First Capital Realty
2150 Lake Shore Boulevard West

Noise & Vibration Impact Assessment

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PROVINCE OF ONTARIO

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HATCH					

Executive Summary

Hatch Ltd. (Hatch) was retained by First Capital Realty (Client) to prepare a Noise and Vibration Impact Study in support of a Zoning By-Law Amendment (ZBA) / Draft Plan of Subdivision (SUB) Application and Official Plan Amendment Resubmission in support of a proposed Master Plan for the redevelopment of the 27.7 acre/11.2 hectare site located at the 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 (hereafter referred to as “the site”). The site will include sensitive land uses, namely a residential condominium and a school. This Noise and Vibration Impact Study assesses the potential noise and vibration impacts from external sources to the site on the proposed sensitive uses. The site is not expected to impose noise impacts on adjacent sensitive land uses, but may pose impacts on itself, as subsequently discussed.

From a noise perspective, the dominant transportation noise sources in the area are vehicular traffic from the Gardiner Expressway and related ramps, Park Lawn Road, Lake Shore Boulevard West, and the Queensway, TTC streetcar traffic along Lake Shore Boulevard West and the future internal TTC streetcar loop, as well as passenger and freight train traffic travelling along the Lake Shore West railway corridor.

Transportation noise modelling was undertaken based on future traffic, train and streetcar volumes for major transportation corridors in the area. Transportation noise will be the most impactful noise component on the proposed development. As a result, noise control measures will be required to attenuate transportation sound levels to meet the Ministry of the Environment, Conservation and Parks (MECP) sound level criteria. Required noise control measures include:

- Upgraded window glazings from typical Ontario Building Code (OBC) standards. The required windows and wall STC ratings to mitigate indoor sound levels to MECP requirements are listed in Table 5-2. It is noted that optimization of window and wall STC ratings can be achieved once detailed unit floor plans become available.
- Brick veneer or acoustical equivalent construction for exterior walls within 100 metres from the rail tracks will be required at select exterior façades. For further details, refer to Section 5.1.1.
- Air conditioning, or provisions for the installation of air conditioning, will be required for all units within the proposed development. However, it is expected that a central air conditioning system will supply air conditioned air to all units within the proposed development, enabling residents to close windows should exterior noise levels increase.
- Warning clauses are to be included in offers of purchase or sale, or tenancy agreements, to formally notify future occupants of potential noise impacts. Refer to Table 5-3 for further details.

The Ontario Food Terminal north of the Gardiner Expressway was identified as the dominant source of stationary noise in the area. Future stationary noise sources include Public Announcement (PA) speakers along the platforms of the proposed Park Lawn GO Station and related rooftop units. Based on predicted stationary noise levels, it is concluded that noise control measures will not be required within the proposed development to mitigate stationary noise.

However, this assessment is deemed preliminary, as the mechanical system of the proposed buildings has not been designed. Typical stationary noise sources in residential developments include HVAC equipment, parking garage ventilation exhaust shafts, and auxiliary generators. Once these details become available, the findings of this study should be reviewed and updated if required, as the development could have a noise impact on itself.

From a vibration perspective, the major sources of vibration are commuter and freight (switcher) rail traffic along the Lake Shore West line, and streetcar traffic along Lake Shore Blvd. West. In the future, a planned internal TTC streetcar loop will also be a major vibration source with the potential to impact the proposed sensitive uses.

Vibration levels were predicted based on existing train pass-bys along the Lake Shore West rail corridor, and Toronto Transit Commission (TTC) streetcar pass-bys. Vibration limits will be exceeded in the vicinity of the boarding/loading platforms by Block D2-2 due to TTC streetcar pass-bys.

- At this location, streetcar speeds were conservatively assumed to be 30 km/h. However, it is likely that TTC streetcars will travel at slower speeds. Based on a sensitivity analysis, vibration levels will become compliant at speeds of 15 km/h or lower. Thus, discussions should be held with the TTC to determine operating speeds of streetcars in this area.
- If it is found that TTC streetcars will travel faster than 15 km/h, vibration mitigation will be required, such as embedded rail rubber boot isolators at special track locations.
- Although not required, a combination of resilient track work and reduced TTC streetcar speeds near Block D2-2 can achieve FTA recommended indoor ground-borne noise levels of 35 dBA. Floating slabs can also meet this objective sound level at speeds of up to 30 km/h.

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Glossary of Terms and Acronyms

Ambient sound level	The sound level that is present in the environment, produced by noise sources other than the source under the impact assessment. (Ontario Ministry of the Environment, 2013)
AIF	Acoustical Insulation Factor. The AIF is based on the difference between the outside predicted sound levels and the required indoor sound levels, plus factors to account for the number of room components (e.g., windows, doors, walls)
Cadna/A	Software package used for predicting sound levels due rail, road, and other sources.
dB	The standard unit of measure for unweighted sound pressure level (reference $2x10^{-5}$ Pa) or sound power level (10^{-12} W). A decibel is the unit of level which denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm of this ratio. (Federal Transit Administration, 2006). This unit is used herein to quantify changes in overall levels.
dBA	The A-weighted sound pressure level. (Ontario Ministry of the Environment, 2013). This unit is used herein to quantify overall noise level.
Equivalent Continuous Sound Level	The A-weighted sound level of a steady sound carrying the same total energy in the time-period T as the observed fluctuating sound. The time period T is given in hours. (Ontario Ministry of the Environment, 2013)
Frequency of Vibration	The number of times that a periodically occurring quantity repeats itself in a specified period. With reference to noise and vibration signals, the number of cycles per second. (Federal Transit Administration, 2006)
FTA	Federal Transit Administration
GO	GO Transit
Hertz (Hz)	The unit of acoustic or vibration frequency representing cycles per second.
HVAC	Heating, ventilation and air-conditioning
L_{eq}	Equivalent Continuous Sound Level. The A-weighted sound level of a steady sound carrying the same total energy in the time period T as the observed fluctuating sound. The time-period T is given in hours. (Ontario Ministry of the Environment, 2013)
MOE, MOEE, MOECC, MECP	Ministry of the Environment/Ministry of the Environment and Energy/Ministry of the Environment and Climate Change/Ministry of Environment, Conservation and Parks. The Ministry of the Environment was created in 1972 and merged with the Ministry of Energy to form the Ministry of

	Environment and Energy (MOEE) from 1993 to 1997 and again in 2002. The Ministry of the Environment changed its name to the Ministry of the Environment and Climate Change (MOECC) on June 24, 2014, and then changed it to the Ministry of Environment, Conservation and Parks in August 2018. Thus, MOE, MOEE, MOECC and MECP are synonymous for the purposes of this Report.
MOECC	Ministry of Environment and Climate Change. MOE, MOEE, MOECC and MECP are synonymous for the purpose of this report.
MOEE	Ministry of Energy and Environment. MOE, MOEE, MOECC and MECP are synonymous for the purpose of this report.
MECP	Ministry of Conservations and Parks. MOE, MOEE, MOECC and MECP
Noise	Unwanted sound. (Ontario Ministry of the Environment, 2013)
NSA	Noise Sensitive Area. Land over which users are sensitive to noise. Also referred to as Noise Sensitive Land use (Ontario Ministry of the Environment, 2013) that accommodates a residential dwelling, a building for commercial use, or a building for institutional use where occupants can be considered to be noise sensitive. Noise sensitive also considers vibration sensitive herein.
NPC	Noise Pollution Control
PPV	Peak Particle Velocity. The peak signal value of an oscillating vibration velocity waveform, usually expressed in millimetres/second in Canada. (Federal Transit Administration, 2006)
Plane of window	A point in space corresponding with the location of the centre of a window of a noise sensitive space. (Ontario Ministry of the Environment, 2013)
POR	Point of Reception is defined as any location on a noise sensitive land use where noise from a noise source is received. Noise sensitive land uses may have one or more points of reception. (Ontario Ministry of the Environment, 2013)
Receptors	Refer to “Point of Reception”
RER	Regional Express Rail
RMS	Root-Mean-Square Velocity. The square root of the mean-square value of an oscillating waveform, where the mean-square value is obtained by squaring the value of amplitudes at each instant of time and then averaging these values over the sample time. (Federal Transit Administration, 2006)
Sensitive Area	Refer to “Noise Sensitive Area”

Sensitive Land Uses	Refer to “Noise Sensitive Area”
Sensitive Receptor	Refer to “Point of Reception”
Sound Pressure Level	The A-weighted sound level of a steady sound carrying the same total energy in the time period T as the observed fluctuating sound. The time period T is given in hours. (Ontario Ministry of the Environment, 2013)
STC	Sound Transmission Class. STC is a rating describing how well a partition such as a wall, window or door attenuates air-borne sound.
Vibration	An oscillation wherein the quantity is a parameter that defines the motion of a mechanical system. (Federal Transit Administration, 2006)
Vibration Sensitive Area	A residential dwelling or place where people ordinarily sleep or a commercial/industrial operation that is exceptionally sensitive to noise and vibration. (Ministry of Environment and Energy, 1994)
VdB	Vibration level in decibels (reference 10^{-6} in/sec or $2.54x10^{-5}$ mm/sec). This unit is used herein to quantify overall vibration levels using the FTA general calculation method.

1. Introduction

1.1 Purpose of Report

Hatch Ltd. (Hatch) was retained by First Capital Realty to prepare a Noise and Vibration Impact Study for the combined Zoning By-Law Amendment (ZBA) / Draft Plan of Subdivision (SUB) Application, and Official Plan Amendment resubmission for 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road ('the site'). The site will include sensitive land uses, namely residential condominiums and a school. This Noise and Vibration Impact Study assesses the potential noise and vibration impacts from external sources to the site on the proposed sensitive uses. This study will also assess the noise and vibration impacts on the site surroundings and itself, given the introduction of the proposed development features.

2. Study Area

2.1 Project Description

2.1.1 The Original Master Plan Proposal (October, 2019)

In October 2019, FCR (Park Lawn) LP and CPPIB Park Lawn Canada Inc. ('the Owners') made an application for an Official Plan Amendment (OPA) in support of a proposed Master Plan for the redevelopment of the 27.7 acre / 11.2 hectare site 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"). The original Master Plan proposal envisioned a vibrant, mixed-use, transit-oriented redevelopment of the site. 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.

2.1.2 The Revised Master Plan Proposal

The Master Plan for the site has further evolved, both in response to comments and suggestions from stakeholders, including City staff, and as a result of a more detailed review to support this combined Zoning By-law Amendment application, Draft Plan of Subdivision application, and OPA resubmission ('the application'). The fundamental vision and key elements of the Master Plan remain consistent, including

- **An Integrated Transit Hub:** the new Park Lawn GO station is located along the northern edge of the site, with the platform spanning the Park Lawn Road right of way and a direct interface with the redeveloped site. A TTC streetcar loop is proposed to bring streetcars into the site, integrating directly with the GO station. Bus service stops are located on Park Lawn Road, also in close proximity to entrances to the GO platform, providing seamless connections between public transit modes.

- **The Relief Road:** a new relief road (Street A) is proposed along the northern edge of the site, connecting the Park Lawn Road Gardiner access ramp with the Gardiner ramp to the east. The proposed relief road works to divert vehicular traffic away from Park Lawn Road and Lake Shore Boulevard West to relieve existing congestion in the area. It also provides access to the proposed shared below-grade parking and servicing areas within the site, significantly minimizing the impacts of vehicles on the public realm.
- **New Local Street Network:** new internal streets extend from the surrounding street network, responding to the unusual shape of this large site to create a loop road (Street B) with spokes that will draw transit vehicles, cars, pedestrians and bikes into the site, and create a multi-modal transit node at the GO station.
- **Diverse Open Space Network:** a range of new interconnected open spaces are proposed across the site, including a new public park, two large squares, a covered galleria (discussed below), and a series of groves, largos (enlarged sidewalks), lanes and mews, which together provide a rich network of places for every-day community interaction, recreation, play and relaxation.
- **The Galleria:** the galleria functions as a covered pedestrian street lined with a variety of retail, services and amenities. It is open to the elements while still offering protection from wind, rain and snow, extending opportunities for vibrant activity during all seasons. The galleria and public park are located at the centre of the site, creating a vibrant 'dual-heart' for the project.
- **Employment, Retail Services & Entertainment:** 64,392 m^2 of employment / office gross floor area (GFA) is included in the Master Plan, creating a significant cluster of new office-type jobs at the GO Station and within the galleria. This is complemented by a range of retail, service, amenity and entertainment uses that together make up 36,659 m^2 of GFA, providing a regionally accessible employment cluster that contributes to the creation of a complete community.
- **A Range of New Homes:** the Master Plan includes a substantive residential component, including 557,642 m^2 of residential GFA, estimated as approximately 7,139 units. This includes a range of unit sizes, typologies and tenure, including a significant commitment to affordable housing and a high percentage of larger units appropriate for families (10% 3+ BD, 15% 2B+Den, 25% 2B).
- **Distinct Architecture:** the Master Plan features a range of building types that blend forms and uses, and respond to the distinct geometry of the proposed street and block pattern. Fifteen towers are proposed on the site with heights ranging from 16 to 70 storeys, with the tallest towers generally clustered near the GO Station. The towers feature generous separation distances, and are interspersed with a range of standalone mid-rise and low-rise building typologies to create a sense of place and urban fabric that appears to have evolved over time.

2.2 Description of Development Area

The redevelopment of the 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.

From a noise perspective, the dominant transportation noise sources in the area are vehicular traffic from the Gardiner Expressway and related ramps, Park Lawn Road, Lake Shore Boulevard West, and the Queensway, TTC streetcar traffic along Lake Shore Boulevard West and the future internal TTC streetcar loop, as well as passenger and freight train traffic travelling along the Lake Shore West rail corridor. The Ontario Food Terminal north of the Gardiner Expressway was identified as the dominant source of stationary noise in the area. Future stationary noise sources include Public Announcement (PA) speakers at the proposed Park Lawn GO Station and related rooftop air conditioning units.

From a vibration perspective, the major sources of vibration are train traffic along the Lake Shore West rail corridor, and streetcar traffic along Lake Shore Boulevard West. In the future, a proposed internal TTC streetcar loop is also a major vibration source with the potential to impact the proposed sensitive uses.

2.3 Sensitive Receptors

Transportation and stationary noise representative sensitive receptors were selected within the site boundaries. The sensitive receptors were selected on a worst-case basis, and they represent a variety of conditions, including near-proximity, full or partial exposure to the dominant noise sources in the area. Figure 2-1 and Figure 2-2 show the location of the transportation and stationary noise receptors, respectively, within the site. Table 2-1 lists the identified sensitive transportation and stationary noise receptors.

Table 2-1: Transportation and Stationary Noise Receptors

Receptor	Block	Land Use	Transportation Noise Exposure	Stationary Noise Exposure	Description[(1)]
A1	A	Residential	Y	N	Facing NW, elevated.
A2			Y	N	Facing SW, elevated
A3			Y	N	Facing NE, ground floor
A4			Y	N	Facing NW, elevated
A5			Y	N	Facing SE, elevated
B1	B	Residential	Y	N	Facing SW, ground floor
B2			Y	N	Facing SE, 2nd floor
B3			Y	N	Facing NW, elevated
C1	C	Residential	Y	N	Facing SW, 2nd floor
C2			Y	N	Facing NW, elevated
C3			Y	N	Facing NE, 2nd floor
D1	D	Residential	Y	Y	Facing NW, elevated

Receptor	Block	Land Use	Transportation Noise Exposure	Stationary Noise Exposure	Description[(1)]
D2			Y	Y	Facing N, elevated
D3			Y	Y	Facing SW, elevated
D4			Y	Y	Facing NW, elevated
D5		School	Y	Y	Facing NW, ground floor
D6		Residential	Y	Y	Facing NW, elevated
D7			Y	Y	Facing NW, elevated
D8			Y	Y	Facing N, elevated
F1	F	Residential	Y	Y	Facing N, elevated
F2			Y	Y	Facing W, elevated
F3			Y	N	Facing S, elevated

(1) Elevation varies depending on whether this is a transportation or stationary noise receptor. Worst-case elevations were selected for each case.

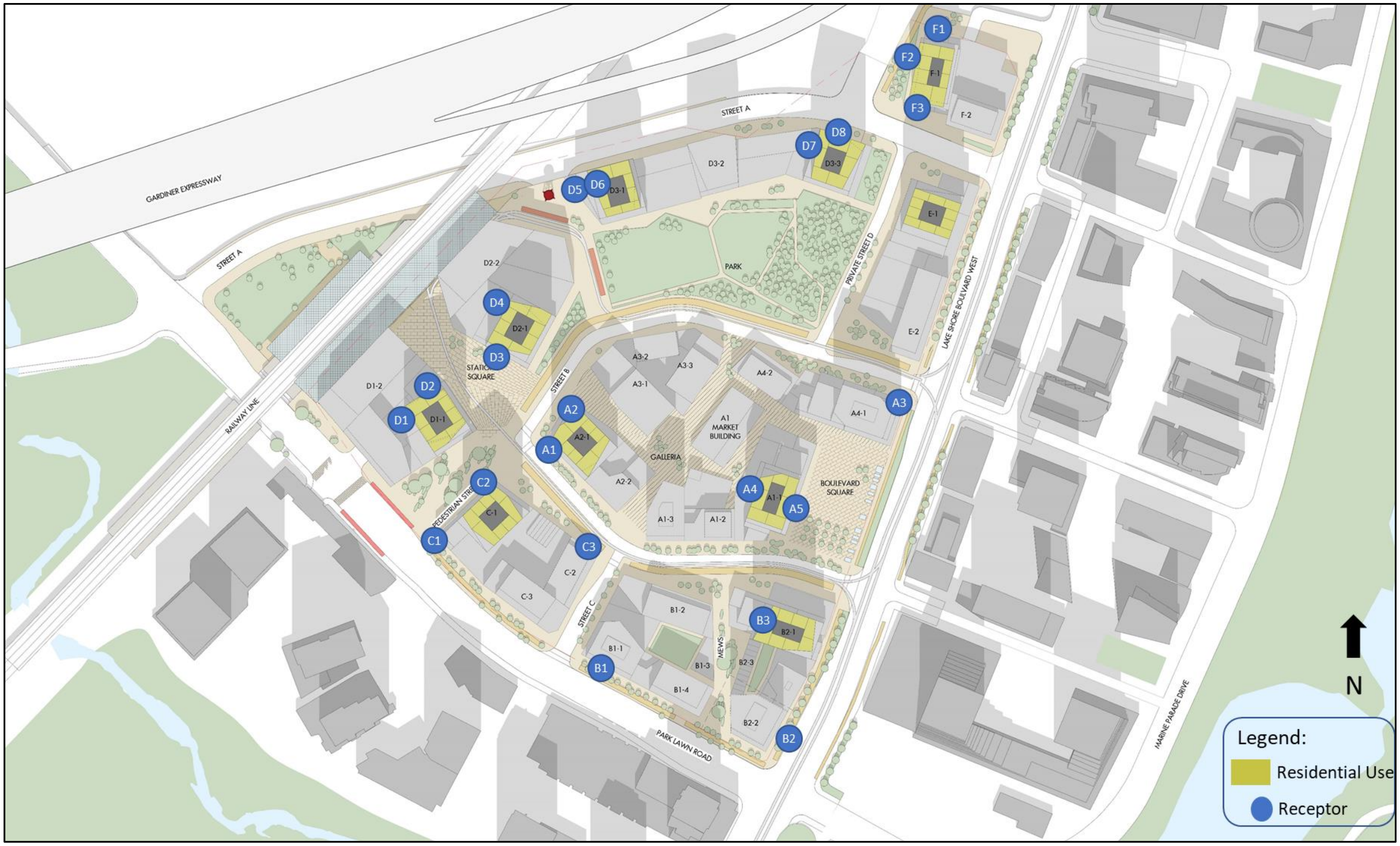

Figure 2-1 Transportation Noise Sensitive Receptors

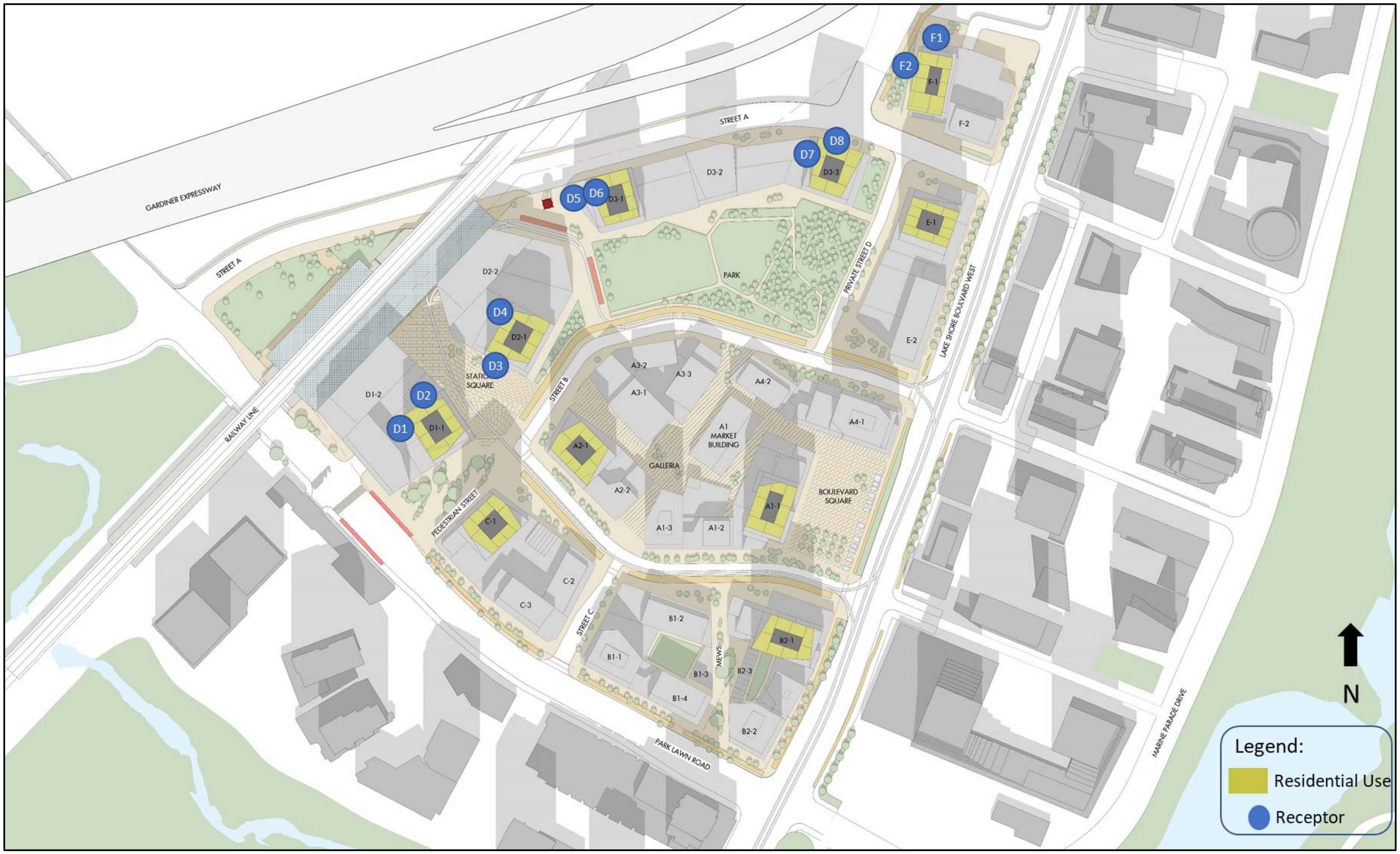

Figure 2-2 Stationary Noise Sensitive Receptors

Vibration sensitive receptors were selected at the nearest sensitive locations from the Lake Shore West rail corridor and the TTC streetcar tracks. Figure 2-3 shows the location of the vibration sensitive receptors.

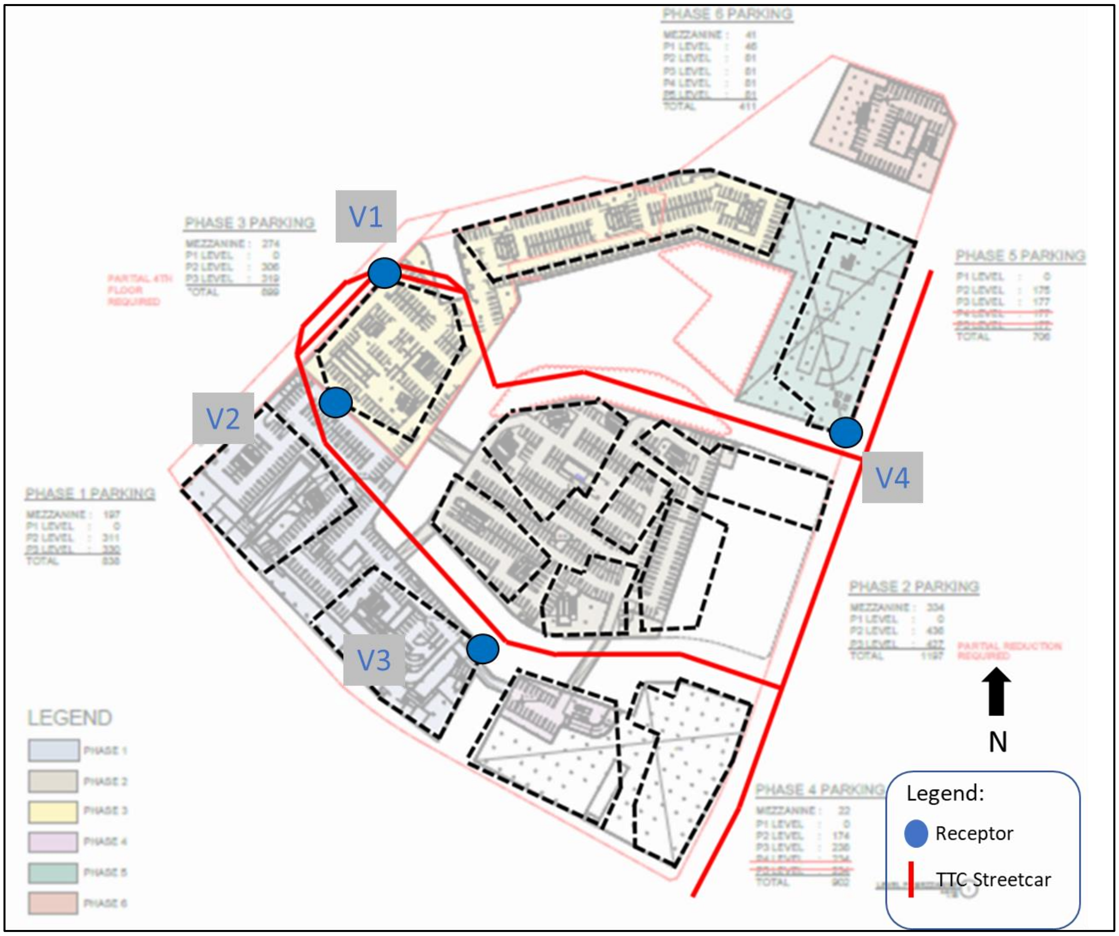

Figure 2-3 Vibration Points of Reception

3. Method of Prediction

3.1 Transportation Noise Modelling

3.1.1 Methods of Prediction

Transportation noise modelling was undertaken using the General Method from the United States Federal Transit Administration (FTA) “Transit Noise and Vibration Impact Assessment”[1] and the United States Federal Highway Administration (FWA) “Traffic Noise Model Version 2.5” (TNM 2.5) [2]. These two algorithms are included in the Cadna/A noise prediction software.

A.1.1.1 The Ministry of the Environment, Conservation and Parks (MECP) “Publication NPC-300: Environmental Noise Guideline, Stationary and Transportation Sources – Approval and

Planning" (hereafter NPC-300) [4] makes reference to the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) [5] and the Sound from Trains Environmental Analysis Method (STEAM) [6] algorithms contained within the STAMSON v5 noise prediction software. However, NPC-300 notes that "other traffic noise prediction models have been and are being developed and may be adopted from time to time". A comparison between the ORNAMENT/STEAM and FTA/TNM algorithms was undertaken using STAMSON and Cadna/A. The comparison reveals that both models yield similar values, the CadnaA resulting in sound levels about 2 dB higher than Stamson. For further details, please refer to Appendix A.

Further, the Cadna/A model allows for more detailed modelling, which includes terrain elevation contours, differing elevations for different roadways, the 3D modelling of the proposed development buildings and existing surrounding buildings, and their impact on sound level propagation, amongst others features. The STAMSON software is essentially a 2D model, which assumes same height conditions along a single road/rail segment. Thus, as the site area features complex geometry, modelling through Cadna/A is the preferred method of assessment.

3.1.2 Transportation Noise Model Inputs

Vehicular noise traffic was modelled based on future total daily traffic volumes projected by BA Group. These are summarized in Table 3-1 and further details are provided in Appendix B. It was assumed that all vehicles will be travelling at the posted speed limit, regardless of congestion that may occur in the area.

Table 3-1: Roadway Traffic Data Inputs

Road	Section	Day Traffic Volume 07:00 to 23:00			Night Traffic Volume 23:00 to 07:00		
		Total Volume	Med. Truck %	Heavy. Truck %	Total Volume	Med. Truck %	Heavy. Truck %
Park Lawn Rd	Immediately North of Gardiner Expy WB On Ramp	29,080	1%	2%	3,230	3%	2%
Park Lawn Rd	Immediately South of Gardiner Expy EB Off Ramp	26,445	0%	1%	2,940	0%	1%
Park Lawn Rd	Immediately North of Lake Shore Blvd W	15,655	0%	1%	1,740	0%	1%
Lake Shore Blvd W	Immediately West of Park Lawn Rd	26,230	1%	1%	2,915	1%	1%
Lake Shore Blvd W	Immediately East of Park Lawn Rd	23,240	1%	1%	2,580	0%	1%
Lake Shore Blvd W	Immediately East of Brookers Ln	9,925	0%	2%	1,105	0%	1%
The Queensway	Immediately East of Park Lawn Rd	36,030	1%	1%	4,005	3%	1%
Gardiner Expy WB On Ramp	From Park Lawn Rd	13,980	3%	2%	1,555	8%	3%

Road	Section	Day Traffic Volume 07:00 to 23:00			Night Traffic Volume 23:00 to 07:00		
		Total Volume	Med. Truck %	Heavy. Truck %	Total Volume	Med. Truck %	Heavy. Truck %
Gardiner Expy EB Off Ramp	To Park Lawn Rd	15,525	1%	1%	1,725	2%	2%
Gardiner Expy Ramps	To/From Relief Rd (Lake Shore)	16,200	0%	1%	1,800	0%	0%
Gardiner Expy	Between Park Lawn Rd and Humber River	141,770	8%(1)	3%(1)	25,020	8%(1)	3%(1)

(1)Truck percentages were not available for the Gardiner Expressway. Truck percentages are based on highest truck percentages related to the Gardiner Expressway On/Off Ramps.

At the time of writing, future train volumes were not available from Metrolinx. As a result, train volumes used for this assessment were extracted from the GO Rail Network Electrification TPAP Noise/Vibration Modelling Report – Lake Shore West Corridor prepared by RWDI Inc. and dated September 2017 [7]. References [8] and [9] were consulted as well; the highest train volumes were conservatively selected. As Park Lawn GO Station future train schedules were unavailable, it was conservatively assumed that all trains will be travelling at the highest allowable speed through the station.

TTC Streetcar volumes were based on existing schedules. For the internal TTC streetcar loop, the same volumes as the Queen 501 streetcar route were conservatively assumed.

Table 3-2 summarizes the train and TTC streetcar inputs incorporated into the Cadna/A model.

Table 3-2: Future Train/TTC Streetcar Volume Inputs

Train Type	Direction	Day Volume 07:00 to 23:00	Night Volume 23:00 to 07:00	Speed (km/h)	No. Locomotives	No. Cars
GO Regular	EB	71	26	105	1	12
	WB	69	25	105	1	12
GO Express	EB	8	1	105	1	12
	WB	8	0	105	1	12
GO Non-Revenue	EB	40	9	105	1	12
	WB	39	8	105	1	12
VIA	EB	5	1	129	1	5
	WB	6	0	129	1	5
VIA Non-Revenue	EB	5	1	129	1	30
	WB	6	0	129	1	30
CN Freight	EB & WB	0	3	97	4	25
TTC Streetcar Lakeshore W	EB & WB	210	98	50 km/h	--	--
TTC Internal Loop	EB & WB	210	98	30 km/h	--	--

Additional noise from wheel squeal resulting from tight TTC Streetcar tight curves was incorporated into the noise model. A point source was added to the model at the locations shown in Figure 3-1, based on TTC streetcar measurements from reference [10]. Wheel squeal was applied to the model as follows:

- L_{max} of 85 dBA at approximately 8 metres;
- Hemispherical propagation to calculate sound power;
- A 5 dB tonal penalty was added to account for the tonal nature of wheel squeal; and
- Squeal event of 5 seconds per vehicle.

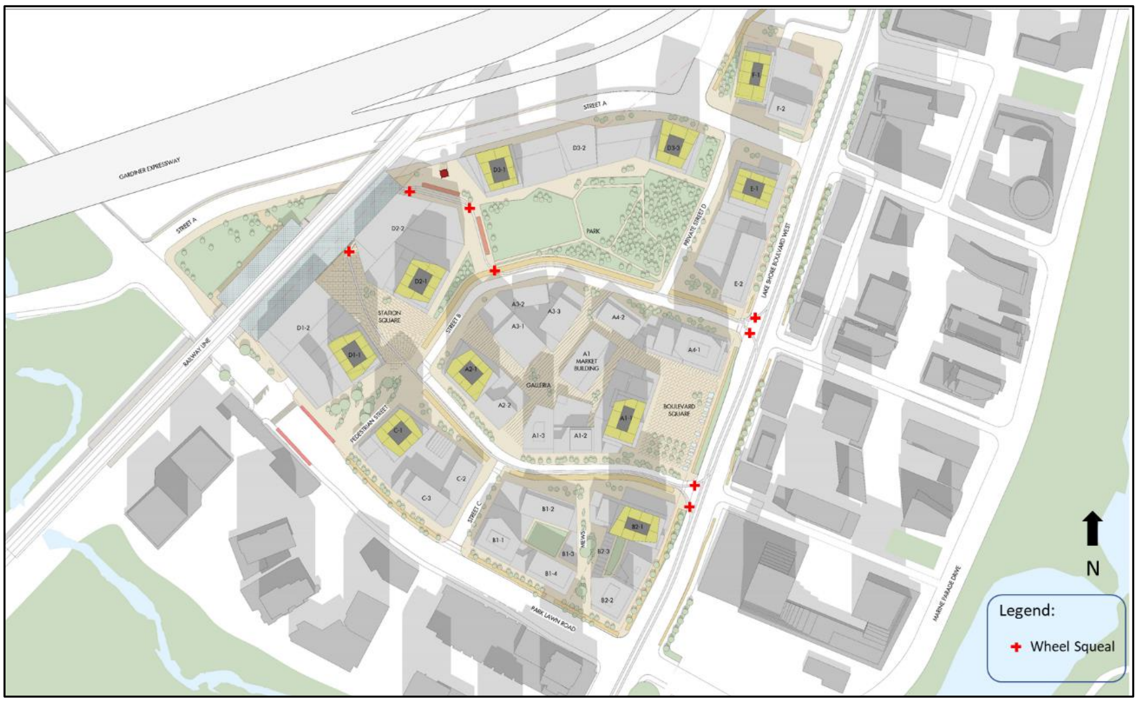

Figure 3-1 Point Source Locations Representing TTC Streetcar Wheel Squeal Events

3.2 Stationary Noise Modelling

3.2.1 Method of Prediction

Stationary noise was modelled using the MECP-approved ISO 9613-2 [3] algorithm, also included in the Cadna/A noise prediction software.

3.2.2 Stationary Noise Model Inputs

Modelled stationary noise sources included Public Announcement (PA) speaker and Heating, Ventilation and Air Conditioning (HVAC) rooftop units, and truck traffic from the Ontario Food Terminal to the north.

Table 3-3 summarizes the PA speaker and rooftop unit reference sound power levels used for this assessment. Sound power levels were obtained from data collected in the design of other transit stations Hatch has been involved in.

Table 3-3: PA Speak and HVAC RTU Sound Power Spectra

Source	Sound Power (dB)							
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
PA Speakers	22	90	101	100	104	107	108	97
HVAC RTU	91	88	79	73	72	68	63	56

Hatch notes that at the time of writing, the design of the future Park Lawn GO station was not available. However, based on experience from other transit stations, the following assumptions were made:

- PA speakers were assumed to operate approximately 7.5 minutes per 8-hour shift. The number of speakers and their spacing was determined based on Google Maps and Streetview photography in vicinity of Mimico Station. A total of 46 PA speakers were modelled along the future Park Lawn GO station platform.

Within the proposed development, it is assumed that all mechanical equipment will be enclosed in a mechanical room in the penthouse; therefore, noise contributions from mechanical equipment is expected to be negligible. However, once details regarding mechanical equipment become available, this assumption will need to be verified, and this report will need to be updated if required.

Similarly, at the time of writing, information related to exhaust shafts for the ventilation of the underground parking was not available. Thus, exhaust shaft noise has not been included in this assessment. Once available, this report will need to be updated as required.

3.3 Vibration Modelling

The anticipated vibration levels resulting from the proposed TTC streetcar loop and the train pass-bys travelling along the Lake Shore West rail corridor were predicted using the general vibration assessment method described in Chapter 10 of the US Federal Transit Administration (FTA) guidelines [1].

Using the generalized ground surface vibration curve for *Rapid Transit or Light Rail Vehicles*, as illustrated in Figure 3-2, a vibration emission baseline curve can be established. This curve is based on both heavy and light rail vehicles on at-grade and subway track across north America. This is a conservative approach as the curve is based on the upper range of measured data from well-maintained systems.

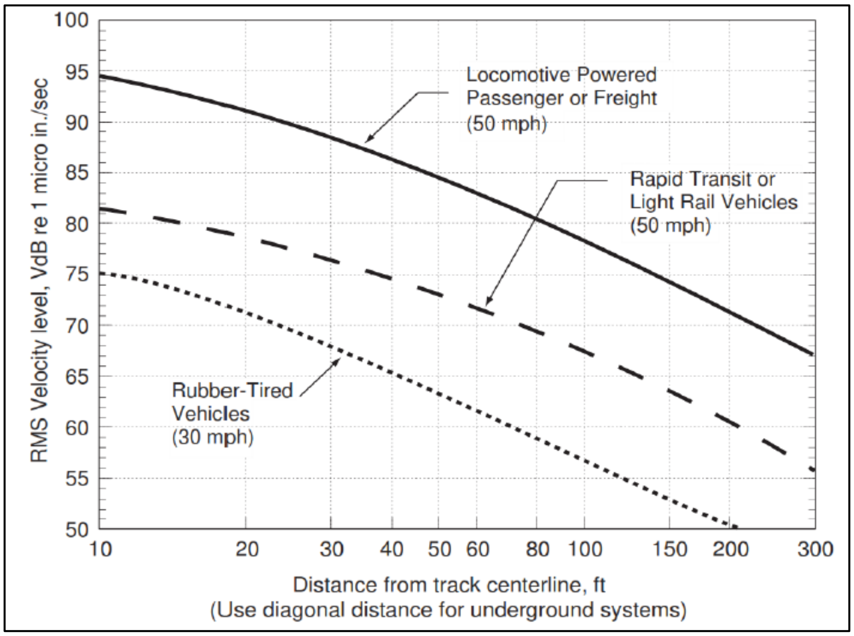

Figure 3-2 Generalized Ground Surface Vibration Curves

The vibration-to-distance decay baseline curve is then adjusted based on several parameters specific to the operating transit system and its surroundings. This is further discussed below.

The adjusted curve is used to identify the vibration impact at the identified PORs.

3.3.1 Vibration Modelling Assumptions

This vibration assessment is based on the following assumptions:

- Part of the TTC streetcar will travel on top of the underground parking and will be supported by a slab, as shown in Figure 2-3. Based on the streetcar data collected for the Eglinton Crosstown Light Rail Transit Project Noise and Vibration Report prepared by J.E. Coulter [11], TTC streetcar frequencies peak at 50 Hz. It is assumed that the resonant frequencies of the slab will be below 50 Hz. Furthermore, it is assumed that the mass of the slabs supporting streetcars will be at least 3 times the mass of the streetcars. Thus, this assessment assumes there will be no vibration amplification through the slabs supporting the streetcars.
- Currently, no special track work is proposed as part of the new Park Lawn GO station.

Table 3-4 summarizes the modelling parameters and associated assumptions.

Table 3-4: FTA General Method (Vibration) Model Assumptions

Modelling Parameter	Value					Basis of Assumption
	V1	V1	V2	V3	V4	
	MX Corridor	TTC Streetcar	TTC Streetcar	TTC Streetcar	TTC Streetcar	
Speed	129 km/h	30 km/h				As per BA Group's Urban Transportation Considerations report [5], one of the key principles of the Master Plan is to create complete streets and prioritize pedestrian mobility. This is achieved through the implementation of traffic calming measures within the site and the streetcar loop, such as narrow lanes, trees/landscaping and speed reduction measures. Although not specified, a speed limit of 30 km/h along the loop is assumed based on the Traffic Calming Guide for Toronto [13], which states local roads can have speed limits as low as 30 km/h. This assumption has been verified with BA Group. Based on information provided by VIA, trains will be traveling at up to 129 km/h. This is faster than GO passenger, VIA passenger, and freight trains.
Vehicle	New or wheel maintained. No wheel flats, no stiff primary suspension.					It is assumed that TTC streetcars will be well maintained, without worn wheels or wheel flats.
Track conditions	Well maintained, non-jointed track, no special track work.	Special track work.	Well maintained, non-jointed track, no special track work.		Special track work.	Based on special trackwork shown in Master Plan architectural drawings. Tracks will be new.

Modelling Parameter	Value					Basis of Assumption
	V1 MX Corridor	V1 TTC Streetcar	V2 TTC Streetcar	V3 TTC Streetcar	V4 TTC Streetcar	
Ground Propagation	Typical	Efficient		Typical		Efficient propagation is assumed for slab-supported tracks as it absorbs less energy than tracks supported on the ground.
Coupling loss	Large Masonry Structure					Based on architectural drawings.
Floor-to-floor attenuation	No floor-to-floor attenuation.					Typically there is dispersion and attenuation of vibration energy as it propagates through the structure. However conservatively no attenuation is assumed; structural drawings are not available.

4. Noise and Vibration Criteria

The noise criteria are based on the MECP publication NPC-300. NPC-300 is primarily intended for the purposes of Ontario Municipalities, whose planners are required to review and comment on new developments, official plans, official plan amendments, etc., in accordance with the requirements of the *Planning Act*.

The vibration criteria are based on the Canadian National Railways (CN) Principal Main Line Requirements [14], the Federation of Canadian Municipalities (FCM) and Railway Association of Canada (RAC) Guidelines [15] (FCM/RAC Guidelines), the MOEE/TTC “Draft Protocol for Noise and Vibration Assessment for the Proposed Waterfront West Light Rail Transit Line” [17] (MOEE/TTC Draft Protocol), and the Metrolinx “Environmental Guide for Noise and Vibration Impact Assessment”[16]

The following sections below summarize the applicable noise and vibration criteria applying to the different components of this assessment.

4.1 Transportation Sources Noise Criteria

4.1.1 Indoor Sound Level Limits

Table 4-1 summarizes the transportation noise criteria applicable to indoor spaces based on NPC-300. Plane of window sound level limits are provided for the daytime and nighttime periods, for both road and rail traffic noise sources. If these limits are exceeded, building components (e.g., windows, walls, doors) should be designed such that indoor sound levels meet the indoor spaces sound level limits shown below.

Table 4-1: MECP’s NPC-300 Transportation Indoor Sound Level Criteria

Point of Reception	Daytime Leq (16h) dBA 07:00 to 23:00		Daytime Leq (8h) dBA 23:00 to 07:00		Requirements
	Road	Rail	Road	Rail	
Plane of Window					
Plane of Window	65	60	60	55	If exceeded, design building components to meet indoor sound levels below.
Indoor Spaces					
Living/Dining Area	45	40	40	40	Meet these indoor sound levels through the design of building components if thresholds above are exceeded
Sleeping Quarters	45	40	40	35	

Further, NPC-300 requires brick veneer or acoustical equivalent construction for exterior walls within 100 metres from the rail tracks, if sound levels are predicted to exceed 60 dBA.

4.1.2 Outdoor Sound Level Limits

Table 4-2 summarizes the transportation noise requirements applicable to outdoor living spaces based on NPC-300. Note that these are applicable only to the daytime period.

Table 4-2: MECP's NPC-300 Transportation Outdoor Living Space Sound Level Criteria

Point of Reception	Daytime Leq (16h) dBA 07:00 to 23:00	Requirements
Outdoor Living Area	≤55	None
	Between 56 and 60	- Noise Barrier OR - Type 'A' Warning Clause
	> 60	- Noise Barrier reducing L_{eq} (16h) to 55 dBA OR - Noise Barrier reducing L_{eq} (16h) to 60 dBA + Type 'B' Warning Clause

4.1.3 *Ventilation and Warning Clause Requirements*

Table 4-3 summarizes the transportation noise ventilation and warning clause requirements based on NPC-300.

Table 4-3: MECP's NPC-300 Transportation Ventilation and Warning Clause Requirements

Point of Reception	Time Period	Leq (Road + Rail) dBA	Requirements
Plane of Window	Daytime – 07:00 to 23:00	≤55	None
		Between 56 and 65	- Unit must include provisions for future installation of central air conditioning - Type 'C' Warning Clause
		> 65	- Unit must include central air conditioning - Type 'D' Warning Clause
	Nighttime – 23:00 to 07:00	≤50	None
		Between 51 and 60	- Unit must include provisions for future installation of central air conditioning - Type 'C' Warning Clause
		> 60	- Unit must include provisions for future installation of central air conditioning - Type 'D' Warning Clause
Outdoor Living Area	Daytime – 07:00 to 23:00	Between 56 and 60	

Metrolinx and CN also require warning clauses for development located within 300 metres of their right-of-way. Specific wording is included in Section 5.1.2.

4.2 Stationary Sources Noise Criteria

The stationary noise criteria are based on the NPC-300 guidelines. The applicable criteria are the higher between either the Exclusion Limits stipulated in Section B7.1 of NPC-300 or background sound levels.

Table 4-4 summarizes NPC-300's exclusion limits for a development proposed in a Class 1 Area. The site is located in a Class 1 Area as it exhibits an acoustic environment of a major urban centre.

Table 4-4: MECP's NPC-300 Class 1 Area Exclusion Limits

Point of Reception	Daytime Leq (1h) dBA 07:00 to 19:00	Evening Leq (1h) dBA 19:00 to 23:00	Nighttime Leq (1h) dBA 23:00 to 07:00
Plane of Window	50	50	45
Outdoor Point of Reception	50	50	N/A

Background Sound levels were calculated based on existing traffic data obtained from the City of Toronto. Conservatively, traffic volumes were not grown to year 2020 existing conditions. Table 4-5 summarizes the calculated background sound levels for each of the identified worst-case representative stationary receptors, for the daytime, evening and nighttime. As these latter ones are higher than MECP's exclusion limits, they become the applicable stationary noise criteria.

Table 4-5: Applicable Stationary Noise Sound Level Criteria

Point of Reception	Daytime Leq (1h) dBA 07:00 to 19:00	Evening Leq (1h) dBA 19:00 to 23:00	Nighttime Leq (1h) dBA 23:00 to 07:00
D1	68	50(1)	59
D2	68	50(1)	59
D3	66	50(1)	57
D4	69	50(1)	60
D5	64	50(1)	55
D6	72	50(1)	64
D7	69	50(1)	60
D8	70	50(1)	61
F1	71	50(1)	60
F2	70	50(1)	60

(1) MECP exclusion limit for a Class 1 area as traffic data was unavailable to calculate evening background levels.

4.3 Vibration Criteria

The vibration criteria are based on the CN Principal Main Line Requirements, the FCM/RAC Guidelines, the MOEE/TTC Draft Protocol, and the Metrolinx Guide. Table 4-6 summarizes the vibration limits according to the above-noted publications.

Table 4-6: Vibration Limits

Source	Limit (mm/sec RMS)
Canadian National Railways	0.14
MOEE/TTC Draft Protocol	0.14
FCM/RAC Guidelines	0.14
Metrolinx Guide	0.14

Based on Table 4-6, the applicable vibration limits are 0.14 mm/s.

5. Sound Level Analysis Findings

5.1 Transportation Noise Findings

Table 5-1 summarizes the predicted transportation sound levels. As can be seen, either provisions for the future installation for air conditioning, or air conditioning, is required for all receptors based on noise levels predicted outdoors at the plane of the window. However, it is expected that all buildings will have a central air conditioning system, meeting or exceeding the ventilation requirements noted below.

Furthermore, the design of building components will be required to meet MECP's indoor sound level limits at representative receptors A1-A3, C2, D1-D8 and F1-F2. Predicted transportation sound levels from these receptors will be extrapolated to other locations within the site, and on that basis, minimum Sound Transmission Class (STC) ratings for windows and walls will be recommended.

Table 5-1: Predicted Transportation Sound Levels

Receptor	Daytime Plane-of-Window Leq 16 hours, dBA			Nighttime Plane-of-Window Leq 8 hours, dBA			Ventilation Requirement	Design of Building Components?
	Road	Rail	Tot.	Road	Rail	Tot.		
A1	65	58	**65**	57	57	**60**	AC Provisions	**YES**
A2	66	58	**66**	58	57	**60**	AC	**YES**
A3	60	74	**75**	54	71	**74**	AC	**YES**
A4	63	52	**63**	55	51	**54**	AC Provisions	NO
A5	55	61	**62**	48	58	**61**	AC	**YES**
B1	55	50	**56**	48	49	**52**	AC Provisions	NO
B2	59	59	**62**	52	57	**60**	AC Provisions	**YES**
B3	58	54	**59**	50	52	**55**	AC Provisions	NO
C1	62	53	**63**	55	53	**56**	AC Provisions	NO
C2	65	61	**67**	57	59	**62**	AC	**YES**
C3	55	58	**60**	48	56	**59**	AC Provisions	**YES**
D1	70	64	**71**	62	63	**66**	AC	**YES**
D2	70	64	**71**	62	62	**65**	AC	**YES**
D3	68	60	**69**	60	59	**62**	AC	**YES**

Receptor	Daytime Plane-of-Window Leq 16 hours, dBA			Nighttime Plane-of-Window Leq 8 hours, dBA			Ventilation Requirement	Design of Building Components?
	Road	Rail	Tot.	Road	Rail	Tot.		
D4	71	62	**72**	64	62	**65**	AC	**YES**
D5	69	69	**72**	62	67	**70**	AC	**YES**
D6	75	69	**76**	68	67	**70**	AC	**YES**
D7	72	61	**72**	65	60	**63**	AC	**YES**
D8	73	60	**73**	66	59	**62**	AC	**YES**
F1	74	61	**75**	68	60	**63**	AC	**YES**
F2	73	60	**73**	66	60	**63**	AC	**YES**
F3	67	52	**67**	60	52	**55**	AC	**YES**

Outdoor living areas were not identified on the master plan architectural plans. Station Square, Boulevard Square and the park will be publicly accessible areas. As per MECP, these are not considered outdoor living areas for the purposes of noise assessments. Thus, an outdoor living area noise assessment was not completed at this time.

However, once more detailed plans become available, an outdoor living area noise assessment is likely required for any condominium outdoor amenities, or terraces and balconies exceeding 4 metres in depth.

5.1.1 Indoor Noise Control Measures

The Acoustical Insulation Factor (AIF) and its calculation were developed by the National Research Council (NRC) [19]. The AIF is based on the difference between the outside predicted L_{eq} and the required indoor L_{eq}, plus factors to account for the number of room components (e.g., windows, doors, walls). Once calculated, the AIF is converted to minimum required STC ratings for walls and windows, based window-to-floor or wall-to-floor ratios, based on conversion factors developed by Canada Mortgage and Housing Corporation (CMHC) [20] [21] . It should be noted that the STC values below are preliminary, as they depend on details such as window-to-floor area ratios, wall-to-floor area ratios, room layout (e.g. corner room), fixed or operable windows, directionality of windows, etc. Thus, the following assumptions have been made based on experience from other projects.

- Window-to-floor area ratios of 80 percent;
- Wall-to-floor area ratio of 100 percent;
- Operable windows; and
- Corner rooms are a special case; an increase of approximately three STC rating points may be required for rooms for which noise enters the room from multiple directions.

It is important to note that the term “windows” used below includes balcony doors. Consequently, all window glass within balcony doors must be designed according to the STC requirements for the windows stated below.

When detailed floor plans are complete, a comprehensive window-to-floor area assessment of the different model suites can be undertaken to optimize the window selection for the development and possibly reduce STC requirements listed below. Further, TTC streetcar wheel squeal has significant impacts to required STC where the loop meets Lake Shore Blvd. West. Once the streetcar loop schedule is determined, STC requirements could be further optimized.

Table 5-2 summarizes the minimum required STC values for different buildings and façades within the proposed development. Detailed calculations are included in Appendix C. For locations not listed below, Ontario Building Code standards will be adequate to meet the remaining window STC requirements, as well as all exterior wall STC requirements for the development

Table 5-2: Window and Wall STC Requirements

Location	Representative Receptor	Window STC Required for Windows		Wall STC Required
		Living Areas	Sleeping Quarters	
Units in: Block 2-1 facing SW and NE, Block C-1 facing SW and NE.	A1	32	33	35
Units in Block 2-1 facing NW.	A2	32	32	34
Units in: Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE , in Block B2-1 facing NNE and ESE.	A3	44	47	49
Units in: Block A1-1 facing the SE	A5	31	34	36
Units in: Block 2-2 facing SE, units in Block E-1 facing ESE	B2	30	33	35
Units in: Block C-1 facing NW.	C2	33	34	36
Units in: Block C-2 facing the SE and NE, in Block A2-2 facing S, units in Block A1-2 facing S, units in Block A1-1 facing SSW, units in Block B1-2 facing NNE	C3	29	32	34
Units in: Block D1-1 facing WSW, units in Block D2-1 facing NE.	D1	37	38	40
Units in: Block D1-1 facing NNW.	D2	38	38	40
Units in: Block D1-1 facing ENE, in Block D2-1 facing SSW, in Block D3-3 facing SSW	D3	34	34	36
Units in: Block D2-1 facing NW, in Block D3-1 facing NNW, in Block D3-2 facing NNW.	D4	37	38	40

Location	Representative Receptor	Window STC Required for Windows		Wall STC Required
		Living Areas	Sleeping Quarters	
School windows facing NNW	D4	37	N/A	39
School façade facing WSW	D5	39	N/A	41
Units in: Block D3-1 facing WSW and ENE, in Block D3-2 facing WSW and ENE.	D6	43	43	45
Units in: Block D3-3 facing NW.	D7	37	35	39
Units in Block D3-3 facing NNW, in Block F-2 facing NNE, in Block E-1 facing NNE	D8	39	35	41
Units in Block F-1 facing NNE	F1	39	35	41
Units in Block F-1 Facing WNW, in Block F-2 facing WNW	F2	39	35	41
Units in Block F-1 facing SSW	F3	31	27	33

NPC-300 requires brick veneer or acoustical equivalent construction for exterior walls within 100 metres from the rail tracks, if sound levels are predicted to exceed 60 dBA. Thus, in addition to the wall STC requirements above, brick veneer or acoustical equivalent exterior walls are required for the following exterior walls. This only applies to residential uses, unless otherwise stated:

- Exterior walls facing WSW, NNW and ENE in Block D1-1;
- Exterior walls facing NW, SSW and NE in Block D2-1;
- Exterior walls facing NNW, WSW and ENE in Block D3-1;
- Exterior walls facing NNW, WSW and ENE in Block D3-1; and
- School exterior walls facing NNW and WSW.

5.1.2 Warning Clauses

The following warning clauses are to be included in offers of purchase or sale, or tenancy agreements, to formally notify future occupants of potential noise impacts. This is a requirement from MECP, Metrolinx and CN. Table 5-3 summarizes the required warning clauses within the development:

Table 5-3: Warning Clauses

Warning Clause	Suggested Wording
Type ‘D’	"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment, Conservation and Parks."

Warning Clause	Suggested Wording
Metrolinx	"Purchasers/occupants are advised that Metrolinx (formerly GO Transit) or its affiliated companies has or have a railway right-of-way within 300 m from this dwelling unit. There may be alterations to or expansions of the railway facilities of such right-of-way in the future, including the possibility that Canadian Pacific Railway (CPR) or its affiliated railway companies as aforesaid, or their assigns or successors may expand their business operations. Such expansion may affect the living and business environment of the residents, tenants and their visitors, employees, customers and patients in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating features in the design of the development. Metrolinx, its affiliated railway companies and their successors and assigns will not be responsible or any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid right of-way."
CN	Purchasers/occupants are advised that Canadian National Railway (CNR) or its affiliated railway companies has or have a railway right-of-way within 300 m from this dwelling unit. There may be alterations to or expansions of the railway facilities of such right-of-way in the future, including the possibility that CPR or its affiliated railway companies as aforesaid, or their assigns or successors may expand their business operations. Such expansion may affect the living and business environment of the residents, tenants and their visitors, employees, customers and patients in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating features in the design of the development. CNR, its affiliated railway companies and their successors and assigns will not be responsible or any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid right of-way

5.2 Stationary Noise Findings

Table 5-4 summarizes the predicted stationary sound levels. As can be seen, all sensitive receptors will meet the applicable criteria. Thus, noise control measures to mitigate stationary noise are not required.

Table 5-4: Applicable Stationary Noise Sound Level Criteria

Point of Reception	Daytime 07:00 to 19:00		Evening 19:00 to 23:00		Nighttime 23:00 to 07:00		Exceeds Criteria?
	Criteria	Stationary Noise Leq (1h) dBA	Criteria	Stationary Noise Leq (1h) dBA	Criteria	Stationary Noise Leq (1h) dBA	
D1	68	47	50	47	59	47	No
D2	68	46	50	46	59	46	No
D3	66	44	50	44	57	44	No
D4	69	47	50	47	60	47	No

Point of Reception	Daytime 07:00 to 19:00		Evening 19:00 to 23:00		Nighttime 23:00 to 07:00		Exceeds Criteria?
	Criteria	Stationary Noise Leq (1h) dBA	Criteria	Stationary Noise Leq (1h) dBA	Criteria	Stationary Noise Leq (1h) dBA	
D5	64	48	50	48	55	48	No
D6	72	49	50	49	64	49	No
D7	69	45	50	45	60	45	No
D8	70	44	50	44	61	44	No
F1	71	43	50	43	60	43	No
F2	70	44	50	44	60	44	No

6. Vibration Analysis Findings

Table 6-1 summarizes the predicted vibration levels at the identified vibration receptors.

Table 6-1: Predicted Vibration Levels

Receiver	Vibration Source	Predicted Vibration Level (mm/s RMS)	Limit (mm/sec RMS)	Exceeds Limit?
V1	Metrolinx Corridor	0.13	0.14	No
	TTC Streetcar Loop	0.23	0.14	**Yes**
V2	TTC Streetcar Loop	0.05	0.14	No
V3	TTC Streetcar Loop	0.02	0.14	No
V4	TTC Streetcar Loop	0.04	0.14	No

As can be seen, vibration levels at receptor V1 are expected to exceed the applicable limit due to TTC streetcar pass-bys. However, it is noted that this assessment is based on the conservative assumption that the streetcars will be travelling at 30 km/h through Station Square, and along the boarding and unloading platforms northwest, northeast and east of Block D2-1 and D2-2. Streetcars are expected to be travelling slower in this area; thus it is possible that mitigation measures are not required.

A sensitivity analysis was undertaken to investigate the impact of TTC streetcars in vicinity of V1. Further, possible mitigation measures were explored to lower vibration levels to compliant levels. This is summarized in Table 6-2.

Table 6-2: Vibration Sensitivity Analysis at Receptor V1

Receptor	Condition	Predicted Vibration Level (mm/s RMS)	Limit (mm/sec RMS)	Exceeds Limit?
V1	Streetcar travels at 15 km/h	0.12	0.14	No
V1	Introduce resilient trackwork	0.13	0.14	No

Discussions should be held with the TTC to determine operating speeds in vicinity of V1. This assessment confirms that streetcars traveling at 15 km/h near V1 will not result in vibration exceedances.

In the event that operating speeds near V1 are 30 km/h, vibration mitigation will be required under the form of rubber boot vibration isolation. Please see Appendix D for a sample drawing illustrating vibration isolation.

6.1 Ground-borne Noise

As vibration propagates through the ground and then the ceiling/floor and walls of a structure, light partitions (e.g. plaster slab) could vibrate and thus generate noise. This is referred to as ground-borne noise. There are no requirements related to maximum indoor ground-borne noise levels. However, the FTA recommends a maximum sound level of 35 dBA. This corresponds to the NPC-300 indoor air-borne sound level limit for sleeping quarters at night exposed to rail noise – see Table 3-4.

Should the team wish to achieve this objective indoor sound level at sensitive uses represented by V1, a floor to floor vibration attenuation analysis should completed and incorporated into the vibration general analysis since all residential dwellings are anticipated to be at higher elevations. The initial analysis conservatively assumes there is no floor to floor attenuation (see Table 3-4). If further attenuation is required, the application of floating slabs at track locations with special trackwork should be evaluated, assuming a streetcar speed of 30 km/h in vicinity of V1.

It possible to mitigate indoor ground-borne noise with resilient trackwork at special trackwork locations, if it is determined streetcars will operate at a maximum speed of 10 km/h.

7. Implementation Procedures

All relevant builder's plans for the dwelling units requiring noise and vibration control measures should be certified by an Acoustical Consultant as being in conformance with the recommendations of the approved Noise Impact and Vibration Study. The acoustic certifications should be based on the final building siting, final grading, final architectural design and required noise control measures.

Prior to final inspection and release for occupancy, these dwellings should also be inspected and certified as being in compliance with the certified builder's plans and the recommendations of the approved Noise Impact Study.

8. Conclusions and Recommendations

Based on this assessment, the following conclusions are drawn:

- Transportation noise modelling was completed, based on future traffic vehicular traffic volumes for major roadways in the area, on future train volumes along the Lake Shore West rail corridor, and streetcar volumes along Lake Shore Boulevard West and the proposed internal TTC streetcar loop. On this basis, it is concluded that noise control measures will be required within the proposed development to mitigate transportation noise.
  - The required windows and wall STC ratings to mitigate indoor sound levels to MECP requirements are listed in Table 5-2. It is noted that optimization of window and wall STC ratings can be achieved once detailed unit floor plans become available. Further, TTC streetcar wheel squeal has significant impacts to required STC where the loop meets Lake Shore Blvd. West. Once the streetcar loop schedule is determined, STC requirements could be further optimized.
  - Furthermore, brick veneer or acoustical equivalent construction for exterior walls within 100 metres from the rail tracks will be required at select exterior façades. For further details, refer to Section 5.1.1.
  - Air conditioning, or provisions for the installation of air conditioning, will be required for all units within the proposed development. However, it is expected that an air conditioning system will be installed in all units within the proposed development, enabling residents to close windows should exterior noise levels increase.
  - Warning clauses are to be included in offers of purchase or sale, or tenancy agreements, to formally notify future occupants of potential noise impacts. Refer to Table 5-3 for further details.
- Stationary noise modelling was completed, accounting for noise emanating from the future Park Lawn GO station PA speaker system and HVAC rooftop units, as well as truck noise from the Ontario Food Terminal. On this basis, it is concluded that noise control measures will not be required within the proposed development to mitigate stationary noise.
- However, this assessment is deemed preliminary, as the mechanical system of the proposed buildings has not been designed. Typical stationary noise sources in residential developments include HVAC equipment, parking garage ventilation exhaust shafts and auxiliary generators. Once these details become available, the findings of this study should be reviewed, as the development could have a noise impact on itself.
- Vibration levels were predicted from train pass-bys along the Lake Shore West rail corridor, and TTC streetcar pass-bys along. Vibration limits will be exceeded in vicinity of the boarding/loading platforms by Block D2-2 due to TTC streetcar pass-bys.

- At this location, streetcar speeds were conservatively assumed to be 30 km/h. However, it is likely that TTC streetcars will travel at slower speeds. Based on a sensitivity analysis, vibration levels will become compliant at speeds of 15 km/h or lower. Thus, discussions should be held with the TTC to determine operating speeds of streetcars in this area.
- If it is found that TTC streetcars will travel faster than 15 km/h, vibration mitigation will be required such as embedded rail rubber boot isolators at special track locations.
- Although not required, a combination of resilient track work and reduced TTC streetcar speeds near Block D2-2 can achieve FTA recommended indoor ground-borne noise levels of 35 dBA. A detailed floor to floor vibration attenuation analysis can be further completed to confirm adequate multi-story vibration attenuation. Floating slabs can also meet this objective sound level.

9. References

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[17] MOEE/TTC, "Protocol for Noise and Vibration Assessment for the Proposed Waterfront West Light Rail Transit Line," 1993.

[18] Ontario Ministry of the Environment (MOECC), STAMSON v5.04: Road, Rail and Rapid Transit Noise Prediction Model, 1996.

[19] National Research Council of Canada, “Acoustic Insulation Factor: A Rating for the Insulation of Buildings Against Outdoor Noise”, June 1980.

[20] Canadian Mortgage and Housing Corporation, “New Housing and Airport Noise”. 1981

[21] Canadian Mortgage and Housing Corporation, “Road and Rail Noise: Effects on Housing”. 1981

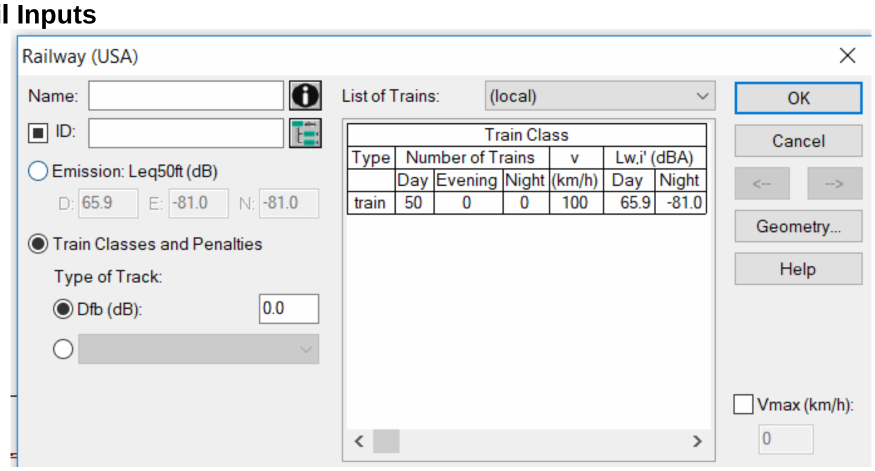
Appendix A

ORNAMENT/STEAM Comparison with FTA/TNM

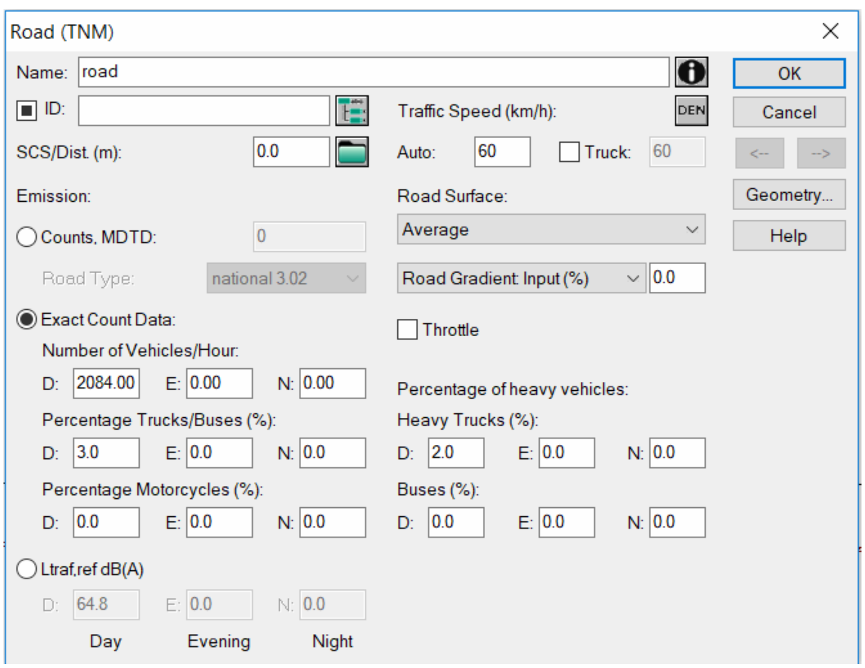
Below are the levels for a sample road and rail segment based on CadnaA (FTA + TNM2.5 algorithms) and STAMSON V5.0 (ORNAMENT and STEAM algorithms). There is a difference of 2 dB between the levels calculated using the CadnaA and STAMSON methods for road and rail traffic noise prediction.

FTA+TNM2.5

Rail Inputs



Roadway Inputs



Results

Name	Level Lr		Limit. Value		Land Use			Height		Coordinates		
	Day	Ln	Day	Ln	Type	Auto	Noise Type			X	Y	Z
	(dBA)	(dBA)	(dBA)	(dBA)				(m)		(m)	(m)	(m)
Receiver	68.2	-69.3	0.0	0.0		x	Total	1.50	r	2375.80	258.45	1.50

The daytime level using the TNM/FTA calculation methods is **68 dBA.**

STAMSON V5.0 ORNAMENT/STEAM Noise Prediction Models

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STAMSON 5.0        NORMAL REPORT        Date: 28-04-2020 21:49:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: validate.te          Time Period: 24 hours
Description: Comparison of CadnaA and Stamson


Rail data, segment # 1: Sample Rail
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Train            ! Trains      ! Speed !# loc !# Cars! Eng  !Cont
Type             !             !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             !  50.0/0.0   ! 100.0 !  1.0 ! 12.0 !Diesel! Yes

Data for Segment # 1: Sample Rail
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Absorptive ground surface)
Receiver source distance  : 100.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
No Whistle
Reference angle           :   0.00

Results segment # 1: Sample Rail
--------------------------------

LOCOMOTIVE (0.00 + 55.60 + 0.00) = 55.60 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.58  69.99 -13.06  -1.33   0.00   0.00   0.00  55.60
----------------------------------------------------------------------

WHEEL (0.00 + 47.50 + 0.00) = 47.50 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.66  62.63 -13.68  -1.46   0.00   0.00   0.00  47.50
----------------------------------------------------------------------
```

```
Segment Leq : 56.23 dBA

Total Leq All Segments: 56.23 dBA


Page 2

Road data, segment # 1: Sample Road
-----------------------------------
Car traffic volume  : 47500 veh/TimePeriod  *
Medium truck volume :  1500 veh/TimePeriod  *
Heavy truck volume  :  1000 veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Sample Road
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  50.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Sample Road
--------------------------------

Source height = 1.19 m

ROAD (0.00 + 65.97 + 0.00) = 65.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  71.20   0.00  -5.23   0.00   0.00   0.00   0.00  65.97
-----------------------------------------------------------------------------

Segment Leq : 65.97 dBA
Total Leq All Segments: 65.97 dBA

TOTAL Leq FROM ALL SOURCES:       66.41
```

The daytime level using STAMSON V5.0 is **66 dBA**.

Appendix B

Traffic Volumes

Hi All,

Please see below for a summary of the volumes as requested. I've also attached the various inputs, analysis and data that went into collating this, in case you need further details. Please note that in the absence of data showing exactly what was requested, a number of assumptions had to be made in an effort to best represent what you are looking for. Unfortunately we don't have any heavy vehicle data for the Gardiner Expressway. As previously mentioned by Alun, we also are unable to derive AADT volumes with the data we have available. Hopefully the daily volumes can provide a reasonable representation of this.

We are not proposing to change any speed limits as part of the proposal.

Please let me know if you have any questions or require anything further.

Regards,
Luke

Road	Section	Daily			Day (7am-11pm)			Night (11pm-7am)		
		Total Volume	Medium Vehicle %	Heavy Vehicle %	Total Volume	Medium Vehicle %	Heavy Vehicle %	Total Volume	Medium Vehicle %	Heavy Vehicle %
Park Lawn Rd	Immediately North of Gardiner Expy WB On Ramp	32310	1%	2%	29080	1%	2%	3230	3%	2%
Park Lawn Rd	Immediately South of Gardiner Expy EB Off Ramp	29385	0%	1%	26445	0%	1%	2940	0%	1%
Park Lawn Rd	Immediately North of Lake Shore Blvd W	17395	0%	1%	15655	0%	1%	1740	0%	1%
Lake Shore Blvd W	Immediately West of Park Lawn Rd	29145	1%	1%	26230	1%	1%	2915	1%	1%
Lake Shore Blvd W	Immediately East of Park Lawn Rd	25820	1%	1%	23240	1%	1%	2580	0%	1%
Lake Shore Blvd W	Immediately East of Brookers Ln	11030	0%	2%	9925	0%	2%	1105	0%	1%
The Queensway	Immediately East of Park Lawn Rd	40035	1%	1%	36030	1%	1%	4005	3%	1%
Gardiner Expy WB On Ramp	From Park Lawn Rd	15535	3%	2%	13980	3%	2%	1555	8%	3%
Gardiner Expy EB Off Ramp	To Park Lawn Rd	17250	1%	1%	15525	1%	1%	1725	2%	2%
Gardiner Expy Ramps	To/From Relief Rd (Lake Shore)	18000	0%	1%	16200	0%	1%	1800	0%	0%
Gardiner Expy	Between Park Lawn Rd and Humber River	166790			141770			25020		

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Appendix C

Building Envelope Noise Reduction Calculation

Representative Receptor	Applies to	Overall Leq	Road Leq	Rail Leq	Requires Component Design?	Aircraft (NEF)	Number of Room Components, C	AIF Required				Window/Floor Area Ratio (%)	Wall/Floor Area Ratio (%)	Window STC	Wall STC	Ventilation Requirements
								Road	Rail	Air	Overall					
A1	Units in: Block 2-1 facing SW and NE, Block C-1 facing SW and NE.	**65**	65	58	NO		2	25	23	0	27	80	100	**32**	**34**	FA
A2	Units in: Block 2-1 facing NNW.	**66**	66	58	YES		2	26	23	0	28	80	100	32	34	AC
A3	Units in: Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE , in Block B2-1 facing NNE and	**75**	60	74	YES		2	20	39	0	39	80	100	**44**	**46**	AC
A4		**63**	63	52	NO		2	23	17	0	24	80	100	28	30	FA
A5	Units in: Block A1-1 facing the SE	**62**	55	61	YES		2	15	26	0	26	80	100	**31**	**33**	FA
B1		**56**	55	50	NO		2	15	15	0	18	80	100	22	24	FA
B2	Units in: Block 2-2 facing SE, units in Block E-1 facing ESE	**62**	59	59	NO		2	19	24	0	25	80	100	**30**	**32**	FA
B3		**59**	58	54	NO		2	18	19	0	22	80	100	26	28	FA
C1		**63**	62	53	NO		2	22	18	0	23	80	100	**28**	**30**	FA
C2	Units in: Block C-1 facing NW.	**67**	65	61	YES		2	25	26	0	29	80	100	33	35	AC
C3	Units in: Block C-2 facing the SE and NE, in Block A2-2	**60**	55	58	NO		2	15	23	0	24	80	100	**29**	**31**	FA
D1	Units in: Block D1-1 facing WSW, units in Block D2-1 facing NE.	**71**	70	64	YES		2	30	29	0	33	80	100	37	39	AC
D2	Units in: Block D1-1 facing NNW.	**71**	70	64	YES		2	30	29	0	33	80	100	**38**	**40**	AC
D3	Units in: Block D1-1 facing ENE, in Block D2-1 facing SSW, in Block D3-3 facing SSW	**69**	68	60	YES		2	28	25	0	30	80	100	34	36	AC
D4	Units in: Block D2-1 facing NW, in Block D3-1 facing NNW, in Block D3-2 facing NNW. School windows facing NNW.	**72**	71	62	YES		2	31	27	0	32	80	100	**37**	**39**	AC
D5	School façade facing WSW	**72**	69	69	YES		2	29	34	0	35	80	100	39	41	AC
D6	Units in: Block D3-1 facing WSW and ENE, in Block D3-2 facing WSW and ENE.	**76**	75	69	YES		2	35	34	0	38	80	100	**43**	**45**	AC
D7	Units in: Block D3-3 facing NW.	**72**	72	61	YES		2	32	26	0	33	80	100	37	39	AC
D8	Units in Block D3-3 facing NNW, in Block F-2 facing NNE, in Block E-1 facing NNE	**73**	73	60	YES		2	33	25	0	34	80	100	**39**	**41**	AC
F1	Units in Block F-1 facing NNE	**75**	74	61	YES		2	34	26	0	35	80	100	39	41	AC
F2	Units in Block F-1 Facing WNW, in Block F-2 facing WNW	**73**	73	60	YES		2	33	25	0	34	80	100	**39**	**41**	AC
F3	Units in Block F-1 facing SSW	**67**	67	52	YES		2	27	17	0	27	80	100	31	33	AC

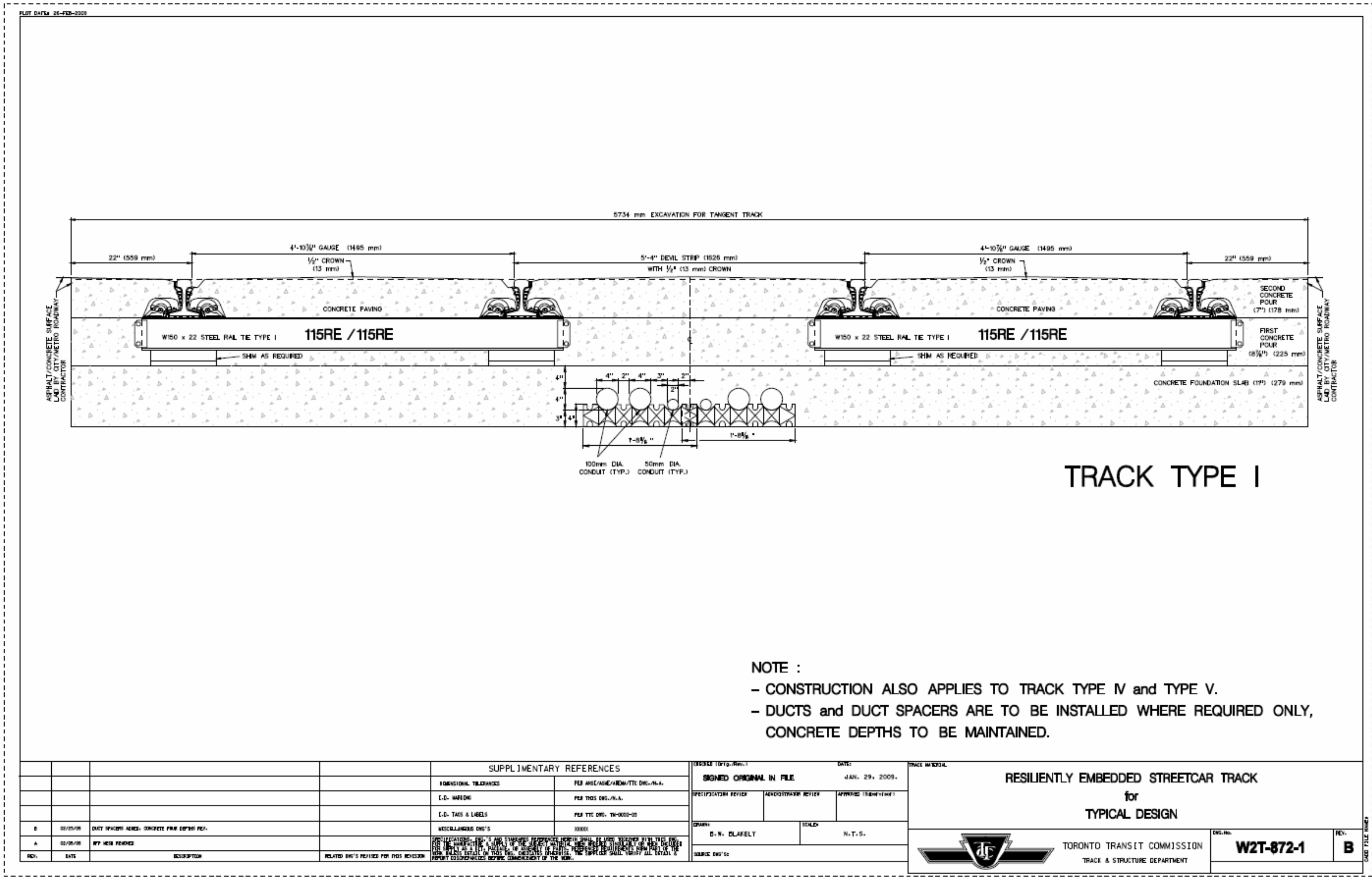
Daytime Building Envelope Noise Reduction Calculation

Representative Receptor	Applies to	Overall Leq	Road Leq	Rail Leq	Requires Component Design?	Aircraft (NEF)	Number of Room Components, C	AIF Required				Window/Floor Area Ratio (%)	Wall/Floor Area Ratio (%)	Window STC	Wall STC	Ventilation Requirements
								Road	Rail	Air	Overall					
A1	Units in: Block 2-1 facing SW and NE, Block C-1 facing SW and NE.	**60**	57	57	YES		2	22	27	0	28	80	100	**33**	**35**	FA
A2	Units in: Block 2-1 facing NNW.	**60**	57	57	YES		2	22	27	0	28	80	100	32	34	FA
A3	Units in: Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE , in Block B2-1 facing NNE and ESE.	**74**	71	71	YES		2	36	41	0	42	80	100	**47**	**49**	AC
A4		**54**	51	51	NO		2	16	21	0	22	80	100	26	28	FA
A5	Units in: Block A1-1 facing the SE	**61**	58	58	YES		2	23	28	0	29	80	100	**34**	**36**	AC
B1		**52**	49	49	NO		2	14	19	0	20	80	100	24	26	FA
B2	Units in: Block 2-2 facing SE, units in Block E-1 facing ESE	**60**	57	57	YES		2	22	27	0	28	80	100	**33**	**35**	FA
B3		**55**	52	52	NO		2	17	22	0	23	80	100	27	29	FA
C1		**56**	53	53	NO		2	18	23	0	24	80	100	**29**	**31**	FA
C2	Units in: Block C-1 facing NW.	**62**	59	59	YES		2	24	29	0	30	80	100	34	36	AC
C3	Units in: Block C-2 facing the SE and NE, in Block A2-2 facing S, units in Block A1-2 facing S, units in Block A1-1 facing SSW, units in Block B1-2 facing NNE	**59**	56	56	YES		2	21	26	0	27	80	100	**32**	**34**	FA
D1	Units in: Block D1-1 facing WSW, units in Block D2-1 facing NE.	**66**	63	63	YES		2	28	33	0	34	80	100	38	40	AC
D2	Units in: Block D1-1 facing NNW.	**65**	62	62	YES		2	27	32	0	33	80	100	**38**	**40**	AC
D3	Units in: Block D1-1 facing ENE, in Block D2-1 facing SSW, in Block D3-3 facing SSW	**62**	59	59	YES		2	24	29	0	30	80	100	34	36	AC
D4	Units in: Block D2-1 facing NW, in Block D3-1 facing NNW, in Block D3-2 facing NNW. School windows facing NNW.	**65**	62	62	YES		2	27	32	0	33	80	100	**38**	**40**	AC
D5	School façade facing WSW	**70**	67	67	YES		2	32	37	0	38	80	100	42	44	AC
D6	Units in: Block D3-1 facing WSW and ENE, in Block D3-2 facing WSW and ENE.	**70**	67	67	YES		2	32	37	0	38	80	100	**43**	**45**	AC
D7	Units in: Block D3-3 facing NW.	**63**	60	60	YES		2	25	30	0	31	80	100	35	37	AC
D8	Units in Block D3-3 facing NNW, in Block F-2 facing NNE, in Block E-1 facing NNE	**62**	59	59	YES		2	24	29	0	30	80	100	**35**	**37**	AC
F1	Units in Block F-1 facing NNE	**63**	60	60	YES		2	25	30	0	31	80	100	35	37	AC
F2	Units in Block F-1 Facing WNW, in Block F-2 facing WNW	**63**	60	60	YES		2	25	30	0	31	80	100	**36**	**38**	AC
F3	Units in Block F-1 facing SSW	**55**	52	52	NO		2	17	22	0	23	80	100	27	29	FA

Nighttime Building Envelope Noise Reduction Calculation

Appendix D

Embedded Track Vibration Isolators


5734 mm EXCAVATION FOR TANGENT TRACK
22" (559 mm)
4'-10⅞" GAUGE (1495 mm)
½" CROWN (13 mm)
5'-4" DEVIL STRIP (1626 mm)
WITH ½" (13 mm) CROWN
CONCRETE PAVING
W150 x 22 STEEL RAIL TIE TYPE I
115RE / 115RE
SHIM AS REQUIRED
SECOND CONCRETE POUR (7") (178 mm)
FIRST CONCRETE POUR (8⅞") (225 mm)
CONCRETE FOUNDATION SLAB (11") (279 mm)
ASPHALT/CONCRETE SURFACE LAID BY CITY/METRO ROADWAY CONTRACTOR
100mm DIA. CONDUIT (TYP.)
50mm DIA. CONDUIT (TYP.)
TRACK TYPE I
NOTE :
- CONSTRUCTION ALSO APPLIES TO TRACK TYPE IV and TYPE V.
- DUCTS and DUCT SPACERS ARE TO BE INSTALLED WHERE REQUIRED ONLY, CONCRETE DEPTHS TO BE MAINTAINED.
SUPPLIMENTARY REFERENCES
SIGNED ORIGINAL IN FILE
JAN. 29, 2009.
B.W. BLAKELY
N.T.S.
RESILIENTLY EMBEDDED STREETCAR TRACK
for
TYPICAL DESIGN
TORONTO TRANSIT COMMISSION
TRACK & STRUCTURE DEPARTMENT
W2T-872-1
B