NOISE AND VIBRATION FEASIBILITY STUDY
PROPOSED RESIDENTIAL DEVELOPMENT
23 ELIZABETH STREET NORTH
MISSISSAUGA, ONTARIO

FOR

EDENSHAW ELIZABETH DEVELOPMENTS LIMITED

PREPARED BY

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1.0 INTRODUCTION

At the request of Edenshaw Elizabeth Developments Limited, J.E. COULTER ASSOCIATES LIMITED has completed a noise and vibration feasibility study of the proposed 30-storey residential development on the northeast corner of Elizabeth Street and Park Street in Mississauga, Ontario. See Figure 1 in Appendix A for an Area Plan.

The purpose of the study is to prepare recommendations to address noise/vibration issues in support of the subject property's rezoning and site plan applications. This report will show that applicable MECP, Metrolinx, CN, and City of Mississauga noise guidelines can be met with modest noise control measures. These recommendations will take into consideration the sound from the surrounding transportation sources. Please see Figure 2 in Appendix A for a Site Plan.

This report also briefly reviews the impact of the development on itself and surrounding areas.

The site is surrounded on all sides by existing residential development with Port Credit GO Station located farther north. A review of the area indicates there are no sources of stationary noise that would have the potential to affect the occupants of the future building itself. As a result, stationary noise sources are not considered further within this report. This report focuses on the transportation noise and vibration impacts.

2.0 APPLICABLE CRITERIA

The Ministry of the Environment and Climate Change's (MECP) applicable criteria to a site such as this are found in its publication *NPC-300* "Environmental Guide for Noise, Stationary and Transportation Sources – Approval and Planning."

As per *NPC-300*, this development would be considered a Class 1 – Urban area.

The MECP and the City of Mississauga do not promulgate vibration limits on new developments. Best practice standards in Ontario are based on the previous versions of the ISO-2631 vibration guidelines, which suggested a maximum limit of 0.14mm/s RMS for vibration in areas where people sleep. MECP and TTC typically target 0.10 mm/s RMS at residences during transit expansions. These standards are reviewed within this study. Vibration control is not a strict requirement but a guideline.

2.1 Transportation Noise Guidelines

Transportation noise sources addressed by *NPC-300* include aircraft, rail traffic, and roadway traffic (which include cars, trucks, buses, etc.).

Where the sound levels exceed 55 dB L_{eq} in private outdoor living areas (OLA), MECP requires noise mitigation measures to be incorporated into the building design (i.e., intervening structures such as acoustic barriers or buildings and/or greater setbacks from the noise source). However, MECP will permit sound levels up to 60 dB L_{eq} daytime (5 dB above the criterion level of 55 dB L_{eq}) in private outdoor living areas (OLA) if it is not technically feasible to achieve 55 dB. Where the criterion levels are marginally exceeded, a warning clause is required in the *Agreement of Purchase and Sale* and the applicable agreements with the planning authorities. With respect to multi-unit residential buildings, balconies are considered OLAs only if they are 4m or greater in depth.

For residential buildings, the Ministry's ventilation requirements are based on the sound level at the exterior building façade. Where the sound levels at the exterior of the building façade exceed 55 dB L_{eq} daytime at the living room window or 50 dB L_{eq} nighttime at the bedroom window, the unit must be provided with forced air heating, with a provision for future air conditioning by the owner. An excess up to 10 dB is permissible, provided a warning clause is given. Where the sound levels exceed this limit (i.e., 65 dB L_{eq} daytime or 60 dB L_{eq} nighttime), air conditioning must be incorporated into the building design prior to occupancy. Warning clauses are applicable as well.

Air-conditioning requirements are applied so that adequate interior sound levels can be maintained with the windows closed.

The MECP also stipulates acceptable indoor sound levels limits, which vary depending on whether they are railway noise sources or roadway noise sources.

The applicable MECP criteria are summarized in Table 1, below.

Table 1: Noise Criteria Summary

Type of Space	Road		Rail	
	Daytime (dB L_{eq}) (0700–2300)	**Nighttime (dB L_{eq}) (2300–0700)**	**Daytime (dB L_{eq}) (0700–2300)**	**Nighttime (dB L_{eq}) (2300–0700)**
Outdoor Living Area (OLA	55	N/A	55	N/A
Bedrooms	45	40	40	35
Living/Dining	45	45	40	40
Kitchen/Baths	45	45	40	40

Note: OLAs for multi-unit buildings include terraces/balconies greater than 4m in depth and common amenity areas such as rooftop patios intended for quiet enjoyment.

The primary source of transportation noise that has the potential to exceed the guidelines is the railway corridor. The Lakeshore West corridor carries GO Train Traffic, VIA traffic, and some freight traffic. The site is located ~250m from Lakeshore Road and ~280m from Hurontario Street (and the associated Hurontario LRT). Traffic noise from these roadways is not expected to be significant at such setbacks and is not considered further. Similarly, Park Street and Elizabeth Street are projected to carry very little traffic and would not generate sound levels high enough to exceed the guideline levels and alter the recommendations. However, at the request of the City of Mississauga, traffic noise from Park Street and Elizabeth Street have been taken into consideration for potential noise impacts. The other roads, as noted above, are farther away from the site and are unlikely to exceed the applicable criteria.

2.2 Vibration Guidelines

As mentioned, the MECP and the City of Mississauga do not enforce vibration level limits for new developments. Instead, railways such as CP, CN, and Metrolinx request that vibration levels on the nearest residential floor not exceed 0.14mm/s RMS overall between 4 Hz and 200 Hz. These limits are outlined in the Federation of Canadian Municipalities' Railway Proximity

Guidelines and CN's Principal Main Line Requirements. If an excess above this level is expected, vibration control measures need to be incorporated into the development.

The subject site is located approximately 75m south of the railway right of way. As a result, vibration measurements have been completed.

3.0 TRANSPORATION NOISE SOURCES

The following sections summarize the noise sources surrounding the proposed development.

3.1 Railway Traffic

The nearby rail corridor is one of the busier corridors and carries CN freight traffic as well as Metrolinx/GO Transit and VIA Rail. Traffic volumes have been provided by CN and Metrolinx for the corridor. The volumes are summarized in Table 2, below. Except for the GO Transit traffic, which is already projected to the future, the VIA and CN rail volumes are escalated by 10 years using a 2.5% per annum growth rate (approximately 1 dB increase over current traffic volumes).

Table 2: Railway Traffic Summary

Service	Daytime Volume	Nighttime Volume	Locomotives Per Train	Rail Cars Per Train	Speed (km/h)
VIA	12	0	2	10	152
CN Freight	1	0	4	140	96
CN Way Freight	1	4	2	25	96
GO Transit Diesel	254	54	1	10	137

Metrolinx has indicated that the future traffic will consist of a mix of diesel and electric trains, but have indicated that differences in sound levels should not be assumed. As such, all trains are treated as diesel trains for this review.

3.2 Roadway Traffic

The City of Mississauga has confirmed that there are no nearby City counts and have advised that the road traffic counts found in the Transportation Impact Study (February 2025, LEA). The 2030 traffic volumes have been escalated to 2035 using a generous growth rate of 2.5% per annum in accordance with MECP recommendations for noise impact studies for land use planning. The peak hour volumes are multiplied by 10 to obtain the AADT. The traffic volumes are summarized in Table 3 below.

Table 3: Roadway Traffic Summary

Roadway	AADT	Truck %	Medium/Heavy Split	Daytime/Nighttime Split
Park Street	3,225	4	55/45	90/10
Elizabeth Street	1,007	13	55/45	90/10

4.0 TRANSPORTATION NOISE ASSESSMENT

Based on the volumes provided in Section 3.0, the sound levels have been calculated at several locations of the proposed development using the FTA/FRA prediction method and the TNM

prediction method in the CadnaA computer program as per MECP NPC-306. The calculated sound levels are summarized in Table 4, below.

Table 4: Transportation Noise Summary

Location	Description	Rail		Road		Total	
		Daytime (dBA $L_{eq,16hr}$)	Nighttime (dBA $L_{eq,8hr}$)	Daytime (dBA $L_{eq,16hr}$)	Nighttime (dBA $L_{eq,8hr}$)	Daytime (dBA $L_{eq,16hr}$)	Nighttime (dBA $L_{eq,8hr}$)
1	North Façade, West Side	67	63	49	43	67	63
2	South Façade, West Side	57	53	57	52	60	56
3	Ground Floor Amenity Area – West Side	N/A	N/A	N/A	N/A	65	N/A
4	Ground Floor Amenity Area – North Side	N/A	N/A	N/A	N/A	64	N/A
5	2nd Floor Amenity Area – East Side	N/A	N/A	N/A	N/A	60	N/A
5	2nd Floor Amenity Area – West Side	N/A	N/A	N/A	N/A	64	N/A

1. OLA sound level calculations assume the presence of a 1.1m high noise barrier.
2. There are no private terraces or balconies greater than 4m in depth.

As noted above, the roadway-only sound levels are generally insignificant relative to the railway sound level, which would dominate the acoustic environment in the area once traffic levels reach those forecasted by Metrolinx.

4.1 Noise Control Recommendations

The calculated sound levels exceed the MECP guidelines. As a result, noise control measures will be required.

Ventilation Upgrades

As the sound levels exceed 65 dBA L_{eq} during the daytime and 60 dBA L_{eq} during the nighttime, the entire development should be provided with central air conditioning. All of the affected units will need to be supplied with Warning Clause D (see Appendix C) in their *Agreements of Purchase and Sale or Lease*. The use of central air-conditioning is fairly standard for new residential developments.

Noise Barriers

All 4 amenity areas exceed the MECP lower limit of 55 dBA L_{eq} during the daytime.

Table 5: Barrier Heights vs. Sound Levels

Amenity Area	Barrier Height (m)	OLA Sound Level (dBA $L_{eq,16hr}$)
Ground Floor – West Side	2.8	55
	2.2	58
	2.0	60
Ground Floor – North Side	2.8	55
	2.2	56
	1.9	60
2nd Floor Amenity Area – East Side	2.4	55
	1.5	60
2nd Floor Amenity Area – West Side	2.8	55
	1.8	60

As can be seen from Table 5, achieving the target sound level of 55 dBA in the ground floor amenity areas requires 2.8m high noise barriers. These are not recommended due to the negative visual impact and access issues. Even meeting the upper MECP limit of 60 dBA requires barriers up to 2.0m tall, which is not typically ideal for common outdoor amenity areas. As shown above, the residents have access a large amenity area on the 2nd floor that meets the lower MECP limits.

The common amenity areas on the 2nd floor can easily meet the noise criteria of 55 dBA using 2.4m to 2.8m high noise barriers. The shielding provided by existing buildings assists with lower barrier heights for these amenity areas. Figure 3 shows the barrier locations for these amenity areas

For rooftops, noise barriers can be constructed from a variety of materials including glass, concrete, masonry, metal, or plastic. As per *NPC-300*, such a rooftop noise barrier may have surface densities as low as 10 kg/m^2 and "should be structurally sound, appropriately designed to withstand wind and snow load, and constructed without cracks or surface gaps. Any gaps under the barrier that are necessary for drainage purposes should be minimized and localized, so that the acoustical performance of the barrier is maintained."

All units should be provided with Warning Clauses A and B in their *Agreements of Purchase and Sale or Lease*.

Exterior Glazing and Walls/Panels

Spandrel panels on the north, east, and west façades of the development should be constructed to achieve an approximately STC 52 rating to simplify the glazing requirements. An example construction for metal spandrel would be:

- Aluminum panel in aluminum frames
- 50mm rigid batt insulation
- 20 GA. galvanized steel backpan
- 13mm gypsum board or 10mm cement board laminated to backpan
- 12mm air space
- 64mm batt insulation
- 64mm steel studs @ 600mm o/c
- 2x16mm gypsum board (Fire Code C or Type X).

The suite layouts for the proposed development have not been detailed. Preliminary sound levels have been calculated using the National Research Council's BPN-56 prediction procedure using the most current plans. The preliminary calculations assume a 50% window-to-floor area ratio for bedrooms and a 75% window-to-floor area ratio for living rooms. The glazing recommendations are summarized in Table 6 below.

Table 6: Window STC Requirements

Façade	Room Type	Window STC
North	Bedroom	36
	Living Room	38
East/West	Bedroom	34
	Living Room	36
South	Bedroom	33
	Living Room	33

The above façade (window and spandrel) STC recommendations are preliminary. The sound levels on some of the lower floors would be slightly lower due to shielding offered by the intervening buildings. The STC requirements should be confirmed by qualified acoustical consultant based on the final building designs.

5.0 VIBRATION ASSESSMENT

CN and Metrolinx typically require vibration measurements for developments 75m or closer to their railway rights-of-way. Vibration measurements were conducted along the northern property line of the future development. The vibration levels are summarized in Table 6, below. Sample passby spectrum data are provided in Appendix B. The measurement location is also shown in Appendix B.

Table 7: Measured Vibration Levels

Train Passby	Direction	RMS Vibration (mm/s)
1	Westbound	0.02
2	Eastbound	0.02
3	Westbound	0.02
4	Eastbound	0.03
5	Westbound	0.02
6	Eastbound	0.02
7	Westbound	0.02
8	Eastbound	0.02
9	Westbound	0.02

As can be seen in Table 7, the vibration levels are well below the limit of 0.14 mm/s RMS. This is to be expected due to the setback to the nearest tracks, the soils on site, and the lack of special trackwork (switches). Vibration control measures are not required for the subject site.

6.0 IMPACT OF THE DEVELOPMENT ON ITSELF AND THE SURROUNDING AREA

The City requests that new developments consider the noise impact of the development both on itself and the surrounding area.

There is residential development around the entire subject site. Typically, for a development such as this, exhaust fans and mechanical equipment located on the rooftop are the major noise generators.

In terms of the impact of the development on itself, the development's own mechanical/electrical equipment needs to be considered.

The mechanical design of the development has not yet progressed to the point where the impact of the development on itself or its surroundings can be accurately quantified. As plans mature, a review of the impacts of the development on itself as well as on the surrounding area can be completed. In most cases, the most critical receptors are often the building's own future occupants.

Noise control measures for the development's mechanical equipment can be readily incorporated into the design. In many cases, equipment can also be selected to avoid a noise impact entirely. It is recommended that a review of the outdoor noise impact of the development be completed at such a time when the mechanical design is completed, prior to the building permit application.

7.0 CONCLUSIONS

The proposed development is located in an area with a modest amount of transportation noise. The transportation sound levels exceed the MECP guidelines, and noise control measures in the form of ventilation upgrades, noise barriers, and façade elements have been recommended. The extent and nature of these upgrades is similar to those required for residential development built nearby busy railways. These recommendations will be confirmed and detailed as part of as the building design is finalized, typically around the building permit stage.

This analysis has been completed to demonstrate the development's feasibility. The glazing recommendations may need to be revisited should there be changes to the layouts that affect the noise control measures noted in this report.

Overall, the transportation noise study demonstrates that the proposed development is technically feasible from a noise and vibration perspective. There are no major noise and/or vibration issues that would prove challenging to address at later stages of the design.

8.0 SUMMARY OF RECOMMENDATIONS

To meet the requirements of the Ministry of the Environment, Conservation and Parks, the City of Mississauga, Metrolinx, and CN, the following noise control measures will be required:

1. All units will be supplied with central air conditioning. Warning Clause Type D should be inserted into the *Agreements of Purchase and Sale or Lease* for all units.

2. All units within the development need to be supplied with Warning Clauses Type A and B in their *Agreements of Purchase and Sale or Lease*.

3. General glazing and spandrel panel recommendations have been provided based on current suite layouts. An updated analysis should be completed if there are changes to the floor plans and window elevations that would affect the glazing requirements.

4. The sound levels in the 2nd floor outdoor amenity area are expected to exceed the noise guidelines. It is recommended that this amenity area be provided with a 2.4m to 2.8m high noise barrier in order to meet the MECP limit of 55 dBA.

5. Noise barriers are not recommended for the ground floor amenity areas due to the visual and access impacts those barriers may have. The occupants have access to a large amenity area on the 2nd floor that meets the MECP limits.

6. As the development is located within 300m of the railway corridor, all units should be provided with the standard CN and Metrolinx Warning Clauses in any case. The warning clauses are to be inserted into the *Agreements of Purchase and Sale or Lease*.

7. Vibration control is not required as the vibration levels were measured to be well below 0.14 mm/s RMS.

8. Prior to the building permit application, or at such a time when the final design is completed, a review of the proposed development's mechanical and electrical equipment should be completed to ensure that applicable noise guidelines are met at the surrounding areas as well as at the future development itself.

APPENDIX A: FIGURES

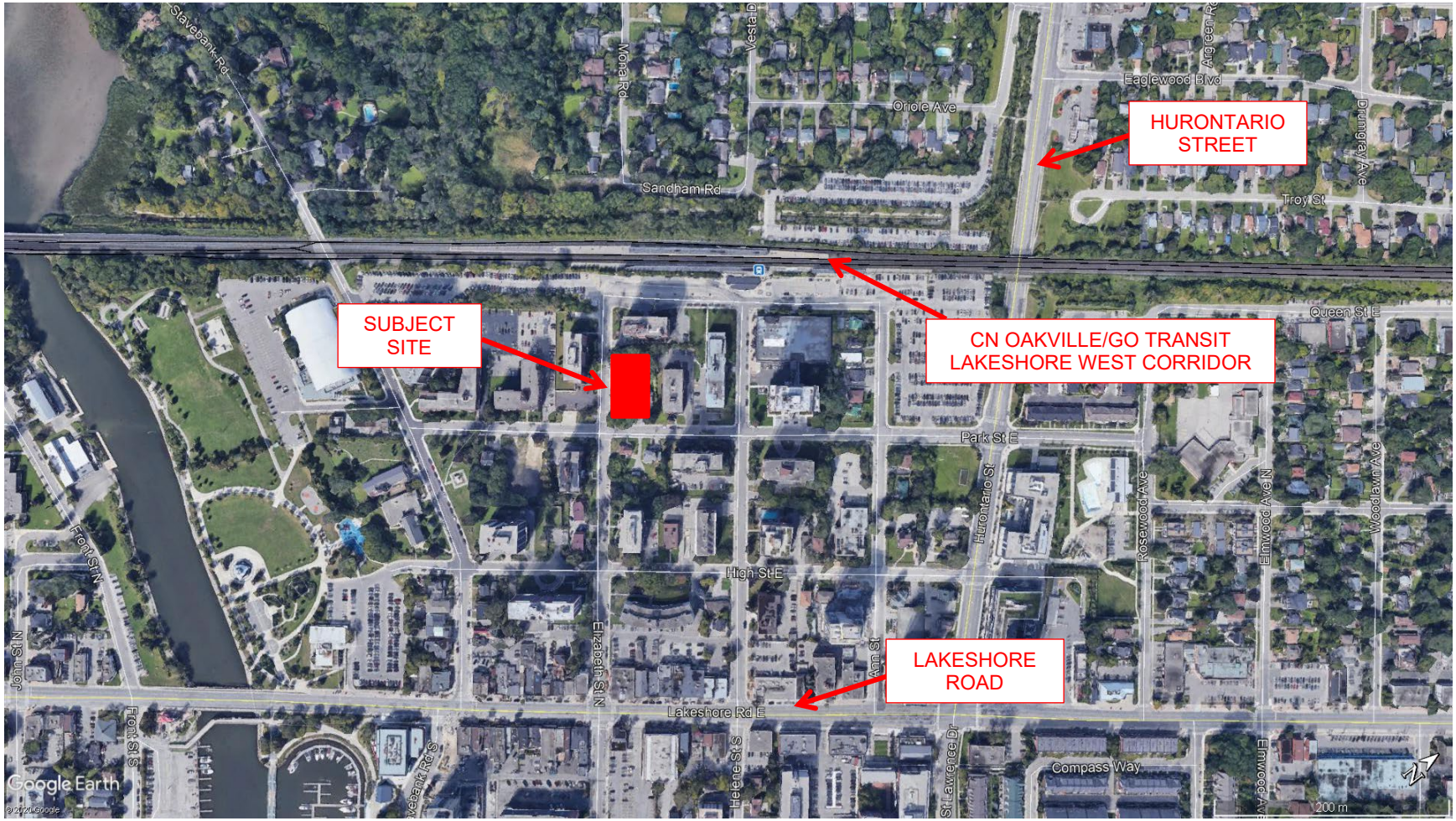


Figure 1: Key Plan

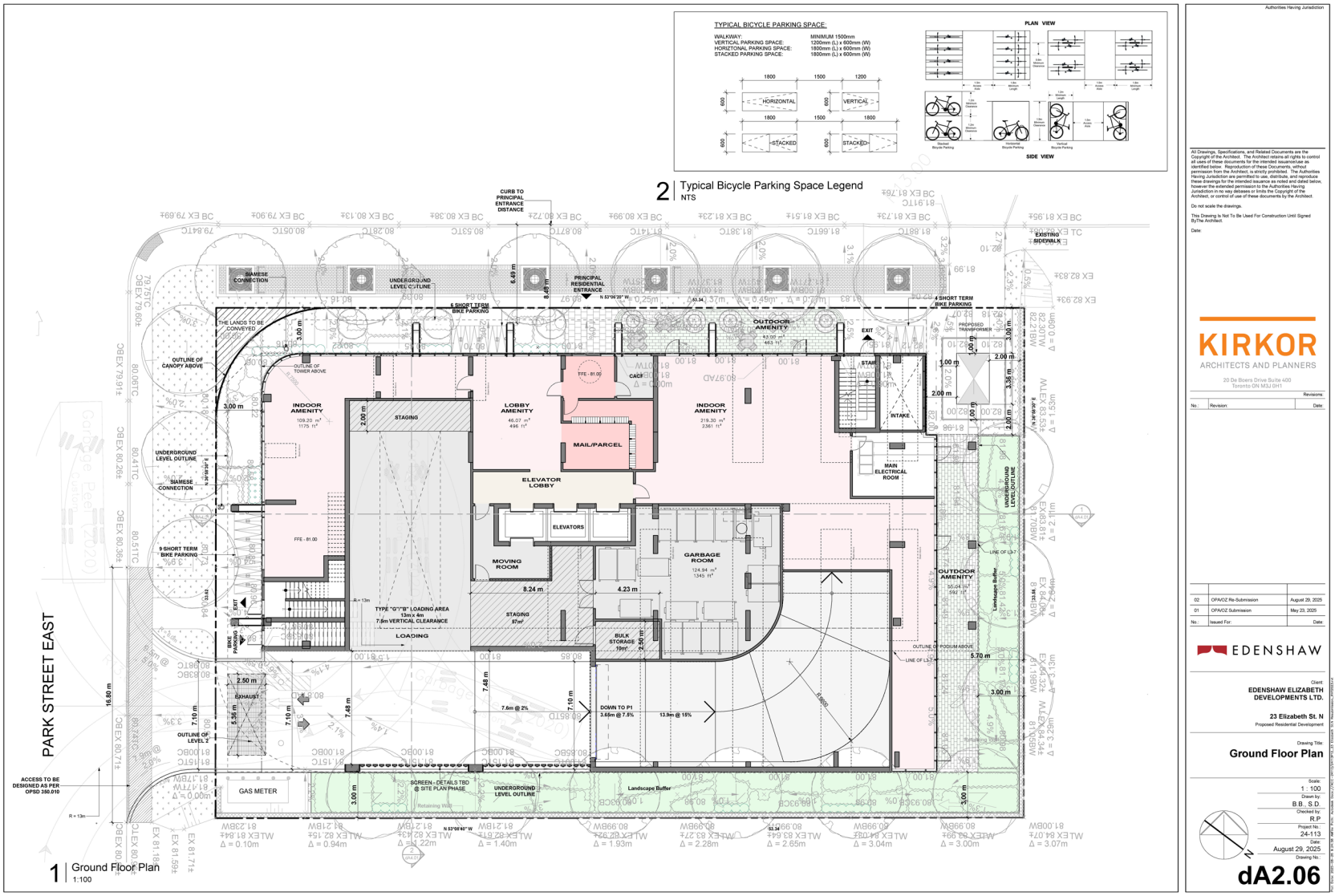


Figure 2: Site Plan

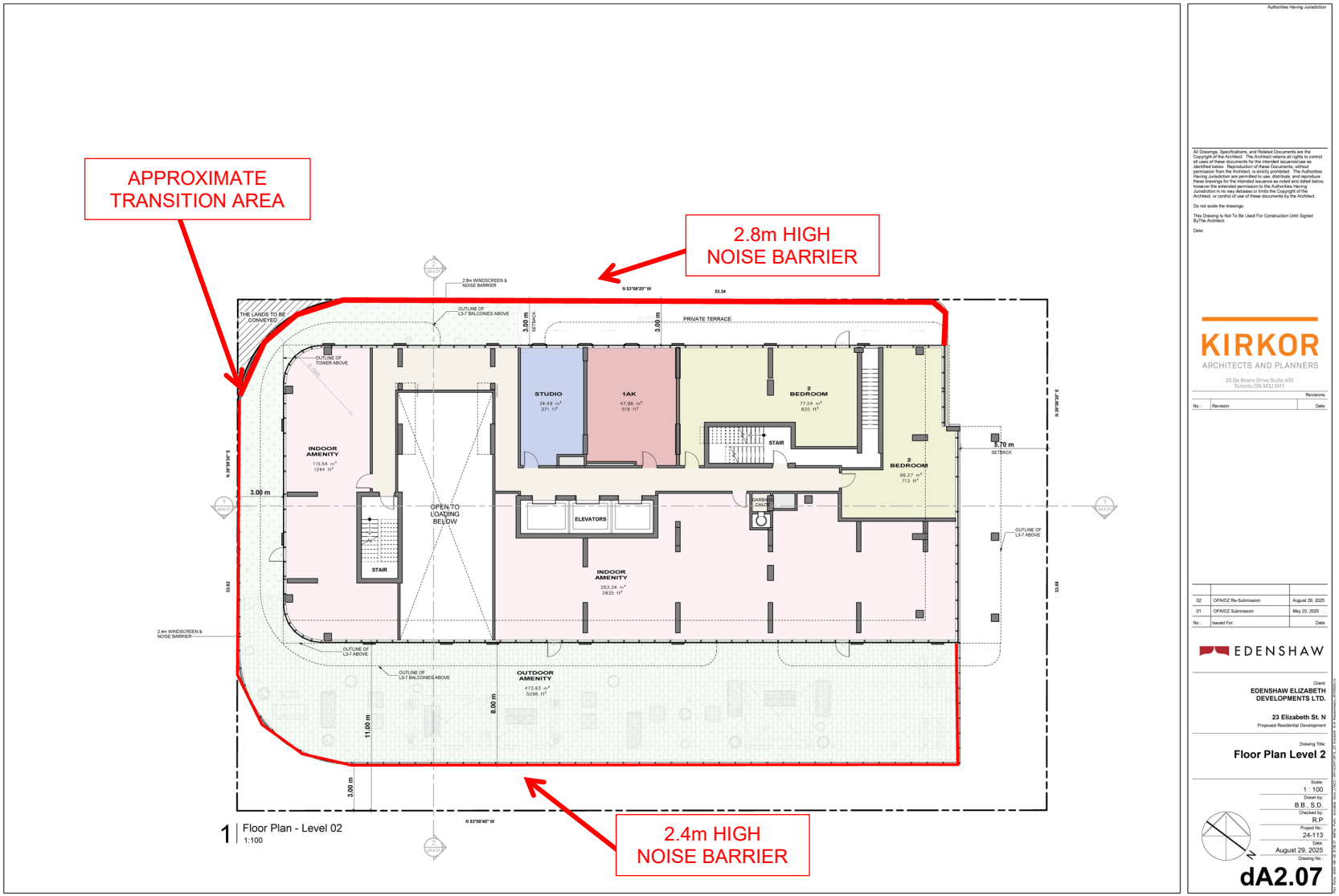


Figure 3: 2nd Floor Amenity Noise Barriers

APPENDIX B: TRAFFIC DATA AND MEASUREMENTS

Date: 2020/03/31 Project Number: OAK – 13.0- 23 Elizabeth Street N Mississauga ON

Dear Sam:

Re: Train Traffic Data – CN Oakville Subdivision near 23 Elizabeth Street N, Mississauga ON

The following is provided in response to Sam's 2020/03/18 request for information regarding rail traffic in the vicinity of 23 Elizabeth Street North, in Mississauga ON at approximately Mile 13.01 on CN's Oakville Subdivision.

Typical daily traffic volumes are recorded below. However, traffic volumes may fluctuate due to overall economic conditions, varying traffic demands, weather conditions, track maintenance programs, statutory holidays and traffic detours that when required may be heavy although temporary. For the purpose of noise and vibration reports, train volumes must be escalated by 2.5% per annum for a 10-year period.

Typical daily traffic volumes at this site location are as follows:

***Maximum train speed is given in Miles per Hour**

	0700-2300			
Type of Train	Volumes	Max.Consist	Max. Speed	Max. Power
Freight	1	140	60	4
Way Freight	1	25	60	4
Passenger	12	10	95	2

	2300-0700			
Type of Train	Volumes	Max.Consist	Max. Speed	Max. Power
Freight	0	140	60	4
Way Freight	4	25	60	4
Passenger	0	10	95	2

The volumes recorded reflect westbound and eastbound freight and passenger operations on CN's Oakville Subdivision.

Except where anti-whistling bylaws are in effect, engine-warning whistles and bells are normally sounded at all at-grade crossings. There are two (2) at-grade crossing in the immediate vicinity of the study area at Mile 12.02 Revus Ave, and Mile 13.11 Stavebank Rd Xing. Anti-whistling bylaws are in effect at both Mile 12.02 Revus Ave and Mile 13.11 Stavebank Rd. Please note that engine warning whistles may be sounded in cases of emergency, as a safety and or warning precaution at station locations and pedestrian crossings and occasionally for operating requirements.

With respect to equipment restrictions, the gross weight of the heaviest permissible car is 286,000 lbs.

The double mainline track is considered to be continuously welded rail throughout the study area.

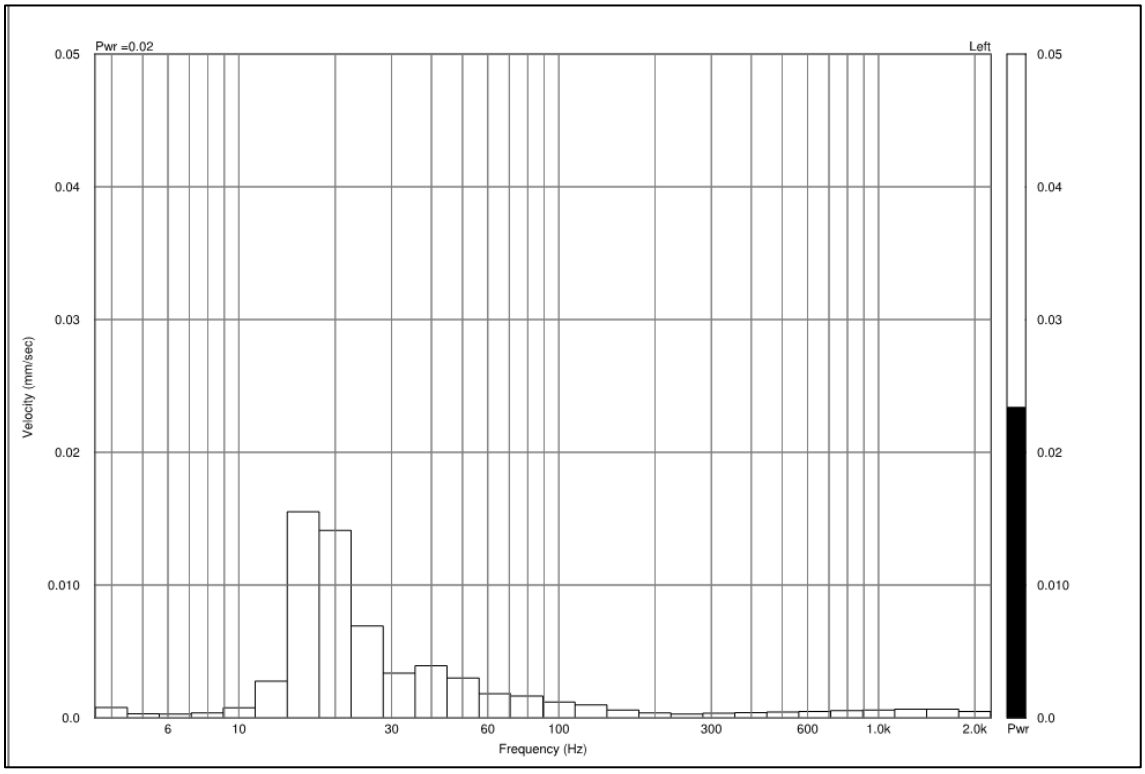
The Canadian National Railway continues to be strongly opposed to locating developments near railway facilities and rights-of-way due to potential safety and environmental conflicts. Development adjacent to the Railway Right-of-Way is not appropriate without sound impact mitigation measures to reduce the incompatibility. For confirmation of the applicable rail noise, vibration and safety standards, **Adjacent Development**, Canadian National Railway Properties at Proximity@cn.ca should be contacted directly.

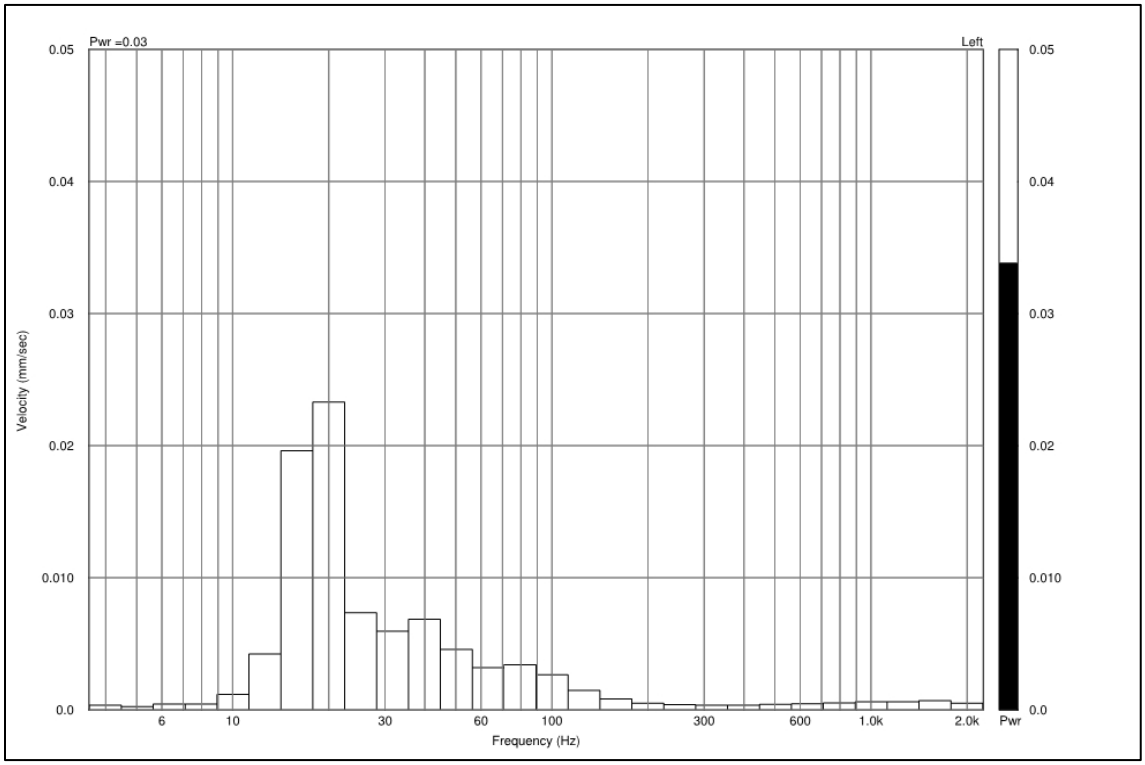
I trust the above information will satisfy your current request.

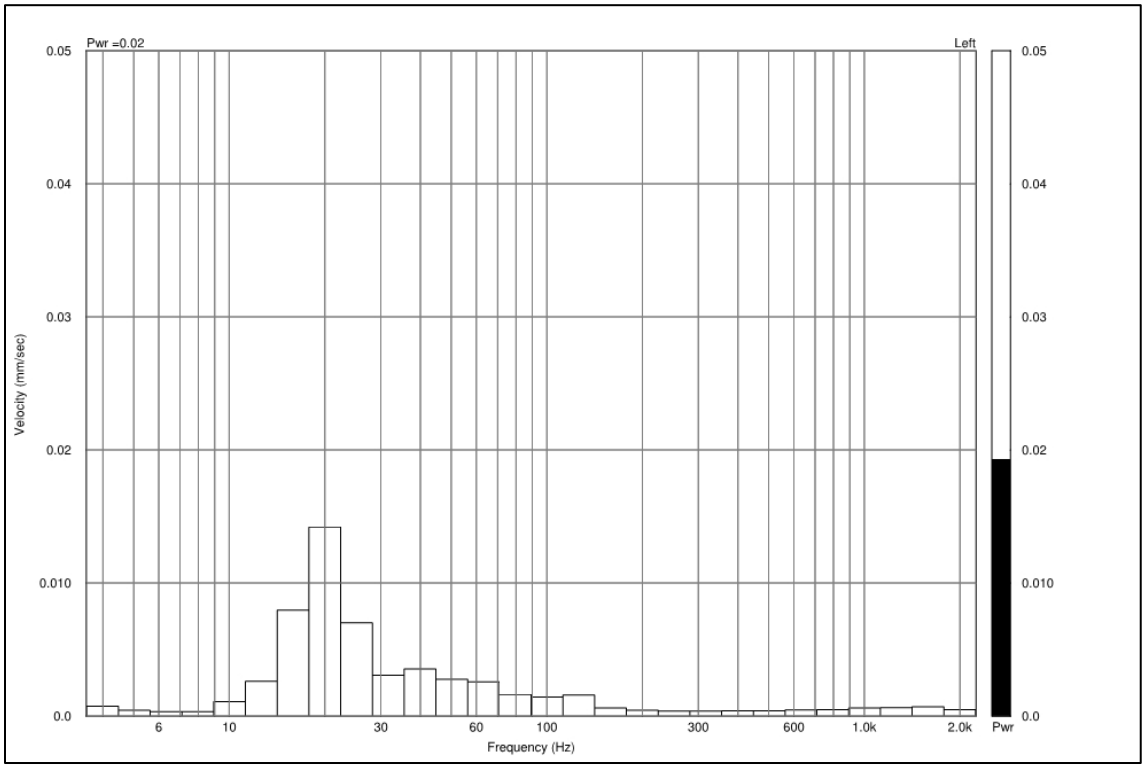
Sincerely,

Michael Vallins P.Eng
Manager, Public Works- Eastern Canada

VIBRATION MEASUREMENT LOCATION AND DATA



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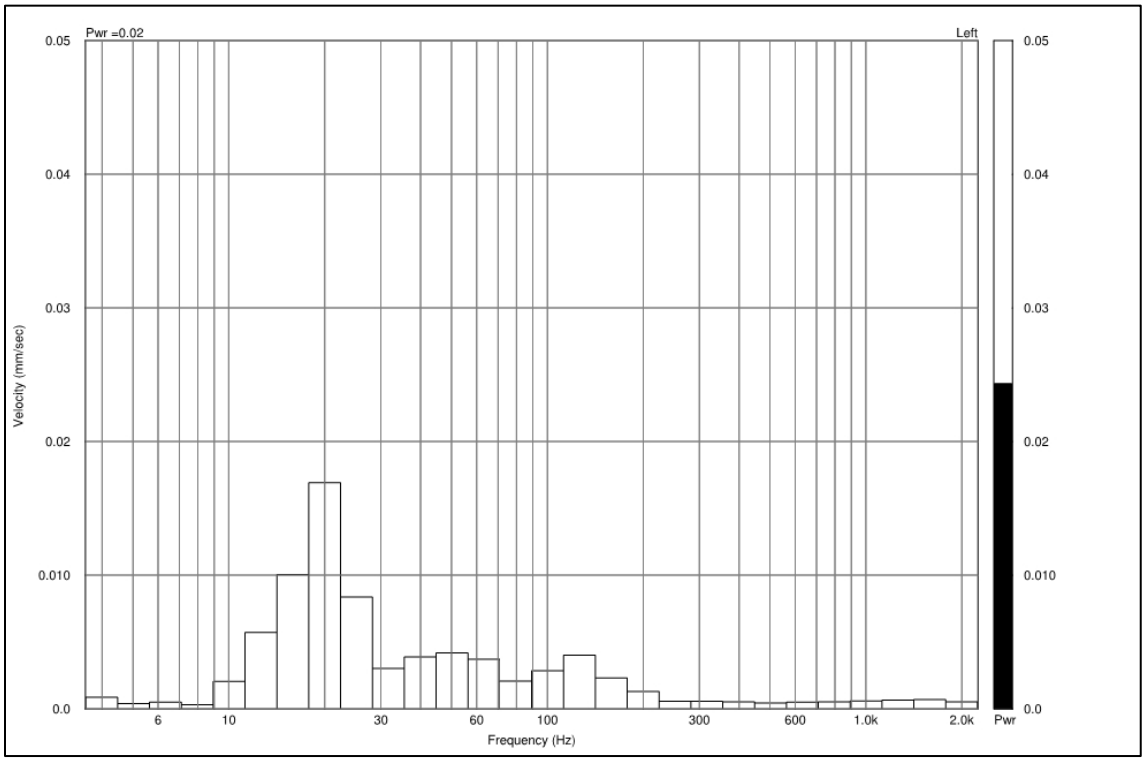
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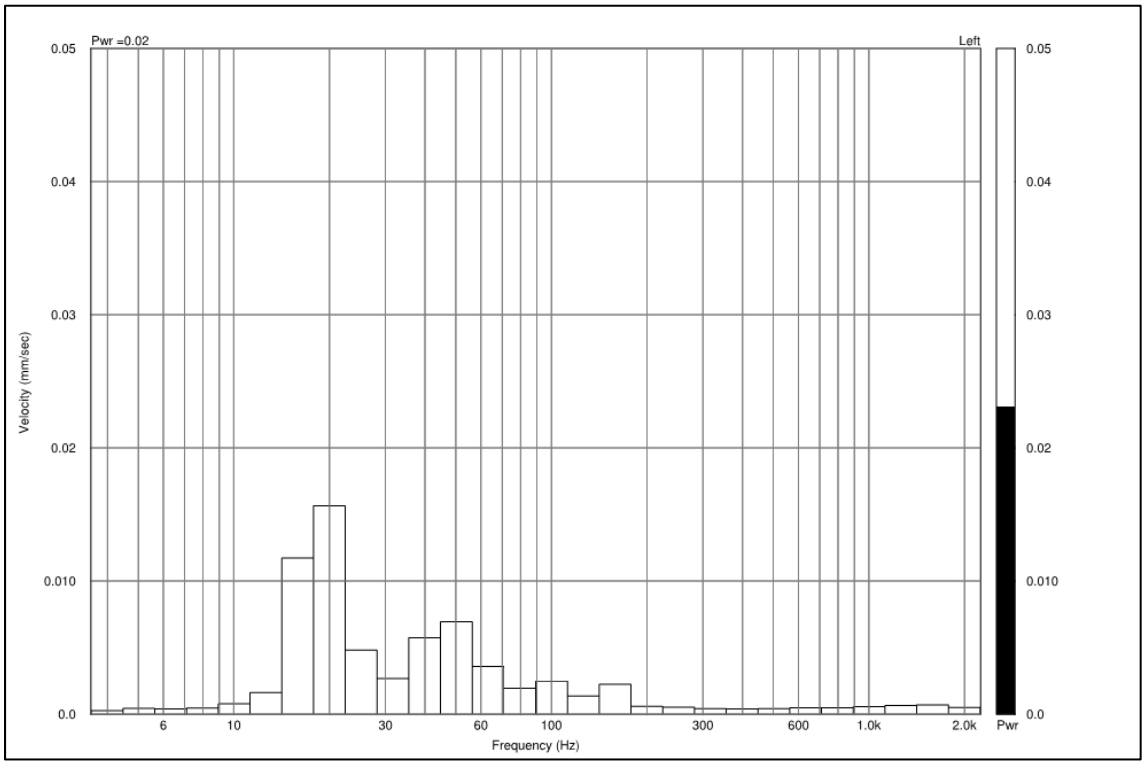
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Queen St E
Vibration Measurements
Hayes St N
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Google earth

APPENDIX C: WARNING CLAUSES

TYPE A: "Purchasers/tenants are advised that sound levels due to increasing road traffic and rail 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."

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 Municipality and the Ministry of the Environment, Conservation and Parks."

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."

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."

TYPE E: "Purchasers/tenants are advised that due to the proximity of the adjacent industry, noise from the industry may at times be audible."

CN: "Warning: Canadian National Railway Company or its assigns or successors in interest has or have a right-of-way within 300 metres from the land the subject thereof. There may be alterations to or expansions of the rail facilities on such right-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its 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). CNR 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."

Metrolinx: "Metrolinx, carrying on business as GO Transit, and its assigns and successors in interest has or have a right-of-way within 300 metres from the land 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 use 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."

CP: "All persons intending to acquire an interest in the real property by purchase or lease are advised of the existence of the right-of-way of the Canadian Pacific Railway. In future, it is possible that such rail facilities and operations may be altered or expanded, which expansion or alteration may affect the living environment of residents despite the inclusion of noise and vibration attenuating measures in the design of the subdivision and individual units and that the Canadian Pacific Railway will not be responsible for complaints or claims arising from its use of its facilities and/or arising from its operations."

APPENDIX D: REFERENCES

1. Ministry of the Environment, “Model Municipal Noise Control By-Law, Final Report”, August 1978.

2. Ontario Ministry of the Environment, Environmental Approvals and Land Use Planning Branch, “Guidelines for Road Traffic Noise Assessment”, July 1986.

3. Ministry of the Environment’s *STAMSON* Computer Programme (Version 5.03) for the IBM PC.

4. Ministry of the Environment, *ORNAMENT*, “Ontario Road Noise Analysis Method for Environment and Transportation”, November 1988.

5. Quirt, D.J., “Controlling Sound Transmission into Buildings”, National Research Council, Building Practice Note 56, Update 1.1.

6. Ministry of the Environment, *STEAM* “Sound from Trains Environmental Analysis Method”, July 1990.

7. Ministry of the Environment, “Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning”, Publication *NPC-300*, August 2013.