First Capital
2150 Lake Shore Boulevard West

Noise & Vibration Impact Study

					
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Executive Summary

A Noise and Vibration Impact Study was prepared in support of Official Plan Amendment, Zoning By-law Amendment, and Draft Plan of Subdivision Application resubmission for the redevelopment of the 27.7 acre/11 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 noise and vibration sensitive land uses, namely a residential condominium and two potential schools. 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 significant 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 is traffic from the Gardiner Expressway and related ramps, Park Lawn Road, Lake Shore Boulevard West, the Queensway, the proposed Relief Road, Toronto Transit Commission (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 masonry construction for exterior walls within 100 metres from the rail tracks will be required at exterior façades exceeding 60 dBA for the rail traffic noise component over a 24-hour period. This level is achieved for at least one façade for all proposed sensitive uses within 100 metres of the rail corridor. Thus, brick veneer or acoustical equivalent masonry construction is required for exterior walls within 100 metres of the rail tracks. 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 a source of stationary noise in the area. Other sources include future stationary noise sources including 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 are developed, measures will be refined at the Site Plan stage, as the development could have a noise impact on itself or its surroundings.

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 Boulevard 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 measured for heavy rail train pass-bys along the Lake Shore West line. Future TTC streetcar vibration levels were conservatively predicted based on US Federal Transit Administration vibration emission levels for transit vehicles. 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, confirmation with the TTC is required during Site Plan stage to confirm 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 2.54×10^{-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

A Noise and Vibration Impact Study was prepared for the combined Official Plan Amendment, Zoning By-law Amendment, and Draft Plan of Subdivision Application resubmission for 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road ('the site') submitted by First Capital (Park Lawn) Corporation. The site will include sensitive land uses, namely residential condominiums and two potential schools. 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 Initial Master Plan Proposal (October, 2019)

In October 2019, First Capital (Park Lawn) Corporation filed an Official Plan Amendment (OPA) application on behalf of First Capital (Park Lawn) Corporation and 2253213 Ontario Limited ('the Owners') that establishes a framework for a transit-oriented mixed-use master plan redevelopment of a 27.7 acre/11 hectare site 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 ("the site" or "2150 Lake Shore").

The initial Master Plan Proposal introduced a new proposed Park Lawn GO station integrated with Toronto Transit Commission (TTC) streetcar and bus stations. A network of fine-grained internal streets was proposed and connected the site to the surrounding network, while a new 'relief road' was proposed along the northern edge of the site to function as an alternative access to the Gardiner Expressway and a bypass route for through traffic on Park Lawn Road and Lake Shore Boulevard West, providing traffic relief to the community.

A diverse open space system was proposed across the site, including a new 0.5-hectare public park, a covered Galleria, three urban squares and a series of largos (enlarged sidewalks), lanes and pedestrian mews woven into a rich public realm network. The existing water tower on the site was proposed to be retained as a historic landmark.

A diverse mix of uses were proposed including significant employment uses comprising office-type, retail, entertainment, and service uses. 1.4 hectares of General Employment Areas were proposed along the Gardiner Expressway on the north edge of the site. Significant residential uses were also proposed with approximately 7,500 new units, including larger 2- and 3-bedroom family-sized units, as well as affordable housing units. The proposal featured a distinct assembly of built form typologies including low, mid and high-rise buildings. Fifteen towers were proposed, ranging in height between 22 and 71 storeys.

2.1.2 *The May 2020 Master Plan Proposal*

The May 2020 Master Plan proposal maintained the fundamental vision and features of the initial 2019 Master Plan proposal, including the provision of an integrated GO/TTC transit hub, a new relief road and a fine-grained internal street network, a covered galleria lined with retail and amenities, significant employment, diversity of housing options, and unique architecture featuring a blend of built form and uses. The height of proposed towers ranged from 16 to 70 storeys. The May 2020 proposal featured the following key changes:

- Provision of an enlarged park of approximately 1 hectare
- Accommodation of two potential elementary schools in response to the Toronto District School Board and Toronto Catholic District School Board's interest in co-locating schools within the Master Plan site
- Increased provision of employment GFA by approximately 33%, and locating the General Employment Areas around the GO station and in the central Galleria block, creating a cluster of office-type uses proximate to regional transit, public park, and retail and amenities in the Galleria
- Refinements to the built form to reinforce a pedestrian-scaled street wall along Park Lawn Road and Lake Shore Boulevard West through measures such as shifting towers behind mid-rise buildings and introducing setbacks
- Conversion of previously proposed street into a pedestrian plaza that extends Station Square to Park Lawn Road, creating a safe and convenient pedestrian connection between the proposed TTC bus activity along Park Lawn Road and the GO station

2.1.3 *The Current Master Plan Proposal (February 2021)*

The current Master Plan proposal has further evolved as a result of the continued effort to align with key feedback from various City departments and commenting agencies, as well as with policy directions emerging out of the City's draft Christie's Secondary Plan. The current proposal maintains the vision and key features of the May 2020 Master Plan proposal, incorporating the following additional revisions:

- Boulevard Square Park: In addition to the 1- hectare Community Park, the current proposal adds the 2,500 m2 Boulevard Square as a public park. This addition brings the proposed total on-site parkland provision to 1.25 hectares, nearly 2.5 times the size in the initial Master Plan proposal. As Boulevard Square was previously proposed as a privately-owned publicly-accessible space (POPS) with an underground parking structure below, this change required a reconfiguration and redistribution of parking areas to ensure that Boulevard Square Park is now fully unencumbered. The overall open space system continues to make up 42.6% of the net site area.
- New Community Uses: Discussions on community benefits with City staff have advanced since the May 2020 proposal. The current proposal now includes two daycares, a community recreation centre, a public library, and a not-for-profit community agency space,

all to be delivered on site in contributing to the Master Plan vision of creating a complete community. These facilities are intended to be secured through a Section 37 agreement with the City, subject to review and finalization. These new facilities are proposed in addition to the space allocated for two potential schools within the site. It is noted that the actual realization of these schools rely on a number of factors including approval and funding by the Ministry of Education, to be secured by the two School Boards.

- A Sunnier Community Park: Access to sunlight in the proposed Community Park has been improved by shifting height and density away from the south and east of the park. With the exception of shadows cast by the existing context surrounding the site, the May 2020 proposal achieved no new net shadow on 70% of the park for 5 continuous hours during spring and autumn equinoxes. With the redistribution of height and density, the current Master Plan exceeds the more rigorous sunlight metric in the draft Christie's Secondary Plan to create no new shadows on 85% of the park or more for 5 continuous hours, achieving 6 continuous hours between 9:18 and 15:18.
- Enhanced Street Wall along Park Lawn, Lake Shore, and the Loop Road: A number of built form refinements have been made in reinforcing pedestrian-scaled street walls along Park Lawn Road, Lake Shore Boulevard West, and the loop road. This involved reducing street wall heights to be no taller than the width of the right-of-way on these streets, and stepping back upper floors of some mid-rise and podium buildings.
- Retention of the Water Tower in Station Square: As a response to City Staff comments, the historic water tower is now proposed to be located in Station Square, from its previous location in the Community Park. At this location, the water tower will have visual prominence as it will remain visible from the Gardiner Expressway, and also visible from a number of other key locations including Park Lawn Road, the loop road, and the proposed Community Park.
- Overall Redistribution of Height and Density: The revisions noted above; enhanced sunlight in the Community Park, new community facilities, and reinforcing the pedestrian scale; have all resulted in overall shifts in heights and distribution of density across the site. This has generally resulted in taller tower heights to the north of the Community Park and along Park Lawn Road, and lower tower heights to the immediate south and east of the Park. As a result, tower heights now range between 28 and 70 storeys, maintaining the 70 storey height peak at the proposed GO station. These revisions have also resulted in a modest increase in the overall density of the project. This includes non-residential density associated with the introduction of the proposed library, community recreation centre, two daycares, and community agency space, along with a 4.9% increase in residential density above the May 2020 Proposal associated with the costs of delivering the comprehensive package of new community benefits identified by the City.
- A Wider Loop Road: The central loop road has been widened from a 23-metre right-of-way in the May 2020 submission to a 26-metre right-of-way in discussion with City staff. The portion of the street along the proposed Community Park has also been widened from 20

metres to 22 metres. Taking a complete streets approach, the widened right-of-way accommodates wider pedestrian zones, vehicle lanes, planting zones, a bi-directional multi-use trail, and TTC streetcar tracks, balancing the needs of all users.

2.2 Description of Development Area

The redevelopment of the 11 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 future Relief Road is also deemed a significant transportation noise source.

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. They represent the different identified noise and vibration sensitive uses within the subject property, which include residential uses and two potential schools. Note that other potential proposed sensitive institutional uses include daycares, a community centre, and a library. The location of these latter uses have not been finalized, thus they will be assessed as part of the Site Plan Application.

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
D2			Y	Y	Facing N, elevated
D3			Y	Y	Facing SW, elevated
D4			Y	Y	Facing NW, elevated
D5		School/Residential	Y	Y	Facing NW, ground floor
D6		School/Residential	Y	Y	Facing NW, elevated
D7		Residential	Y	Y	Facing NW, elevated
D8			Y	Y	Facing N, elevated
E1	E	Residential	Y	N	Facing S, elevated
E2			Y	N	Facing S, 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

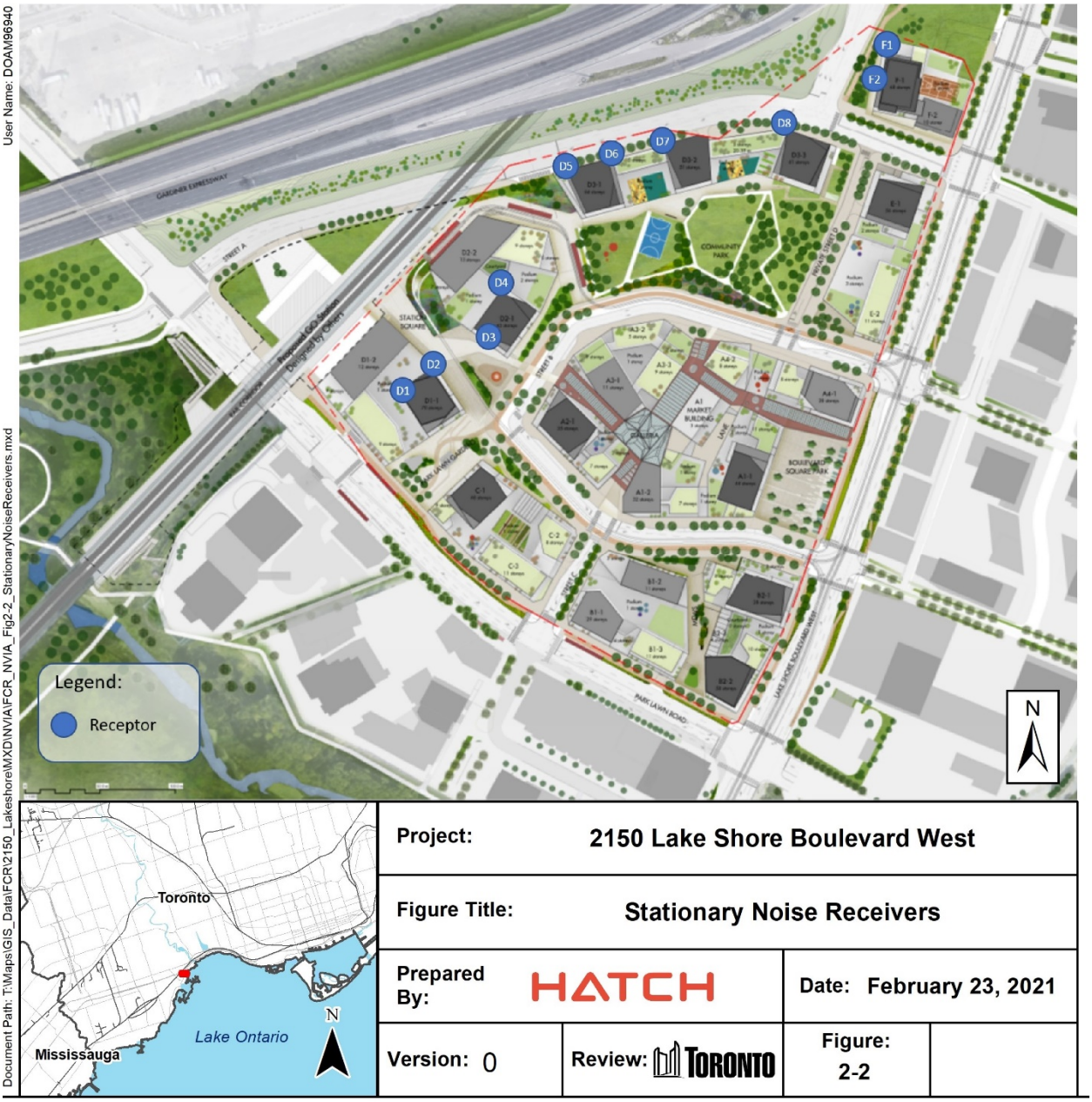

Figure 2-2: Stationary Noise Sensitive Receptors

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.

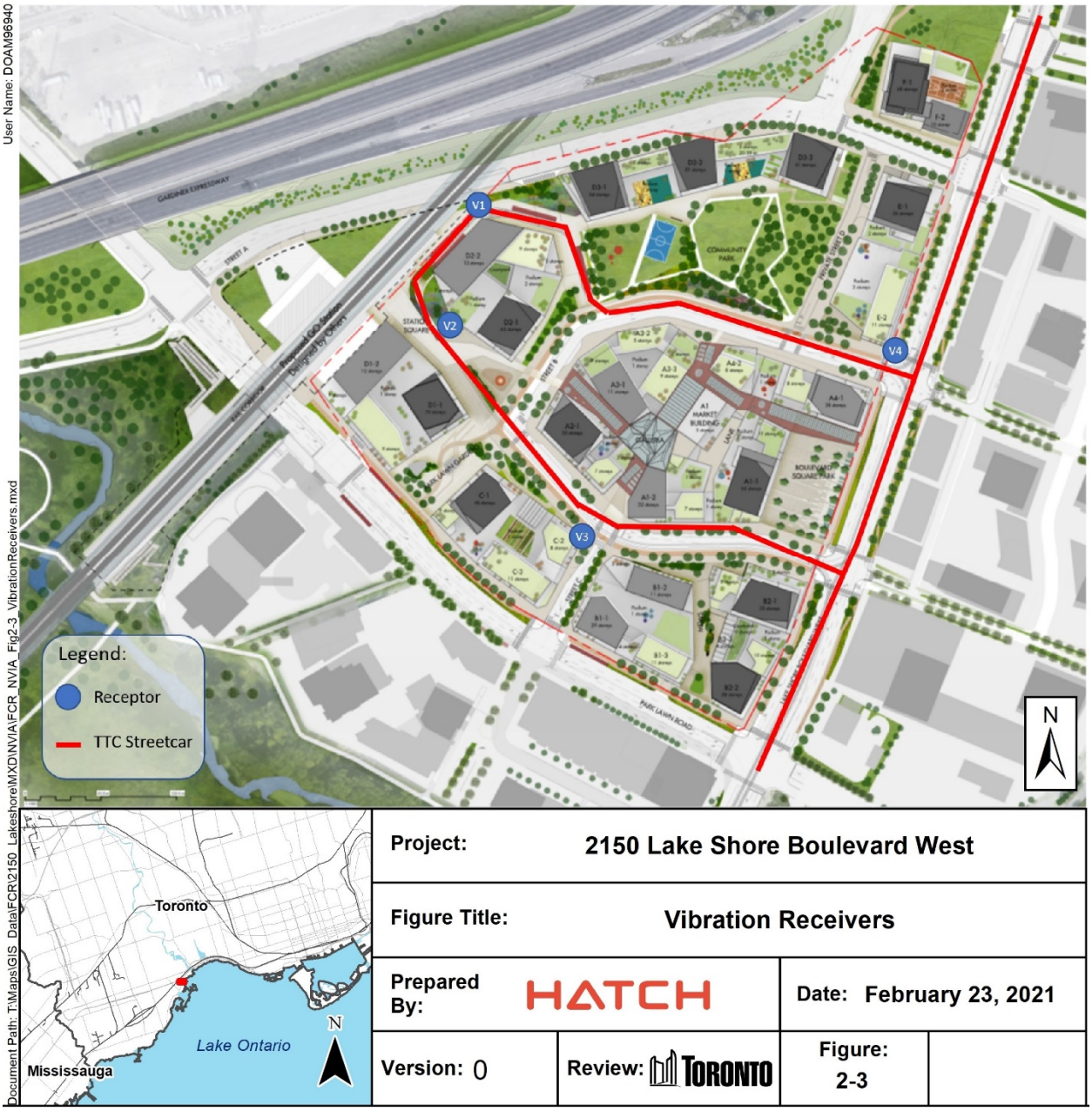

Figure 2-3: Vibration Points of Reception

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.

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 for year 2028. It is understood that year 2028 represents worst-case conditions; future years are expected to see a larger non-auto transportation modal split and thus a lowering in automobile vehicular traffic in the area. These are summarized in Table 3.1: Roadway Traffic Data Inputs and further details are provided in Appendix C. 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	28,040	1%	2%	3,115	3%	2%
Park Lawn Rd.	Immediately South of Gardiner Expy EB Off Ramp	23,850	0%	1%	2,650	0%	1%
Park Lawn Rd.	Immediately North of Lake Shore Blvd W	17,100	0%	1%	1,900	0%	1%
Lake Shore Blvd W.	Immediately West of Park Lawn Rd	22,530	1%	1%	2,505	1%	1%
Lake Shore Blvd. W.	Immediately East of Park Lawn Rd	24,170	1%	1%	2,685	0%	1%
Lake Shore Blvd. W.	Immediately East of Brookers Ln	12,025	0%	2%	1,335	0%	1%
The Queensway	Immediately East of Park Lawn Rd	38,090	1%	1%	4,230	3%	1%
Gardiner Expy WB On Ramp	From Park Lawn Rd	14,370	3%	2%	1,595	8%	3%
Gardiner Expy EB Off Ramp	To Park Lawn Rd	16,125	1%	1%	1,790	2%	2%
Gardiner Expy Ramps/ Relief Road	To/From Relief Rd (Lake Shore)	13,660	0%	1%	1,515	0%	0%
Gardiner Expy	Between Park Lawn Rd and Humber River	141,770	2%	2%	25,020	5%	2%

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.

The train volumes and train consists included in this assessment are based on year 2037 data obtained from Metrolinx. It is unknown if the electric/diesel train consists from 2037 data can be applied to a 10-year horizon or will be achieved by year 2037. Thus, the train consists were conservatively assumed to be diesel trains consisting of two locomotives and 12 cars (D2L12), with a locomotive at each end of the consist. 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. Please see further details in Appendix C.

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 Transit Passenger – (Revenue)	EB & WB	219	42	105	2	12
GO Transit Passenger – (Non-Revenue)	EB & WB	37	5	105	2	12
VIA Passenger – (Revenue)	EB & WB	15	1	105	1	5
VIA Passenger - (Non-Revenue)	EB & WB	19	9	105	1	30
Freight – CN Rail	EB & WB	1	0	105	1	25
TTC Streetcar Lakeshore W	EB & WB	210	98	50	--	--
TTC Internal Loop	EB & WB	210	98	30	--	--

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.

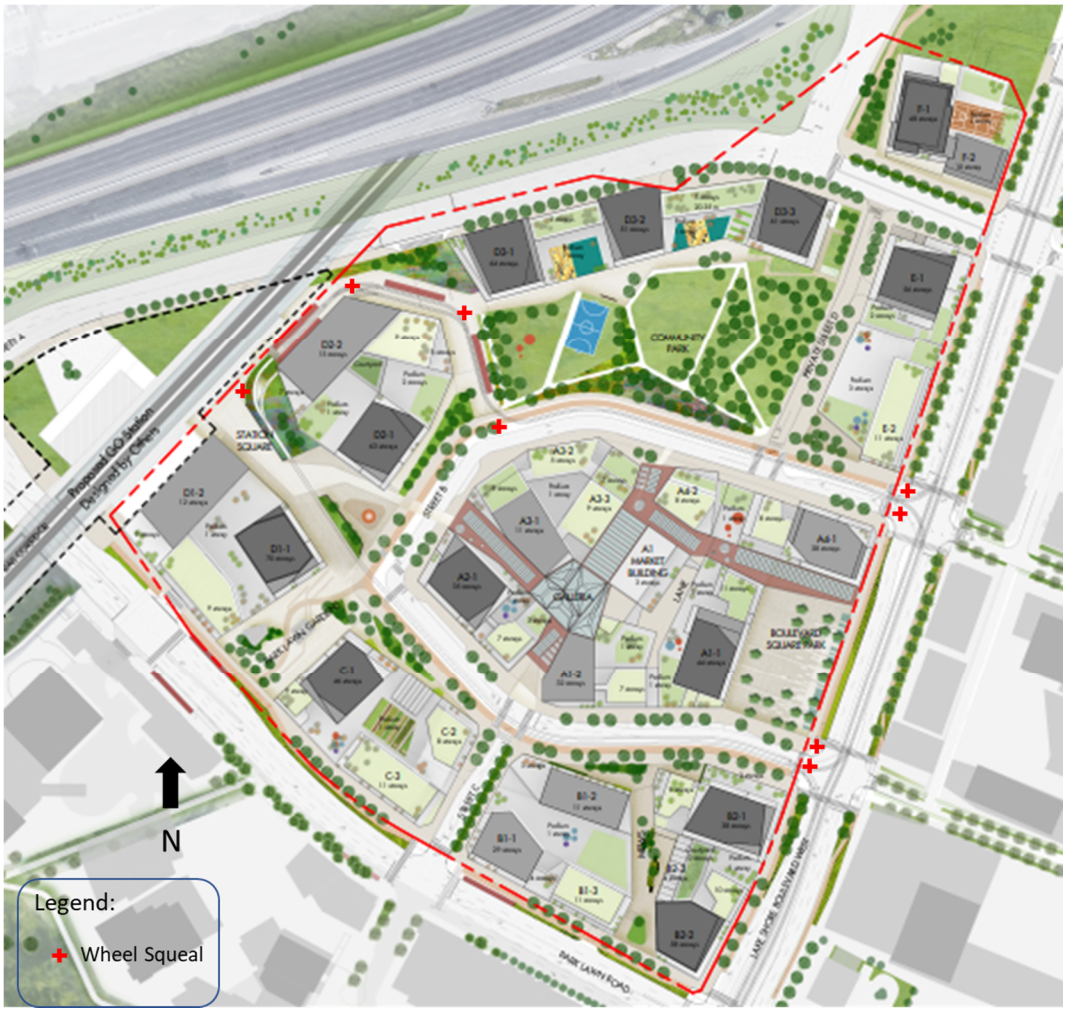

Figure 3-1: Point Source Locations Representing TTC Streetcar Wheel Squeal Events

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.

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. Refrigerated (Reefer) truck sound power levels from reference [22] as levels were higher than those from Hatch's sound level library.

Table 3.3: Stationary Noise Sources 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
Reefer	118	110	105	99	93	89	86	85

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.
- The Ontario Food Terminal 100 reefers conservatively modelled to be operating 100 percent of the time during the daytime, evening and nighttime periods. Conservatively, no directivity or shielding from the trailers or other obstacles within the terminal were accounted for.
- Truck pass-bys within the Ontario Food Terminal were modelled based on traffic peak hour data extracted from reference [12]. All trucks were assumed to travel at 40 km/h within the terminal.

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 Analysis

3.3.1 Vibration Measurements

The LDS Dactron Focus II Dynamic Signal Analyzer with high sensitivity seismic transducers model 3191A with sensitivities of 4,804 mV/g and 4,700 mV/g were utilized for the vibration measurements. Two transducers were ground mounted 24.5 metres (nearest building footprint to tracks) from the track to bare earth, both locations equidistant to the track. This is to account for potential variations in ground composition, allow a comparison of measurements at the same distances, and provide redundancy in case of equipment failure. This setup is shown in Figure 3-2. The vibration instrumentation specification can be found in Appendix B.

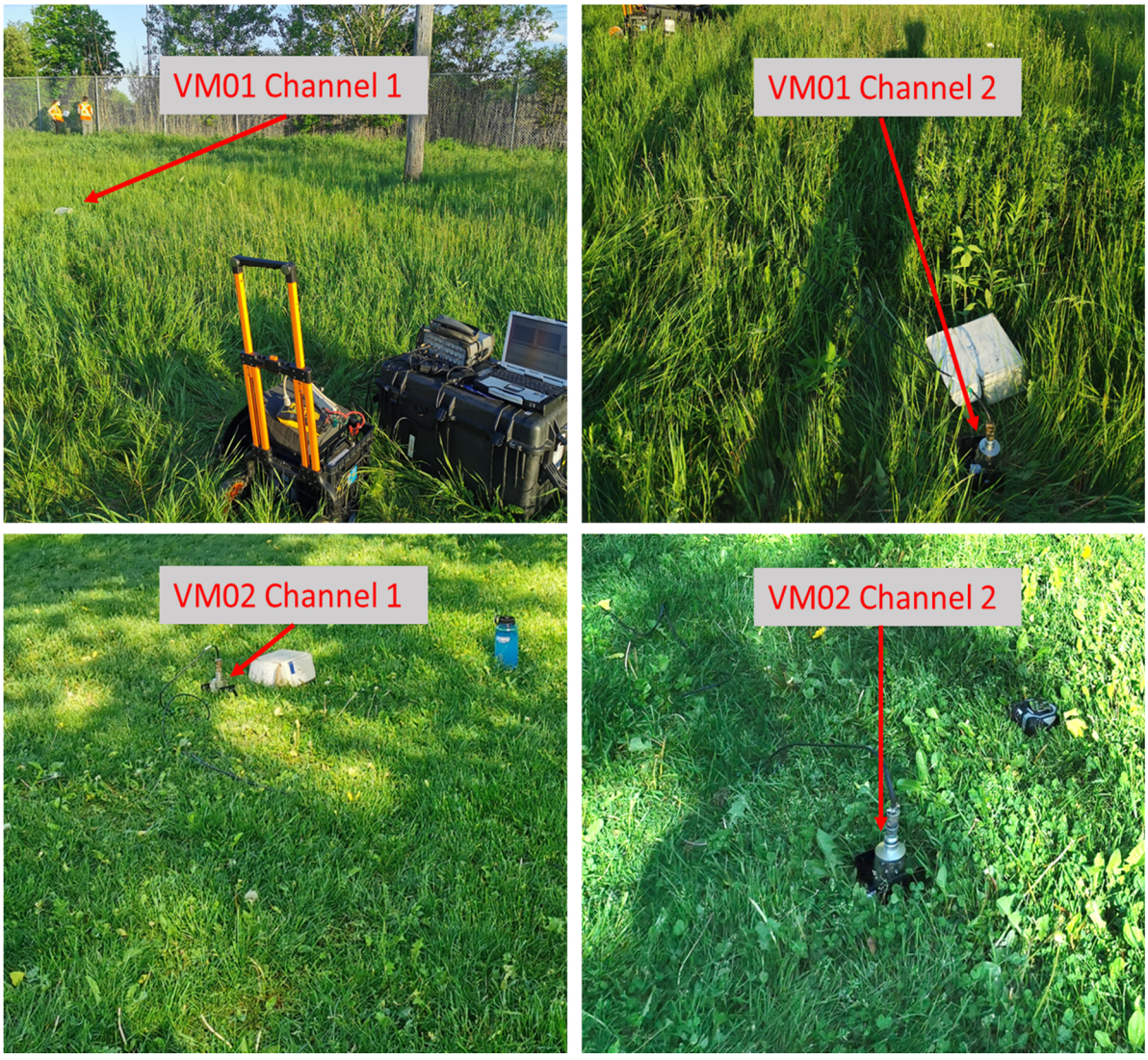

Figure 3-2: Vibration Instrumentation Setup

3.3.2 Vibration Modelling

The TTC was consulted regarding the availability of TTC streetcar vibration levels, but these were not available. It is noted that even if measurements were available, these may not be representative of the proposed loop conditions (ground composition, operating speeds, track conditions, track curve radii, track support system, etc.). Thus, a modelling approach was undertaken to predict TTC streetcar loop vibration levels with the intent of ensuring feasibility of vibration control. A more detailed analysis may be required to specify vibration control measures once further details regarding the TTC streetcar loop become available.

The anticipated vibration levels resulting from the proposed TTC streetcar loop were predicted using the general vibration assessment method described in Chapter 10 of the US Federal

Transit Administration (FTA) guidelines [1]. A rationale is provided below in this section regarding the suitability of FTA vibration emission levels.

Using the generalized ground surface vibration curve for *Rapid Transit or Light Rail Vehicles*, as illustrated in Figure 3-3, 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.

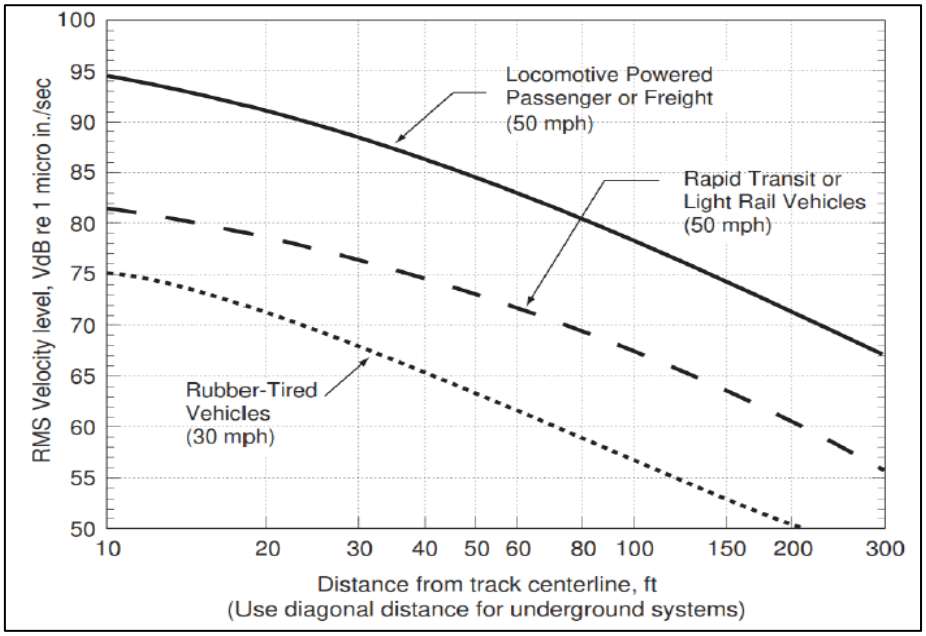

Figure 3-3: Generalized Ground Surface Vibration Curves

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.

3.3.3 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.

- The TTC was consulted regarding the availability of TTC streetcar vibration data. As this data was unavailable, FTA vibration levels from the 'Rapid Transit or Light Rail Vehicles' curve was compared to measured levels from Aercoustics [23][24], JE Coulter [25] and SENES Consultants Limited [26]. Vibration levels from these references were normalized such that they represent a speed of 30 km/h and a distance of 3 and 7 metres. The upper-range resulting levels are 0.12 mm/s RMS (3 metres) and 0.07 mm/s RMS (7 metres). The FTA reference curves yield levels of 0.23 mm/s RMS and 0.16 mm/s RMS, at 3 and 7 metres, respectively. Thus, FTA reference curves are deemed conservative and deemed suitable for this preliminary vibration analysis.
- 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 [12], 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.

Modelling Parameter	Value					Basis of Assumption
	V1	V1	V2	V3	V4	
	MX Corridor	TTC Streetcar	TTC Streetcar	TTC Streetcar	TTC Streetcar	
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.
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 masonry 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	Type 'A' Warning Clause

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 2021 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. Note that evening background levels correspond to nighttime ambient levels.

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	67	63	63
D2	67	63	63
D3	66	62	62
D4	68	64	64
D5	69	65	65
D6	71	67	67
D7	71	66	66
D8	69	65	65
F1	70	65	65
F2	70	65	65

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 4.5 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 A2-A3, D2-D8, and F1-F3. 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. See Appendix F for the noise contour figures.

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	59	59	62	55	55	58	AC Provisions	NO
A2	60	60	63	56	56	59	AC Provisions	**YES**
A3	61	62	65	55	62	63	AC	**YES**
A4	60	57	62	56	54	58	AC Provisions	NO
A5	56	50	57	49	48	52	AC Provisions	NO
B1	59	52	60	53	49	54	AC Provisions	NO
B2	61	56	62	54	55	57	AC Provisions	NO
B3	50	55	56	43	53	54	AC Provisions	NO
C1	62	56	63	56	53	58	AC Provisions	NO
C2	63	56	64	58	53	59	AC Provisions	NO
C3	53	57	58	49	54	56	AC Provisions	NO
D1	64	58	65	60	55	61	AC	NO
D2	67	63	69	63	59	64	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.		
D3	65	62	67	61	58	63	AC	**YES**
D4	68	64	69	64	60	65	AC	**YES**
D5	65	70	71	61	66	67	AC	**YES**
D6	71	64	72	67	60	67	AC	**YES**
D7	69	63	70	64	59	65	AC	**YES**
D8	68	62	69	64	58	65	AC	**YES**
E1	63	55	64	57	52	58	AC Provisions	NO
E2	65	58	65	60	54	61	AC	NO
F1	70	62	71	66	58	66	AC	**YES**
F2	69	61	69	64	57	65	AC	**YES**
F3	65	58	66	61	54	61	AC	**YES**
F4	63	55	64	57	53	59	AC Provisions	NO

Outdoor living areas were not identified on the Master Plan architectural plans. Station Square, Boulevard Square Park and the Community 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 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 D. 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 NNW, in Block E-1 facing NW	A2	30	31	33
Units in: Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE, in Block B2-1 facing NNE and E	A3	33	37	39
Units in: Block D1-1 facing NNW.	D2	36	37	39
Units in: Block D1-1 facing the ENE, Block D2-1 facing SW, Block D2-1 facing NE, Block D3-2 facing ESE.	D3	33	34	36
Units in: Block D2-1 facing NW.	D4	37	38	40
School façade facing WSW, units in Block D3-1 facing the WSW	D5	39	40	42
Units in: Block D3-1 facing NNW, in Block D3-2 facing NNW. School windows facing NNW.	D6	38	39	41
Units in: Block 3-1 facing ENE, Block D3-2 facing W & WSW.	D7	36	36	38
Units in Block D3-3 facing NNW and NNE	D8	36	37	39
Units in Block F-1 facing NNE	F1	36	37	39
Units in Block F-1 Facing NW	F2	36	36	38
Units in Block F-1 facing SSW, in Block 3-1 facing SSE, in Block D3-2 facing SSE, in Block D3-3 facing SW	F3	31	32	34

In addition to the wall STC requirements presented in Table 5.2, NPC-300 requires brick veneer or acoustical equivalent masonry construction for exterior walls within 100 metres from the rail tracks, if rail sound levels are predicted to exceed 60 dBA (averaged over 24 hours). Thus, in addition to the wall STC requirements above, brick veneer or acoustical equivalent masonry exterior walls are required for the following exterior walls. As the intent is to mitigate low-frequency locomotive noise, brick veneer or acoustical equivalent masonry construction for exterior walls are recommended to provide at least 35 dB of Transmission Loss at 63 Hz. This typically results in an exterior wall with at least STC 55, exceeding requirements noted in Table 5.2.

This only applies to the following residential uses, unless otherwise stated:

- Exterior walls facing WSW, NNW and ENE in Block D1-1;
- Exterior walls facing NW, SW and NE in Block D2-1;
- Exterior walls facing NNW, WSW, and ENE in Block D3-1;
- Exterior walls facing NNW, WSW, W and ENE in Block D3-2; 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	Applicable Location
Type ‘A’	"Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment, Conservation and Parks."	In general, all residential units with access to an Outdoor Living Area (e.g. units with a balcony with a min of 4 metres in width, or with access to other outdoor amenity area, where unmitigated levels are greater than 55 dBA and less than or equal to 60 dBA. Specific blocks/units to be specified once floor plans become available.
Type ‘B’	"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic and rail traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the	In general all residential units with access to an Outdoor Living Area (e.g. units with a balcony with a min of 4 metres in width, or with access to other outdoor amenity area, where it is unfeasible to reduce sound levels to 55 dBA

Warning Clause	Suggested Wording	Applicable Location
	Municipality and the Ministry of the Environment."	through noise control measures. Specific blocks/units to be specified once floor plans become available.
Type 'C'	"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments 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."	All residentials units and school (if not provided with central air conditioning system).
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."	All residentials units and school (if provided with central air conditioning system).
Type 'E'	"Purchasers/tenants are advised that due to the proximity of the adjacent school, noise from the school may at times be audible."	Residences in Block D
Metrolinx	"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."	All Sensitive Uses

Warning Clause	Suggested Wording	Applicable Location
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	All Sensitive Uses

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	67	54	63	54	63	54	No
D2	67	60	63	60	63	60	No
D3	66	61	62	61	62	61	No
D4	68	62	64	62	64	62	No
D5	69	57	65	57	65	57	No
D6	71	64	67	64	67	64	No
D7	71	64	66	64	66	64	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	
D8	69	62	65	62	65	62	No
F1	70	61	65	61	65	61	No
F2	70	60	65	60	65	60	No

6. Vibration Analysis Findings

6.1 Vibration Measurement Results – Existing Train Traffic

A total number of four GO Transit train passes were measured at the shortest future building to track distance. These measured levels are summarized in Table 6.1. All measured levels are compliant as they are below the 0.14 mm/s RMS criteria. Details regarding the measurements are provided in Appendix B.

Table 6.1 Measured Vibration Levels GO Transit Trains

Monitor Location	Channel	Distance from Tracks (m)	Avg Measured Vibration Level of all train passes (mm/sec, RMS)*	Max. Measured Vibration Level of all train passes (mm/sec, RMS)	Compliant?
VM-01	1	24.5	0.07	0.12	Yes
	2	24.5	0.09	0.13	

6.2 Vibration Modelling Results – Future TTC Streetcar Loop

Table 6.2 summarizes the predicted vibration levels for the TTC Streetcar Loop at the identified vibration receptors.

Table 6.2: Predicted Vibration Levels

Receiver	Vibration Source	Predicted Vibration Level (mm/s RMS)	Limit (mm/sec RMS)	Exceeds Limit?
V1	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 6.3.

Table 6.3: 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

The TTC is to confirm 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 E for a sample drawing illustrating vibration isolation.

Once further details are available for the TTC streetcar internal loop, including operating speeds, curve radii, type of track and support system, a more detailed assessment can be undertaken, including TTC Streetcar measurements at a proxy representative location if available. This will assist in identifying and fine-tuning vibration control measurements.

6.3 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.
- It possible to mitigate indoor ground-borne noise with floating slabs at special trackwork location, for streetcar speeds of up to 30 km/h.

7. Implementation Procedures

At the Site Plan Approval Stage, a detailed Noise and Vibration Impact Study should be prepared to update this study. This is typically achieved when details regarding the mechanical equipment within the proposed developments are prepared, as well as detailed floor plans, OLA locations, window or wall to floor ratios. In addition other details pertinent to noise and vibration, will become available.

Any future Development Agreement(s) that may be required in connection with this phase of the planning process should include the requirements for all the necessary noise control measures and procedures as outlined in the noise study to the satisfaction of all concerned parties.

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 and Vibration 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, 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 window STCs, where the loop meets Lake Shore Boulevard West. Once the streetcar loop schedule is determined, STC requirements could be further optimized.

  - Furthermore, brick veneer or acoustical equivalent masonry 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 during the Site Plan stage, as the development could have a noise impact on itself.
- Similarly, once more details become available about potentially sensitive institutional uses (e.g. library, daycare centre, community centre, etc.), this study should be reviewed as part of the Site Plan Application.
- Vibration levels were measured for GO Transit train pass-bys along the Lake Shore West rail corridor. Based on the measurements, GO vibration levels due to train pass-bys along the Lake Shore West corridor will be within the applicable limits.
- Vibration levels were predicted for TTC streetcar pass-bys along the proposed loop. Vibration limits will be exceeded in the vicinity of the boarding/loading platforms by Block D2-2 due to TTC streetcar pass-bys. However, it is feasible to mitigate vibration levels to comply with the applicable criteria at this most stringent location.
  - 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 an overview of the track radii and on the pedestrian mixed-traffic conditions this streetcar loop will be operating on. Based on a sensitivity analysis, vibration levels will become

compliant at speeds of 15 km/h or lower. Thus, confirmation with the TTC is required during Site Plan stage 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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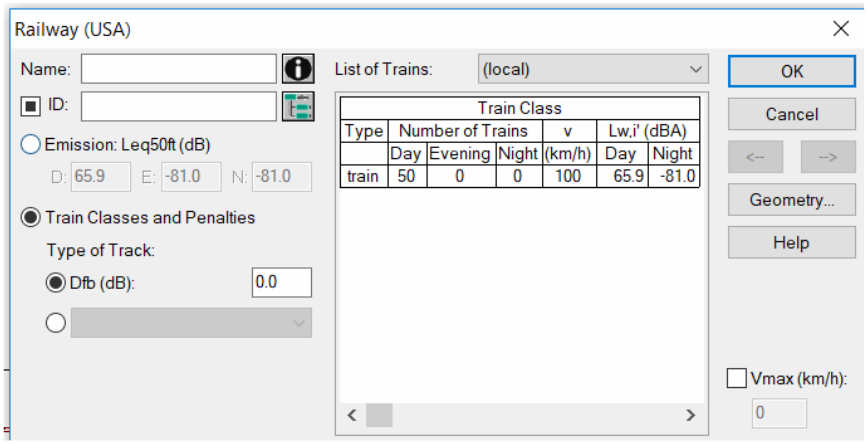
Appendix A

ORNAMENT/STEAM Comparison with FTA/TNM

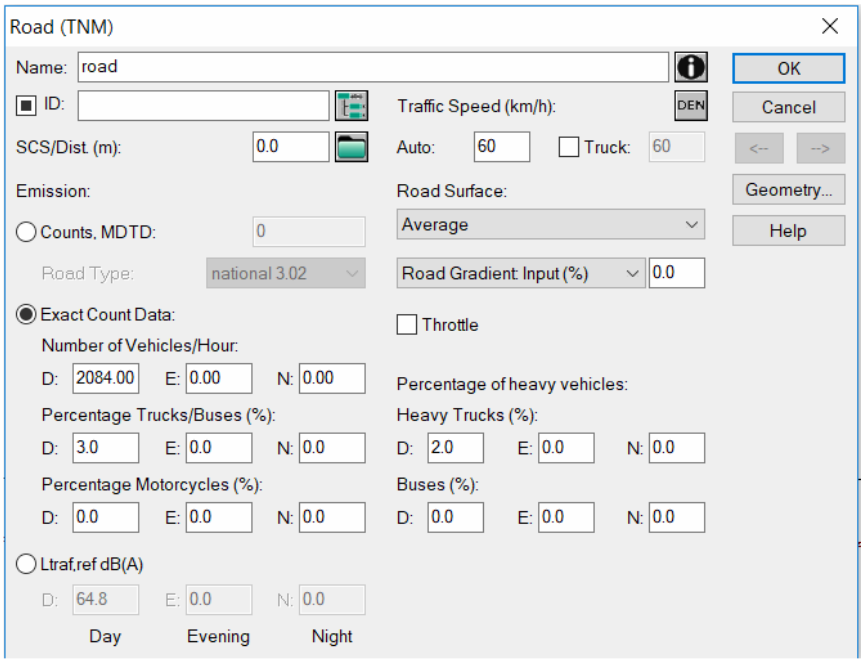
Below are the levels for a sample road and rail segment based on CadnaA (FTA + TNM2.5 algorithms) and STAMSON V5.0 (ORNAMENT and STEAM algorithms). There is a difference of 2 dB between the levels calculated using the CadnaA and STAMSON methods for road and rail traffic noise prediction.

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

```
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
----------------------------------
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

Vibration Instrumentation Specification and Vibrations Measures

Table 9-1: Summary of Vibration Measurements

Value	S1T12Ch1	S1T12Ch2	S1T3Ch1	S1T3Ch2	S1T4Ch1	S1T4Ch2	S1T5CH1	S1T5CH2
RMS (mm/s)	0.12	0.13	0.06	0.06	0.08	0.07	0.03	n/a
Peak (mm/s)	0.66	0.66	0.30	0.43	0.42	0.31	0.16	n/a
Notes	GO Passenger. EB + WB simultaneous pass-	GO Passenger. EB + WB simultaneous pass-	GO Passenger. WB	GO Passenger. WB	GO Passenger. EB	GO Passenger. EB	GO Passenger. WB	Discarded due to cable malfunction
RMS Avg Ch1 (mm/s)	0.07							
RMS Avg Ch2 (mms/)	0.09							

Note that Figure 9-1 to Figure 9-7 present the velocities in the form of Peak Particle Velocity (PPV) in mm/s.

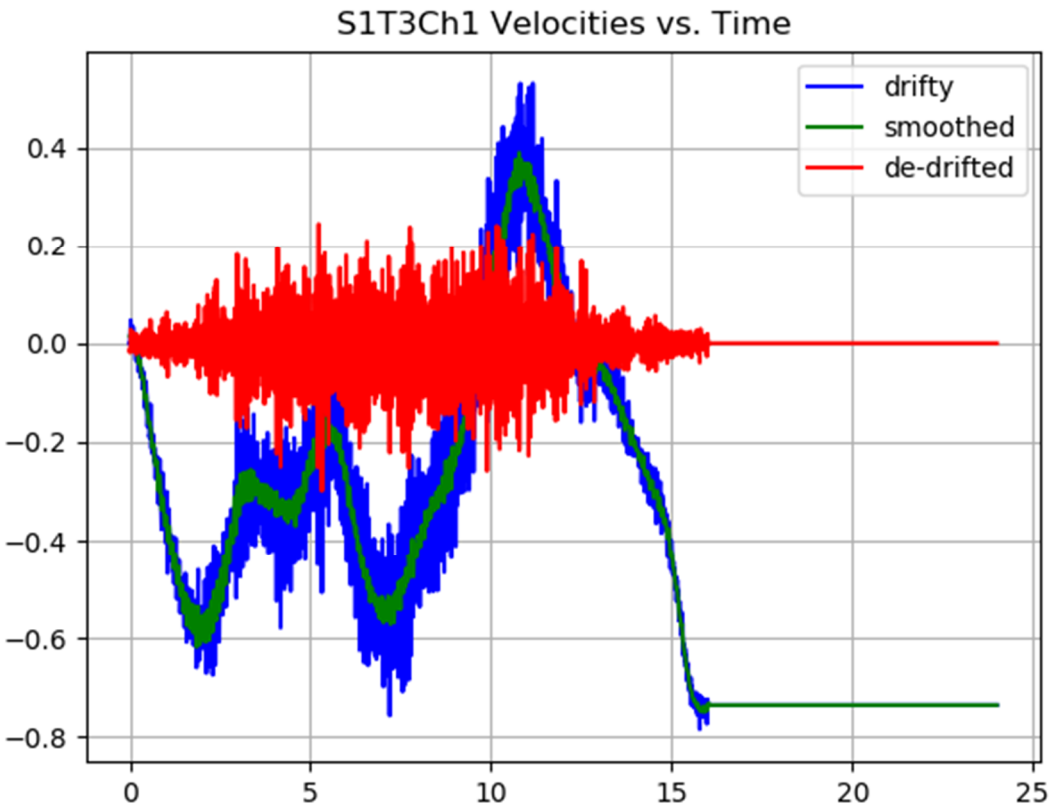


Figure 9-1: Site 1, Train 3, Channel 1 Measured Velocity, in mm/s, as a Function of Time

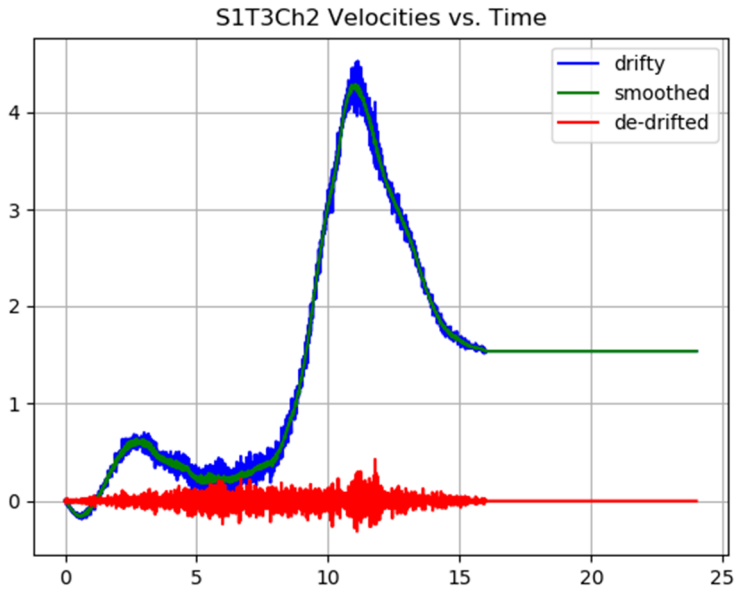


Figure 9-2: Site 1, Train 3, Channel 2 Measured Velocity, in mm/s, as a Function of Time

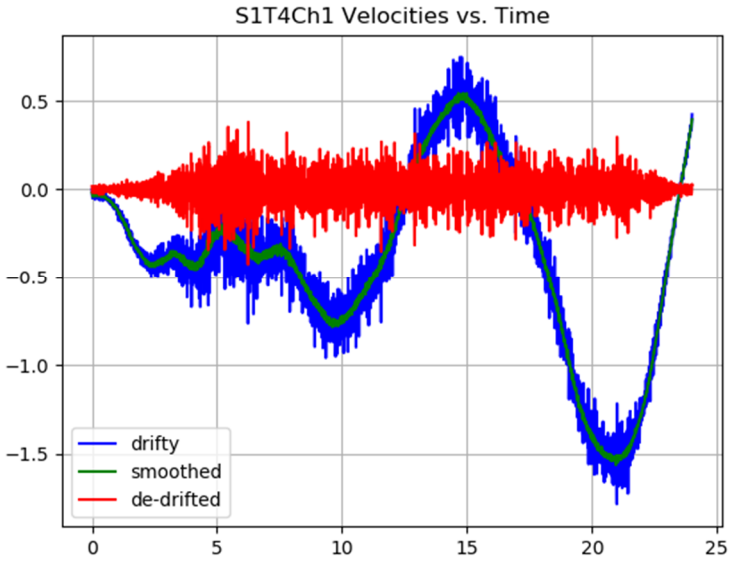


Figure 9-3: Site 1, Train 4, Channel 1 Measured Velocity, in mm/s, as a Function of Time

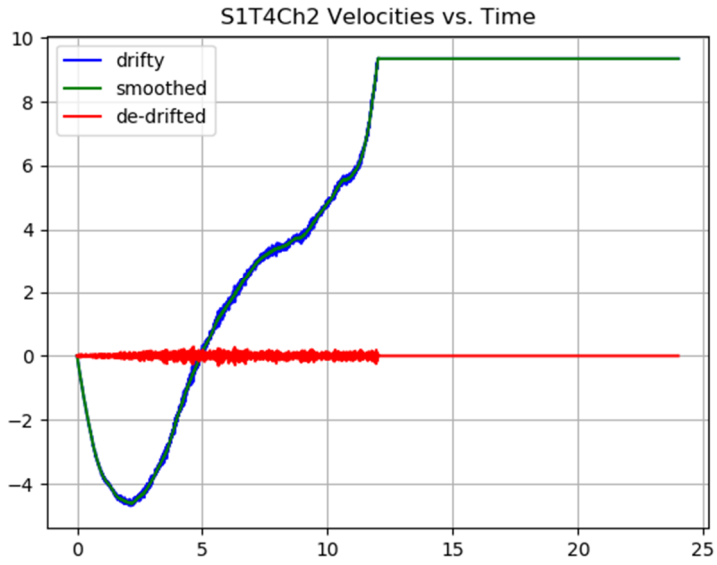


Figure 9-4: Site 1, Train 4, Channel 2 Measured Velocity, in mm/s, as a Function of Time

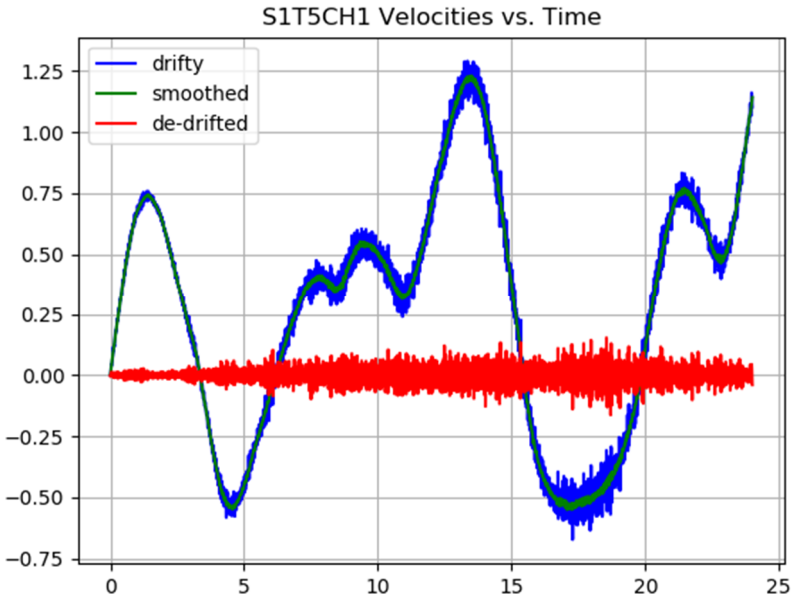


Figure 9-5: Site 1, Train 5, Channel 1 Measured Velocity, in mm/s, as a Function of Time

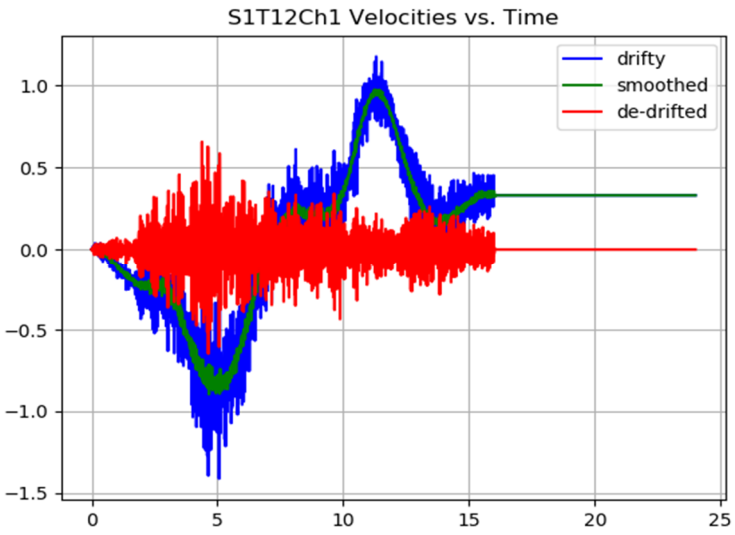


Figure 9-6: Site 1, Train 12, Channel 1 Measured Velocity, in mm/s, as a Function of Time

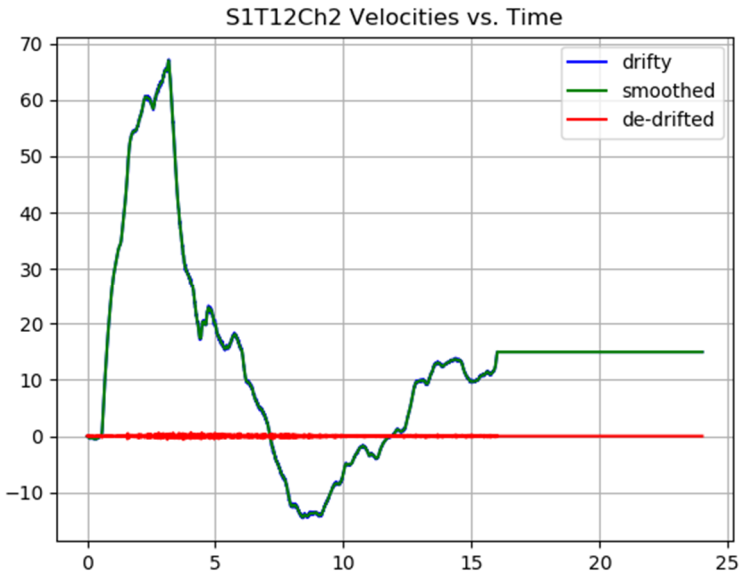


Figure 9-7: Site 1, Train 12, Channel 2 Measured Velocity, in mm/s, as a Function of Time

Appendix C

Traffic Volumes

Hi Felipe and Elyse,

We have been working on our near term (2028) analysis and have refined the volumes slightly. Please see below and attached.

The changes are minor and remain generally consistent with what was previously provided, so hopefully it doesn't affect your analysis too much.

PROJECTED NEAR TERM (2028) VOLUME DAILY PROFILE

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	31155	1%	2%	28040	1%	2%	3115	3%	2%
Park Lawn Rd	Immediately South of Gardiner Expy EB Off Ramp	26500	0%	1%	23850	0%	1%	2650	0%	1%
Park Lawn Rd	Immediately North of Lake Shore Blvd W	19000	0%	1%	17100	0%	1%	1900	0%	1%
Lake Shore Blvd W	Immediately West of Park Lawn Rd	25035	1%	1%	22530	1%	1%	2505	1%	1%
Lake Shore Blvd W	Immediately East of Park Lawn Rd	26855	1%	1%	24170	1%	1%	2685	0%	1%
Lake Shore Blvd W	Immediately East of Brookers Ln	13360	0%	2%	12025	0%	2%	1335	0%	1%
The Queensway	Immediately East of Park Lawn Rd	42320	1%	1%	38090	1%	1%	4230	3%	1%
Gardiner Expy WB On Ramp	From Park Lawn Rd	15965	3%	2%	14370	3%	2%	1595	8%	3%
Gardiner Expy EB Off Ramp	To Park Lawn Rd	17915	1%	1%	16125	1%	1%	1790	2%	2%
Gardiner Expy Ramps	To/From Relief Rd (Lake Shore)	15175	0%	1%	13660	0%	1%	1515	0%	0%
Gardiner Expy	Between Park Lawn Rd and Humber River	166790	2%	2%	141770	2%	2%	25020	5%	2%

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

Luke

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Appendix D

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	N/A	62	59	59	NO		2	19	24	0	25	80	100	30	32	FA
A2	Units in: Block 2-1 facing NNW, in Block E-1 facing NW	63	60	60	NO		2	20	25	0	26	80	100	30	32	FA
A3	Units in: Block D1-1 facing the ENE, Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE, in Block B2-1 facing NNE and E	65	61	62	YES		2	21	27	0	28	80	100	33	35	FA
A4	N/A	62	60	57	NO		2	20	22	0	24	80	100	28	30	FA
A5	N/A	57	56	50	NO		2	16	15	0	19	80	100	24	26	FA
B1	N/A	60	59	52	NO		2	19	17	0	21	80	100	25	27	FA
B2	N/A	62	61	56	NO		2	21	21	0	24	80	100	29	31	FA
B3	N/A	56	50	55	NO		2	10	20	0	20	80	100	24	26	FA
C1	N/A	63	62	56	NO		2	22	21	0	25	80	100	30	32	FA
C2	N/A	64	63	56	NO		2	23	21	0	25	80	100	29	31	FA
C3	N/A	58	53	57	NO		2	13	22	0	23	80	100	28	30	FA
D1	N/A	65	64	58	NO		2	24	23	0	27	80	100	31	33	FA
D2	Units in: Block D1-1 facing NNW.	69	67	63	YES		2	27	28	0	31	80	100	36	38	AC
D3	Units in: Block D1-1 facing ENE, in Block D2-1 facing SW, Block D2-1 facing NE in Block D3-1 facing the WSW and ENE., in Block D3-1 facing E	67	65	62	YES		2	25	27	0	29	80	100	33	35	AC
D4	Units in: Block D2-1 facing NW.	69	68	64	YES		2	28	29	0	32	80	100	37	39	AC
D5	School façade facing WSW, units in Block D3-1 facing the WSW	71	65	70	YES		2	25	35	0	35	80	100	39	41	AC
D6	Units in: Block D3-1 facing NNW, in Block D3-2 facing NNW. School windows facing NNW.	72	71	64	YES		2	31	29	0	33	80	100	38	40	AC
D7	Units in: Block 3-1 facing ENE, Block D3-2 facing W, & WSW & ENE	70	69	63	YES		2	29	28	0	32	80	100	36	38	AC
D8	Units in Block D3-3 facing NNW and NNE	69	68	62	YES		2	28	27	0	31	80	100	36	38	AC
E1	N/A	64	63	55	NO		2	23	20	0	25	80	100	30	32	FA
E2	N/A	65	65	58	NO		2	25	23	0	27	80	100	32	34	FA
F1	Units in Block F-1 facing NNE	71	70	62	YES		2	30	27	0	32	80	100	36	38	AC
F2	Units in Block F-1 Facing WNWNW	69	69	61	YES		2	29	26	0	31	80	100	36	38	AC
F3	Units in Block F-1 facing SSW, in Block D3-1 facing SSE, in Block 3-1 facing SSE, in Block D3-2 facing SSE, in Block D3-3 facing SW	66	65	58	YES		2	25	23	0	27	80	100	31	33	AC
F4	N/A	64	63	55	NO		2	23	20	0	25	80	100	29	31	FA

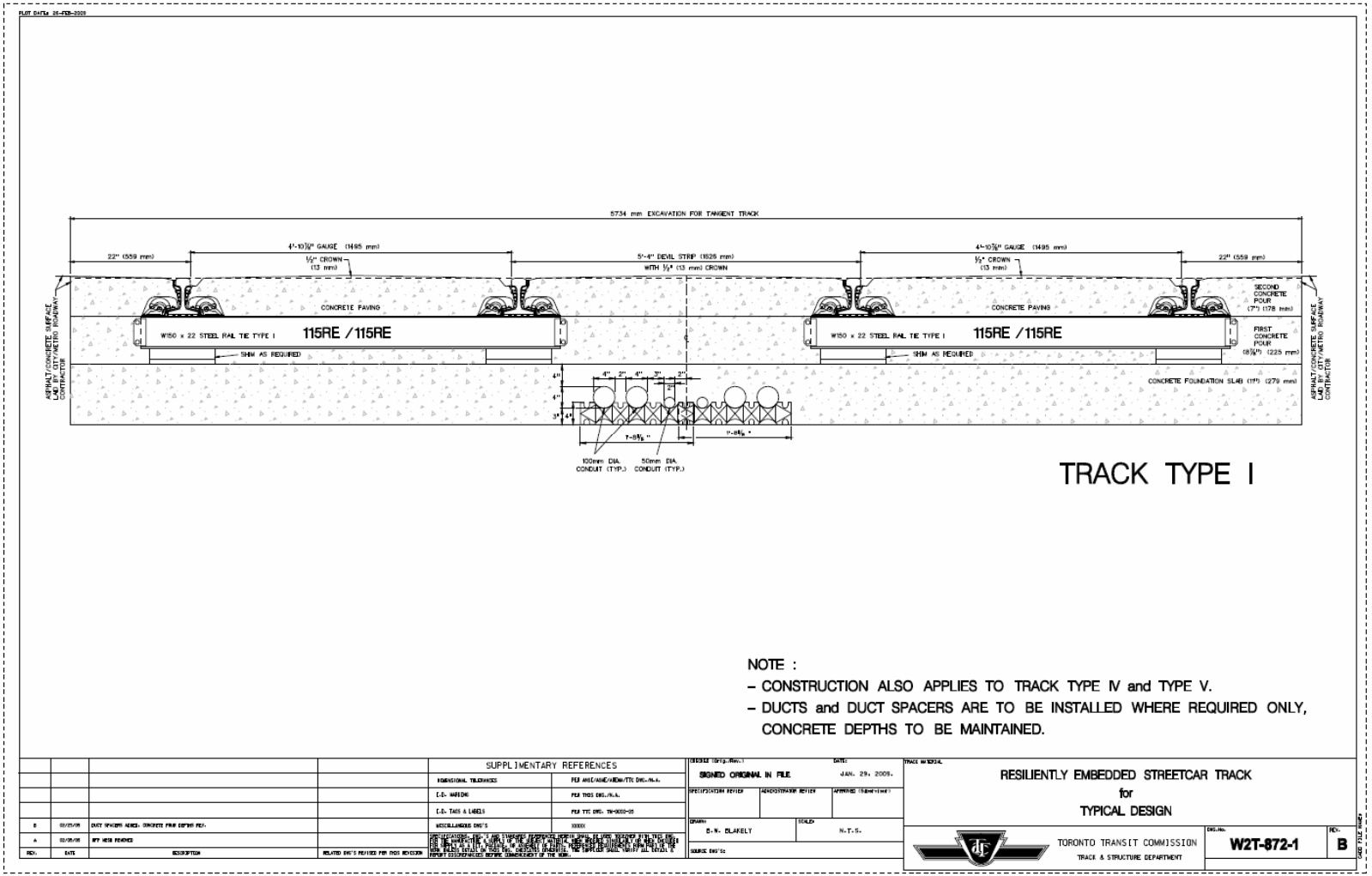
Daytime Building Envelope Noise Reduction Calculation

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	N/A	58	55	55	NO		2	20	25	0	26	80	100	31	33	FA
A2	Units in: Block 2-1 facing NNW, in Block E-1 facing NW	59	56	56	YES		2	21	26	0	27	80	100	31	33	FA
A3	Units in: Block D1-1 facing the ENE, Block E-2 facing SSW and ESE, Block A4-1 facing NNE and ESE, in Block B2-1 facing NNE and E	63	55	62	YES		2	20	32	0	32	80	100	37	39	AC
A4	N/A	58	56	54	NO		2	21	24	0	26	80	100	30	32	FA
A5	N/A	52	49	48	NO		2	14	18	0	20	80	100	25	27	FA
B1	N/A	54	53	49	NO		2	18	19	0	22	80	100	26	28	FA
B2	N/A	57	54	55	NO		2	19	25	0	26	80	100	31	33	FA
B3	N/A	54	43	53	NO		2	8	23	0	23	80	100	27	29	FA
C1	N/A	58	56	53	NO		2	21	23	0	25	80	100	30	32	FA
C2	N/A	59	58	53	NO		2	23	23	0	26	80	100	30	32	FA
C3	N/A	56	49	54	NO		2	14	24	0	24	80	100	29	31	FA
D1	N/A	61	60	55	NO		2	25	25	0	28	80	100	32	34	AC
D2	Units in: Block D1-1 facing NNW.	64	63	59	YES		2	28	29	0	32	80	100	37	39	AC
D3	Units in: Block D1-1 facing ENE, in Block D2-1 facing SW, Block D2-1 facing NE in Block D3-1 facing the WSW and ENE., in Block D3-1 facing E	63	61	58	YES		2	26	28	0	30	80	100	34	36	AC
D4	Units in: Block D2-1 facing NW.	65	64	60	YES		2	29	30	0	33	80	100	38	40	AC
D5	School façade facing WSW, units in Block D3-1 facing the WSW	67	61	66	YES		2	26	36	0	36	80	100	40	42	AC
D6	Units in: Block D3-1 facing NNW, in Block D3-2 facing NNW. School windows facing NNW.	67	67	60	YES		2	32	30	0	34	80	100	39	41	AC
D7	Units in: Block 3-1 facing ENE, Block D3-2 facing W, & WSW & ENE	65	64	59	YES		2	29	29	0	32	80	100	36	38	AC
D8	Units in Block D3-3 facing NNW and NNE	65	64	58	YES		2	29	28	0	32	80	100	37	39	AC
E1	N/A	58	57	52	NO		2	22	22	0	25	80	100	30	32	FA
E2	N/A	61	60	54	NO		2	25	24	0	28	80	100	33	35	AC
F1	Units in Block F-1 facing NNE	66	66	58	YES		2	31	28	0	33	80	100	37	39	AC
F2	Units in Block F-1 Facing WNWNW	65	64	57	YES		2	29	27	0	31	80	100	36	38	AC
F3	Units in Block F-1 facing SSW, in Block D3-1 facing SSE, in Block 3-1 facing SSE, in Block D3-2 facing SSE, in Block D3-3 facing SW	61	61	54	YES		2	26	24	0	28	80	100	32	34	AC
F4	N/A	59	57	53	NO		2	22	23	0	26	80	100	30	32	FA

Nighttime Building Envelope Noise Reduction Calculation

Appendix E

Embedded Track Vibration Isolators



Appendix F

Noise Contour Figures