue is mainly passenger corridor service. The ability to control leakage is in the control of rail operator. Severity of the leakage is dependent on the derailment scenario. In the current state, severe leakage and long response time may affect the local residents. However, the impact is not considered to be permanent. According to the TBS data recored from 2004, there is no leakage of dangerous goods in this area.	All tracks	1	4	4	Acceptable
9	Top level of sea-can (double stack intermodal) freight car becomes airborne in a derailment	The track is elevated relative to the site. In the event of a double-stack sea can becomes airborne in a derailment, there may be some permanent or major injury and temporary environmental damage, but an airborne double sea can would likely not have the velocity to travel very far from the railway. Because of the slope away from the rail corridor, the double stacked freight cars would have travel down the hill and then into the site. In this scenario, a significant amount of energy would be dissapated on impact with the slope. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	4	4	Acceptable

		Current Residual Risks with Existing Conditions					
No.	Harzard	Current Condition	Affected Tracks:	Frequency	Severity	Current Residual Risk Level	Current Risk Classification
0		Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W				86	Medium
10	Crew Member Incapacitated	Rail corridor elevation is higher than the adjacent site. Previous employment centre - no rail safety measures were in place. Employment site was decommissioned in 2016 and torn down in 2018. The site has sat vacant since. The 'Current Condition' is based on the previous existing use at the site, whereby high-occupancy employment uses were unprotected from railway operations. In the current condition, a passenger train travelling above the maximum design speed and derailing and/or colliding with another train would result in significant damage and/or loss of life. While this type of event in the current condition is possible, it is still unlikely. However, this type of event can be reasonably expected to occur during the rail system life cycle - the risk score reflects this probability. Due to the track speeds and volume of passenger train traffic, , in the event of this type of derailment, multiple fatalities and significant environmental impact could occur. While Metrolinx has an excellent record maintaining and operating their passenger train service, there have been a few main line train derailments within the vicinity of the site, according to TSB data. While these events occurred west of the site nearer to the Mimico yard, in the presence of multi-track switches, this type of event can reasonably be expected to occur (with varying levels of severity) over the course the lifecycle of the rail corridor.	All tracks	2	5	10	Tolerable
11	Runaway Rolling Stock - Explosive	Although the Willowbrook Maintenance Yard is located approximately 1.2km east of the site, it is unlikely that Metrolinx will allow rolling stock to sit for any significant duration due to ongoing passenger rail activities / scheduling. However, in the current condition, were this unlikely event to happen, the affect would vary depending on the severity of the derailment, the materials being transported, the number of cars and the speed at which they derail. Given the track alignment at the subject property, it is unlikely a runaway freight car would derail at this location as there are not many variables that would trigger a derailment. In the current condition, a runaway explosive freight car could have signficant impact to a development adjacent to the rail corridor. The current condition offers no formal rail safety protection. There are no containment measures to minimize the impact of an explosion.	All tracks	1	4	4	Acceptable

		Current Residual Risks with Existing Conditions					
No.	Harzard	Current Condition	Affected Tracks:	Frequency	Severity	Current Residual Risk Level	Current Risk Classification
0		Overall Corridor Risk Classification of Oakville Subdivision at Park Lawn GO Station / 2150 Lake Shore Blvd. W				86	Medium
12	Runaway Rolling Stock - Inert	Although the Willowbrook Maintenance Yard is located approximately 1.2km east of the site, it is unlikely that Metrolinx will allow rolling stock to sit for any significant duration due to ongoing passenger rail activities / scheduling. However, in the current condition, were this unlikely event to happen, the affect would vary depending on the severity of the derailment, the materials being transported, the number of cars and the speed at which they derail. Given the track alignment at the subject property, it is unlikely a runaway freight car would derail at this location as there are not many variables that would trigger a derailment. Therefore, while runaway / uncontrolled movement of rolling stock can reasonably be expected to occur over the life cycle of the rail system, it is not considered a highly probably event and given the rail corridor conditions, unlikely to have a significant impact that would result in loss of life or multiple personal injury.	All tracks	2	3	6	Tolerable
13	Movement Exceeds Limits of Authority	A derailment or collision between trains due to one or more vehicles exceeding the allowable speeds of the authority is a very real risk at the site. While a derailment or collision due to this incident type may not occur, trains operating at speeds greater than the maximum allowable speeds is a likely event that will happen multiple times during the rail system lifecycle. In the current condition, the site is unprotected and a derailment or collision of this type could resultin significant permanent injury or loss of life. Track speeds at this location are currently 70-80mph for passenger trains so speeds through here are already quite high. Additionally, all train movements through here are continuous, ie. there are no trains stopping. A train derailing at a speed greater than the allowable limit would lifely have fatal consequences. Depending on the type of train, environmental damage could also arise. However, in the event of this type of derailment or collision, the impact could be significant. However, like all scenarios, the severity would depend on a number of factors. There are a number of obstacles that protect the site from a derailment in the current context, including the bridge and the tunnel. A derailment of this type has not been recorded at the site. However, a record of a train "exceeding the limits of the authority" has been reported before Metrolinx purchased the railway.	All tracks	2	3	6	Tolerable
14	Trespassing onto railroad	According to TSB data, trespassing can be expected frequently and can be fatal. Given the TSB data specific to the Oakville Subdivision, not only is trespassing a common occurence, there is a record of a fatal trespassing incident directly at the site. This type of event is likely to occur multiple times in the future and over the life cycle of the rail system. The current site condition is not difficult for trespassers to enter the corridor as chain link is the only physical measure securing the corridor.	All tracks	3	3	9	Tolerable

		Future Residual Risks with Future Protective Measures Applied (with New Crash Wall Applied)				
No.	Harzard	Future Condition	Affected Tracks:	Frequency	Severity	Future Residual Risk Level
0		Future Overall Corridor Risk Classification of Oakville Sub. at Park Lawn GO / 2150 Lake Shore Blvd. W				52
1	Main Line Derailment - Explosive (Freight)	In the future, the rail corridor will be at grade with the adjacent development site. Levell boarding platforms will be introduced and will further limit the ability for a derailed train to leave the right-of-way. A crash wall safety barrier system will be used to protect both Buiding Block D1 and Block D2. The crash wall will be built to withstand the point loads indicated in the Energy Balance calculations. In case of a freight train derailment containing dangerous / flammable goods, any occupants at the site would be better protected in the future than in the current condition. Freight traffic is lmiited to 60 mph - at this speed, the Energy Balance analysis shows that a freight train would not reach the proposed crash walls for either Block D1 or D2. As freight traffic continues to decline, this type of event has been assessed the lowest frequency event and is unlikely to occur. However, if this type of derailment were to happen, the affect would result in permanent disability and/or death with the high possibility of environmental contamination. Because of the unpredictable nature of explosion and dangerous goods, the outcome is still assessed at a relatively high level. However, the site in its future will implement effective measures to lower the severity of this type of event and the impact to people and infrastructure, to a level of risk lower than in it's curent condition without any protective measures in place. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	4	4
2	Main Line Derailment - Inert (Freight)	In the future, the rail corridor will be at grade with the adjacent development site. Levell boarding platforms will be introduced and will further limit the ability for a derailed train to leave the right-of-way. A crash wall safety barrier system will be used to protect both Buiding Block D1 and Block D2. The crash wall will be built to withstand the point loads indicated in the Energy Balance calculations. A freight train derailing at 60mph along the property line has been shown not to reach the adjacent development site. In the event that any residual energy remains at the time of impact, the crash wall safety barrier system will be able to withstand and absorb any remaining momentum. A freight train derailment of this type would likely be contained within the rail corridor. The higher platforms and Jordan guard rails provide additional measures for containing the train. The crash wall safety barrier provides an additional line of defense and is constructed to avoid damage to or collapse of the principal stucture. This type of detailment is not considered likely as freight traffic continues to decrease. In the event of an accident of this type, there could be loss of life or environmental damage depeding upon time of day, speed of train at derailment, material being transported. However, the impact is considered less when the added safety measures are considered in the future compared to the existing condition today. According to the Transportation Safety Board, there is no history of freight train derailments within proximity of the site between 2004 - 2020.	All tracks	1	4	4
3	Main Line Derailment - Inert (Passenger)	In the future, the rail corridor will be at grade with the adjacent development site. Levell boarding platforms will be introduced and will further limit the ability for a derailed train to leave the right-of-way. A crash wall safety barrier system will be used to protect both Buiding Block D1 and Block D2. The crash wall will be built to withstand the point loads indicated in the Energy Balance calculations. A passenger train derailment along the boundary of the site travelling at-speed reprsents one of the biggest threats to the development. In the future, a passenger train derailment travelling towards the principal buildings is an event that is unlikely but could occur during the lifecycle of the railway. However, in the future, the safety measures at the site will minimize the potential damage to the ancillary buildings and their occupants. The crash wall will be built to withstand impact loads of all train types at high speed. The increase height of platforms and Jordan guard rails further limit the extent the train can travel outside the railway. The station and non-sensitive uses further buffer the development from the rail corridor. While Metrolinx has an excellent record maintaining and operating their passenger train service, there have been a few main line train derailments within the vicinity of the site, according to TSB data. While these events occurred west of the site nearer to the Mimico yard, in the presence of multi-track switches, this type of event can reasonably be expected to occur (with varying levels of severity) over the course the lifecycle of the rail corridor. In the future condition, the site will be better protected by the proposed mitigation measures than in its current state.	All tracks	2	3	6

		Future Residual Risks with Future Protective Measures Applied (with New Crash Wall Applied)				
No.	Harzard	Future Condition	Affected Tracks:	Frequency	Severity	Future Residual Risk Level
0		Future Overall Corridor Risk Classification of Oakville Sub. at Park Lawn GO / 2150 Lake Shore Blvd. W				52
4	Main Line Derailment - Peripheral (Freight)	A derailment of a freight train travelling in an east or westward direction towards the site in the future is considered a lower risk event than in the current condition. In the future, with the platform and development at the same level as the rail corridor, a freight train will not be able to travel down the embankment towards the buildings or occupants. Additionally, a freight train travelling on the Park Lawn bridge would be contained within the rail way by the Jordan guard rails. A train travelling towards the site from the east would be contained within the tunnel under the Gardiner. The proposed crash wall and level boarding platforms also provide additional mitigation measures to protect the site from a derailment. This type of event is unlikely to occur given the declining freight presence along this line. The likelihood of this event is reflected in the risk score. However, because of the platform and station building, a derailment of this type would likely cause some permanent damage, loss of life, or environmental damage, however, this severity is considered less in the future condition than it its current condition.	All tracks	1	3	3
5	Main Line Derailment - Peripheral (Passenger)	A derailment of a passenger train travelling in an east or westward direction towards the site in the future is considered a lower risk event than in the current condition. In the future, with the platform and development at the same level as the rail corridor, a passenger train will not be able to travel down the embankment towards the buildings or occupants. Additionally, a passenger train travelling on the Park Lawn bridge would be contained within the rail way by the Jordan guard rails. A train travelling towards the site from the east would be contained within the tunnel under the Gardiner. In the event that the Jordan guard rails and tunnel failed to contain and minimize the impact of a passenger train derailment, the proposed crash wall and level boarding platforms also provide additional mitigation measures to protect the site from a derailment. The higher speeds associated with passenger train traffic would ultimately result in a higher severity derailment scenario than a freight-related derailment. This has been reflected in the future risk score. This type of event is unlikely to occur given the site specific conditions. A train would likely fall off the bridge or be contained within the tunnel. The likehood of this event is reflected in the risk score. However, because of the platform and station building, a derailment of this type would likely cause some permanent damage, loss of life, or environmental damage, however, this severity is considered less in the future condition than it its current condition.	All tracks	1	4	4
6	Train Traveling Faster than Zone Speed for Freight Train	The derailment of a freight train travelling above the maximum allowable speed through a curve is not likely simply given that there are no cuves in the track near the site. However, a freight train travelling above the maximum allowable speed at the site and subsequently derailing could have a significant impact on the development. The safety features planned in the future help to minizize the severity of this type of event. The results of the Energy Balance calculations show that a train travelling at 60-75mph would lose all momentum and energy before reaching either of the crash walls. As freight speeds are 60mph at the site, it is reasonable to expect that the severity of this derailment event is considered safer in the future condition than in its current state.	All tracks	1	4	4

		Future Residual Risks with Future Protective Measures Applied (with New Crash Wall Applied)				
No.	Harzard	Future Condition	Affected Tracks:	Frequency	Severity	Future Residual Risk Level
0		Future Overall Corridor Risk Classification of Oakville Sub. at Park Lawn GO / 2150 Lake Shore Blvd. W				52
7	Train Traveling Faster than Zone Speed for Passenger Train	The derailment of a passenger train travelling above the maximum allowable speed through a curve is not likely simply given that there are no cuves in the track near the site. However, a passenger train travelling above the maximum allowable speed at the site and subsequently derailing could have a significant impact on the development. The safety features planned in the future help to minizize the severity of this type of event. The results of the Energy Balance calculations show that a train travelling at 75-80mph would have a minimal impact on the crash wall. The crash wall would be able to absord the energy from the derailed train and deflect the train back towards the rail corridor. As passenger trains through this corridor are 75mph, a derailment above the maximum speed has the potential to cause permanent damage or loss of life and/or possible environmental damage. However, in the future state, the buildings and the occupants of the site will be principally protected by the crash wall, which will prevent damage to the adjacent buildings.	All tracks	1	4	4
8	Dangerous Goods Leak/Release	In the event of a derailment or collision involving dangerous goods where there is a risk of exposure to the public, environment or surrounding area, the future condition of the site is considered a lower risk than in the current condition. Given the decline of freight presence as the area continues to de-industrialize, this type of event is considered even less likely in the future. As Metrolinx completes their GO Expansion, passenger rail traffic will increase through the corridor. Furthermore, there is no history of this type of event within proximity of the site. Additionally, in the future, not only will the site and rail corridor be more accessible to emergyency response teams, but various safety measures will be implemented at the site to minimize the impact of this type of derailment or adverse event. Formal drainage systems will attentuate any spilled liquids. Interior ventillation systems and inoperable windows will minimize any impacts to air quality. The crash wall will protect the development from any flying debris or material that may be launched during this type of event. The overall risk in the future is considered lower than the current condition today where no safety measures are present.	All tracks	1	3	3
9	Top level of sea-can (double stack intermodal) freight car becomes airborne in a derailment	In the future, freight traffic is expected to further decline at the site. In the event a double-stacked freight car becomes airborne, the future development site will be principally protected by the setback of 18m from the railway. Additionally, given the future station and level boarding platforms, a train derailment within the station would likely result in a train being contained within the rail right-of-way. A double stacked freight car would be unlikely to travel the distance necessary to impact the closest structures. The crash wall will be increased in height and elements within the station area will likely slow down the momentum of an airborne freight car. The Energy Balance analysis indicated that a derailed freight train would not reach either of the proposed buildings within the setback area in the future. In the unlikely event this were to happen, some permanent injury, loss of life, or environmental damage could occur due to the presence of the train stattion. However, this is an inherent risk at any train station which cannot be eliminated. However, the additional safety measures afford the development site a slightly lower risk score in the future compared to the current condition.	All tracks	1	2	2

		Future Residual Risks with Future Protective Measures Applied (with New Crash Wall Applied)				
No.	Harzard	Future Condition	Affected Tracks:	Frequency	Severity	Future Residual Risk Level
0		Future Overall Corridor Risk Classification of Oakville Sub. at Park Lawn GO / 2150 Lake Shore Blvd. W				52
10	Crew Member Incapacitated	The collision between two trains resulting in a derailment is a possibility in the future. However, the risk to the adjacent buildings in this type of scenario is considered low. Due to the increasing frequency of passenger train traffic, it is reasonably expected that this type of event could occur during the life cycle of the railway system. However, in the future, the proposed mitigation measures provide the buildings and occupants within the setback area a significantly higher level of protection and safety than in the current condition. Jordan guard rails and the retaining wall / tunnel will protect the development from east and westbound trains. The crash wall and higher passenger train platforms will provide significant levels of safety in the event of a derailment along the property line. Additionally, by purposefully locating non-sensitive use station areas within the setback areas, a sacrificial buffer areas further protects the buildings from this type of event. While this type of derailment would likely cause signficant damage to the rolling stock and possible loss of life to any passengers on board the affected trains or waiting on the platform, the impact to the adjacent site is considered low. Furthermore, the planned electrification of the rail network as well as automatic signalling will inherently make railway operations safer. The future condition will provide fewer opportunities for human error / crew member incapacitation to affect railway operations compared to the current conditions.	All tracks	2	2	4
11	Runaway Rolling Stock - Explosive	In the future, a derailment involving a runaway explosive freight car is considered very unlikely. However, the derailment protection measures and station facilities (higher platforms) will better protect any adjacent activity on the site compared to the current condition. There are very few conditions that would result in a derailment of this type. The decline of freight traffic further limits the possibility of this type of event. The track alignment and passenger dominant rail traffic means that this type of event is even less likely to occur in the future.	All tracks	1	3	3

		Future Residual Risks with Future Protective Measures Applied (with New Crash Wall Applied)				
No.	Harzard	Future Condition	Affected Tracks:	Frequency	Severity	Future Residual Risk Level
0		Future Overall Corridor Risk Classification of Oakville Sub. at Park Lawn GO / 2150 Lake Shore Blvd. W				52
12	Runaway Rolling Stock - Inert	Because of the existing Willowbrook maintenance yard to the west, near Mimico GO Station, it is likely to expect there to be an event involving the uncontrolled movement of rolling stock through the lifecycle of rail system. However, given the specific measures that are being proposed at the site, combined with the track conditions and existing infrastructure (Jordan guard rails and tunnel under the Gardiner), a derailment of this type is unlikely to have a significant impact on the development. The derailment may be completely contained within the rail corridor due to the increase height of the platforms. However, in the event that a train car leaves the rail corridor, the crash wall safety barrier will be designed to withstand the impact of this tyoe of derailment. The greatest risk is to the GO station and any occupants that may be present. However, this is a risk that cannot be fully eliminated and is inherently present at all passenger train stations.	All tracks	2	2	4
13	Movement Exceeds Limits of Authority	A derailment or collision between trains due to one or more vehicles exceeding the allowable speeds of the authority is a very real risk at the site. While a derailment or collision due to this incident type may not occur, trains operating at speeds greater than the maximum allowable speeds is a likely event that will happen multiple times during the rail system lifecycle. In the current condition, the site is unprotected and a derailment or collision of this type could resultin significant permanent injury or loss of life. Track speeds at this location are currently 70-80mph for passenger trains so speeds through here are already quite high. In the future, this derailment scenario is considered a lower risk event simply because many of the trains travelling through this site will be travelling at slower speeds, deccelerating to stop at the station, and accelerating as they leave the station. Some train service will remain continuous through the site (express service), however, the seveity of train accidents is lower as the express trains will be limited to using tracks E2, E3. Stopping trains will be on the closest active. tracks. In the event of this type of derailment or collision, the impact could be significant. However, like all scenarios, the severity would depend on a number of factors. The crash wall system and higher platforms further reduce the potential impact in the future.	All tracks	2	2	4
14	Trespassing onto railroad	In the future, access to the rail corridor will be facilitated through the planned GO station. Security fencing will be provided where appropriate to inhibit trespassing. While there will be a greater level of interaction with the railway in the future, this interaction is considered much safer. The station provides a controlled environment where passengers can access the railway. Uncontrolled pedestrian access (ie. trespassing) will be limited at the site in the future. As such, there is a reduced likelihood of this type of event.	All tracks	1	3	3