CANADA LANDS COMPANY

530 TREMBLAY ROAD

ENVIRONMENTAL NOISE & VIBRATION IMPACT STUDY

NOVEMBER 25, 2019

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CANADA LANDS COMPANY

PROJECT NO.: 19M-00169-00
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EXECUTIVE SUMMARY

WSP Canada Inc., (WSP) was retained by Canada Lands Company (CLC) through a joint venture with Public Services and Procurement Canada (PSPC) to prepare an Environmental Noise and Vibration Impact Study for the proposed mixed-use development at 530 Tremblay Road in the City of Ottawa (the Site) in support of the Draft Plan of Subdivision application to the City. The Site is located at the southwest intersection of Queensway (Highway 417) and St. Laurent Boulevard.

This study assesses the potential noise and vibration effects of the environment onto the proposed development, and the potential noise effects of the development onto itself, as well as on its surroundings. This report was based on the Draft Plan of Subdivision, prepared by, Annis, O'Sullivan, Vollebekk Ltd. dated October 30, 2019.

NOISE IMPACT ASSESSMENT

The noise impact assessment was conducted in accordance with the City of Ottawa's *Environmental Noise Control Guidelines, January 2016* (ENCG) and Ministry of Environment, Parks and Conservation (MECP) Noise Pollution Control (NPC) publication NPC-300 "*Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning*".

TRANSPORTATION NOISE SOURCES

Based on the predicted sound levels at the proposed development due to transportation (road and rail) noise sources, the following noise mitigation measures are needed to comply with the City and MECP noise guidelines:

- Mandatory air conditioning for all residential suites within the development;
- Upgraded exterior wall and window construction;
- Final acoustical requirements for building facades should be checked when detailed building plans become available. This is typically done during the building permit application to the City; and
- Appropriate warning clauses are to be included in offers/agreements of purchase and sale or leases or rental agreements, to notify potential purchasers and tenants of the environmental concerns to make an informed decision.

The Site is located outside the Ottawa Macdonald Cartier International Airport Authority's operating influence and development zones and thus, aircraft noise has not been included in the assessment.

STATIONARY NOISE SOURCES

A preliminary noise assessment of the potential noise effects of the nearby industrial facilities (i.e. LRT Maintenance Facility, Pepsi and OC Transpo Belfast Yard, all located to the south of the Site) has been completed. The preliminary assessment indicated that the sound levels at the proposed development, attributable to the operation of these facilities, are predicted to exceed the sound level limits under a Class 1 Area.

Thus, it is recommended that a detailed acoustical assessment of these facilities be completed to accurately assess its potential noise effect and investigate the feasibility of noise mitigation measures needed to comply with the applicable sound level limits at the proposed development. It is anticipated that a detailed acoustical assessment will be completed in a future stage of the project.

The proposed development has the potential to create a significant noise impact to the existing residential developments. The mechanical equipment within the proposed development interfacing the environment must be designed to meet the applicable sound level limits. This is typically done during the detailed design stage.

VIBRATION IMPACT ASSESSMENT

Ground-borne vibration velocities due to rail movements on the VIA Alexandria Subdivision were measured on site at various setback distances from the rail right-of-way (i.e. 30 m, 45 m and 60 m). The measured vibration velocities are well below the criterion of 0.14 mm/s as suggested by the Federation of Canadian Municipalities (FCM) and the

Railway Association of Canada (RAC) at all measurement locations. Therefore, vibration mitigation measures are not needed for this development.

The proposed development is not a significant source of ground-borne vibration. Thus, the assessment of potential vibration impact of the proposed development to the environment has not been considered in the assessment.

1 INTRODUCTION

WSP was retained by CLC through a joint venture with PSPC to prepare an Environmental Noise and Vibration Impact Study for the proposed mixed-use development at 530 Tremblay Road in the City of Ottawa (the Site) in support of the Draft Plan of Subdivision application to the City.

This study assesses the potential noise and vibration effects of the environment onto the proposed development, and the potential noise effects of the development onto itself, as well as on its surroundings.

The findings and recommendations needed to comply with the applicable noise and vibration guidelines are included herein.

1.1 THE SITE AND SURROUNDING AREA

The Site is located southwest of the Highway 417 and St. Laurent Boulevard intersection and is bounded by:

- To the north, existing Tremblay Road with Queensway (Highway 417) and commercial plaza beyond;
- To the east, St. Laurent Boulevard with existing industrial facilities;
- To the south, VIA Alexandria Subdivision with LRT Maintenance Facility, Pepsi and OC Transpo Belfast Yard; and
- To the west, a small office building with existing residential developments.

Figure 1 shows the location of the Site and the surrounding area.

1.2 THE PROPOSED DEVELOPMENT

This report was based on the Draft Plan of Subdivision, prepared by, Annis, O'Sullivan, Vollebekk Ltd. dated October 30, 2019.and is comprised of the following blocks:

- Block 1, 0.185 hectares of Residential Block;
- Block 2, 0.213 hectares of Residential Block;
- Block 3, 0.444 hectares of Residential Block;
- Block 4, 0.445 hectares of Residential Block;
- Block 5, Municipal Park;
- Block 6, 1.160 hectares of Mixed-use Block; and
- Block 7, 1.000 hectares of Stormwater Management Pond;

The Site layout also includes the realignment of Tremblay Road. **Figure 2** shows the Draft Plan of Subdivision.

The Site is currently zoned as mostly Transit Oriented Development Zone and General Industrial on the area located on the southwest corner. A zoning map, showing the current zoning of the Site and the adjacent properties, was obtained from the City of Ottawa and is provided in **Figure 3.**

2 TRANSPORTATION NOISE IMPACT ASSESSMENT

2.1 NOISE SOURCES

The City of Ottawa Official Plan stipulates that a noise study shall be prepared when a new development is proposed within distances as follows:

- 100 metres from the right-of-way of an existing or proposed road; arterial, major collector, light rail transit, bus rapid transit or transit priority corridor;
- 250 metres from the right-of-way of an existing or proposed highway or secondary main railway line; or
- 500 metres from the right-of-way of a freeway or 400-series provincial highway or principal main railway line.

The identified transportation noise sources in the area surrounding the Site are:

- Road traffic on Highway 417, St. Laurent Boulevard (arterial), and Realigned Tremblay Road (major collector); and
- Train movements on the VIA Alexandria Subdivision.

Other roads are over 100 metres away from the Site and are not expected to have a significant impact. Thus, these roads are not considered further in the assessment.

The light rail transit corridor, bus rapid transit and transit priority corridors are located greater than 100 m away from the Site and, therefore, are not included in the assessment.

The proposed development is not within City of Ottawa's International Airport (Macdonald–Cartier International Airport) Operating Influence Zone or Airport Vicinity Development Zone; therefore, an assessment of aircraft noise is not considered in this study.

2.2 NOISE GUIDELINES AND ASSESSMENT CRITERIA

Noise is recognized as a pollutant in the Environmental Protection Act, as uncontrolled noise can affect human activities. Ontario provincial noise control guidelines require that noise concerns are addressed in the planning of any new development.

2.2.1 MECP AND CITY OF OTTAWA NOISE GUIDELINES

In land use planning, although elimination or control of the source of pollution is usually a primary objective, there are general limits as to what is practical and technically possible. The City of Ottawa's ENCG follows the MECP's Publication NPC-300, "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning" for acceptable levels of road traffic noise impacting residential developments. These limits are discussed in Section "Part C – Land Use Planning" of NPC-300 as well as Section 2 of the ENCG. **Table 2-1** summarizes these limits.

Table 2-1 ENCG & NPC-300 Sound Level Criteria for Road and Rail Noise

AREA	TIME PERIOD	L_{EQ} (dBA) [1] - ROAD/RAIL	REFERENCE
Outdoor Living Area (OLA)	Daytime (0700 – 2300h)	55 both	ENCG Table 2.2a
Indoor Living/Dining Room	Daytime (0700 – 2300h)	45 / 40	ENCG Table 2.2b
	Night time (23:00 – 07:00h)	45 / 40	ENCG Table 2.2b
Indoor Sleeping Quarters (i.e. Bedroom)	Daytime (0700 – 2300h)	45 / 40	ENCG Table 2.2b
	Night time (23:00 – 07:00h)	40 / 35	ENCG Table 2.2b

Notes: [1] Daytime: $L_{EQ\ 16HR}$; Nighttime: $L_{EQ\ 8\text{-}HR}$.

NPC-300 and ENCG provide sound level limits in terms of energy equivalent (average) sound levels [LEQ] in units of A-weighted decibels [dBA] at a specific noise-sensitive location. Both outdoor and indoor locations are identified, with the focus of outdoor areas being amenity spaces. Indoor criteria vary with sensitivity of the space. As a result, sleeping areas have more stringent criteria than living/dining room space.

NPC-300 and ENCG further defines that in order to qualify as an OLA a certain minimum area as well as depth (measured from the façade) requirement should be met. Accordingly, a balcony or terrace that are less than 4 meters in depth are not considered an OLA.

OLA, VENTILATION, BUILDING REQUIREMENTS AND WARNING CLAUSES

In order to decide appropriate control to achieve the criteria sound level limits, NPC-300 and ENCG has provided further guidance.

Sound Level in Outdoor Living Area (OLA) - If the future daytime (0700 – 2300h) sound level in an OLA is 55 dBA or less, no control is required; an excess of daytime sound level up to 5 dBA over the 55 dBA limit is often acceptable without noise control, however such excess should be notified to the future occupants (in case of residential receptors) with a warning clause. If sound level exceeds 60 dBA, feasibility of controlling the noise in terms of economic, technical and administrative feasibility should be investigated and where possible noise control is to be included in the design. **Table 2-2** summarizes the warning clause requirements for OLAs.

Table 2-2 Warning Clause Requirements for Outdoor Living Areas

AREA	TIME PERIOD	$L_{EQ\ 16\text{-}HR}$ (dBA)	WARNING CLAUSE REQUIREMENTS
Outdoor Living Area (OLA)	Daytime (0700 – 2300h)	≤ 55	• None
		> 55 and ≤ 60	• Warning Clause (Type A)
		> 60	• Warning Clause (Type B) • Distance Setback with Soft Ground • Insertion of insensitive land use between source and receptor • Orientation of buildings to provide sheltered zones in rear yards • Shared outdoor amenity areas • Berm or barrier

Sound Level in Indoor Spaces - To comply with the indoor sound level criteria listed in **Table 2-1**, ENCG and NPC-300 provides guidelines based on predicted sound level at the façade/plane of window. If the predicted sound level at the plane of window exceeds, additional considerations such as the type of ventilation; type of windows, exterior walls, and doors that can provide noise attenuation must be selected. In addition, warning clauses to inform the future occupants are also required.

Table 2-3 summarizes requirements for ventilation, type of building façade construction and the requirement for warning clauses to inform the future occupants of the exceedances.

Table 2-3 Warning Clause, Ventilation and Building Requirements for Indoor Spaces

AREA	TIME PERIOD	LEQ (DBA)[2]	VENTILATION REQUIREMENTS	BUILDING COMPONENT REQUIREMENTS	WARNING CLAUSE
Plane of Window [1]	Daytime (0700 – 2300h)	≤ 55	None	Building components compliant with Ontario Building Code (OBC)	None
		> 55 and ≤ 65	Forced Air Heating with provision for central air condition	Building components compliant with OBC	Type C required
		> 65	Central air conditioning is required	Building components designed/selected to meet Indoor Requirements	Type D required
	Night time (2300 – 0700h)	≤ 50	None	Building components compliant with OBC	None
		> 50 and ≤ 60	Forced Air Heating with the provision to add central air conditioning	Building components compliant with OBC	Type C required
		> 60	Central air conditioning is required	Building components designed/selected to meet Indoor Requirements	Type D required

Notes: [1] Plane of Window of a Bedroom, Living Room or Dining Room.
[2] Daytime: $L_{EQ\ 16HR}$; Nighttime: $L_{EQ\ 8\text{-}HR}$. Whistle noise is included (if there is a whistle nearby).

In addition to the building component criteria outlined in **Table 2-3**, NPC-300 also includes a façade construction requirement for rail noise only, which is outlined in **Table 2-4**. The façade construction requirements are only necessary for the first row of dwellings.

Table 2-4 NPC-300 Rail Noise Façade Requirements

AREA	First Row of Dwellings Distance to Railway	$L_{EQ\ 24\text{-}HR}$ (dBA) [1]	BUILDING COMPONENT REQUIREMENTS
Plane of Window	≤ 100 m	≤ 60	No additional requirements.
		> 60	Brick Veneer or Masonry Equivalent Required.
	> 100 m	≤ 60	No additional Requirements.
		> 60	No additional Requirements.

The warning clauses referred to in **Table 2-3** are defined in **Table 2-5**. In a residential development, where required, these clauses are to be included in offers/agreements of purchase and sale or leases or rental agreements, to notify potential purchasers and tenants of the environmental concerns to make an informed decision. However, in a school development, it is important to communicate future owners, and operators.

Table 2-5 NPC-300 and ENCG Warning Clauses

TYPE	WARNING CLAUSES
Type A	"Purchasers/tenants are advised that sound levels due to increasing (road) (transitway) (rail) (air) traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the Environment's noise criteria."
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) (transitway) (rail) (air) traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the Environment's noise criteria."
Type C	"This dwelling unit has been fitted with a forced air heating system and ducting, etc. and was sized to accommodate central air conditioning. Installation of central air conditioning by the occupant will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of the Environment's noise criteria." (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both on and in the immediate vicinity of the subject property."
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 City's and the Ministry of the Environment's noise criteria."

Additionally, the Railway requirements for a Principal Main Line indicate a warning clause (Type E) should be inserted into all development agreements, offers to purchase, and agreements of Purchase and Sale or Lease of each dwelling unit within 300 metres of the railway right-of-way. The warning clause details are provided below.

> "Canadian National Railways Company or its assigns or successors in interest has or have a right-of-way within 300 metres from the land subject hereof. There may be alteration to or expansions of the railway facilities on such right-of-ways in the future including the possibility that the railway 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 dwellings. CNR will not be responsible for any complaints or claims arising from use of such facility and/or operations on, over or under the aforesaid rights-of-way."

2.2.2 RAILWAY GUIDELINE

The Federation of Canadian Municipalities (FCM) and The Railway Association of Canada (RAC) has developed "Guidelines for New Development in Proximity to Railway Operations", dated May 2013. As mentioned, the VIA rail line would be classified as a Principal Main Line. Accordingly, the applicable guideline limits are presented below:

Table 2-6 Railway Guideline Sound Level Criteria for Rail Noise

AREA	TIME PERIOD	L_{EQ} (dBA) [1]	ASSESSMENT LOCATION
Outdoor Living Area (OLA)	Daytime (0700 – 2300h)	55	Outdoors
Living/Dining Room	Daytime (0700 – 2300 h)	40	Indoors
Bedroom	Nighttime (2300 – 0700 h)	35	Indoors

Notes: [1] Daytime: $L_{EQ\ 16HR}$; Nighttime: $L_{EQ\ 8\text{-}HR}$.

In addition, the following requirements for a principal main line:

- Safety setback of habitable buildings from the railway rights-of-way to be a minimum of 30 metres in conjunction of a safety berm. The safety berm shall be adjoining the railway rights-of-way with returns at the ends, 2.5 metres above grade at the property line.
- A noise barrier shall be adjoining and parallel to the railway rights-of-way, having returns at the ends, and a minimum total height of 5.5 metres above top of rail. They also must be constructed without holes or gaps and should be made of durable material not less than 20 kg per square metre of surface area.
- Layout of residential buildings could be configured to reduce impact of rail noise (i.e. bedrooms on the side furthest from the rail corridor, and bathrooms, laundry rooms on the side closest to rail corridor).
- Minimizing the number of doors and windows on the side closest to the rail corridor.
- Masonry concrete construction or heavy wall be used for all buildings in close proximity to the railway corridors.
- Window and Door requirements.
- Warning clause requirements.

2.3 TRAFFIC DATA AND FUTURE PREDICTIONS

2.3.1 ROAD TRAFFIC DATA

Road traffic volumes were obtained from the ENCG Appendix B for St. Laurent Boulevard, Tremblay Road, and Highway 417. The data obtained from the ENCG provides future traffic volume data for various roadways based on roadway class and number of lanes. This traffic data represents future traffic volumes and corresponding to a "mature state of development", in the City's Official Plan.

Tremblay Road currently is a 2-lane urban arterial road; however, it has been flagged by the city as potential in the future to be a 4-lane urban undivided arterial. The traffic and road parameters used for sound level predictions are shown in **Table 2-7**. The surrounding topography was assessed as generally flat.

Road traffic data from ENCG and calculations used for the study are included in **Appendix B**.

Table 2-7 Summary of Road Traffic Data Used in the Transportation Noise Analysis

ROAD	ROAD CLASSIFICATION	TRAFFIC VOLUMES (AADT)	DAY/NIGHT SPLIT (%)	MEDIUM TRUCKS (%)	HEAVY TRUCKS (%)	POSTED SPEED LIMIT (KPH)
St. Laurent Blvd	6-Lane Urban Arterial-Divided	50,000	92/8	7%	5%	70
Tremblay Road	4-Lane Urban Major Collector	24,000	92/8	7%	5%	50
Highway 417	Freeway, Queensway, Highway	146,664*	92/8	7%	5%	100
Highway 417 Eastbound Exit Ramp	2 Lane Urban Arterial	15,000	92/8	7%	5%	70

Notes: * 18,333 vehicles per day per lane (Westbound and Eastbound have four lanes each)

2.3.2 RAIL TRAFFIC DATA

Rail traffic data was obtained from VIA Rail Canada Inc. on August 14, 2019 and upon request for VIA Alexandria Subdivision in the area of Queensway (Highway 417) and St. Laurent Boulevard, located to east of Ottawa Station. The rail traffic data used in this assessment is summarized in **Table 2-8**. Copy of the information provided by VIA rail is included in **Appendix B**. A default growth rate of 2.5% was used to forecast the 15-year future rail traffic volumes.

Table 2-8 VIA Rail Traffic Data Projected to Year 2034

TYPE OF TRAIN	NUMBER OF TRAINS DAY/NIGHT	NUMBER OF LOCOMOTIVES	NUMBER OF CARS	MAX SPEED (KPH)
Passenger	36 / 7	2	5	105

There is an at-grade rail crossing at Michael Road, however as per information provided by VIA Rail the sounding of a whistle is prohibited at Mile 75.37 (Michael Road).

The tracks are constructed of continuously welding rail along the subdivision area. Rail traffic data used for the study are included in **Appendix B**.

2.4 ANALYSIS METHOD

Predicted sound levels at the receptors was estimated using the future road traffic data presented in **Table 2.7 and** future rail traffic data presented in **Table 2-8**. The sound level predictions were made using the algorithms ORNAMENT and STEAM, both developed by MECP, and implemented by STAMSON version 5.04, a computer software also developed by MECP. STAMSON output files are included in **Appendix C**.

The following factors were taken into account in the analysis:

- Vehicle/Train speeds;
- Road/Rail traffic volumes;
- Percentage of trucks;
- Horizontal and vertical road-receiver geometry;

— Ground absorption; and
— Screening provided by terrain, houses or existing barriers.

Most impacted receptor locations (in terms of façade and height) were chosen as representative receptor locations for each facade. The modelled receptor locations are shown on the Draft Development Concept Plan and included in **Figure 4** of **Appendix A**. The parameters used in STAMSON to assess the noise impacts at the receiver locations can be found in **Table C1** in **Appendix C**. **Figure 5 to Figure 9** in **Appendix A** shows the corresponding angles and distances used in the model.

The analysis method in the NRC document, BPN56 "*Controlling Sound Transmissions into Buildings*", dated September 1985, were used to estimate the acoustical requirements for the building components. The assessment of indoor sound levels and the acoustical requirements for building components were assessed separately for road and rail noise. The overall acoustical requirements for building components were obtained by combining the sound isolation parameters for road and rail noise logarithmically (on an energy basis).

2.5 RESULTS

Sound levels were predicted at the most impacted façades during the daytime and nighttime hours. The predicted sound levels were used to investigate ventilation and building construction requirements. The results of these predictions are summarized in **Table 2-9**.

The predicted sound levels indicate that due to the magnitude of exterior sound level, there is a potential to exceed indoor sound level; therefore, as per the City of Ottawa's ENCG and the MECP's NPC-300 noise control façade construction and warning clauses are required.

Table 2-9 Summary of Predicted Facade Sound Levels – Transportation (Road & Rail)

ASSESSMENT LOCATIONS	DESCRIPTION	DAYTIME SOUND LEVEL (dBA)	NIGHTIME SOUND LEVEL (dBA)
A	Block 2, Northwest Corner along West Façade	73	65
B	Block 2, Northwest Corner along North Façade	78	70
C	Block 2, Northeast Corner along North Façade	77	70
D	Block 2, Northeast Corner along East Façade	75	68
E	Block 4, Northeast Corner along East Façade	75	67
F	Block 4, Southeast Corner along East Façade	74	66
G	Block 1, Southeast Corner along East Façade	73	66
H	Block 1, Southeast Corner along South Façade	65	58
I	Block 1, Southwest Corner along South Façade	62	57
J	Block 1, Southwest Corner along West Façade	69	62
K	Block 3, Southwest Corner along West Facade	69	62
L	Block 3, Northwest Corner along West Facade	70	63
M	Block 6, Northwest Corner along West Façade	67	61
N	Block 6, Northwest Corner along North Façade	73	66

ASSESSMENT LOCATIONS	DESCRIPTION	DAYTIME SOUND LEVEL (dBA)	NIGHTIME SOUND LEVEL (dBA)
O	Block 6, Northeast Corner along North Façade	74	66
P	Block 6, Northeast Corner along East Façade	71	64
Q	Block 6, Southeast Corner along East Façade	70	63
R	Block 6, Southeast Corner along South Façade	66	61
S	Block 6, Southwest Corner along South Façade	65	61
T	Block 6, Southwest Corner along West Façade	66	62

2.6 RECOMMENDATIONS

The following discussion outlines the recommendations for building facade constructions, ventilation requirements, and warning clauses to achieve the noise criteria stated in **Table 2-3**.

2.6.1 OUTDOOR LIVING AREA (OLA)

OLA's are outdoor spaces intended and designed for quite enjoyment of the outdoor environment. OLA includes, backyards, terraces, balconies and elevated terraces with a minimum depth of 4 m and are not enclosed. Common outdoor living areas associated with high-rise residential buildings are also considered OLA's.

When sound levels at the OLA's are predicted to exceed the design objective of 55 dBA, noise control mitigations should be investigated for its technical, administrative and economical reasons. Noise control mitigations could be in the form of acoustic barriers and should meet a minimum surface density of 20 kg/m^2. When acoustic barriers are not feasible, another noise control mitigation is through the building design by limiting the depth of the OLA to less than 4 m.

As the project is still in its early stage, building footprints, building design and outdoor living areas are not yet available. This should be reviewed when more detailed drawings become available.

2.6.2 VENTILATION REQUIREMENTS

Based on the predicted sound levels at the exterior façade on all blocks, central air conditioning should be provided. This will allow occupants to keep windows closed and maintain a comfortable indoor living environment.

As required by the City of Ottawa's ENCG and MECP, warning clauses (Type D) should be included in all offers of purchase and sales, and lease or rental agreements.

2.6.3 BUILDING COMPONENT REQUIREMENTS

As shown on **Table 2-9**, the sound levels at the plane of window are predicted to exceed 65 dBA during the daytime at most locations. Thus, the building components will require upgraded wall, door and window glazing assemblies as described below.

To estimate the acoustical requirements for the building components, it is assumed that the wall and window areas are 50% of the associated floor area of the space. For the purposes of this analysis, doors were included in the window area calculations.

Exterior wall construction: Since both Block 1 and Block 6 are on first row, within the 100 m of the rail line, and the $L_{EQ\ 24\text{-}HR}$ exceeded the 60 dBA, as per the NPC-300, the exterior walls must be constructed with brick veneer or masonry equivalent. It is assumed that this assembly will have an estimated STC rating of at least 54.

The remaining blocks will require exterior walls meeting an STC rating of 54 as well.

Window and door assemblies: Windows and doors meeting the STC rating of at least 39 will be needed to meet the indoor sound level limit at the residential suites. A double glazed fully sealed window assembly consisting of two 6 mm panes separated by 30 mm air gap or greater is estimated to provide this STC rating. Typically, window assemblies include small operable portion within the window assembly. A good weather seal should be included for this operable portion to minimize the noise flanking. The door system should also include good weather seals to minimize flanking noise. It should also be noted that the entire assembly, including the frames, should meet the acoustical requirement. The acoustic performance of the window/door should be confirmed through acoustical test data by an acoustical laboratory testing facility.

Since the analysis was based on assumptions, these acoustical requirements should be reviewed once detailed building plans become available. This is typically done during the building permit application to the City.

2.6.4 WARNING CLAUSES

As per the City of Ottawa's ENCG and the MECP's guideline, the inclusion of warning clauses in all offers of purchase and sale, and lease or rental agreements are required. Appropriate wording is provided below and can be altered as required by the City of Ottawa as needed.

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 City's and the Ministry of the Environment's noise criteria."*

Type E

> *"Canadian National Railways Company or its assigns or successors in interest has or have a rights-of-way within 300 metres from the land subject hereof. There may be alteration to or expansions of the railway facilities on such right-of-ways in the future including the possibility that the railway 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 dwellings. CNR will not be responsible for any complaints or claims arising from use of such facility and/or operations on, over or under the aforesaid rights-of-way."*

3 STATIONARY NOISE IMPACT ASSESSMENT

3.1 NOISE SOURCES

The stationary noise sources that have the potential to create a significant noise effect to the proposed development are the industries located to the south of the Site (i.e. LRT Maintenance Facility, Pepsi, and OC Transpo Belfast Yard).

The establishments located on the north side of Queensway (Highway 417) and on the east side of St. Laurent Boulevard are not expected to create significant noise impact to the Site as these establishments are separated by very busy roadways. This was confirmed during the site visit on July 17 and 18, 2019, where noise from these establishments was not audible over the existing road traffic noise at the Site.

3.1.1 LRT MAINTENANCE FACILITY

The LRT Maintenance Facility is located to the southwest of the Site with existing residential dwellings located closer. The noise sources associated with this facility include rooftop units (i.e. exhaust fans, HVAC units, etc.), LRT movements, and noise associated with maintenance work inside the building emitted outdoors through the open overhead doors.

3.1.2 PEPSI FACILITY

The Pepsi Facility is located immediately to the south of the Site, on the south side of the rail corridor. Based on the aerial imagery, there are several trailers parked within its site and loading docks facing the proposed development. The main noise sources from this facility include heavy truck movements, idling and potentially coupling/uncoupling activities at the parking lot, as well as loading and unloading activities at the loading area.

3.1.3 OC TRANPORT BELFAST YARD

The OC Transport Belfast Yard is located to the southeast of the Site. The noise sources associated with this facility include rooftop units (i.e. exhaust fans, HVAC units, etc.), bus movements, idling, and noise associated with maintenance work inside the building emitted outdoors through the open overhead doors.

3.2 PRELIMINARY NOISE ASSESSMENT

A preliminary noise assessment of the potential noise effect of the nearby industrial facilities (i.e. LRT Maintenance Facility, Pepsi and OC Transpo Belfast Yard, all located to the south of the Site) has been completed.

The predictive analysis of these facilities to assess the potential noise impact at the Site was completed using the commercially available software package CADNA/A, a computerized implementation of the algorithms contained in the ISO 9613 “Acoustics – Attenuation of Sound during Propagation Outdoors”. The CADNA/A modelling takes into account the following:

- Source sound power levels;
- Distance attenuation
- Source-receptor geometry;

- Ground and air (atmospheric) attenuation; and,
- Temperature and humidity effects on noise propagation.

The location, type and size of the rooftop units were estimated based on the aerial imagery. Bus and heavy truck activities were taken from similar facilities from studies previously completed.

The preliminary assessment indicated that the sound levels at the proposed development, attributable to the operation of these facilities, are predicted to exceed the sound level limits under a Class 1 Area.

3.3 MITIGATION

As the project is still in its early stages, specifics regarding the noise mitigation measures are not available. MECP prefers that noise mitigation measures be implemented on the property of the stationary source. This method normally is the most economical and practical option. Noise mitigation could include rooftop acoustic screens, acoustic louvres, silencers, and reselecting a quieter unit.

Receptor-based noise control measures are also acceptable for implementation at the proposed development. An effective means of meeting the noise guideline criteria is through the use of architectural designs, i.e. no noise sensitive windows facing the industrial/commercial establishments.

NPC 300 also specifies a new area classification for areas in transition. For a site that is good candidates for Class 4, sound level limits are less stringent than Class 1 area. This new area classification will allow a site to be developed for residential use while the adjacent to industrial/commercial establishments are still in compliance with the sound level limits. It should be noted that this Class 4 designation is subject for approval by the authorizing agency, in this case, the City of Ottawa.

3.4 NEXT STEPS

It is recommended that a detailed acoustical assessment of these facilities be completed to accurately assess its potential noise effect and investigate the feasibility of noise mitigation measures needed to comply with the applicable sound level limits at the proposed development.

This is typically completed during the Site Plan Application submission to the City and recommended to be included as a condition during the Draft Plan of Subdivision approval.

3.5 WARNING CLAUSES

The Site is located in close proximity to the industry and thus, the inclusion of this warning clause in all offers of purchase and sale, and lease or rental agreements is recommended.

Type F

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

4 VIBRATION IMPACT ASSESSMENT

4.1 SOURCES OF VIBRATION

The only significant source of ground-borne vibration that has the potential to have a significant impact to the proposed development are the train movements on the VIA Alexandria Subdivision that runs along the south boundary of the Site.

During WSP's site visit on July 17, 2019, only VIA Rail trains were observed. Ground-borne vibration velocities were measured from eight (8) trains of varying sizes which are summarized in **Table 4-1** below. OLRT movements at the LRT Maintenance Facility located south of the Site were also noted during the site visit and found to be insignificant.

Table 4-1 Summary of VIA Rail Trains Measured

TRAIN PASS-BY NO.	TIME	DIRECTION	NUMBER OF LOCO/CARS
1	16:20	Eastbound	1 / 6
2	16:51	Eastbound	1 / 4
3	17:02	Westbound	1 / 4
4	18:58	Westbound	1 / 7
5	19:03	Eastbound	1 / 6
6	19:16	Westbound	1 / 6
7	19:48	Eastbound	1 / 7
8	20:03	Westbound	1 / 7

4.2 VIBRATION GUIDELINES

The City of Ottawa has no specific vibration limits for new developments. Therefore, the guideline document, "*Guidelines for New Development in Proximity to Railway Operations*" published by FCM/RAC, dated May 2013, has been adapted to assess the potential vibration impact at the proposed development.

The guidelines require measurements of ground-borne vibration when residential dwelling units are to be located within 75 metres of a principal mainline such as the VIA Alexandria Subdivision to the south of the Site.

Specifically, FCM/RAC requires:

- Ground-borne vibration transmission to be evaluated through site testing.
- A minimum of five (5) train pass-bys to be recorded
- Proposed dwellings within 75 metres of the railway rights-of-way to be evaluated with a limit of 0.14 mm/sec RMS (75 VdB in 1 µin/s) between 4 Hz and 200 Hz.
- If in excess of the limit, isolation measures will be required to ensure living areas do not exceed 0.14 mm/sec RMS on and above the first floor of the dwelling.
- Findings and recommendations are to be summarized in a report.

4.3 VIBRATION INSTRUMENTATION

Ground-borne vibration measurements were conducted using a CoCo-80 dynamic signal analyzer along with three (3) single-axis accelerometers. The sensors measured vibration simultaneously at various setback distances from the railway right-of-way (ROW), as summarized in **Table 4-2** and shown in **Figure 10**. Location 1 represents the closest setback distance (30 m) possible for a residential development near a rail line. The sensors were placed level on rigid spikes hammered firmly into the ground using a magnetic connection. Measurements were conducted on July 17, 2019 between 13:30 and 20:30. Calibration of sensors were verified before and after measurements using an IMI Hand Held Shaker, model 699B02, to verify data quality. Calibration certificates can be found in **Appendix E**.

Table 4-2 Summary of Vibration Transducers

LOCATION	APPROX. SETBACK (m)	MODEL #	SERIAL #	SENSITIVITY (mV/g)
1	30	PCB Piezotronics 393A03	40647	986
2	45	PCB Piezotronics 393A03	51043	1015
3	60	PCB Piezotronics 393A03	9743	967.1

The measured vibration data in acceleration were integrated using a cut-off frequency of 512 Hz to obtain the velocities. The root mean-square (RMS) was then found using a 90% overlap and 1 second average time.

4.4 VIBRATION RESULTS

Ground-borne vibration levels during the pass-bys are below the Railway Guideline's limit of 0.14 mm/s (-17 dB) at all 3 locations. The vibration time histories for all pass-bys are attached in **Appendix D**. **Table 4-3** shows the summary of measured overall maximum vibration velocity magnitudes of the trains during each train pass-bys. The overall vibration velocity magnitudes reported are the maximum RMS values that occurred for the duration of each individual pass-by.

Table 4-3 Maximum Vibration Velocity of Train Pass-bys

TRAIN PASS-BY	LOCATION 1 APPROX. 30 M FROM RAILWAY R.O.W (MM/S RMS) [1]	LOCATION 2 APPROX. 45 M FROM RAILWAY R.O.W (MM/S RMS) [1]	LOCATION 3 APPROX. 60 M FROM RAILWAY R.O.W (MM/S RMS) [1]
1	0.014	0.025	0.024
2	0.011	0.013	0.007
3	0.011	0.011	0.006
4	0.009	0.006	0.006
5	0.014	0.009	0.006
6	0.011	0.008	0.006
7	0.012	0.010	0.012
8	0.010	0.013	0.014

Notes: [1] Maximum overall vibration velocity occurring for the entire pass-by; one second RMS averaging.

The results indicate that the vibration velocities are well below the 0.14 mm/s RMS vibration limit suggested by FCM/RAC. Thus, vibration mitigation is not required for the proposed development.

5 IMPACT OF THE DEVELOPMENT ON THE SURROUNDING ENVIRONMENT

The proposed development is not a significant source of vibration and thus, it is not expected to create a significant vibration effect to the nearby vibration sensitive receptors. However, the proposed development has the potential to create a significant noise impact to the nearby noise sensitive receptors.

This section discusses the sources of noise attributable to the proposed development

5.1 VEHICLE TRAFFIC GENERATED BY THE PROJECT

The Transportation Impact Assessment, Forecasting Report prepared by WSP, dated September 3, 2019, indicated that the vehicle traffic generated by the proposed development was estimated to be up to 20,000 vehicles per day by the year 2033. This traffic volume is significantly less than the existing traffic volume on Highway 417 (151,500 vehicles per day applicable to the year 2016, obtained from the Ontario Ministry of Transportation website).

Thus, road traffic noise generated by the project is not expected to create a significant noise effect to the acoustical environment of the area.

5.2 MECHANICAL EQUIPMENT

The noise sources associated with the proposed development are expected to be rooftop HVAC units and other similar mechanical units (i.e. boilers, chillers, elevators, pumps, emergency generators, chillers, exhaust fans, air conditioners, parking garage exhausts) which could have the potential to have adverse impacts on the surrounding neighborhood.

Typically, these mechanical units are located inside a mechanical room and if there are rooftop sources they are not expected to have an impact on adjacent residential receptors given that the high ambient sound levels in the area and the fact that the systems will be designed to ensure that the applicable noise guidelines are met at on-site receptors, off-site impacts are not anticipated.

It is recommended that a detailed noise assessment of the potential noise impact of the mechanical units within the development to off-site noise receptors be investigated to ensure compliance with the applicable sound level limits. This is typically done during the detailed design stage, building permit application and shop drawing review stage.

6 IMPACT OF THE DEVELOPMENT ON ITSELF

6.1 DEMISING PARTITIONS

The Ontario Building Code (OBC) provides the minimum Sound Transmission Class (STC) or Apparent Sound Transmission Class (ASTC) ratings for demising walls and floor-ceiling assemblies:

- STC 50 (laboratory rating) or ASTC 47 (field rating) for demising partitions between a dwelling unit and other spaces in a building in which noise may be generated; and
- STC 55 (laboratory rating only) for demising partitions between a dwelling unit and an elevator shaft or a refuse chute.

Although not mandatory, OBC also recommends that the floor-ceiling construction has an impact insulation class rating of Impact Isolation Class (IIC) 55 to reduce the transmission of impact noise (i.e. footsteps, etc.). Adding a carpet and/or underlayment have proven to improve the IIC rating and can help resolve the noise complaints within the building.

6.2 BUILDING SERVICES

Mechanical equipment (i.e. elevator, garbage chutes, plumbing, HVAC units) are recommended to be placed as far as possible from sensitive areas. OBC also recommends that vibrating parts be isolated from the building structure using resilient materials to reduce the vibration transmission to acceptable levels.

The OBC also recommends that indoor sound levels due to mechanical noise be assessed in accordance with good engineering practice such as that described in the American Society of Heating and Air-Conditioning Engineers (ASHRAE) Fundamentals Handbook in order to provide a suitable indoor acoustical environment to the occupants.

7 CONCLUSIONS

Based on the predicted sound levels at the proposed development due to transportation (road and rail) noise sources, the following noise mitigation measures are needed to comply with the City and MECP noise guidelines:

- Mandatory air conditioning for all residential suites within the development;
- Upgraded exterior wall and window construction;
- Final acoustical requirements for building facades should be checked when detailed building plans become available. This is typically done during the building permit application to the City; and
- Warning clauses are to be included in the offers/agreements of purchase and sale or leases or rental agreements, to notify potential purchasers and tenants of the environmental concerns to make an informed decision.

A preliminary noise assessment of the potential noise effect of the nearby industrial facilities indicated that the predicted sound levels at the proposed development, attributable to the operation of these facilities, are predicted to exceed the sound level limits under a Class 1 Area. Thus, it is recommended that a detailed acoustical assessment of these facilities be completed in the next stage of the project.

Table 7-1 Summary of Noise Control Requirements and Noise Warning Clauses

LOCATION	VENTILATION REQUIREMENTS	WALL STC	WINDOW STC	WARNING CLAUSES
All Residential Suites	Mandatory A/C	First row adjacent to rail corridor: Brick Veneer (or masonry equivalent) Remaining Blocks: STC 54	STC 39	D + E + F

Ground-borne vibration velocities due to rail movements on VIA Alexandria Subdivision were measured on site at various setback distances and determined that the measured vibration velocities are well below the criterion of 0.14 mm/s as suggested by the FCM/RAC. Therefore, vibration mitigation measures are not needed for this development.

BIBLIOGRAPHY

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- Ontario Ministry of the Environment (1989). Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), Ontario, Canada
- City of Ottawa (2016; January). Environmental Noise Control Guidelines (ENCG), Ontario, Canada
- The Federation of Canadian Municipalities and The Railway Association of Canada (2013, May). Guidelines for New Development in Proximity to Railway Operations, Ontario, Canada.

APPENDIX

A FIGURES

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

SITE LOCATION

RAIL LINE

N
W E
S

60 30 0 60 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
1	1:6,000

TITLE:

SITE MAP

DISCIPLINE:

ENVIRONMENT

ISSUE:	REV.:
	-

Document Path: T:\19M-00609-00\MXD\19M-00609-00 305 Figure 1 Site Map.mxd

wsp

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AURORA, ONTARIO CANADA L4G 0G9
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LEGEND

SITE LOCATION

BASE DRAWING BY:
Annis, O'Sullivan, Vollebekk Ltd.
dated October 30, 2019

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY:
-

DRAWN BY:
T.P.

CHECKED BY:
-

FIGURE NO:	SCALE:
2	1:2,000

TITLE:

DRAFT PLAN OF SUBDIVISION

DISCIPLINE:
ENVIRONMENT

ISSUE:	REV.:
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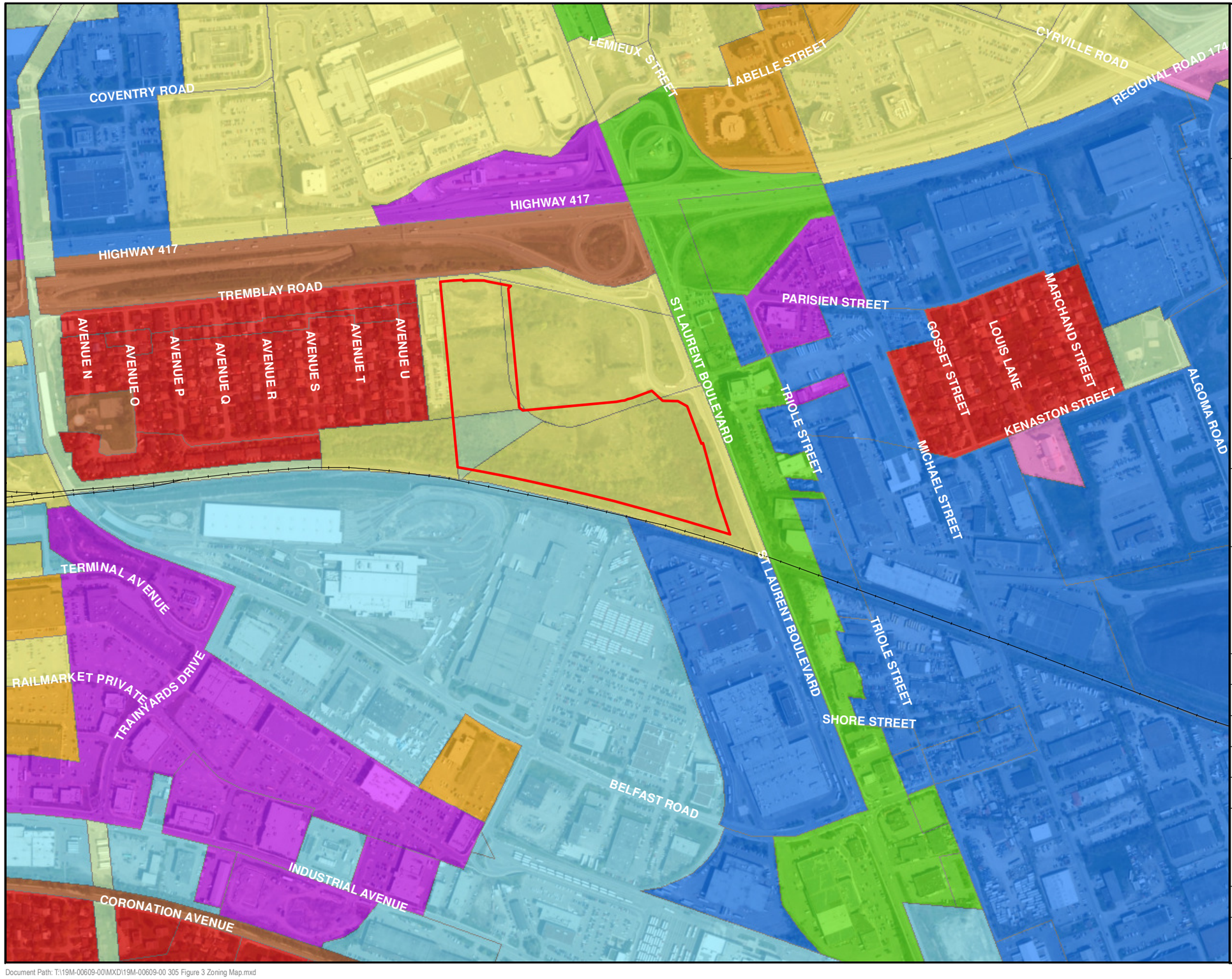
Document Path: T:\19M-00609-00\MXD\19M-00609-00 305 Figure 2 Conceptural Site Plan.mxd



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LEGEND

- APPROXIMATE SITE LOCATION
- RAIL LINE

CITY OF OTTAWA ZONING

- ARTERIAL MAINSTREET ZONE
- COMMUNITY LEISURE FACILITY ZONE
- GENERAL MIXED USE
- GENERAL INDUSTRIAL
- LIGHT INDUSTRIAL
- MINOR INSTITUTIONAL
- MIXED USE CENTRE ZONE
- PARKS AND OPEN SPACE
- RESIDENTIAL
- TRANSIT ORIENTED DEVELOPMENT ZONE

N W E S

60 30 0 60 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
3	1:5,900

TITLE:

ZONING MAP

DISCIPLINE: ENVIRONMENT

ISSUE:	REV.:
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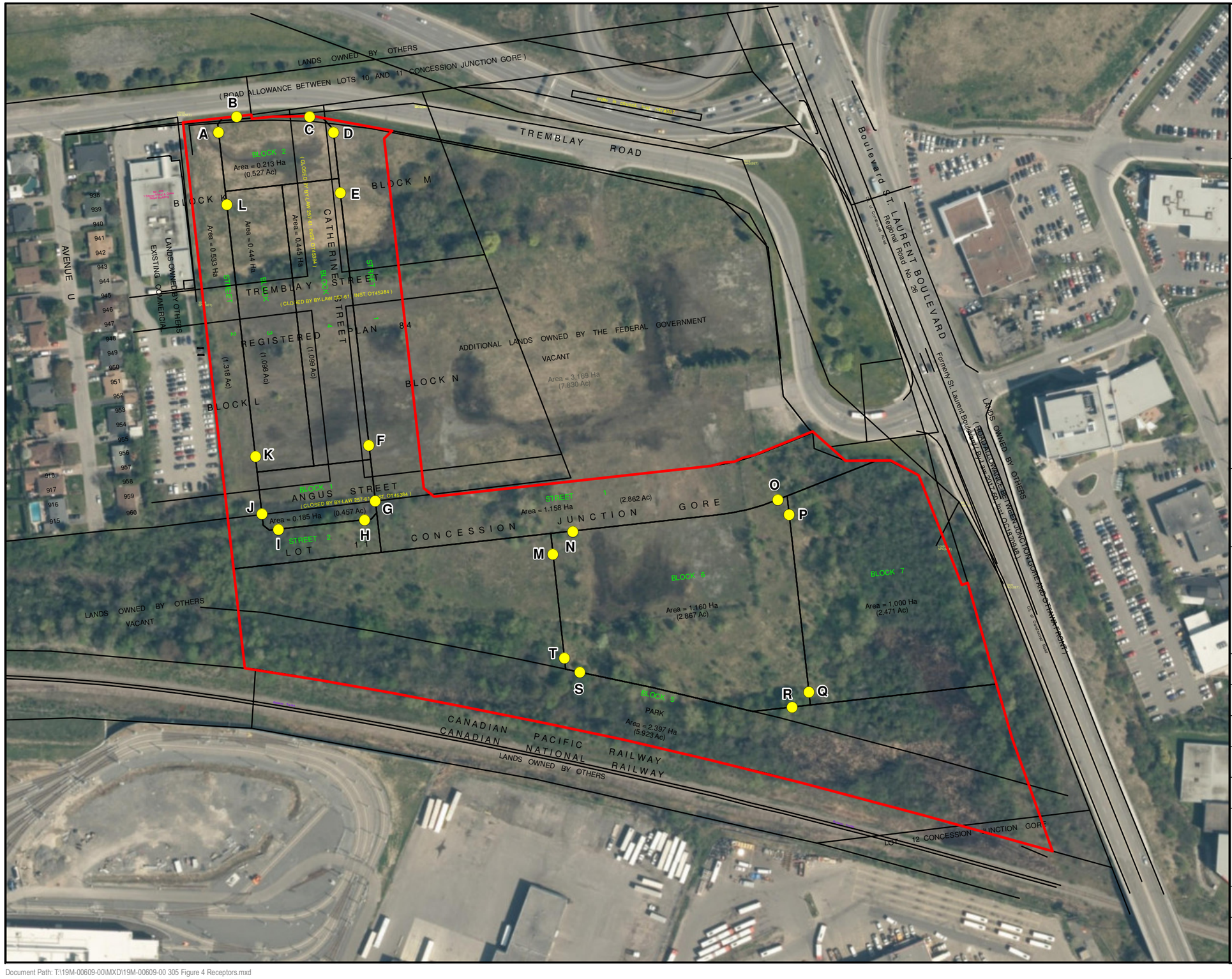

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LEGEND

APPROXIMATE SITE LOCATION

RECEPTOR

N
W E
S

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
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TITLE:

RECEPTOR LOCATIONS

DISCIPLINE:

ENVIRONMENT

ISSUE:	REV.:
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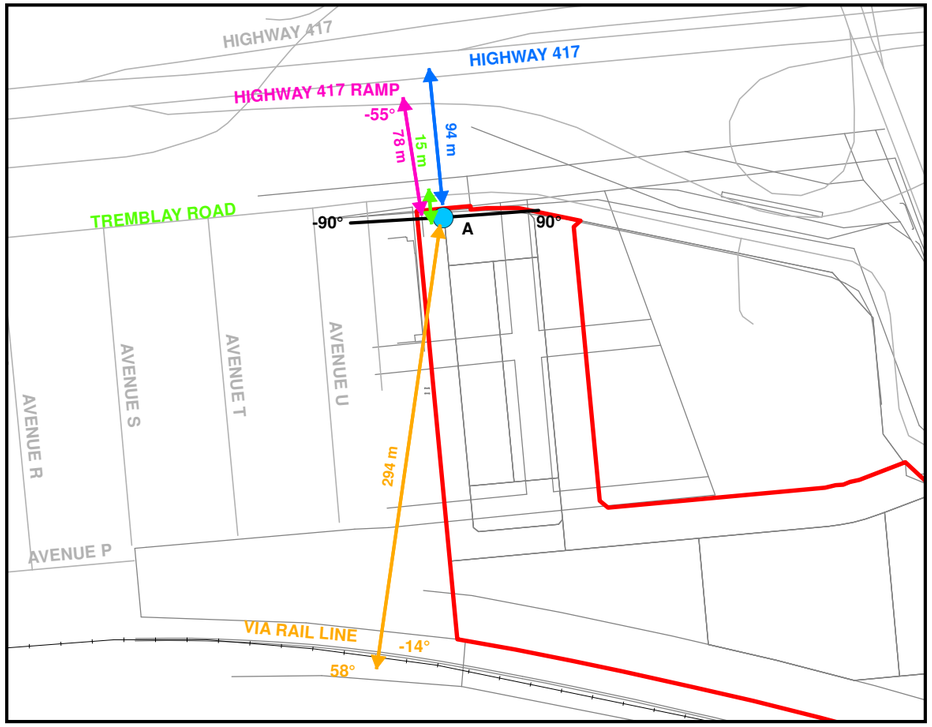

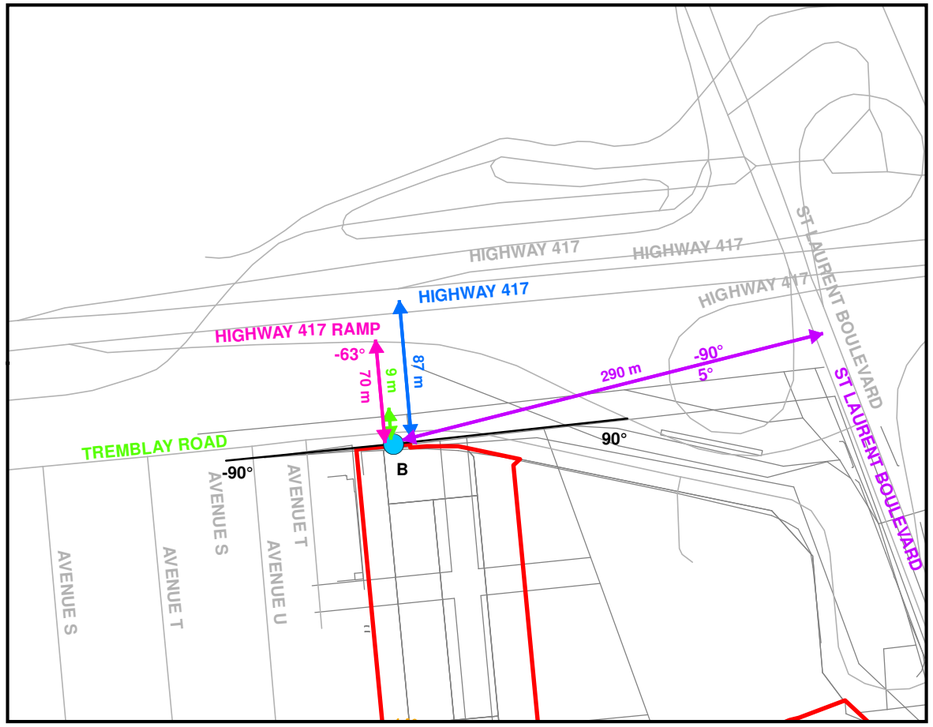

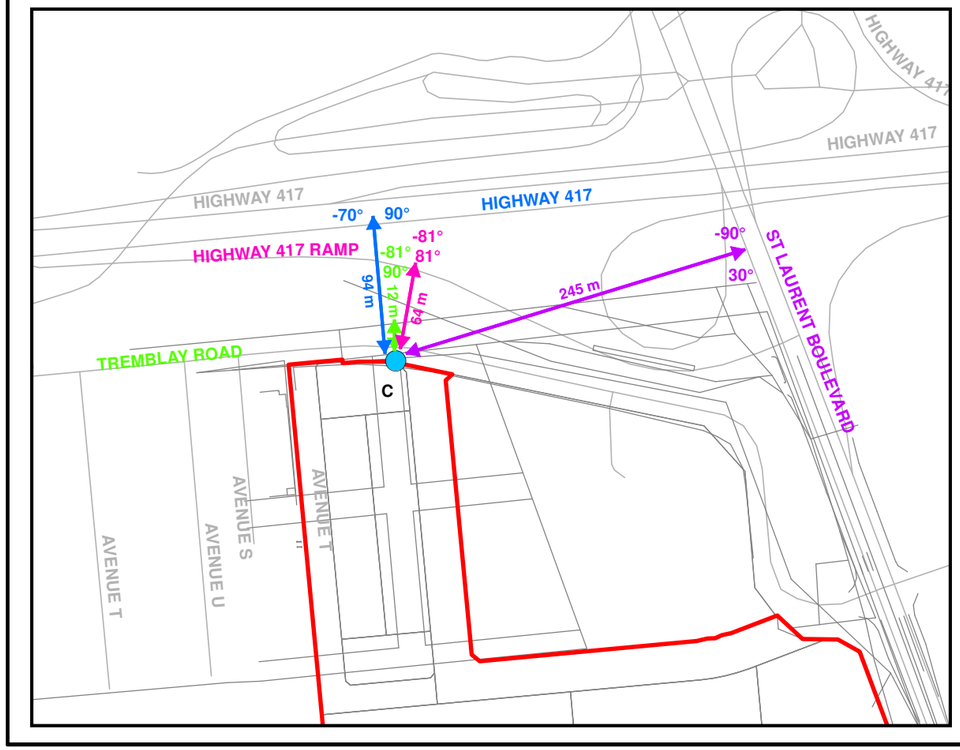

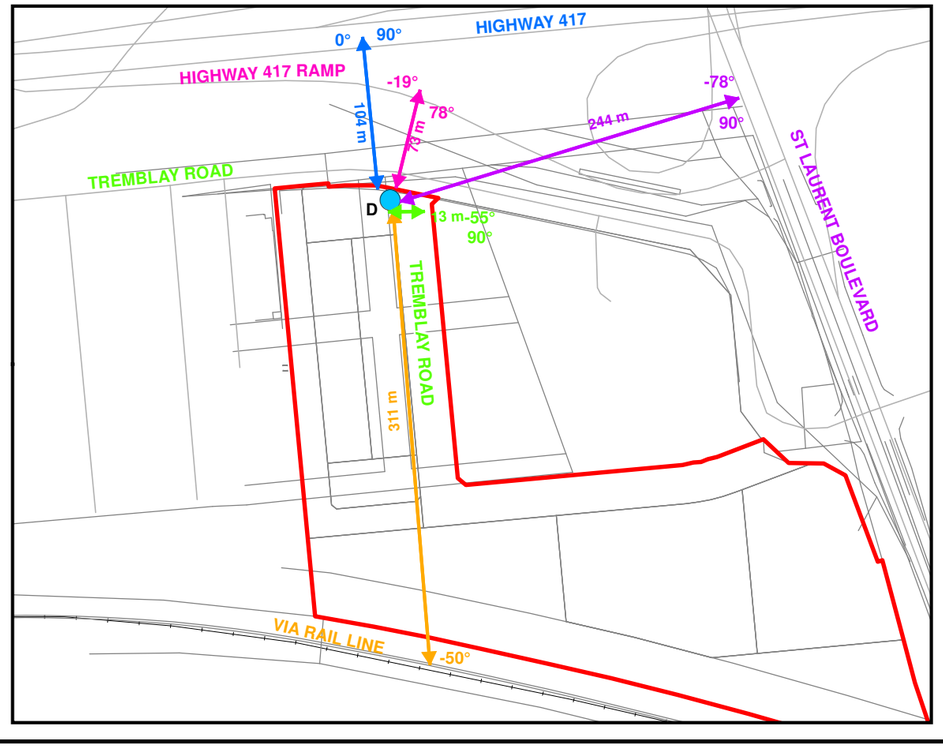

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LEGEND

- APPROXIMATE SITE LOCATION
- POR LOCATION
- PROPOSED DEVELOPMENT

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
5	-

TITLE:

RECEIVER LOCATIONS
A, B, C & D

DISCIPLINE: ENVIRONMENT

ISSUE:	REV.:
	-

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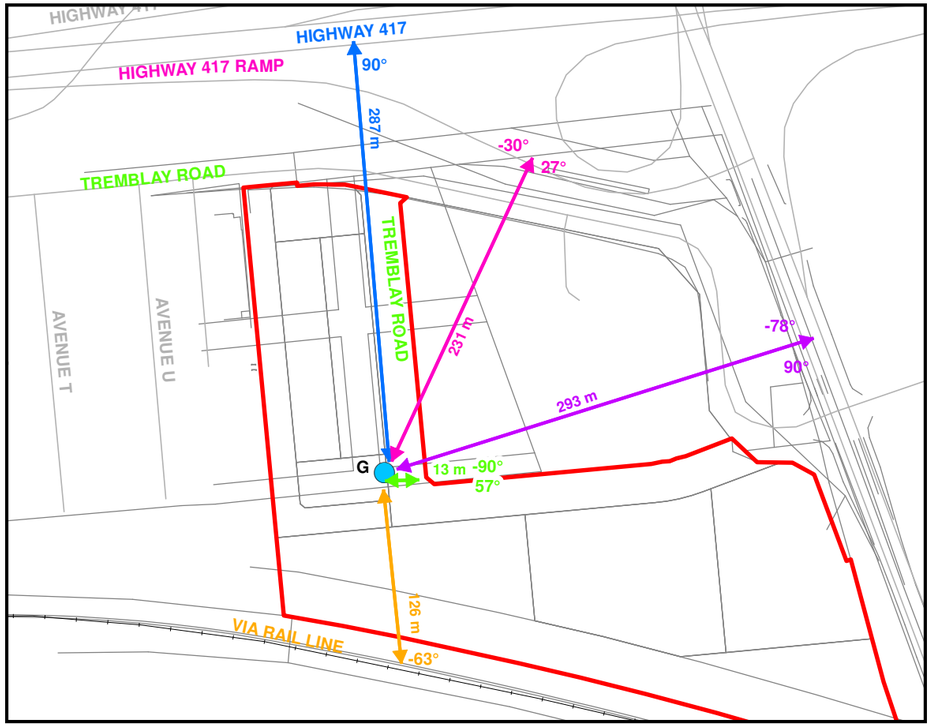

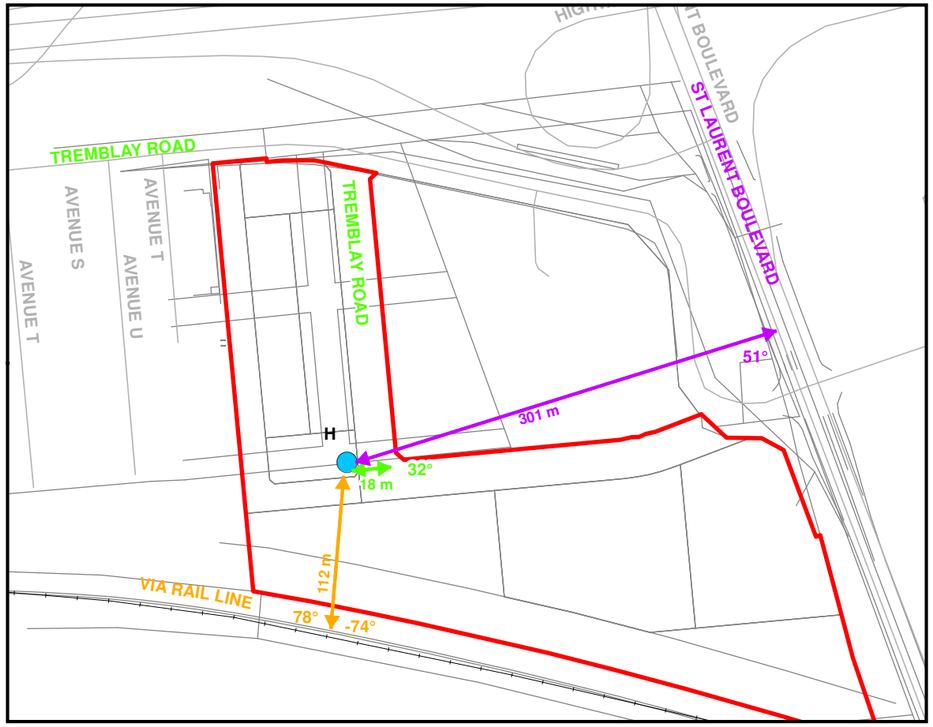

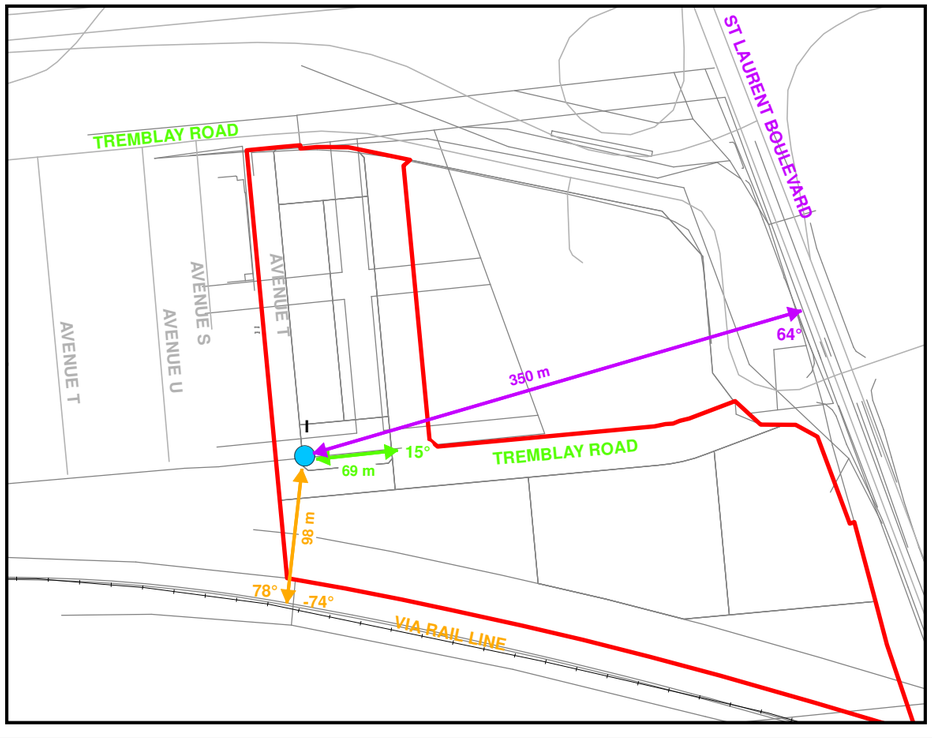

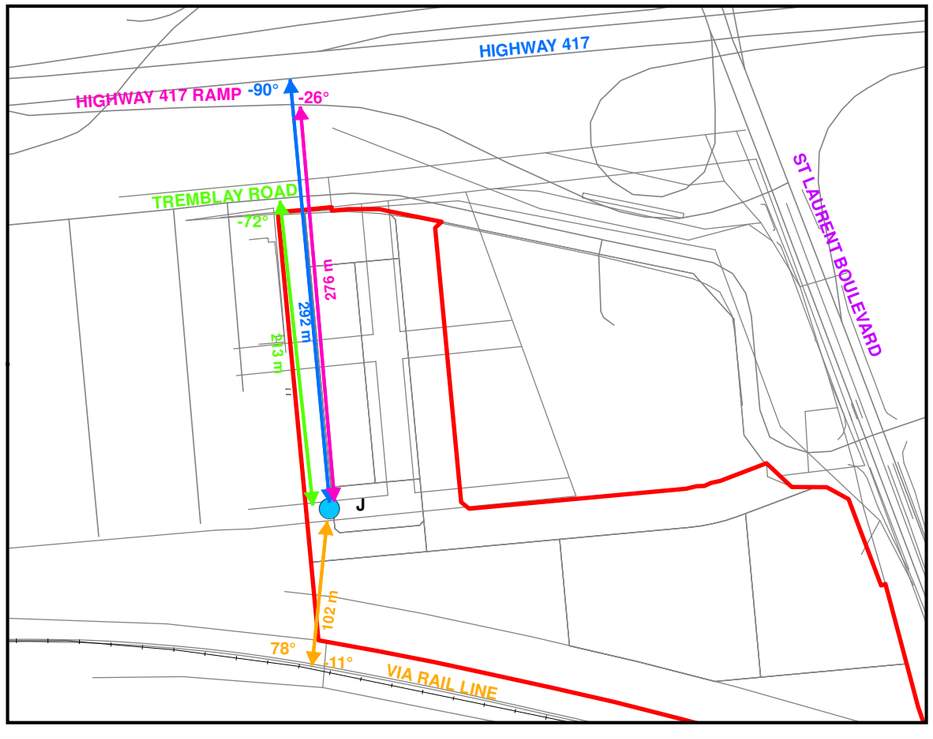

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LEGEND

APPROXIMATE SITE LOCATION

POR LOCATION

N
W E
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10 5 0 10 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
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TITLE:

RECEIVER LOCATIONS
G, H, I & J

DISCIPLINE: ENVIRONMENT

ISSUE:	REV.:
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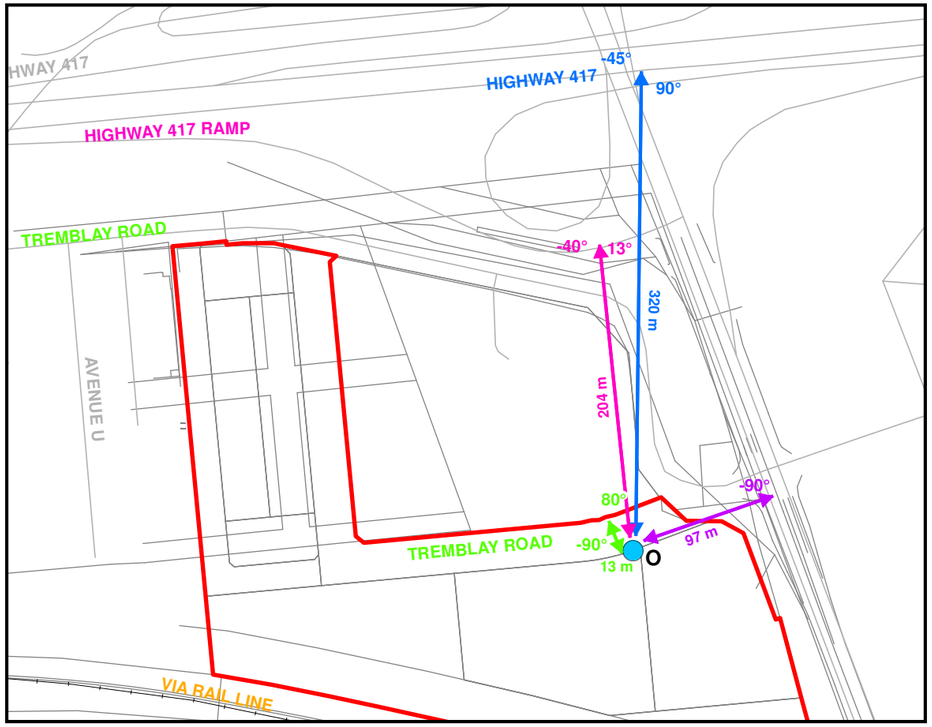

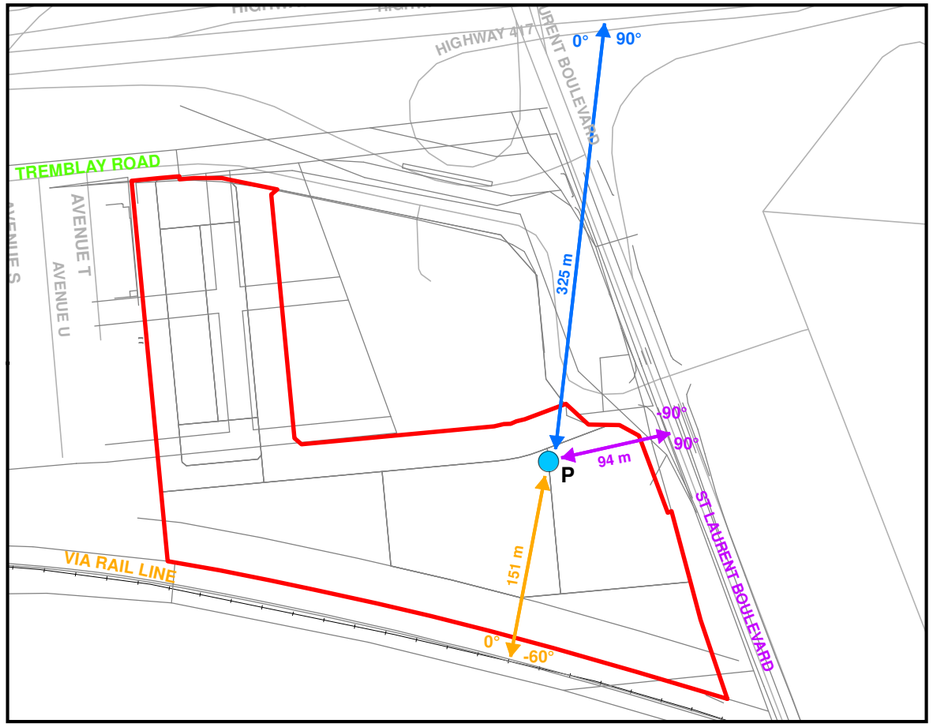

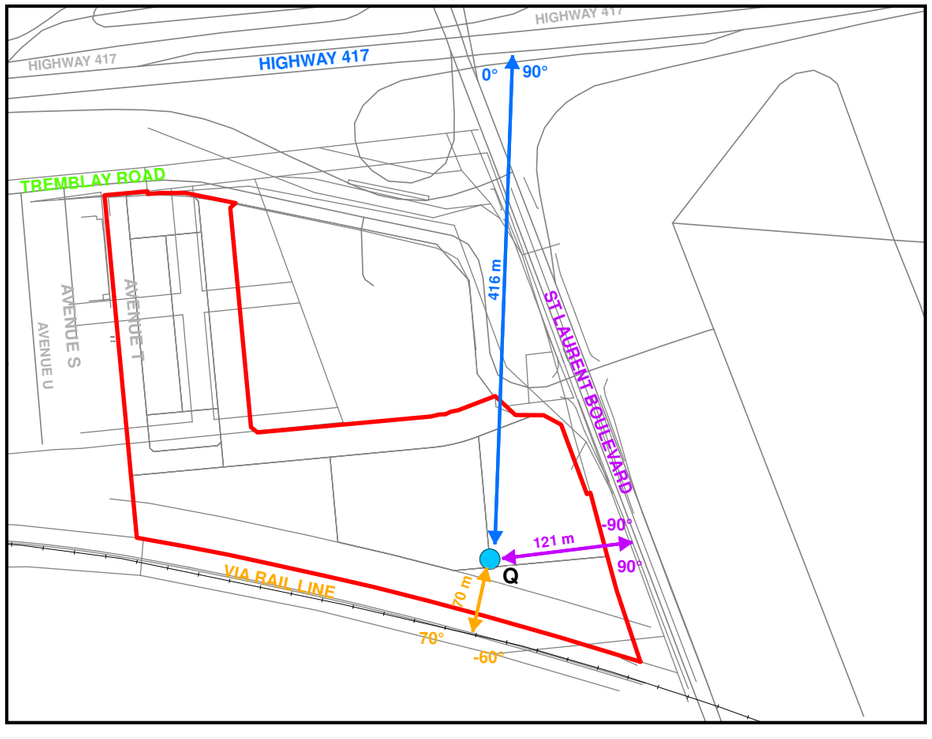

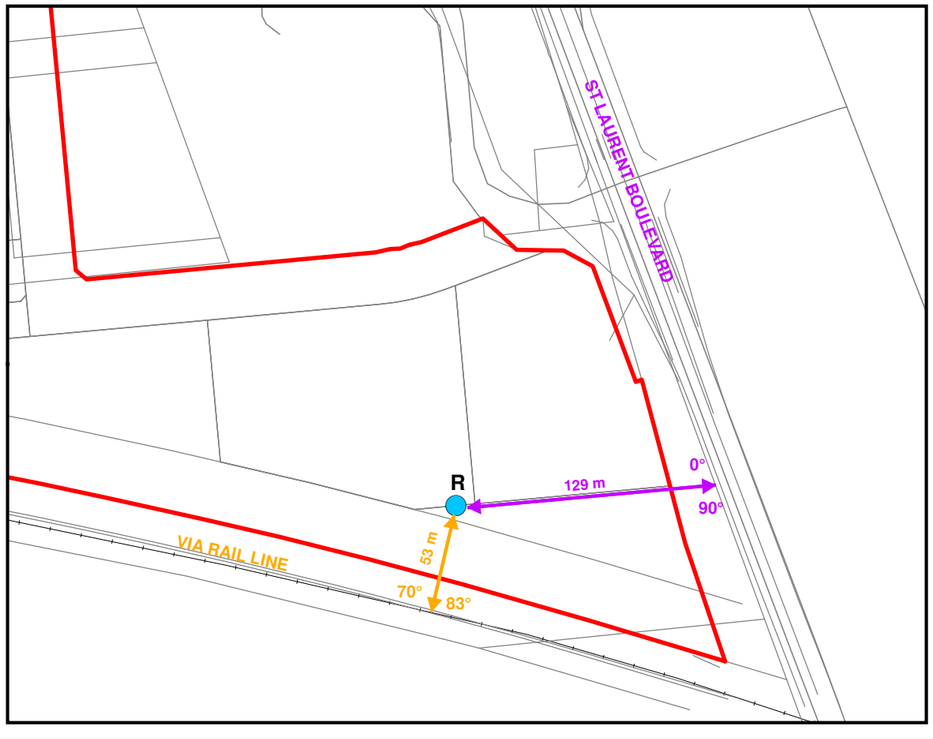

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LEGEND

- APPROXIMATE SITE LOCATION
- POR LOCATION

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
7	-

TITLE:

RECEIVER LOCATIONS
O, P, Q & R

DISCIPLINE: ENVIRONMENT

ISSUE:	REV.:
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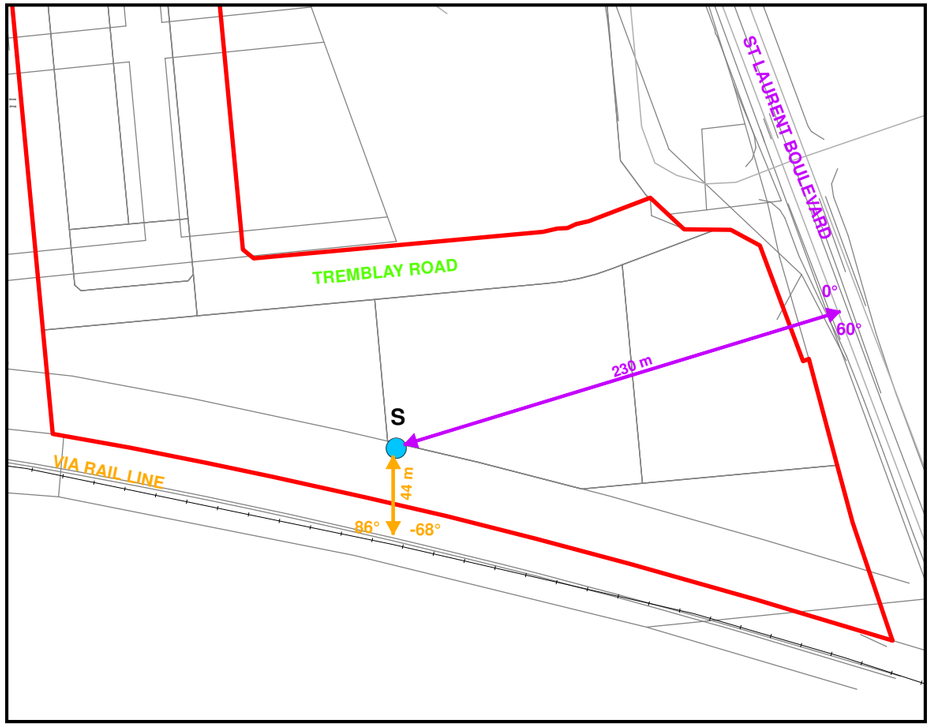

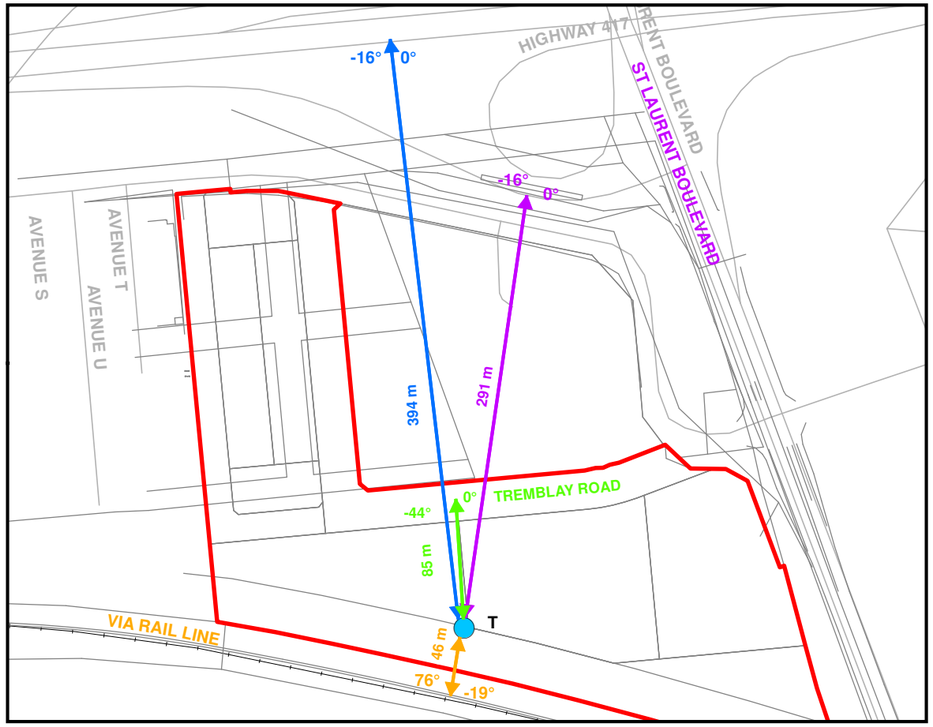

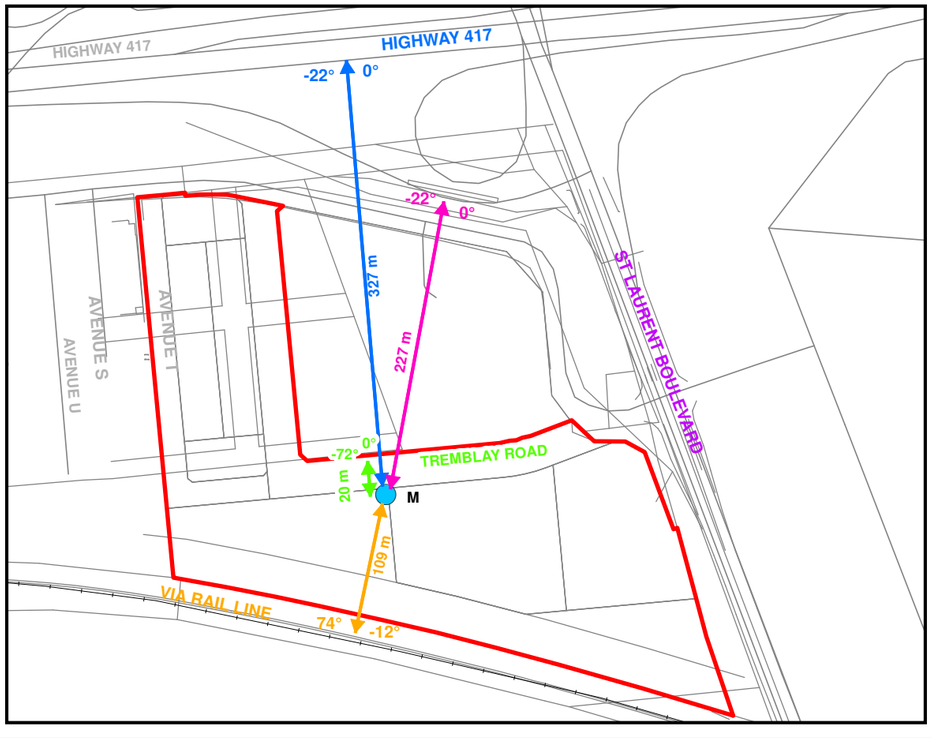

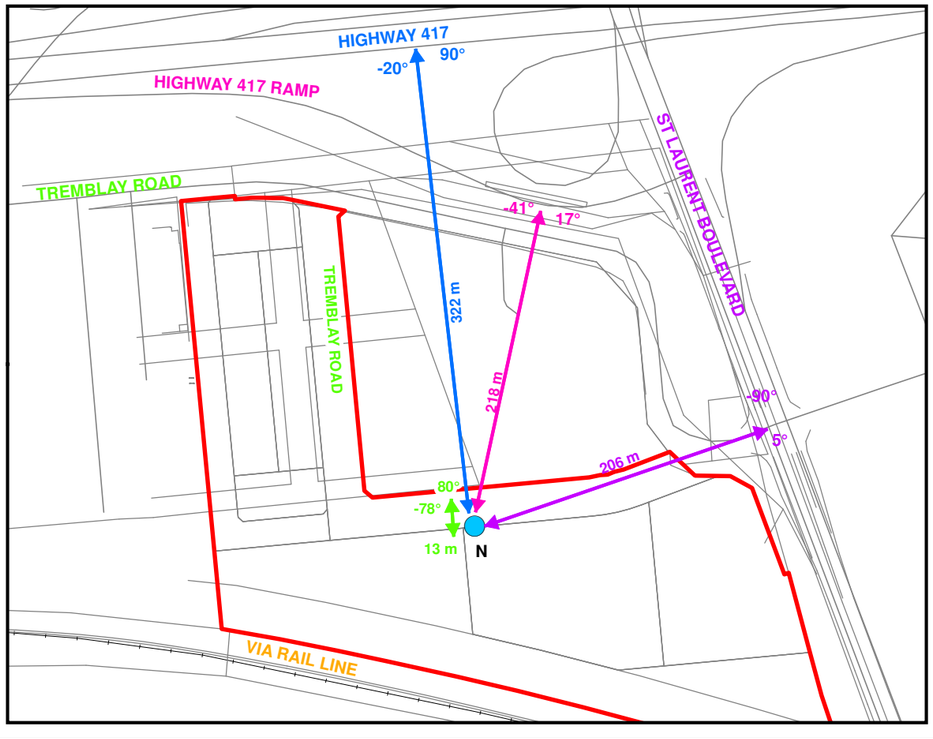

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TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

APPROXIMATE SITE LOCATION

POR LOCATION

N
W E
S

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
8	-

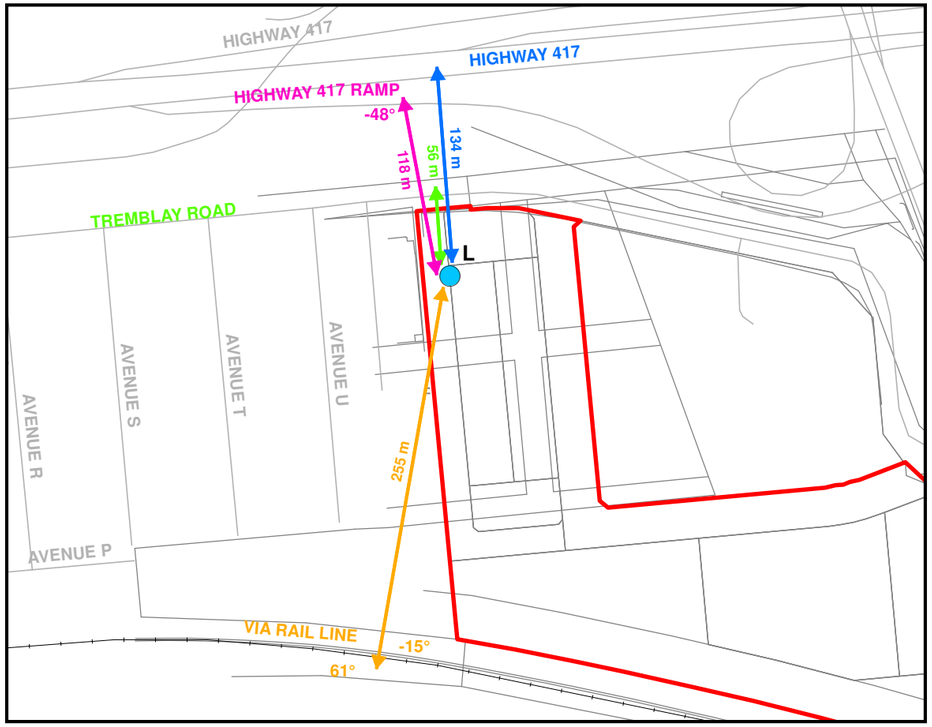
TITLE:

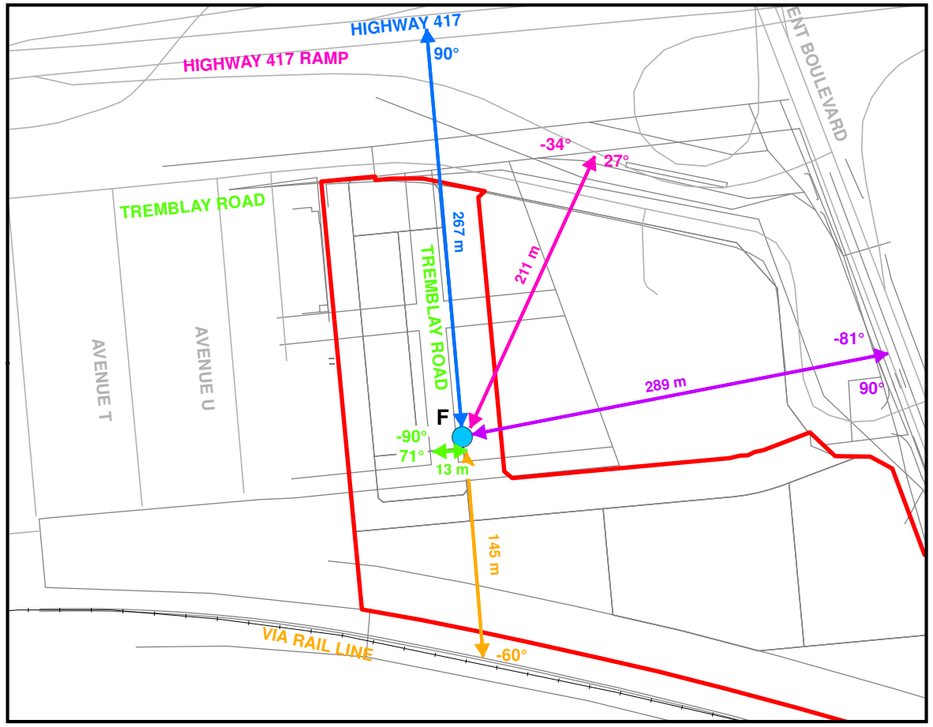
RECEIVER LOCATIONS
M, N, S & T

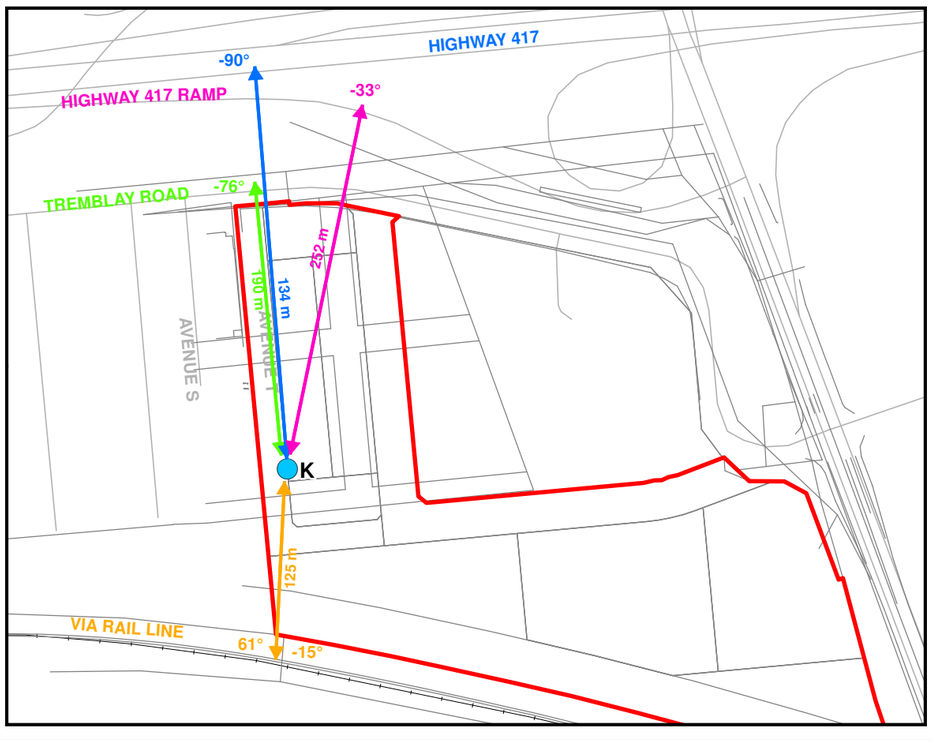
DISCIPLINE: ENVIRONMENT

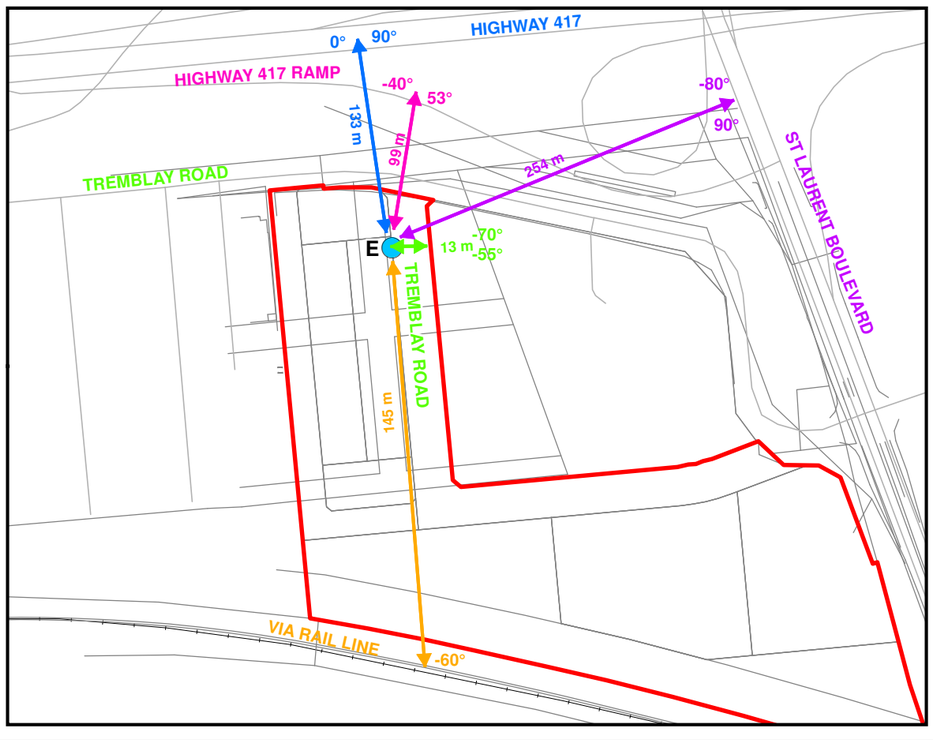
ISSUE:	REV.:
	-

Document Path: T:\19M-00609-00\MXD\19M-00609-00 305 Figure 8 POR M N S T.mxd









126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

- APPROXIMATE SITE LOCATION
- POR LOCATION
- PROPOSED DEVELOPMENT

N
W E
S

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT
ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
9	-

TITLE:

RECEIVER LOCATIONS
E, F, K & L

DISCIPLINE: ENVIRONMENT

ISSUE:	REV.:
	-

Document Path: T:\19M-00609-00\MXD\19M-00609-00 305 Figure 9 POR E F L.mxd

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

- APPROXIMATE SITE LOCATION
- RAIL LINE
- VIBRATION MONITORING LOCATION

N
W E
S

60 30 0 60 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

CANADA LANDS COMPANY CLC LIMITED

PROJECT:

NOISE AND VIBRATION IMPACT ASSESSMENT STUDY
530 TREMBLAY ROAD
OTTAWA, ONTARIO

PROJECT NO:	DATE:
19M-00609-00 305	NOVEMBER 2019

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: -

FIGURE NO:	SCALE:
10	1:2,500

TITLE:

VIBRATION MONITORING LOCATIONS

DISCIPLINE:

ENVIRONMENT

ISSUE:	REV.:
	-

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APPENDIX

B TRAFFIC DATA

Project Name: Noise Impact Study
Site Name: Residential Development
Site Address: 800 Eagelson Road, Ottawa
WSP Project #: 181-02513-00

Table B1: Road Traffic Data

Area	Time Period	Autos	Medium Trucks	Heavy Trucks	Total
St. Laurent Blvd NB	0700-2300h	20,240	1,610	1,150	23,000
	2300-0700h	1,760	140	100	2,000
	Total	22,000	1,750	1,250	25,000
St. Laurent Blvd SB	0700-2300h	20,240	1,610	1,150	23,000
	2300-0700h	1,760	140	100	2,000
	Total	22,000	1,750	1,250	25,000
Tremblay Road	0700-2300h	19,430	1,546	1,104	22,080
	2300-0700h	1,690	134	96	1,920
	Total	21,120	1,680	1,200	24,000
Highway 417 WB	0700-2300h	59,370	4,723	3,373	67,465
	2300-0700h	5,163	411	293	5,867
	Total	64,532	5,133	3,667	73,332
Highway 417 EB	0700-2300h	59,370	4,723	3,373	67,465
	2300-0700h	5,163	411	293	5,867
	Total	64,532	5,133	3,667	73,332
Highway 417 EB Ramp	0700-2300h	12,144	966	690	13,800
	2300-0700h	1,056	84	60	1,200
	Total	13,200	1,050	750	15,000

Information	St. Laurent	Tremblay	Hwy 174 WB	Hwy 174 EB	Hwy 174 EB Ramp
Classification	6 Lane Urban Arterial Divided	4 Lane Urban Major Collector	Freeway, Queensway, Highway	Freeway, Queensway, Highway	2 Lane Urban Arterial
AADT	50,000	24,000	73,332	73,332	15,000
Road Gradient %	<2%	<2%	<2%	<2%	<2%
Medium Truck %	7%				
Heavy Truck %	5%				
Posted Speed Limit (kph)	60/70	50	100	100	70
Day/Night Split	92%				
	8%				

Notes:

Information obtained from the City of Ottawa ENCG

Road Gradient based on topography maps of the area.

Project Name: Noise Impact Study
Site Name: Residential Development
Site Address: 800 Eagelson Road, Ottawa
WSP Project #: 181-02513-00

Table B2: Rail Traffic Data

Train	Type of Train	Engine Type	Welding Track	Speed (KPH)	Number of Trains		Number of Locomotives	Number of Cars	Projected Number of Trains (2034)	
					Day	Night			Day	Night
VIA	Passenger	Diesel	No	105	25	5	2	5	36	7

Note: VIA Rail Traffic Provided by VIA Rail - Access to Information Request #19-1920 AI(D).
As per the Ottawa ENCG in the absence of information from railway company on the future rail traffic volume, the existing data should be increased at an annual rate of 2.5% for a minimum of 15 years.

Appendix B: Table of Traffic and Road Parameters To Be Used For Sound Level Predictions

Table B1 Traffic And Road Parameters To Be Used For Sound Level Predictions

Row Width (m)	Implied Roadway Class	AADT Vehicles/Day	Posted Speed Km/Hr	Day/Night Split %	Medium Trucks %	Heavy Trucks % [1]
NA [2]	Freeway, Queensway, Highway	18,333 per lane	100	92/8	7	5
37.5-44.5	6-Lane Urban Arterial-Divided (6 UAD)	50,000	50-80	92/8	7	5
34-37.5	4-Lane Urban Arterial-Divided (4-UAD)	35,000	50-80	92/8	7	5
23-34	4-Lane Urban Arterial-Undivided (4-UAU)	30,000	50-80	92/8	7	5
23-34	4-Lane Major Collector (4-UMCU)	24,000	40-60	92/8	7	5
30-35.5	2-Lane Rural Arterial (2-RAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Urban Arterial (2-UAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Major Collector (2-UMCU)	12,000	40-60	92/8	7	5
30-35.5	2-Lane Outer Rural Arterial (near the extremities of the City) (2-RAU)	10,000	50-80	92/8	7	5
20-30	2-Lane Urban Collector (2-UCU)	8,000	40-50	92/8	7	5

[1] The MOE Vehicle Classification definitions should be used to estimate automobiles, medium trucks and heavy trucks.

[2] The number of lanes is determined by the future mature state of the roadway.

Montreal, August 14, 2019

BY EMAIL
(Carolyn.ropp@wsp.com)

Ms. Carolyn Ropp
WSP
582 Lancaster Street West
Kitchener (Ontario) N2K 1M3

Access to Information and Privacy Office
3, Place Ville Marie, Suite 500
Montreal (Quebec) H3B 2C9
Fax: 514- 874-0661
Email: Gabrielle_Caron@viarail.ca

Gabrielle Caron
✆ 514-871-6215

Object: Response to Access to Information Request #19-1920 AI (D)

Dear Ms. Ropp,

We write further to your request for access to information made under the *Access to Information Act* (*"ATIA"*) and received by VIA Rail Canada Inc. ("VIA Rail") on June 25, 2019 and modified on July 25, 2019 for the following records/information:

> ***"Here is a breakdown of the information I am looking for the Alexandria Subdivision in the area of Queensway (Hwy 417) and St. Laurent Blvd, located to the east of Ottawa Station, in the City of Ottawa.***
>
> 1. ***Type of train (passenger/freight, etc.)***
> 2. ***Engine Type (assumed diesel)***
> 3. ***Welded Rail (yes/no)***
> 4. ***No. of trains (day/night)***
> 5. ***# of locomotives and # of cars per train***
> 6. ***Speed***
> 7. ***At grade-crossings in the area and if any whistles are blown."***

You will find enclosed hereto a table (Appendix A) which provides the requested information.

Please be advised that you may file a complaint regarding the handling of your request with the *Information Commissioner of Canada*, in accordance with the requirements of section 31 of the *ATIA*, which reads as follows:

> *"31. A complaint under this Act shall be made to the Information Commissioner in writing unless the Commissioner authorizes otherwise. If the complaint relates to a request by a person for access to a record, it shall be made within sixty days after the day in which the person receives a notice of a refusal under section 7, is given to access to all or part of the record or, in any other case, becomes aware that grounds for the complaint exist."*

Notice of complaint should be sent to the following address:

Office of the Information Commissioner of Canada
30, Victoria Street
Gatineau (Quebec) K1A 1H3
E-mail: general@oic-ci.gc.ca

Please note that you may also file a complaint online on the *Information Commissioner of Canada*'s website at the following address: http://www.oic-ci.gc.ca/eng/lc-cj-logde-complaint-deposer-plainte.aspx.

Before submitting a complaint pursuant to the *ATIA* to the *Information Commissioner of Canada*, you may contact us to obtain more information regarding the handling of your access to information request.

Trusting the whole to be in order, we remain at your disposal should you have any questions.

Best regards,

Gabrielle Caron
Access to Information and Privacy Coordinator
VIA Rail Canada Inc.

Encl. Requested documentation – Appendix A

APPENDIX A

Train	Type	Engine Type	Welding Track	Number of Trains (day)	Number of Trains (night)	Number of Locomotives	Number of Cars	Speed (KPH)
VIA Rail	Passenger	Diesel	Yes	25	5	1 to 2 (depending on the train)	5 (avg.)	See below

With regards to speed, please see table below, which table is an extract from the current Time Table indicating the maximum allowable speeds in that area (shaded in green for your ease of reference)

VIA TIMETABLE NO. 8 — ALEXANDRIA SUBDIVISION

5. SPEEDS

5.1

MILE		MPH PASSENGER P1	*P2	*P3	P4	FREIGHT
0.4 to 24.6	**Zone**	**100**	**100**	**95**	**95**	**60**
*0.4 to 0.6	PSO	45	45	45	45	30
*0.54	Bridge					10
*6.1 Railway crossing at grade		50	50	50	50	35
6.9 Siding De Beaujeu		30	30	30	30	15
10.9 to 11.6	PSO		95		85	
12.3 to 14.1	PSO	85	75	75	70	
15.0 Siding Glen Robertson		30	30	30	30	15
21.7 to 22.3	PSO	85	80	80	75	
24.6 to 36.4	**Zone**	**85**	**85**	**85**	**80**	**60**
24.7 to 26.8	PSO		75	75	70	
29.3 to 30.4	PSO		75	75	70	
32.3 to 32.8	PSO		75	75	70	
35.1 Siding Maxville		30	30	30	30	15
35.9 to 36.4	PSO		75	75	70	
36.4 to 72.5	**Zone**	**100**	**100**	**95**	**95**	**60**
39.5 to 40.0	PSO	85	75	75	70	
47.3 to 48.4	PSO	80	75	75	70	50
47.5 Siding Casselman		30	30	30	30	15
*47.90	Bridge					30
72.5 to 76.43	**Zone**	**75**	**70**	**70**	**65**	**35**
72.6 70 73.2	PSO	65	60	60	55	
*73.7 to 74.8	PSO	60	60	60	60	
*75.9 to 76.3	PSO	30	30	30	30	30
*76.3 to 76.43	PSO	10	10	10	10	10

*Not marked by Speed Signs

With regards to the whistle, Mile 75.37 is subject to Rule 14(L)(iv) of the Canadian Rail Operating Rules, which states that except to prevent an accident or in case of an emergency, the sounding of the whistle is prohibited at the following crossing at grade: Mile 75.37 – Michael Road.

In addition, please see the table below for equipment classification for speed charts:

Equipment Classification for Speed Charts - New Timetable

Locomotive	Cars	P1	P2	P3	P4
P42	REN	X			
P42	LRC		X		
P42	HEP			X	
F40	REN			X	
F40	LRC			X	
F40	HEP			X	
--	RDC				X

Notes:
1) LRC cars assumed to be non-banking
2) HEP designation includes Glen Fraser
3) In mixed consists, consist speed shall be governed by most restrictive piece of equipment

APPENDIX

C STAMSON OUTPUTS

Project Name: Noise Impact Study
Site Name: Residential Development
Site Address: 800 Eagelson Road, Ottawa
WSP Project #: 181-02513-00

Table C1: Stamson Parameters and Results

ID	Description	Stamson File Name	Road/Rail Segment	Road Viewable Angle		Source - Receiver Distance	Ground Type	Topography Type	Receiever Height	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Ventilation Requirements	Warning Clause	Building Component Requirements
				A1	A2	(m)	(Hard/Soft)		(m)	Day		Night				
A	Residential Block 2 Northwest Corner along West Façade	LOCA.TE	Tremblay	-90	0	15	Hard	1	1.5/4.5	73	**73**	65	**65**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-90	0	109	Hard	1	1.5/4.5							
			417 EB	-90	0	94	Hard	1	1.5/4.5							
			417 EB Ramp	-55	0	78	Hard	1	1.5/4.5							
			VIA	-14	58	294	Hard	1	1.5/4.5	56		52				
B	Residential Block 2 Northwest Corner along North Façade	LOCB.TE	Tremblay	-90	90	9	Hard	1	1.5/4.5	78	**78**	70	**70**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-90	90	102	Hard	1	1.5/4.5							
			417 EB	-90	90	87	Hard	1	1.5/4.5							
			417 EB Ramp	-63	90	70	Hard	1	1.5/4.5							
			St. Laurent NB	-90	5	305	Hard	1	1.5/4.5							
			St. Laurent SB	-90	5	290	Hard	1	1.5/4.5							
C	Residential Block 2 Northeast Corner along North Façade	LOCC.TE	Tremblay	-81	90	12	Hard	1	1.5/4.5	77	**77**	70	**70**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-70	90	109	Hard	1	1.5/4.5							
			417 EB	-70	90	94	Hard	1	1.5/4.5							
			417 EB Ramp	-81	81	64	Hard	1	1.5/4.5							
			St. Laurent NB	-90	30	260	Hard	1	1.5/4.5							
			St. Laurent SB	-90	30	245	Hard	1	1.5/4.5							
D	Residential Block 2 Northeast Corner along East Façade	LOCD.TE	Tremblay	-55	90	13	Hard	1	1.5/4.5	75	**75**	67	**68**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	0	90	119	Hard	1	1.5/4.5							
			417 EB	0	90	104	Hard	1	1.5/4.5							
			417 EB Ramp	-19	78	73	Hard	1	1.5/4.5							
			St. Laurent NB	-78	90	259	Hard	1	1.5/4.5							
			St. Laurent SB	-78	90	244	Hard	1	1.5/4.5							
			VIA	-50	0	311	Hard	1	1.5/4.5	46		43				
E	Residential Block 4 Northeast Corner along East Façade	LOCE.TE	Tremblay	-70	90	13	Hard	1	1.5/4.5	75	**75**	67	**67**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	0	90	148	Hard	1	1.5/4.5							
			417 EB	0	90	133	Hard	1	1.5/4.5							
			417 EB Ramp	-40	53	99	Hard	1	1.5/4.5							
			St. Laurent NB	-80	90	269	Hard	1	1.5/4.5							
			St. Laurent SB	-80	90	254	Hard	1	1.5/4.5							
			VIA	-50	0	281	Hard	1	1.5/4.5	47		44				
F	Residential Block 4 Southeast Corner along East Façade	LOCF.TE	Tremblay	-90	71	13	Hard	1	1.5/4.5	73	**74**	66	**66**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	0	90	282	Hard	1	1.5/4.5							
			417 EB	0	90	267	Hard	1	1.5/4.5							
			417 EB Ramp	-34	27	211	Hard	1	1.5/4.5							
			St. Laurent NB	-81	90	304	Hard	1	1.5/4.5							
			St. Laurent SB	-81	90	289	Hard	1	1.5/4.5							
			VIA	-60	0	145	Hard	1	1.5/4.5	52		49				
G	Residential Block 1 Southeast Corner along	LOCG.TE	Tremblay	-90	57	13	Hard	1	1.5/4.5	73	**73**	65	**66**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	0	90	302	Hard	1	1.5/4.5							
			417 EB	0	90	287	Hard	1	1.5/4.5							
			417 EB Ramp	-30	27	231	Hard	1	1.5/4.5							

Table C1: Stamson Parameters and Results

ID	Description	Stamson File Name	Road/Rail Segment	Road Viewable Angle		Source - Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type	Receiver Height (m)	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Ventilation Requirements	Warning Clause	Building Component Requirements
				A1	A2					Day		Night				
	East Façade		St. Laurent NB	-78	90	308	Hard	1	1.5/4.5					Conditioning		
			St. Laurent SB	-78	90	293	Hard	1	1.5/4.5							
			VIA	-63	0	126	Hard	1	1.5/4.5	53		50				
H	Residential Block 1 Southeast Corner along South Façade	LOCH.TE	Tremblay	0	32	18	Hard	1	1.5/4.5	64	**65**	56	**58**	Central Air Conditioning	Type D	Designed/Selected
			St. Laurent NB	0	51	316	Hard	1	1.5/4.5							
			St. Laurent SB	0	51	301	Hard	1	1.5/4.5							
			VIA	-74	78	112	Soft	1	1.5/4.5	57		54				
I	Residential Block 1 Southwest Corner along South Façade	LOCI.TE	Tremblay	0	15	69	Hard	1	1.5/4.5	59	**62**	52	**57**	Forced Air	Type C	OBC
			St. Laurent NB	0	64	365	Hard	1	1.5/4.5							
			St. Laurent SB	0	64	350	Hard	1	1.5/4.5							
			VIA	-74	78	98	Soft	1	1.5/4.5	58		55				
J	Residential Block 1 Southwest Corner along West Façade	LOCJ.TE	Tremblay	-72	0	213	Hard	1	1.5/4.5	69	**69**	61	**62**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-90	0	307	Hard	1	1.5/4.5							
			417 EB	-90	0	292	Hard	1	1.5/4.5							
			417 EB Ramp	-26	0	276	Hard	1	1.5/4.5							
			VIA	-11	78	102	Soft	1	1.5/4.5	56		52				
K	Residential Block 3 Southwest Corner along West Façade	LOCK.TE	Tremblay	-76	0	190	Hard	1	1.5/4.5	69	**69**	61	**62**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-90	0	284	Hard	1	1.5/4.5							
			417 EB	-90	0	269	Hard	1	1.5/4.5							
			417 EB Ramp	-33	0	252	Hard	1	1.5/4.5							
			VIA	-9	76	125	Soft	1	1.5/4.5	54		51				
L	Residential Block 3 Northwest Corner along West Façade	LOCL.TE	Tremblay	-90	0	56	Hard	1	1.5/4.5	70	**70**	63	**63**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-90	0	149	Hard	1	1.5/4.5							
			417 EB	-90	0	134	Hard	1	1.5/4.5							
			417 EB Ramp	-48	0	118	Hard	1	1.5/4.5							
			VIA	-15	61	255	Hard	1	1.5/4.5	57		53				
M	Mixed Used Block 6 Northwest Corner along West Façade	LOCM.TE	Tremblay	-72	0	20	Hard	1	1.5/4.5	66	**67**	59	**61**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-22	0	342	Hard	1	1.5/4.5							
			417 EB	-22	0	327	Hard	1	1.5/4.5							
			417 EB Ramp	-22	0	227	Hard	1	1.5/4.5							
			VIA	-12	74	109	Hard	1	1.5/4.5	61		57				
N	Mixed Use Block 6 Northwest Corner along North Façade	LOCN.TE	Tremblay	-78	80	13	Hard	1	1.5/4.5	73	**73**	66	**66**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-20	90	337	Hard	1	1.5/4.5							
			417 EB	-20	90	322	Hard	1	1.5/4.5							
			417 EB Ramp	-41	17	218	Hard	1	1.5/4.5							
			St. Laurent NB	-90	5	221	Hard	1	1.5/4.5							
			St. Laurent SB	-90	5	206	Hard	1	1.5/4.5							
O	Mixed Use Block 6 Northeast Corner along North Façade	LOCO.TE	Tremblay	-90	80	13	Hard	1	1.5/4.5	74	**74**	66	**66**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-45	90	335	Hard	1	1.5/4.5							
			417 EB	-45	90	320	Hard	1	1.5/4.5							
			417 EB Ramp	-40	13	204	Hard	1	1.5/4.5							
			St. Laurent NB	-90	0	110	Hard	1	1.5/4.5							
			St. Laurent SB	-90	0	97	Hard	1	1.5/4.5							
P	Mixed Use Block 6 Northeast Corner along East Façade	LOCP.TE	417 WB	0	90	340	Hard	1	1.5/4.5	71	**71**	64	**64**	Central Air Conditioning	Type D	Designed/Selected
			417 EB	0	90	325	Hard	1	1.5/4.5							
			St. Laurent NB	-90	90	106	Hard	1	1.5/4.5							
			St. Laurent SB	90	90	94	Hard	1	1.5/4.5							
			VIA	-60	0	151	Soft	1	1.5/4.5	52		48				

Table C1: Stamson Parameters and Results

ID	Description	Stamson File Name	Road/Rail Segment	Road Viewable Angle		Source - Receiver Distance	Ground Type	Topography Type	Receiever Height	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Total Road/Rail Leq (dBA)	Combined Leq (dBA)	Ventilation Requirements	Warning Clause	Building Component Requirements
				A1	A2	(m)	(Hard/Soft)		(m)	Day		Night				
Q	Mixed Use Block 6 Southeast Corner along East Façade	LOCQ.TE	417 WB	0	90	431	Hard	1	1.5/4.5	70	**70**	63	**63**	Central Air Conditioning	Type D	Designed/Selected
			417 EB	0	90	416	Hard	1	1.5/4.5							
			St. Laurent NB	-90	90	133	Hard	1	1.5/4.5							
			St. Laurent SB	-90	90	121	Hard	1	1.5/4.5							
			VIA	-60	0	70	Soft	1	1.5/4.5	57		53				
R	Mixed Use Block 6 Southeast Corner along South Façade	LOCR.TE	St. Laurent NB	0	90	141	Hard	1	1.5/4.5	64	**66**	56	**61**	Central Air Conditioning	Type D	Designed/Selected
			St. Laurent SB	0	90	129	Hard	1	1.5/4.5							
			VIA	-83	70	53	Soft	1	1.5/4.5	62		59				
S	Mixed Use Block 6 Southwest Corner along South Façade	LOCS.TE	St. Laurent NB	0	60	242	Hard	1	1.5/4.5	60	**65**	52	**61**	Central Air Conditioning	Type D	Designed/Selected
			St. Laurent SB	0	60	230	Hard	1	1.5/4.5							
			VIA	-68	86	44	Soft	1	1.5/4.5	64		60				
T	Mixed Use Block 6 Southwest Corner along West Façade	LOCT.TE	Tremblay	-44	0	85	Hard	1	1.5/4.5	60	**66**	53	**62**	Central Air Conditioning	Type D	Designed/Selected
			417 WB	-16	0	409	Hard	1	1.5/4.5							
			417 EB	-16	0	394	Hard	1	1.5/4.5							
			417 EB Ramp	-16	0	291	Hard	1	1.5/4.5							
			VIA	-19	76	46	Soft	1	1.5/4.5	65		61				

```
STAMSON 5.0        NORMAL REPORT        Date: 07-11-2019 10:38:50
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: LOCD.te              Time Period: Day/Night 16/8 hours
Description: Location D


Rail data, segment # 1: VIA (day/night)
----------------------------------
Train            ! Trains      ! Speed !# loc !# Cars! Eng  !Cont
Type             !             !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
* 1. Passenger   !  36.2/7.2   ! 105.0 !  2.0 !  5.0 !Diesel!  No

* The identified number of trains have been adjusted for
  future growth using the following parameters:

Train type:         ! Unadj. ! Annual % ! Years of !
 No  Name           ! Trains ! Increase !  Growth  !
--------------------+--------+----------+----------+
  1. Passenger      !  25.0/5.0   !    2.50  !   15.00  !

Data for Segment # 1: VIA (day/night)
----------------------------------
Angle1   Angle2           : -50.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 311.00 / 311.00 m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
No Whistle
Reference angle           :   0.00

FF
Results segment # 1: VIA (day)
------------------------------

LOCOMOTIVE (0.00 + 45.45 + 0.00) = 45.45 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -50      0   0.58  72.22 -20.87  -5.90   0.00   0.00   0.00  45.45
-------------------------------------------------------------------------

WHEEL (0.00 + 35.83 + 0.00) = 35.83 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -50      0   0.66  63.63 -21.86  -5.94   0.00   0.00   0.00  35.83
-------------------------------------------------------------------------

Segment Leq : 45.90 dBA

Total Leq All Segments: 45.90 dBA

FF
Results segment # 1: VIA (night)
--------------------------------

LOCOMOTIVE (0.00 + 42.68 + 0.00) = 42.68 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -50      0   0.50  68.22 -19.68  -5.85   0.00   0.00   0.00  42.68
-------------------------------------------------------------------------

WHEEL (0.00 + 32.65 + 0.00) = 32.65 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -50      0   0.60  59.63 -21.07  -5.91   0.00   0.00   0.00  32.65
-------------------------------------------------------------------------

Segment Leq : 43.09 dBA
```

```
Total Leq All Segments: 43.09 dBA

FF
Road data, segment # 1: St.LaurentNB (day/night)
-----------------------------------------------
Car traffic volume  : 20240/1760  veh/TimePeriod  *
Medium truck volume :  1610/140   veh/TimePeriod  *
Heavy truck volume  :  1150/100   veh/TimePeriod  *
Posted speed limit  :    70 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  25000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: St.LaurentNB (day/night)
-----------------------------------------------
Angle1   Angle2           : -78.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 259.00 / 259.00 m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

FF
Road data, segment # 2: Tremblay (day/night)
-------------------------------------------
Car traffic volume  : 19430/1690  veh/TimePeriod  *
Medium truck volume :  1546/134   veh/TimePeriod  *
Heavy truck volume  :  1104/96    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  24000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Tremblay (day/night)
-------------------------------------------
Angle1   Angle2           : -55.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

FF
Road data, segment # 3: 417 WB (day/night)
-----------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
```

```
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  73332
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 3: 417 WB (day/night)
----------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 119.00 / 119.00 m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

FF
Road data, segment # 4: 417 EB (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  73332
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 4: 417 EB (day/night)
----------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 104.00 / 104.00 m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

FF
Road data, segment # 5: 417 EB Ramp (day/night)
-----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    70 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00
```

```
Data for Segment # 5: 417 EB Ramp (day/night)
-----------------------------------------------
Angle1   Angle2           : -19.00 deg   78.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  73.00 / 73.00  m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

FF

```
Road data, segment # 6: St.LaurentSB (day/night)
-------------------------------------------------
Car traffic volume  : 20240/1760  veh/TimePeriod  *
Medium truck volume :  1610/140   veh/TimePeriod  *
Heavy truck volume  :  1150/100   veh/TimePeriod  *
Posted speed limit  :    70 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  25000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 6: St.LaurentSB (day/night)
-------------------------------------------------
Angle1   Angle2           : -78.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 244.00 / 244.00 m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

FF

```
Results segment # 1: St.LaurentNB (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.86 + 0.00) = 60.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -78     90   0.00  73.53   0.00 -12.37  -0.30   0.00   0.00   0.00  60.86
-------------------------------------------------------------------------------

Segment Leq : 60.86 dBA
```

FF

```
Results segment # 2: Tremblay (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 69.58 + 0.00) = 69.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -55     90   0.00  70.52   0.00   0.00  -0.94   0.00   0.00   0.00  69.58
-------------------------------------------------------------------------------

Segment Leq : 69.58 dBA
```

FF

```
Results segment # 3: 417 WB (day)
```

Source height = 1.50 m

ROAD (0.00 + 69.39 + 0.00) = 69.39 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	81.40	0.00	-8.99	-3.01	0.00	0.00	0.00	69.39

Segment Leq : 69.39 dBA

FF

Results segment # 4: 417 EB (day)

Source height = 1.50 m

ROAD (0.00 + 69.98 + 0.00) = 69.98 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	81.40	0.00	-8.41	-3.01	0.00	0.00	0.00	69.98

Segment Leq : 69.98 dBA

FF

Results segment # 5: 417 EB Ramp (day)

Source height = 1.50 m

ROAD (0.00 + 61.76 + 0.00) = 61.76 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-19	78	0.00	71.32	0.00	-6.87	-2.69	0.00	0.00	0.00	61.76

Segment Leq : 61.76 dBA

FF

Results segment # 6: St.LaurentSB (day)

Source height = 1.50 m

ROAD (0.00 + 61.12 + 0.00) = 61.12 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	90	0.00	73.53	0.00	-12.11	-0.30	0.00	0.00	0.00	61.12

Segment Leq : 61.12 dBA

Total Leq All Segments: 75.02 dBA

FF

Results segment # 1: St.LaurentNB (night)

Source height = 1.50 m

ROAD (0.00 + 53.27 + 0.00) = 53.27 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	90	0.00	65.94	0.00	-12.37	-0.30	0.00	0.00	0.00	53.27

Segment Leq : 53.27 dBA

FF

Results segment # 2: Tremblay (night)

Source height = 1.50 m

ROAD (0.00 + 61.98 + 0.00) = 61.98 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-55	90	0.00	62.92	0.00	0.00	-0.94	0.00	0.00	0.00	61.98

Segment Leq : 61.98 dBA

FF
Results segment # 3: 417 WB (night)

Source height = 1.49 m

ROAD (0.00 + 61.79 + 0.00) = 61.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	73.80	0.00	-8.99	-3.01	0.00	0.00	0.00	61.79

Segment Leq : 61.79 dBA

FF
Results segment # 4: 417 EB (night)

Source height = 1.49 m

ROAD (0.00 + 62.38 + 0.00) = 62.38 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	73.80	0.00	-8.41	-3.01	0.00	0.00	0.00	62.38

Segment Leq : 62.38 dBA

FF
Results segment # 5: 417 EB Ramp (night)

Source height = 1.50 m

ROAD (0.00 + 54.16 + 0.00) = 54.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-19	78	0.00	63.72	0.00	-6.87	-2.69	0.00	0.00	0.00	54.16

Segment Leq : 54.16 dBA

FF
Results segment # 6: St.LaurentSB (night)

Source height = 1.50 m

ROAD (0.00 + 53.52 + 0.00) = 53.52 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	90	0.00	65.94	0.00	-12.11	-0.30	0.00	0.00	0.00	53.52

Segment Leq : 53.52 dBA

Total Leq All Segments: 67.42 dBA

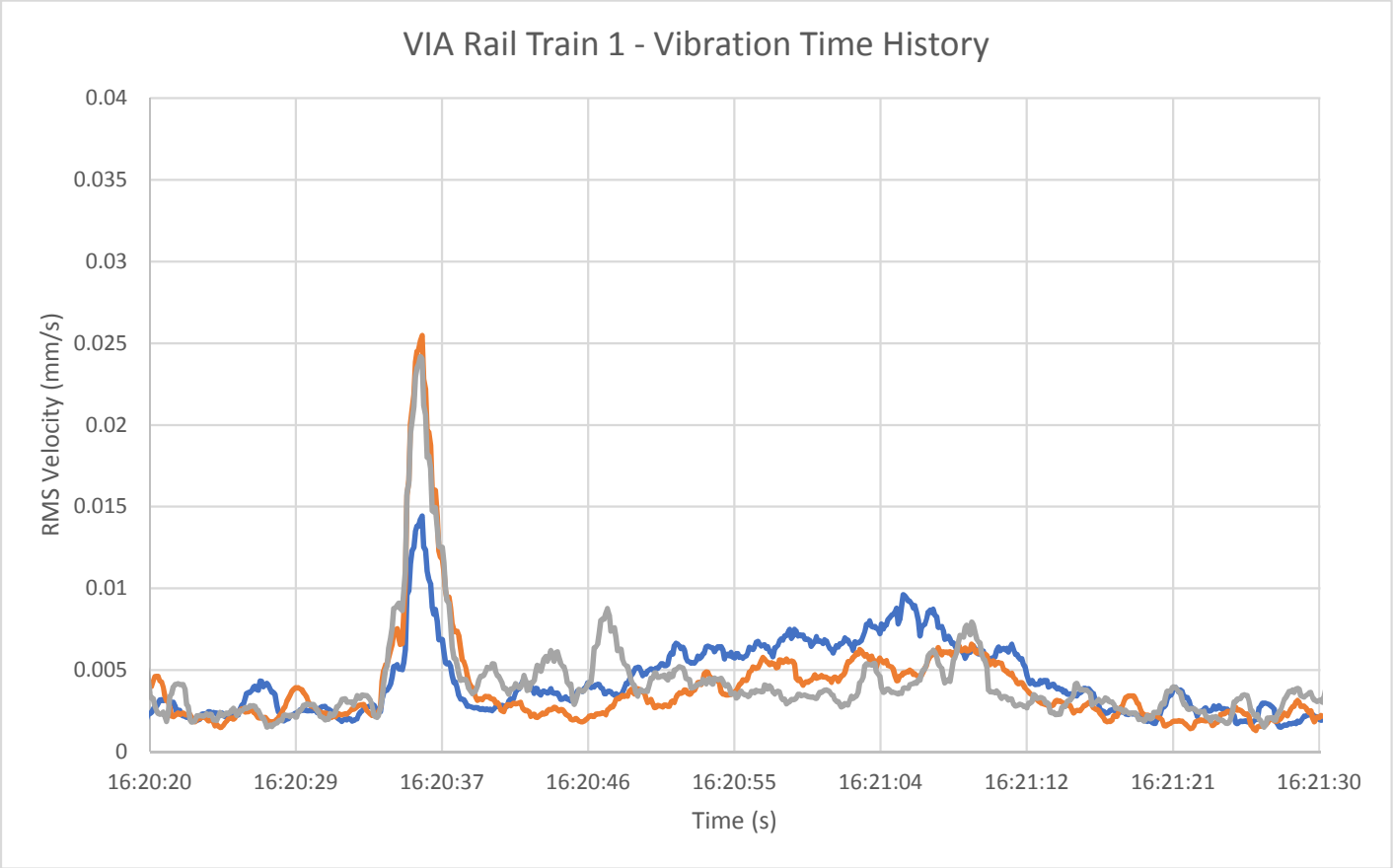
FF

TOTAL Leq FROM ALL SOURCES (DAY): 75.02
(NIGHT): 67.43

FF
FF

APPENDIX

D VIBRATION DATA



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.014
2	0.025
3	0.024

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO, CANADA L4G 0G9
TEL: 905-750-3080 | FAX: 905-727-0483 | WWW.WSP.COM

PROJECT: 530 TREMBLAY ROAD
NOISE & VIBRATION IMPACT STUDY

TITLE: RAIL VIBRATION MEASUREMENTS
JULY 17, 2019

CLIENT: PUBLIC SERVICES AND PROCUREMENT CANADA

SCALE: ---

DRAWN BY: M.B.

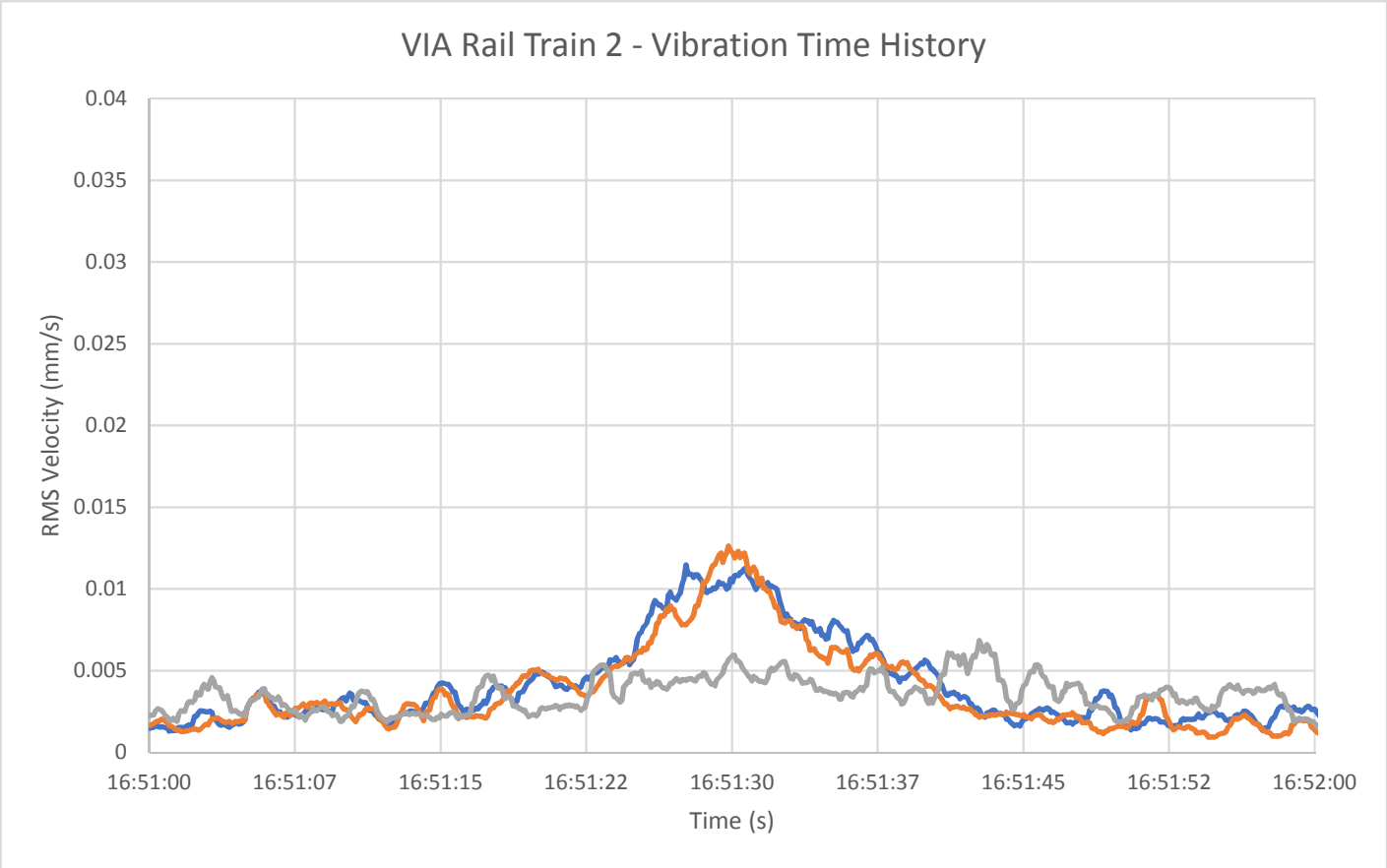
CHECKED BY: C.D.S.

PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.011
2	0.013
3	0.007

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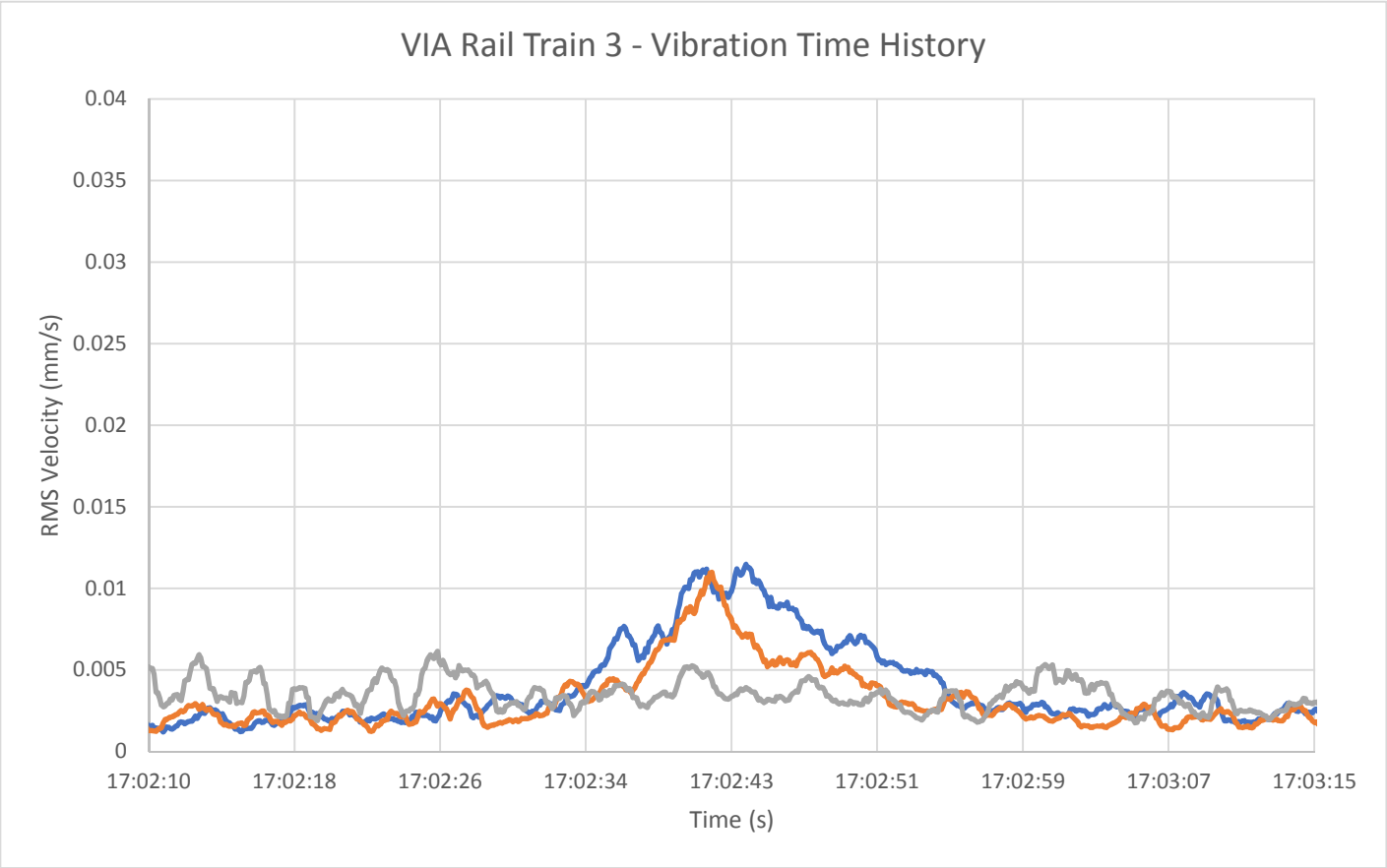
FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.011
2	0.011
3	0.006

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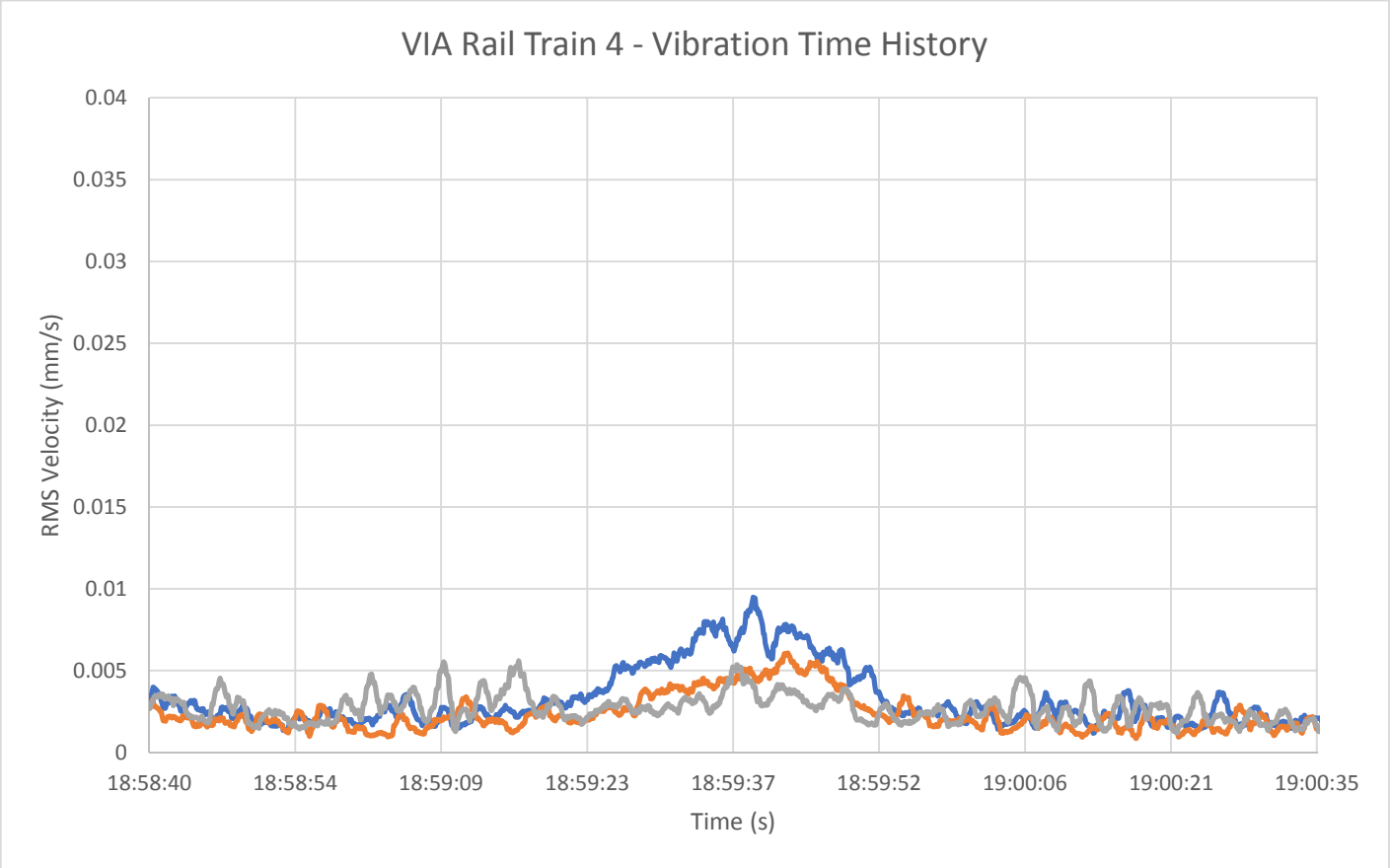
REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.009
2	0.006
3	0.006

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PROJECT
530 TREMBLAY ROAD
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TITLE
RAIL VIBRATION MEASUREMENTS
JULY 17, 2019

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

SCALE: ---

DRAWN BY: M.B.

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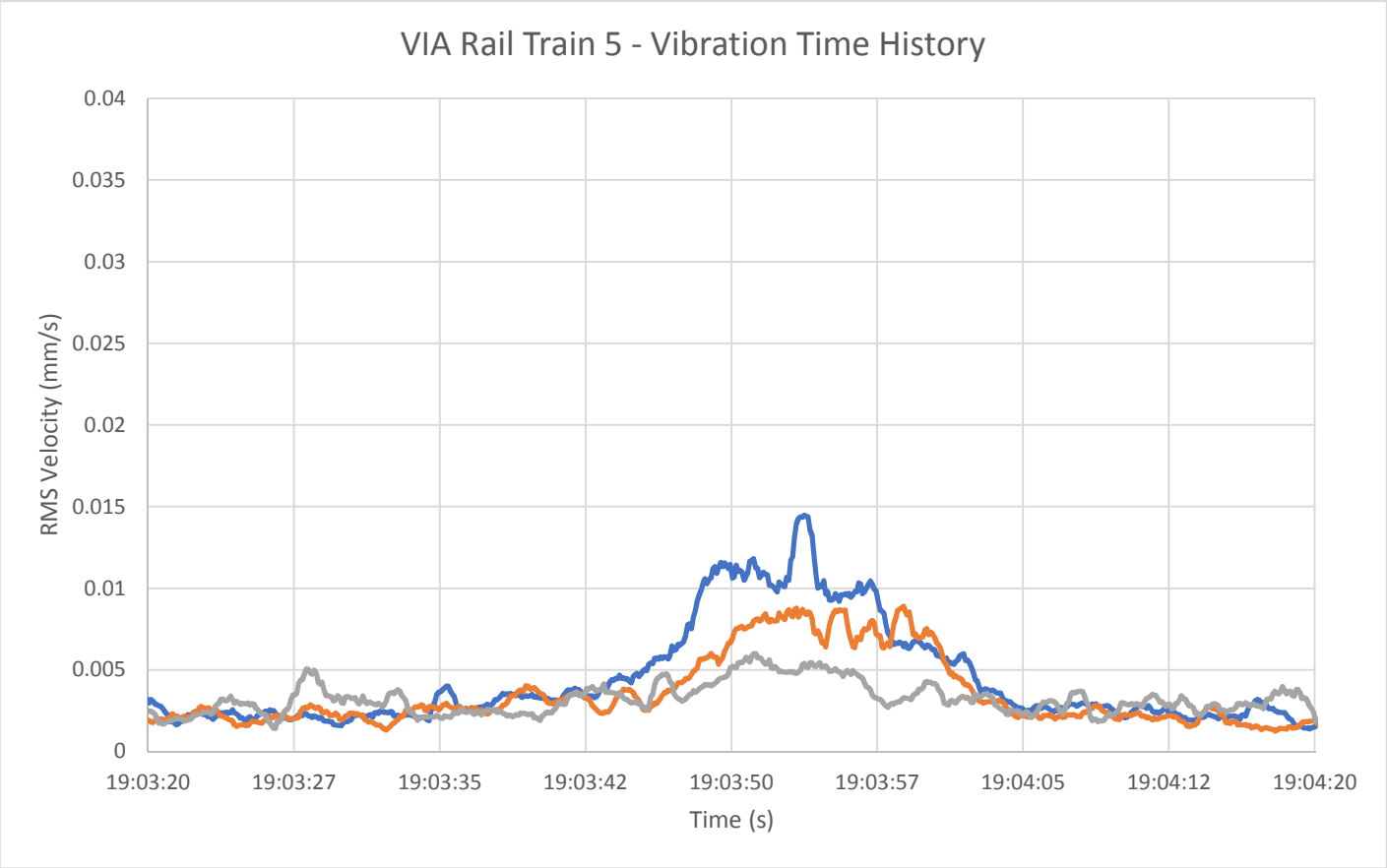
PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.014
2	0.009
3	0.006

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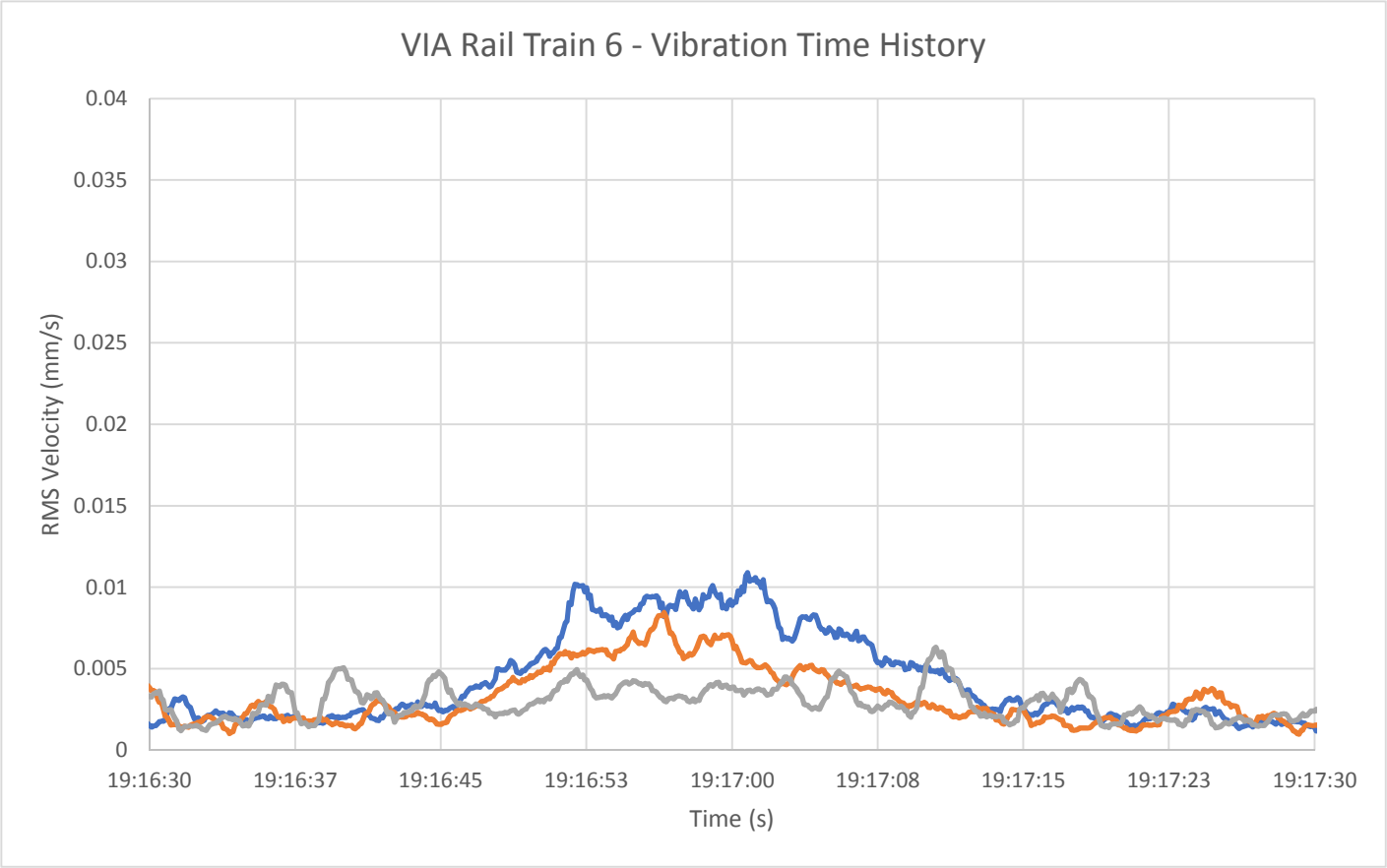
PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.011
2	0.008
3	0.006

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NOISE & VIBRATION IMPACT STUDY

TITLE: RAIL VIBRATION MEASUREMENTS
JULY 17, 2019

CLIENT: PUBLIC SERVICES AND PROCUREMENT CANADA

SCALE: ---

DRAWN BY: M.B.

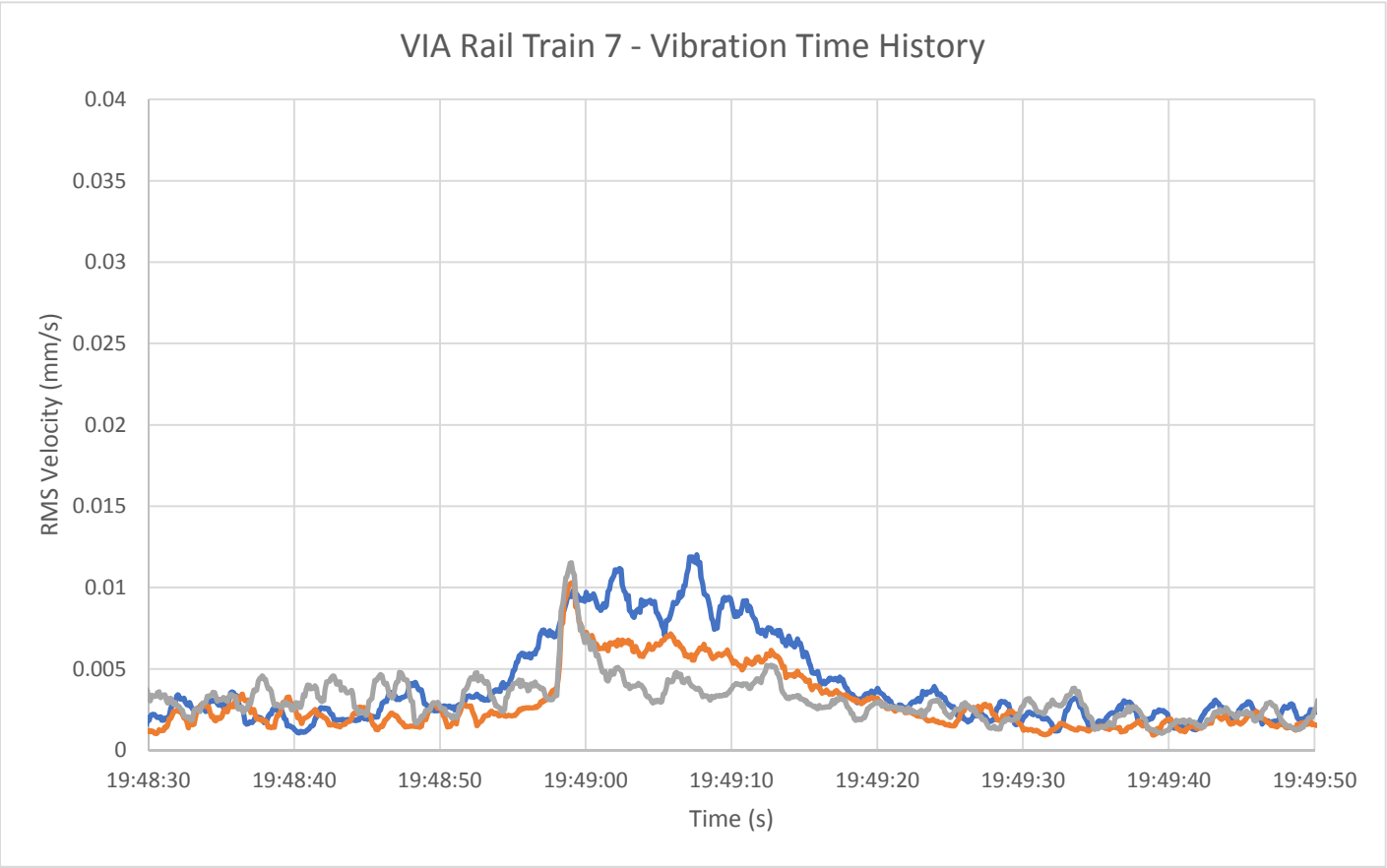
CHECKED BY: C.D.S.

PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
- Location 3 (approx. 60 m setback)

Location	Maximum RMS Velocity (mm/s)
1	0.012
2	0.010
3	0.012

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO, CANADA L4G 0G9
TEL: 905-750-3080 | FAX: 905-727-0483 | WWW.WSP.COM

PROJECT: 530 TREMBLAY ROAD
NOISE & VIBRATION IMPACT STUDY

TITLE: RAIL VIBRATION MEASUREMENTS
JULY 17, 2019

CLIENT: PUBLIC SERVICES AND PROCUREMENT CANADA

SCALE: ---

DRAWN BY: M.B.

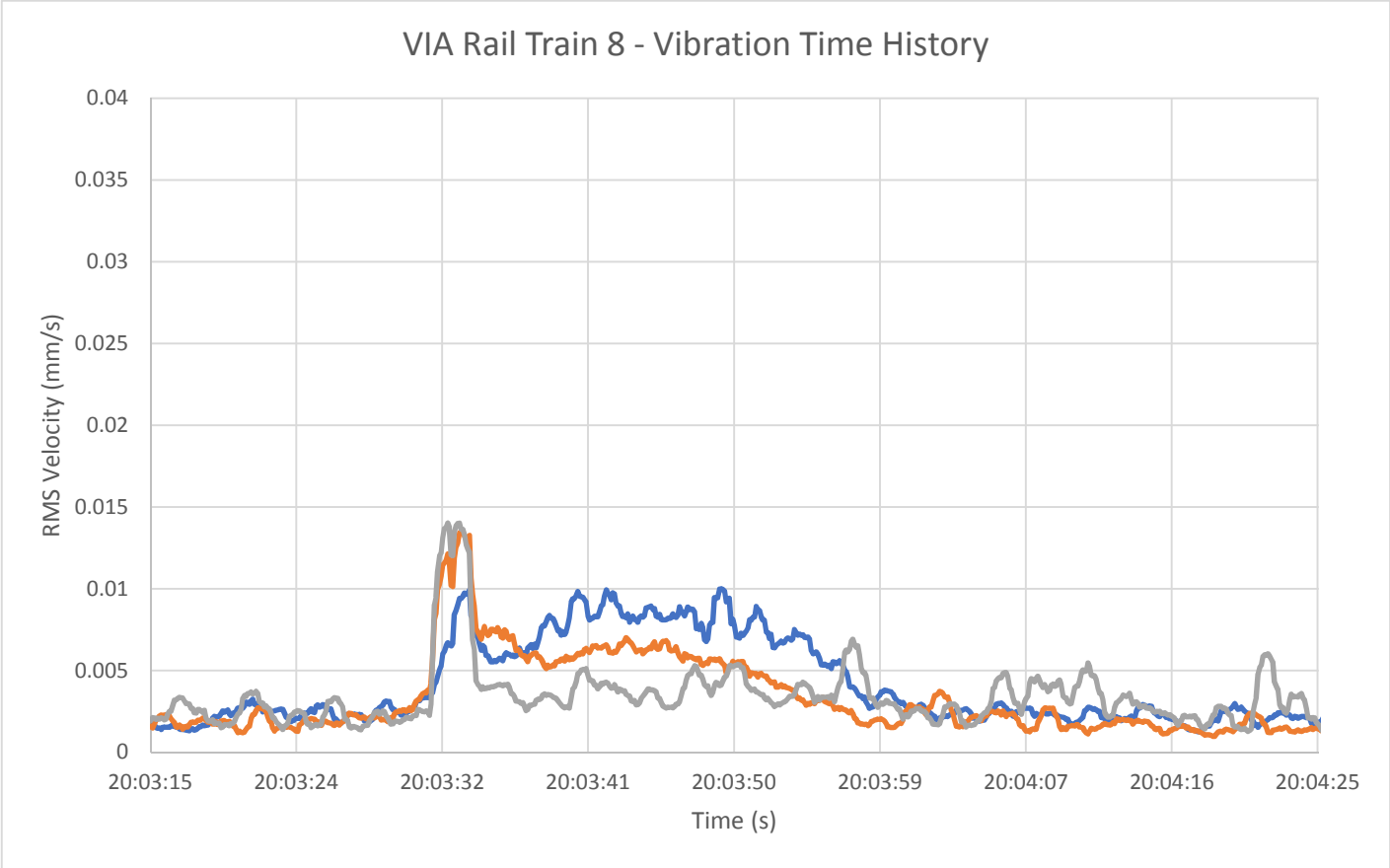
CHECKED BY: C.D.S.

PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:



LEGEND

- Location 1 (approx. 30 m setback)
- Location 2 (approx. 45 m setback)
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Location	Maximum RMS Velocity (mm/s)
1	0.010
2	0.013
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PROJECT NO.: 19M-00609-00

DATE: NOVEMBER 2019

FIGURE NO.:

REV.:

APPENDIX

E CALIBRATION CERTIFICATES

CERTIFICATE of CALIBRATION

Make :	Crystal Instruments	Reference # :	157342
Model :	COCO-80	Customer :	WSP Canada Inc. Aurora, ON
Descr. :	Data Acquisition System		
Serial # :	49667	P. Order :	
Asset # :	NAN		

Cal. status : Received in spec's, no adjustment made.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : Jun 03, 2019 By : Petro Onasko

Cal. Due : Jun 03, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-215 J-233 J-512 J-519

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com
Phone : 800-668-7440 Fax: 905 565 8325 e-Mail: service @ navair.com

CERTIFICATE of CALIBRATION

Make :	PCB Piezotronics	Reference # :	157389
Model :	393A03	Customer :	WSP Canada Inc. Aurora, ON
Descr. :	Accelerometer IEPE		
Serial # :	40647	P. Order :	
Asset # :	NAN		

Cal. status : Received in spec's, no adjustment made.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : Jun 03, 2019 By : Petro Onasko

Cal. Due : Jun 03, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-275 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com
Phone : 800-668-7440 Fax: 905 565 8325 e-Mail: service @ navair.com

THE MODAL SHOP
MTS SYSTEMS CORPORATION

~Calibration Certificate~

3149 East Kemper Rd.
Cincinnati, OH 45241
Ph : 513-351-9919
Fax: 513-458-2172
www.modalshop.com

Sensor Information

Model Number:	393A03
Serial Number:	51043
Manufacturer:	PCB
ID Number:	64711

Calibration Data

Sensitivity @ 100 Hz:	1,015	mV/g
	103.5	mV/m/s²
Phase @ 100 Hz:	-0.75	deg.
Test Level:	1.00	g

Transducer Specifications

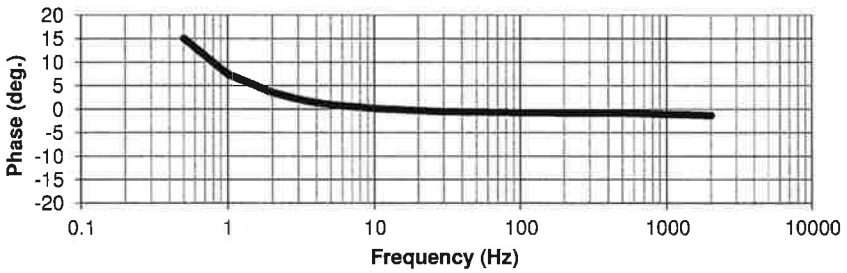
Amp. Range:	± 5	g
Resolution:	0.00001	g
Resonant Freq:	≥ 10000	Hz
Temp. Range:	-54 to 121	℃
	-65 to 250	℉
Axis:	Uni-Axial	

Description: ICP® Accelerometer

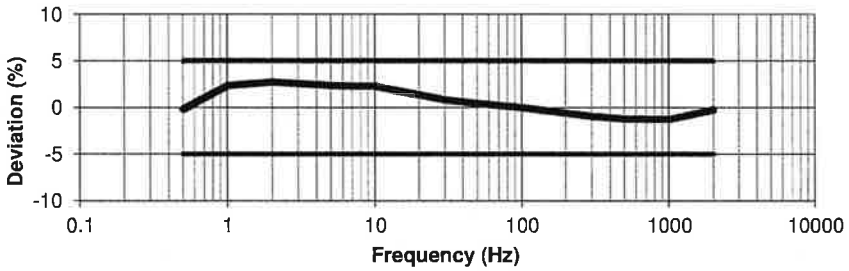
Data Table

Freq. (Hz)	Deviation (%)	Phase (deg)
0.5	-0.1587	15.1209
1	2.3515	7.4667
2	2.7362	3.5440
3	2.5512	2.0934
4	2.4665	1.3807
5	2.3512	0.9759
6.3	2.3073	0.6458
7	2.2621	0.5120
8	2.2604	0.3493
10	2.2558	0.1028
30	0.8137	-0.5435
50	0.4146	-0.6134
100	0.0000	-0.7471
300	-0.9446	-0.8625
500	-1.2424	-0.8338
1000	-1.2765	-1.1451
2000	-0.2298	-1.3015

Phase Response



Amplitude Response



Notes

Results relate only to the items calibrated.

This certificate may not be reproduced except in full, without written permision.

Method: Back-to-Back Comparison Calibration per ISO 16063 Part 21

This calibration was performed with TMS 9155 Calibration Workstation 2 version 6.0.0

Calibration traceable to NIST (project number 17014/17004).

Back-to-Back Comparison Calibration per ISO 16063-21

Procedures Used: PRD-P220, PRD-P214

Measurement uncertainty (95% confidence level with coverage factor 2) for frequency ranges tested during calibration are as follows: 0.5-1 Hz; 1.10%; >1-10 Hz; ± 0.75%, 11-99 Hz; ±1.20%, 100 Hz; ± 0.75%, 101-920 Hz; ± 1.00%, 921-5000 Hz; ± 1.40%, 5001-10,000 Hz; ± 1.90%, 10,001-15,000 Hz; ± 2.20%, 15,001-20,000 Hz; ± 2.8%.

Customer

TMS Rental
3149 E. Kemper Rd
Cincinnati, OH 45241

User Notes

Lab Conditions

Temperature: 69 (21) ℉ (℃)
Humidity: 50 %

Cal Date: 9-Jul-19
Due Date:

Unit Condition

As Found: In Tolerance
As Left: In Tolerance

Approval Information

Technician: Ed Devlin
Approval:

ACCREDITED
2649.01

Cal ID: 40358 Calibration Lab

Equipment Used

Description	Manufacturer	Model	Serial	Due Date
Data Aquisition Card	NI	PCI-4461	1A9CBC1	12/12/2019
Ref Std Conditioner	NI	PCI-6251	1B765F0	6/12/2020
Reference Std	PCB	080A200	175127	12/12/2019
Air Bearing Shaker	PCB	396C10	712	n/a
Ref Std Conditioner	PCB	442A102	261	12/12/2019
SUT Signal Conditioner	PCB	443B101	450	6/10/2020
Power Amplifier	TMS	2100E21-C	50097	n/a
Reference Std	TMS	2129E025 Sys 2	111	6/12/2020
Long Stroke Shaker	TMS	2129E025-779	104	n/a

THE MODAL SHOP INC
A PCB GROUP CO.

3149 East Kemper Rd.
Cincinnati, OH 45241
Ph: 513-351-9919
Fax: 513-458-2172
www.modalshop.com

~Calibration Certificate~

Sensor Information

Model Number:	393A03
Serial Number:	9743
Manufacturer:	PCB
ID Number:	62090
Description:	ICP® Accelerometer

Calibration Data

Sensitivity @ 100 Hz:	967.1	mV/g
Phase @ 100 Hz:	-1.07	deg.
Test Level:	1.00	g

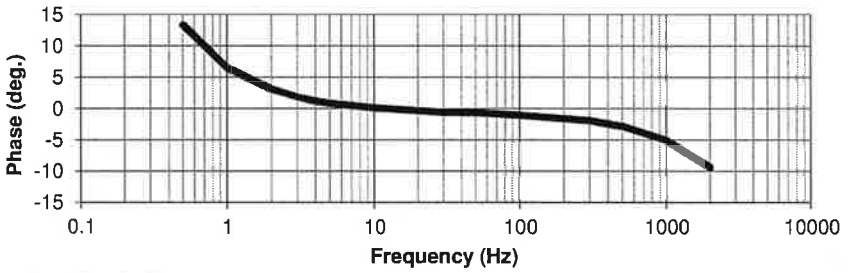
Transducer Specifications

Amp. Range:	± 5	g
Resolution:	0.00001	g
Resonant Freq:	≥ 10000	Hz
Temp. Range:	-54 to 121	℃
	-65 to 250	℉
Axis:	Uni-Axial	

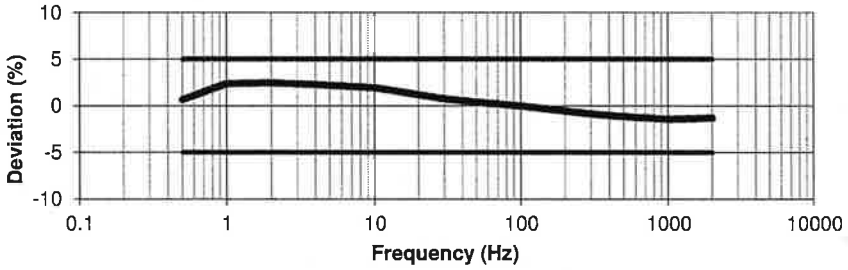
Data Table

Freq. (Hz)	Deviation (%)	Phase (deg)
0.5	0.6505	13.3644
1	2.3874	6.4775
2	2.4758	3.0595
3	2.3388	1.8026
4	2.2787	1.1726
5	2.1652	0.8168
10	1.9512	0.0948
30	0.7411	-0.5915
50	0.3828	-0.7152
100	0.0000	-1.0671
300	-0.8611	-1.9699
500	-1.1482	-2.8505
1000	-1.4188	-5.0421
2000	-1.2989	-9.3643

Phase Response



Amplitude Response



Notes

Results relate only to the items calibrated.

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Method: Back-to-Back Comparison Calibration per ISO 16063 Part 21

This calibration was performed with TMS 9155 Calibration Workstation 1 version 6.0.0

Calibration traceable to NIST (project number 822/271196).

Back-to-Back Comparison Calibration per ISO 16063-21

Procedures Used: PRD-P220 and PRD-P214, or PRD-P239

Measurement uncertainty (95% confidence level with coverage factor 2) for frequency ranges tested during calibration are as follows: 0.5-1 Hz; 1.10%; >1-10 Hz; ± 0.80%, 11-99 Hz; ±1.20%, 100 Hz; ± 0.75%, 101-920 Hz; ± 1.00%, 921-5000 Hz; ± 1.40%, 5001-10,000 Hz; ± 1.90%, 10,001-15,000 Hz; ± 2.20%, 15,001-20,000 Hz; ± 2.8%.

Customer

TMS Rental

User Notes

Lab Conditions

Temperature:	70 (21)	℉ (℃)
Humidity:	54	%

Unit Condition

As Found:	In Tolerance
As Left:	In Tolerance

Cal Date: 10-Aug-18

Due Date:

Approval Information

Technician: William Moses

Approval:

ACCREDITED
2649.01
Cal ID: 37346 Calibration Lab

Equipment Used

Description	Manufacturer	Model	Serial	Due Date
Data Aquisition Card	NI	PCI-4461	1AB3E9B	1/3/2019
Ref Std Conditioner	NI	PCI-6251	136F2A3	2/13/2019
Reference Std	PCB	080A200	110553	2/8/2019
Air Bearing Shaker	PCB	396C11	603	n/a
Ref Std Conditioner	PCB	442A102	305	2/8/2019
SUT Signal Conditioner	PCB	443B101	373	10/13/2018
Power Amplifier	TMS	2100E21-C	50002	n/a
Reference Std	TMS	2129E025	111	2/13/2019
Long Stroke Shaker	TMS	2129E025-779	111	n/a