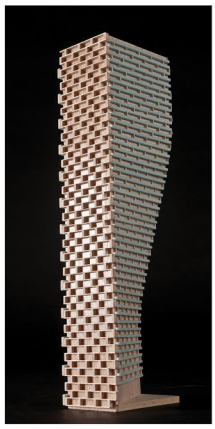
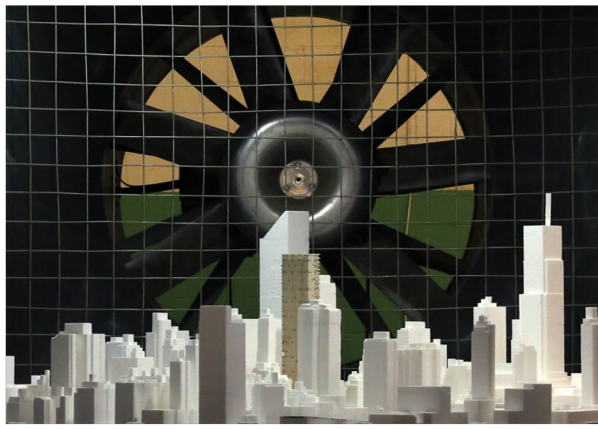
GRADIENTWIND
ENGINEERS & SCIENTISTS

ENVIRONMENTAL NOISE ASSESSMENT

30 Cleary Avenue
Ottawa, Ontario

REPORT: GW23-243-Environmental Noise





January 10th, 2024

PREPARED FOR
Theia Partners
1554 Carling Avenue, Suite 55
Ottawa, ON, K1Z 7M4

PREPARED BY
Adam Bonello, BASc., Junior Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes an environmental noise assessment performed for the proposed residential development, located 30 Cleary Avenue in Ottawa, Ontario. The proposed development comprises of two buildings, one high-rise and the other low-rise. The major contributors of traffic noise are Kichi Zibi Mikan (formerly Sir John A. MacDonald Parkway), Richmond Road, and Byron Avenue. Additionally, an LRT station is under construction in proximity to the study site. When completed, this will also pose a source of noise. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[2] guidelines, concept masterplan provided by Theia Partners from July 2023, with future roadway traffic volumes corresponding with the City of Ottawa's Official Plan (OP) roadway classifications.

The results of the current analysis indicate that noise levels will range between 53 and 63 dBA during the daytime period (07:00-23:00) and between 51 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs along the North façades of the buildings, which are nearest and most exposed to Sir John A. MacDonald Parkway.

Results of the calculations also indicate that the building will require forced air heating systems with central air conditioning, or similar mechanical system, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. The following Type D Warning Clause[3] will be required on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Noise levels at the high-rise rooftop terrace receptor are expected to exceed the 55 dBA OLA noise criterion during the daytime period. If this area is to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA. Further analysis investigated the impact of implementing noise barriers to the area. Results of the investigation proved that noise levels can be reduced to 55 dBA with a 1.5m noise guard along the edge of the high-rise rooftop terrace.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ministry of the Environment, Conservation and Parks (MECP), Environmental Noise Guideline – Publication NPC-300, August 2013
[3] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and City of Ottawa Noise By-Law No. 2017-255.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Theia Partners to undertake an environmental noise assessment for the proposed residential development, located at 30 Cleary Avenue in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to an environmental noise assessment.

The present scope of work involves assessing exterior noise and ground vibration levels at the study site generated by the surrounding industrial properties and transportation sources. The assessment was performed based on theoretical noise calculation methods conforming to the City of Ottawa[4] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[5] guidelines, concept masterplan provided by Theia Partners from July 2023, with future roadway traffic volumes corresponding with the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The proposed development comprises of two, multi-storey building spanning 7 and 17 floors up. The first building (low-rise) can be identified having a simple rectangular shape while overhanging the grade level lobby. The second building (high-rise) has a less rectilinear shape than the low-rise building. The building is angular along the North façade and has multiple terraces, rooves, and overhangs scattered throughout.

The major contributors of traffic noise are Kichi Zibi Mikan (formerly Sir John A. MacDonald Parkway), Richmond Road, and Byron Avenue. Additionally, an LRT station is under construction in proximity to the study site. When completed, this will also be a source of noise onto the development. Figure 1 illustrates a complete site plan with surrounding context.

NPC-300 consider balconies and elevated terraces (e.g., rooftops), with a minimum depth of 4 metres, as outdoor living areas (OLA). Therefore, terraces only with a depth greater than 4 metres are included as OLAs in this study.

[4] City of Ottawa Environmental Noise Control Guidelines, January 2016
[5] Ministry of the Environment, Conservation and Parks (MECP), Environmental Noise Guideline – Publication NPC-300, August 2013

Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses and comply with the ENCG Sound Level Limits and City of Ottawa Noise By-Law No. 2017-255.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise and vibration levels on the study site produced by local transportation, (ii) ensure that interior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00)/8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The NPC-300 guidelines specify that the recommended indoor noise limit range (that is relevant to this study) is 45 and 40 dBA for residence living rooms and sleeping quarters, respectively, as listed in Table 1. However, to account for deficiencies in building construction and to control peak noise, these levels should be targeted toward 42 and 37 dBA.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [6]

Type of Space	Time Period	L_{eq} (dBA)
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50
Living/dining/den areas of **residences**, hospitals, schools, nursing/retirement homes, day-care centers, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 - 07:00	45
Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while a standard closed window is capable of providing a minimum 20 dBA noise reduction[7]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air

[6] Adapted from Table C-2, Part C, Section 3.2.3 of NPC-300
[7] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125

conditioning (or similar systems). Where noise levels exceed 65 dBA daytime and 60 dBA nighttime building components will require higher levels of sound attenuation[8].

For designated Outdoor Living Areas (OLAs), the sound level limit is 55 dBA during the daytime period. An excess above the limit is acceptable only in cases where the required noise control measures are not feasible for technical, economic or administrative reasons.

4.2.2 Roadway and Railway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[9] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Class	Speed Limit (km/h)	Ultimate AADT	Day/Night Split	Truck Volume Percentages	
					Medium Truck	Heavy Truck
Sir John A. Macdonald Pkwy.	4-Lane Urban Arterial Divided	60	**35,000**	92/8	**7**	**5**
Richmond Rd.	2-Lane Urban Arterial	50	**15,000**	92/8	**7**	**5**
Byron Ave.	2-Lane Urban Collector	40	**8,000**	92/8	**7**	**5**
Confederation Line	Light Rail Transit	50	**180/34**	-	**-**	**-**

[8] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[9] City of Ottawa Transportation Master Plan, November 2013

4.2.3 Theoretical Traffic Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix A includes the STAMSON 5.04 input and output data.

Roadway traffic noise calculations were performed by treating each roadway segment as a separate line source of noise, and by using proposed and existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Vehicle parameters such as truck traffic volume percentages, posted speed limit, and day/night split are summarized in Table 2.
- Default ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Noise receptors were strategically placed at 13 locations around the study area (see Figure 2).
- For select sources where appropriate, receptors considered the proposed and existing building as a barrier partially or fully obstructing exposure to the source.
- Receptor distances and exposure angles are illustrated in Figures 4-5.
- LRT vehicles are assessed as 4 car SRT vehicles using the RT custom feature in STAMSON.

4.3 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness, and interior finish details. For example, concrete and masonry walls can achieve STC 50 or more. Curtainwall systems typically provide around STC 35, depending on the glazing elements. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40 depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

According to the ENCG, when daytime noise levels (from road and rail sources) at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[10] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[11], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, which was prepared for site plan approval, final detailed floor layouts and building elevations were unavailable and therefore detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels + safety factor).

4.4 Ground Vibration & Ground-borne Noise

Rail systems and heavy vehicles on roadways can produce perceptible levels of ground vibrations, especially when they are in close proximity to residential neighbourhoods or vibration-sensitive buildings. Similar to sound waves in air, vibrations in solids are generated at a source, propagated through a medium, and intercepted by a receiver. In the case of ground vibrations, the medium can be uniform, or more often, a complex layering of soils and rock strata. Also, similar to sound waves in air, ground vibrations produce perceptible motions and regenerated noise known as ‘ground-borne noise’ when the vibrations encounter a hollow structure such as a building. Ground-borne noise and vibrations are generated when there is an excitation of the ground, such as from a train or subway. The repetitive motion of the wheels on the track or rubber tires passing over an uneven surface causes vibration to propagate through the

[10] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[11] CMHC, Road & Rail Noise: Effects on Housing

soil. When they encounter a building, vibrations pass along the structure of the building beginning at the foundation and propagating to all floors. Air inside the building excited by the vibrating walls and floors represents regenerated airborne noise. Characteristics of the soil and the building are imparted to the noise, thereby creating a unique noise signature.

Human response to ground vibrations is dependent on the magnitude of the vibrations, which is measured by the root mean square (RMS) of the movement of a particle on a surface. Typical units of ground vibration measures are millimeters per second (mm/s), or inch per second (in/s). Since vibrations can vary over a wide range, it is also convenient to represent them in decibel units, or dBV. In North America, it is common practice to use the reference value of one micro-inch per second (µin/s) to represent vibration levels for this purpose. The threshold level of human perception to vibrations is about 0.10 mm/s RMS or about 72 dBV. Although somewhat variable, the threshold of annoyance for continuous vibrations is 0.5 mm/s RMS (or 85 dBV), five times higher than the perception threshold, whereas the threshold for significant structural damage is 10 mm/s RMS (or 112 dBV), at least one hundred times higher than the perception threshold level.

4.4.1 Ground Vibration Criteria

In the United States, the Federal Transportation Authority (FTA) has set vibration criteria for sensitive land uses next to transit corridors. Similar standards have been developed by the MECP. These standards indicate that the appropriate criteria for residences is 0.10 mm/s RMS for vibrations. For main line railways, a document titled *Guidelines for New Development in Proximity to Railway Operations*[12], indicates that vibration conditions should not exceed 0.14 mm/s RMS averaged over a one second time-period at the first floor and above of the proposed building. The Federal Transportation Authority (FTA) criterion was adopted as the appropriate standard for this study. As the main vibration source is due to a mainline railway which has infrequent events, the 0.14 mm/s RMS (75 dBV) vibration criteria and 40 dBA ground borne noise criteria were adopted for this study.

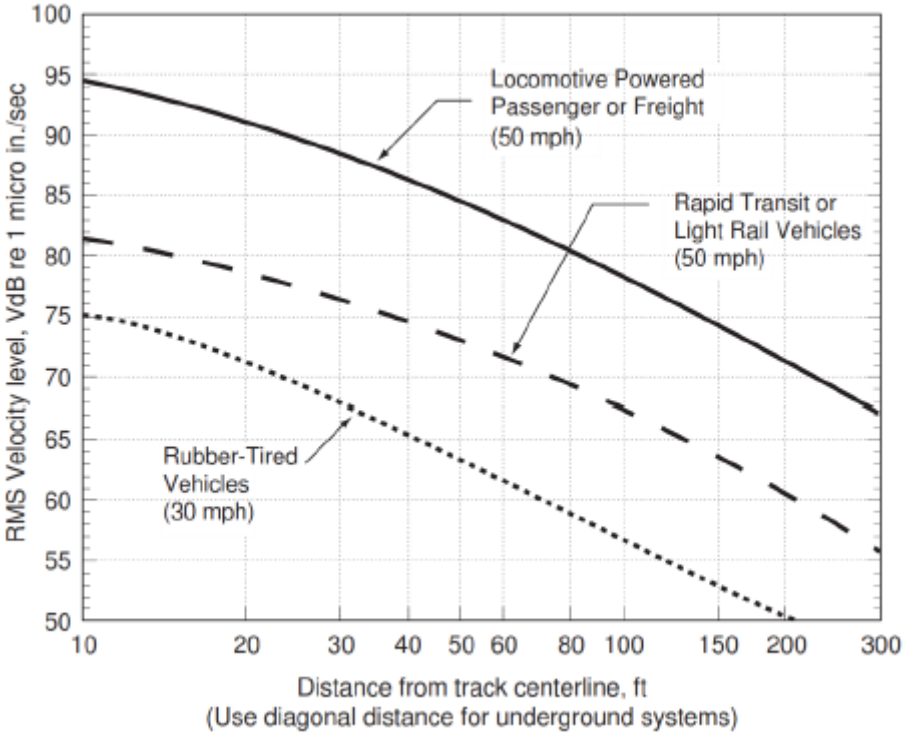
[12] Dialog and J.E. Coulter Associates Limited, prepared for The Confederation of Canadian Municipalities and The Railway Association of Canada, May 2013

4.4.2 Criteria for Roadway Traffic Noise

Potential vibration impacts of the trains were predicted using the Federal Transit Authority's (FTA) Transit Noise and Vibration Impact Assessment[13] protocol. The FTA general vibration assessment is based on an upper bound generic set of curves that show vibration level attenuation with distance. These curves, illustrated in the figure on the following page, are based on ground vibration measurements at various transit systems throughout North America. Vibration levels at points of reception are adjusted by various factors to incorporate known characteristics of the system being analyzed, such as operating speed of vehicle, conditions of the track, construction of the track and geology, as well as the structural type of the impacted building structures. The vibration impact on the building was determined using a set of curves for light rail vehicles at a speed of 50 mph. Adjustment factors were considered based on the following information:

- The speed limit is 50 km/h (31 mph)
- The distance between the development and the closest track is 115 m.
- The vehicles are assumed to have soft primary suspensions.
- Tracks are not welded, though in otherwise good condition.
- Soil conditions do not efficiently propagate vibrations.
- The building's foundation is large masonry on piles.

[13] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018



FTA GENERALIZED CURVES OF VIBRATION LEVELS VERSUS DISTANCE (ADOPTED FROM FIGURE 6.4, FTA TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT)

5. RESULTS

5.1 Roadway Traffic Noise Levels

The results of the current analysis indicate that noise levels will range between 53 and 63 dBA during the daytime period (07:00-23:00) and between 51 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs along the North façades of the buildings, which are nearest and most exposed to Sir John A. MacDonald Parkway.

TABLE 5: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON Roadway Noise Level (dBA)	
			Day	Night
Outdoor Living Areas				
1	1.5	Outdoor Amenity Path	53	N/A*
2	1.5	Outdoor Amenity Path	54	N/A*
3	1.5	Gathering Space	53	N/A*
4	51.25	High-Rise Rooftop Terrace	63	N/A*
Pane of Window				
5	17.4	Low-Rise West Façade	61	53
6	17.4	Low-Rise North Façade	63	55
7	17.4	Low-Rise East Façade	61	54
8	17.4	Low-Rise South Façade	58	51
9	51.25	High-Rise West Façade	63	56
10	51.25	High-Rise North Façade	63	56
11	51.25	High-Rise East Façade	61	53
12	51.25	High-Rise South Façade	61	53

**Noise levels during the nighttime are not considered for OLAs*

5.2 Noise Control Measures

The pane of window noise levels predicted due to roadway and railway traffic do not exceed the 65 dBA criteria listed in Section 4.2 for building components for the development. Thus, building components compliant with Ontario Building Code Standards will be sufficient to attenuate indoor noise levels.

5.2.1 Noise Barrier Calculation

Noise levels at the high-rise rooftop terrace receptor are expected to exceed the 55 dBA OLA noise criterion during the daytime period. If this area is to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA. Further analysis investigated the impact of implementing noise barriers to the area. Table 7 (below) and Figure 3, summarizes the results of the barrier investigation. Results of the investigation proved that noise levels can be reduced to 55 dBA with a 1.5m noise guard along the edge of the high-rise rooftop terrace. Details of the calculations are provided in Appendix A.

TABLE 7: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)		
			No Barrier	With 1.1m Barrier	With 1.5m Barrier
5	51.25	High-Rise Rooftop Terrace	63	56	55

5.3 Ground Vibrations & Ground-Borne Noise Levels

Estimated vibration levels were calculated between the building facade and the nearest streetcar track. These vibration levels were found to be 0.006 mm/s RMS (47 dBV) based on the FTA protocol and a conservative offset distance of 115 m to the nearest railway track centerline. Details of the calculation are provided in Appendix B. Due to minimal impacts; no vibration mitigation is required.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 53 and 63 dBA during the daytime period (07:00-23:00) and between 51 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs along the North façades of the buildings, which are nearest and most exposed to Sir John A. MacDonald Parkway.

Results of the calculations indicate that standard building components will be sufficient to achieve acceptable indoor noise levels. Although the building will require forced air heating systems, with provisions for central air conditioning to be added by the homeowners if desired. Installation of air conditioning would allow windows and doors to remain close, thus providing a quiet and comfortable

indoor environment. Due to the nature of the development, air conditioning is likely to be provided. Therefore, the following Type D Warning Clause[14] will also be required on all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

> *"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*

Noise levels at the high-rise rooftop terrace receptor are expected to exceed the 55 dBA OLA noise criterion during the daytime period. If this area is to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA. Further analysis investigated the impact of implementing noise barriers to the area. Results of the investigation proved that noise levels can be reduced to 55 dBA with a 1.5m noise guard along the edge of the high-rise rooftop terrace.

Furthermore, Gradient Wind investigated the potential stationary noise impacts from existing nearby commercial properties surrounding the study site. The analysis confirmed noise levels on the proposed development from the existing nearby properties will fall below NPC-300 criteria during the daytime and nighttime periods. It should be noted that noise generated from these existing sources typically fall below ambient noise levels generated from nearby roadway and rail traffic along Sir John A. MacDonald Parkway, and other roads in the vicinity. Based on the findings of the stationary noise analysis, the proposed development is expected to be compatible with the existing stationary sources of noise.

Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses and comply with the ENCG Sound Level Limits and City of Ottawa Noise By-Law No. 2017-255.

[14] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

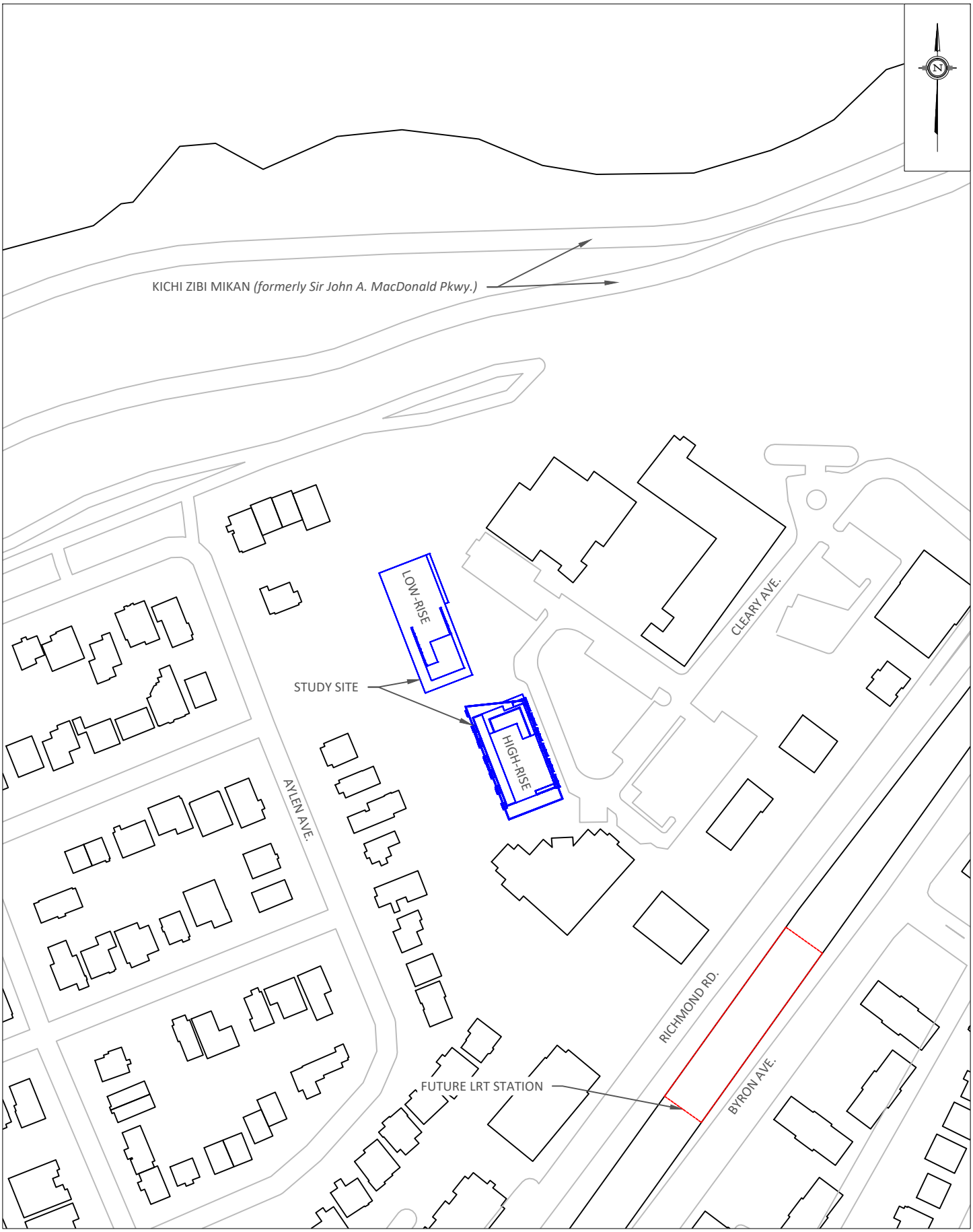
Sincerely,

Gradient Wind Engineering Inc.

Adam Bonello, BASc.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #23-243-Environmental Noise



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PROJECT	30 CLEARY AVENUE, OTTAWA ROADWAY TRAFFIC/STATIONARY NOISE ASSESSMENT		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW23-234-1
DATE	JANUARY 10, 2024	DRAWN BY	A.B.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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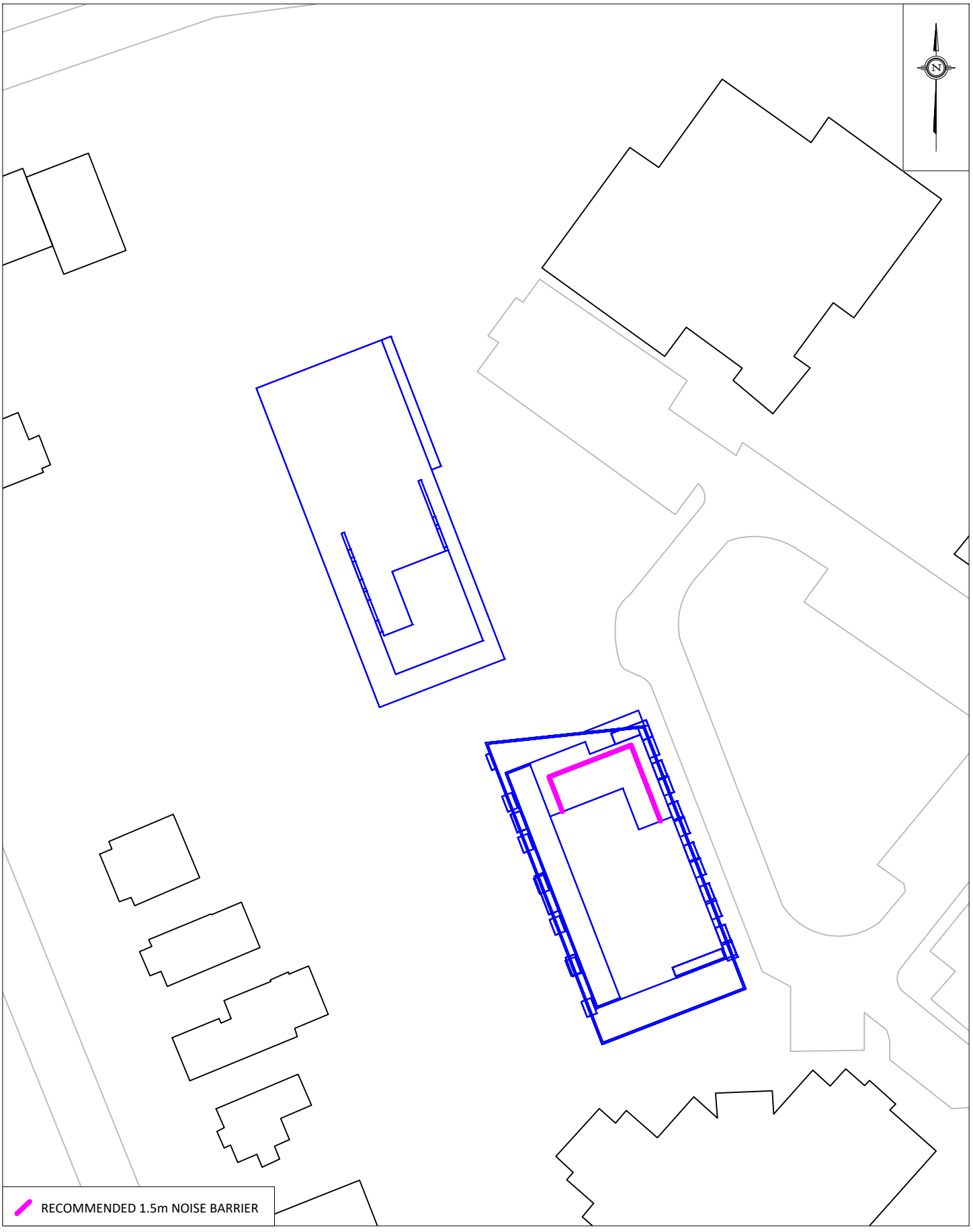
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW23-234-2
DATE	JANUARY 10, 2024	DRAWN BY	A.B.

FIGURE 2:
TRAFFIC NOISE RECEPTOR LOCATIONS



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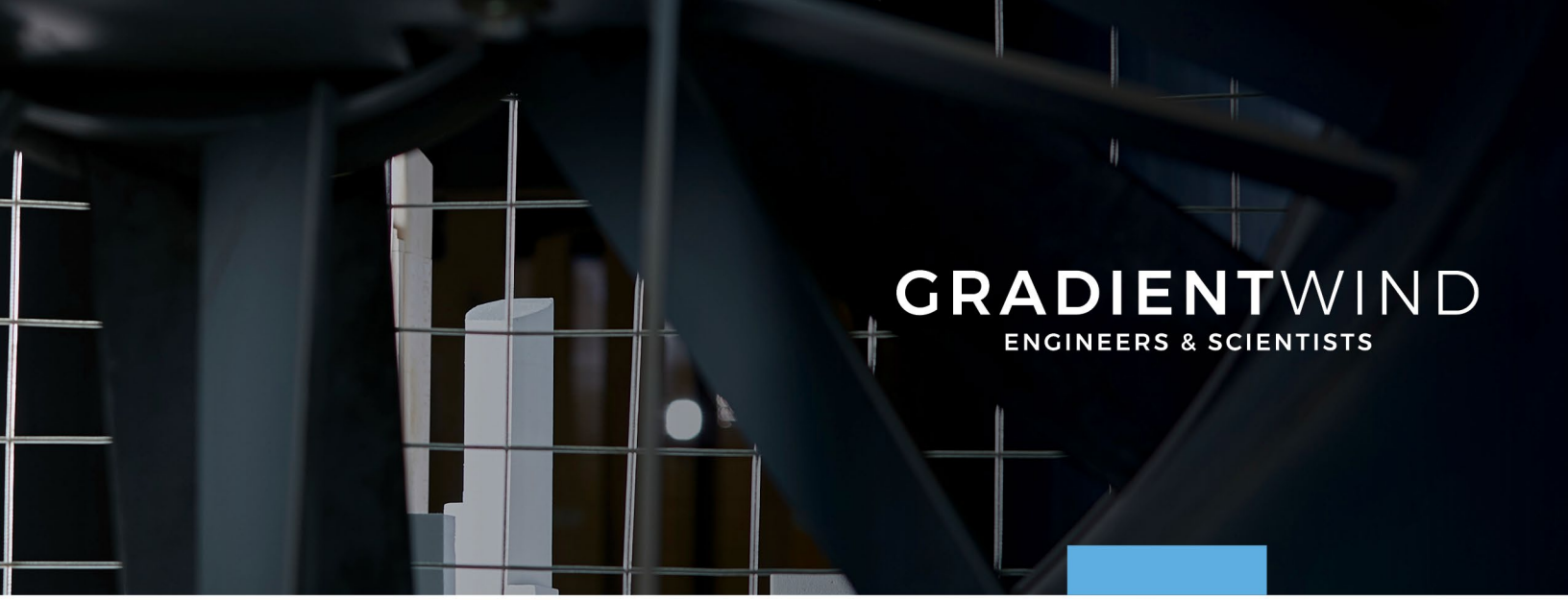
PROJECT	30 CLEARY AVENUE, OTTAWA ROADWAY TRAFFIC/STATIONARY NOISE ASSESSMENT		DESCRIPTION
SCALE	1:750 (APPROX.)	DRAWING NO.	GW23-234-3
DATE	JANUARY 10, 2024	DRAWN BY	A.B.

FIGURE 3:
NOISE BARRIER LOCATIONS



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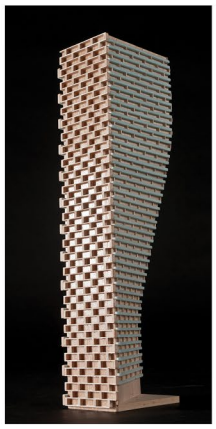

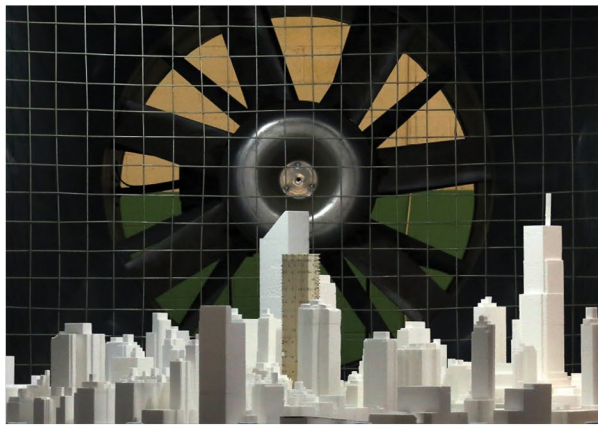

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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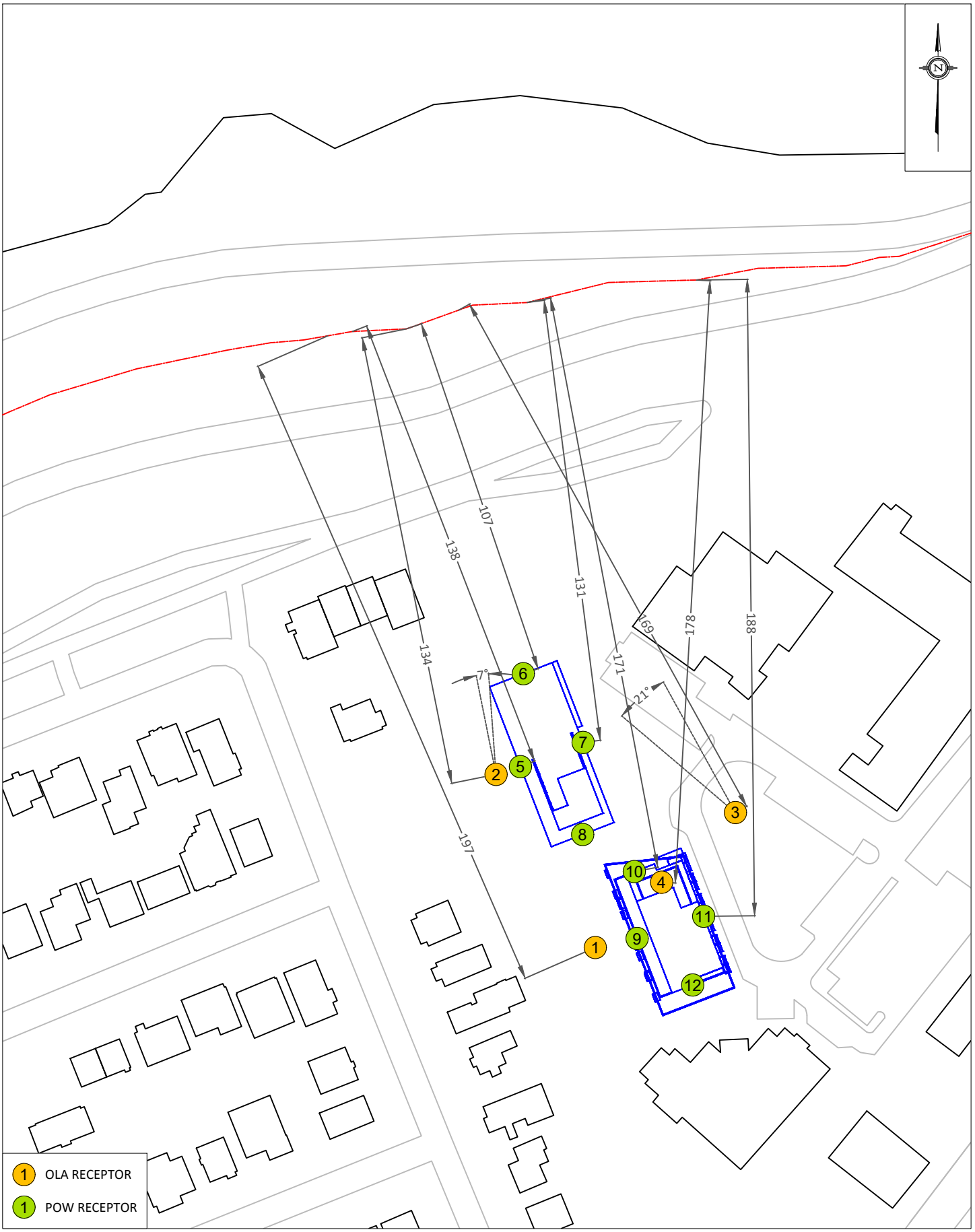

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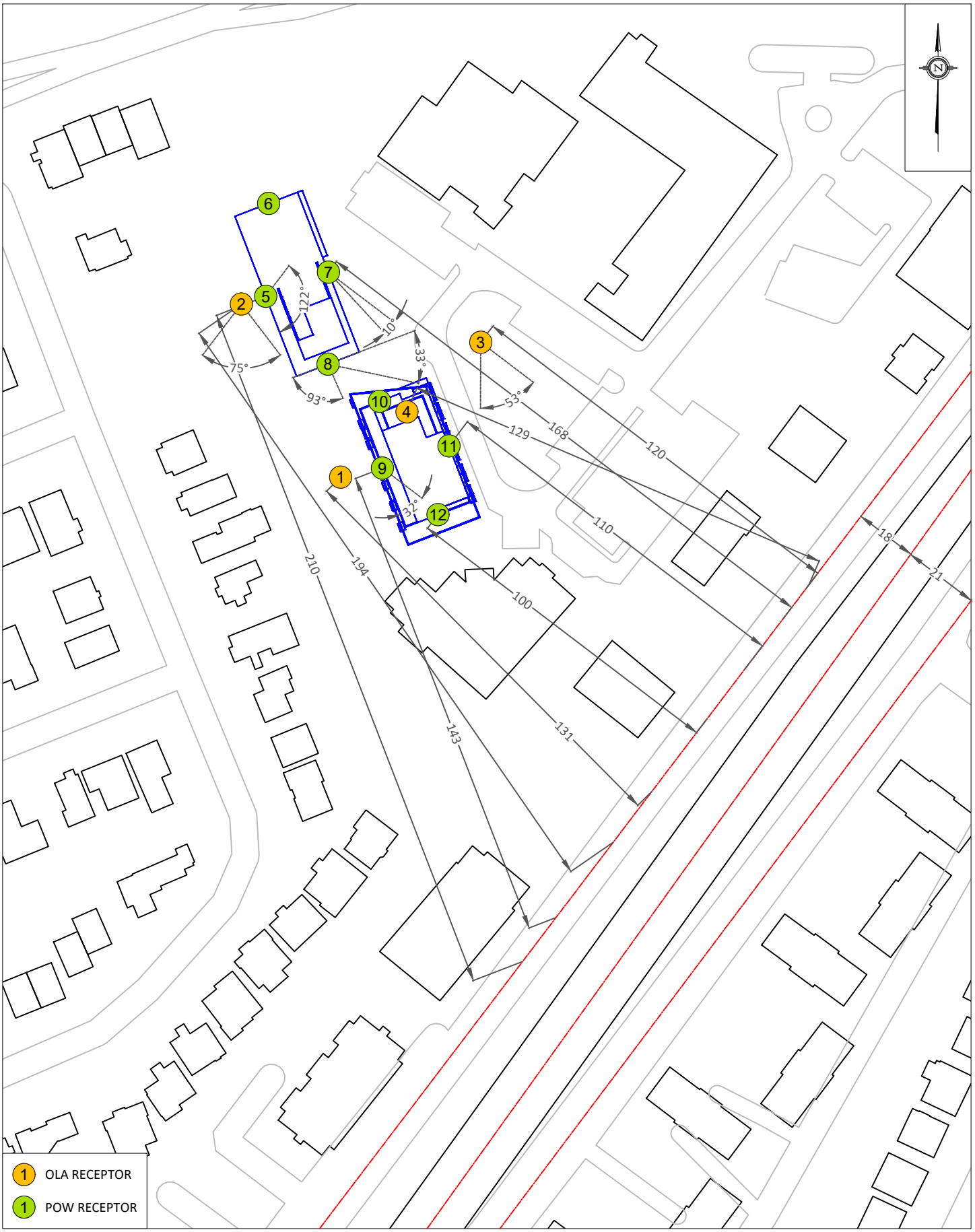
PROJECT	30 CLEARY AVENUE, OTTAWA ROADWAY TRAFFIC/STATIONARY NOISE ASSESSMENT		
SCALE	1:1500 (APPROX.)	DRAWING NO.	GW23-234-A1
DATE	JANUARY 10, 2024	DRAWN BY	A.B.

DESCRIPTION

FIGURE A1:
RECEPTOR DISTANCES AND EXPOSURE ANGLES



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PROJECT	30 CLEARY AVENUE, OTTAWA ROADWAY TRAFFIC/STATIONARY NOISE ASSESSMENT
SCALE	1:1500 (APPROX.)
DRAWING NO.	GW23-234-A2
DATE	JANUARY 10, 2024
DRAWN BY	A.B.

DESCRIPTION

FIGURE A2:
RECEPTOR DISTANCES AND EXPOSURE ANGLES

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:27:25
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 197.00 / 197.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           :   8.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 131.00 / 131.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           :   8.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 174.00 / 174.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.64 + 0.00) = 50.64 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.66  73.68   0.00 -18.57  -4.47   0.00   0.00   0.00  50.64
-------------------------------------------------------------------------------

Segment Leq : 50.64 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 47.81 + 0.00) = 47.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     8     90   0.66  68.48   0.00 -15.62  -5.04   0.00   0.00   0.00  47.81
-------------------------------------------------------------------------------

Segment Leq : 47.81 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 41.24 + 0.00) = 41.24 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     8     90   0.66  63.96   0.00 -17.67  -5.04   0.00   0.00   0.00  41.24
-------------------------------------------------------------------------------

Segment Leq : 41.24 dBA

Total Leq All Segments: 52.78 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 43.05 + 0.00) = 43.05 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.66  66.08   0.00 -18.57  -4.47   0.00   0.00   0.00  43.05
-------------------------------------------------------------------------------

Segment Leq : 43.05 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 40.22 + 0.00) = 40.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     8     90   0.66  60.88   0.00 -15.62  -5.04   0.00   0.00   0.00  40.22
-------------------------------------------------------------------------------

Segment Leq : 40.22 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 33.65 + 0.00) = 33.65 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     8     90   0.66  56.36   0.00 -17.67  -5.04   0.00   0.00   0.00  33.65
-------------------------------------------------------------------------------

Segment Leq : 33.65 dBA

Total Leq All Segments: 45.19 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           :   8.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 153.00 / 153.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 33.96 + 0.00) = 33.96 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
     8     90   0.66  55.74 -16.74  -5.04   0.00   0.00   0.00  33.96
-------------------------------------------------------------------------

Segment Leq : 33.96 dBA

Total Leq All Segments: 33.96 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 29.73 + 0.00) = 29.73 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
     8     90   0.66  51.52 -16.74  -5.04   0.00   0.00   0.00  29.73
-------------------------------------------------------------------------

Segment Leq : 29.73 dBA

Total Leq All Segments: 29.73 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.83
                           (NIGHT): 45.31
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:27:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te                    Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   7.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 134.00 / 134.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 194.00 / 194.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 243.00 / 243.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.87 + 0.00) = 53.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      7   0.66  73.68   0.00 -15.79  -4.02   0.00   0.00   0.00  53.87
-------------------------------------------------------------------------------

Segment Leq : 53.87 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 44.42 + 0.00) = 44.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    15     90   0.66  68.48   0.00 -18.45  -5.61   0.00   0.00   0.00  44.42
-------------------------------------------------------------------------------

Segment Leq : 44.42 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 38.27 + 0.00) = 38.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    15     90   0.66  63.96   0.00 -20.08  -5.61   0.00   0.00   0.00  38.27
-------------------------------------------------------------------------------

Segment Leq : 38.27 dBA

Total Leq All Segments: 54.44 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.27 + 0.00) = 46.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      7   0.66  66.08   0.00 -15.79  -4.02   0.00   0.00   0.00  46.27
-------------------------------------------------------------------------------

Segment Leq : 46.27 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 36.82 + 0.00) = 36.82 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    15     90   0.66  60.88   0.00 -18.45  -5.61   0.00   0.00   0.00  36.82
-------------------------------------------------------------------------------

Segment Leq : 36.82 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 30.67 + 0.00) = 30.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    15     90   0.66  56.36   0.00 -20.08  -5.61   0.00   0.00   0.00  30.67
-------------------------------------------------------------------------------

Segment Leq : 30.67 dBA

Total Leq All Segments: 46.84 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 222.00 / 222.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 30.71 + 0.00) = 30.71 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
    15     90   0.66  55.74 -19.43  -5.61   0.00   0.00   0.00  30.71
-------------------------------------------------------------------------

Segment Leq : 30.71 dBA

Total Leq All Segments: 30.71 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 26.48 + 0.00) = 26.48 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
    15     90   0.66  51.52 -19.43  -5.61   0.00   0.00   0.00  26.48
-------------------------------------------------------------------------

Segment Leq : 26.48 dBA

Total Leq All Segments: 26.48 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.46
                           (NIGHT): 46.88
```

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:28:11
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -21.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 169.00 / 169.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -38.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 120.00 / 120.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -38.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 159.00 / 159.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.82 + 0.00) = 46.82 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -21      0   0.66  73.68   0.00 -17.46  -9.40   0.00   0.00   0.00  46.82
-------------------------------------------------------------------------------

Segment Leq : 46.82 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 50.19 + 0.00) = 50.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -38     53   0.66  68.48   0.00 -14.99  -3.30   0.00   0.00   0.00  50.19
-------------------------------------------------------------------------------

Segment Leq : 50.19 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 43.63 + 0.00) = 43.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -38     53   0.66  63.96   0.00 -17.02  -3.30   0.00   0.00   0.00  43.63
-------------------------------------------------------------------------------

Segment Leq : 43.63 dBA

Total Leq All Segments: 52.45 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 39.22 + 0.00) = 39.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -21      0   0.66  66.08   0.00 -17.46  -9.40   0.00   0.00   0.00  39.22
-------------------------------------------------------------------------------

Segment Leq : 39.22 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 42.59 + 0.00) = 42.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -38     53   0.66  60.88   0.00 -14.99  -3.30   0.00   0.00   0.00  42.59
-------------------------------------------------------------------------------

Segment Leq : 42.59 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 36.04 + 0.00) = 36.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -38     53   0.66  56.36   0.00 -17.02  -3.30   0.00   0.00   0.00  36.04
-------------------------------------------------------------------------------

Segment Leq : 36.04 dBA

Total Leq All Segments: 44.85 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -38.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 138.00 / 138.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 36.44 + 0.00) = 36.44 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -38     53   0.66  55.74 -16.00  -3.30   0.00   0.00   0.00  36.44
-------------------------------------------------------------------------

Segment Leq : 36.44 dBA

Total Leq All Segments: 36.44 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 32.22 + 0.00) = 32.22 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -38     53   0.66  51.52 -16.00  -3.30   0.00   0.00   0.00  32.22
-------------------------------------------------------------------------

Segment Leq : 32.22 dBA

Total Leq All Segments: 32.22 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.55
                           (NIGHT): 45.08
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:28:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te                    Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 178.00 / 178.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 129.00 / 129.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 171.00 / 171.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
```

```
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 62.93 + 0.00) = 62.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  73.68   0.00 -10.74   0.00   0.00   0.00  -4.97  57.97*
   -90     90   0.00  73.68   0.00 -10.74   0.00   0.00   0.00   0.00  62.93
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 62.93 dBA

Results segment # 2: Richmond (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 47.50 + 0.00) = 47.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  68.48   0.00  -9.34  -3.74   0.00   0.00  -7.89  47.50
-------------------------------------------------------------------------------

Segment Leq : 47.50 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m
```

```
Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 43.57 + 0.00) = 43.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  63.96   0.00 -10.57  -3.74   0.00   0.00  -6.07  43.57
-------------------------------------------------------------------------------

Segment Leq : 43.57 dBA

Total Leq All Segments: 63.10 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 55.34 + 0.00) = 55.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  66.08   0.00 -10.74   0.00   0.00   0.00  -4.97  50.37*
   -90     90   0.00  66.08   0.00 -10.74   0.00   0.00   0.00   0.00  55.34
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 55.34 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 39.91 + 0.00) = 39.91 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90    -14   0.00  60.88   0.00  -9.34  -3.74   0.00   0.00  -7.89  39.91
-------------------------------------------------------------------------

Segment Leq : 39.91 dBA

Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 35.98 + 0.00) = 35.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90    -14   0.00  56.36   0.00 -10.57  -3.74   0.00   0.00  -6.07  35.98
-------------------------------------------------------------------------

Segment Leq : 35.98 dBA

Total Leq All Segments: 55.51 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 148.00 / 148.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
```

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

Source height = 0.50 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 35.01 + 0.00) = 35.01 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  55.74  -9.94  -3.74   0.00   0.00  -7.05  35.01
-------------------------------------------------------------------

Segment Leq : 35.01 dBA

Total Leq All Segments: 35.01 dBA

Results segment # 1: O-Train (night)
-----------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 30.78 + 0.00) = 30.78 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  51.52  -9.94  -3.74   0.00   0.00  -7.05  30.78
-------------------------------------------------------------------

Segment Leq : 30.78 dBA

Total Leq All Segments: 30.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.11
                           (NIGHT): 55.53
```

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:30:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 138.00 / 138.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 210.00 / 210.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 260.00 / 260.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.77 + 0.00) = 58.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.18  73.68   0.00 -11.40  -3.51   0.00   0.00   0.00  58.77
-------------------------------------------------------------------------------

Segment Leq : 58.77 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 55.33 + 0.00) = 55.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  68.48   0.00 -11.46  -1.69   0.00   0.00   0.00  55.33
-------------------------------------------------------------------------------

Segment Leq : 55.33 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.88 + 0.00) = 49.88 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  63.96   0.00 -12.39  -1.69   0.00   0.00   0.00  49.88
-------------------------------------------------------------------------------

Segment Leq : 49.88 dBA

Total Leq All Segments: 60.76 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.17 + 0.00) = 51.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.18  66.08   0.00 -11.40  -3.51   0.00   0.00   0.00  51.17
-------------------------------------------------------------------------------

Segment Leq : 51.17 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.73 + 0.00) = 47.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  60.88   0.00 -11.46  -1.69   0.00   0.00   0.00  47.73
-------------------------------------------------------------------------------

Segment Leq : 47.73 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 42.28 + 0.00) = 42.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  56.36   0.00 -12.39  -1.69   0.00   0.00   0.00  42.28
-------------------------------------------------------------------------------

Segment Leq : 42.28 dBA

Total Leq All Segments: 53.16 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 239.00 / 239.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 42.03 + 0.00) = 42.03 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     32   0.00  55.74 -12.02  -1.69   0.00   0.00   0.00  42.03
-------------------------------------------------------------------------

Segment Leq : 42.03 dBA

Total Leq All Segments: 42.03 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 37.80 + 0.00) = 37.80 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     32   0.00  51.52 -12.02  -1.69   0.00   0.00   0.00  37.80
-------------------------------------------------------------------------

Segment Leq : 37.80 dBA

Total Leq All Segments: 37.80 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.82
                           (NIGHT): 53.29
```

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:30:44
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 107.00 / 107.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.08 + 0.00) = 63.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.18  73.68   0.00 -10.10  -0.50   0.00   0.00   0.00  63.08
-------------------------------------------------------------------------------

Segment Leq : 63.08 dBA

Total Leq All Segments: 63.08 dBA

Results segment # 1: MacDonald (night)
---------------------------------------
```

```
Source height = 1.50 m

ROAD (0.00 + 55.49 + 0.00) = 55.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.18  66.08   0.00 -10.10  -0.50   0.00   0.00   0.00  55.49
-------------------------------------------------------------------------------

Segment Leq : 55.49 dBA

Total Leq All Segments: 55.49 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.08
                           (NIGHT): 55.49
```

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:31:30
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 131.00 / 131.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   10.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 168.00 / 168.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   10.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 207.00 / 207.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.03 + 0.00) = 59.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.18  73.68   0.00 -11.14  -3.51   0.00   0.00   0.00  59.03
-------------------------------------------------------------------------------

Segment Leq : 59.03 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 55.44 + 0.00) = 55.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     10   0.00  68.48   0.00 -10.49  -2.55   0.00   0.00   0.00  55.44
-------------------------------------------------------------------------------

Segment Leq : 55.44 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.00 + 0.00) = 50.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     10   0.00  63.96   0.00 -11.40  -2.55   0.00   0.00   0.00  50.00
-------------------------------------------------------------------------------

Segment Leq : 50.00 dBA

Total Leq All Segments: 60.97 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.44 + 0.00) = 51.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.18  66.08   0.00 -11.14  -3.51   0.00   0.00   0.00  51.44
-------------------------------------------------------------------------------

Segment Leq : 51.44 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.84 + 0.00) = 47.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     10   0.00  60.88   0.00 -10.49  -2.55   0.00   0.00   0.00  47.84
-------------------------------------------------------------------------------

Segment Leq : 47.84 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 42.41 + 0.00) = 42.41 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     10   0.00  56.36   0.00 -11.40  -2.55   0.00   0.00   0.00  42.41
-------------------------------------------------------------------------------

Segment Leq : 42.41 dBA

Total Leq All Segments: 53.38 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   10.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 186.00 / 186.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 42.26 + 0.00) = 42.26 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     10   0.00  55.74 -10.93  -2.55   0.00   0.00   0.00  42.26
-------------------------------------------------------------------------

Segment Leq : 42.26 dBA

Total Leq All Segments: 42.26 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 38.03 + 0.00) = 38.03 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     10   0.00  51.52 -10.93  -2.55   0.00   0.00   0.00  38.03
-------------------------------------------------------------------------

Segment Leq : 38.03 dBA

Total Leq All Segments: 38.03 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.03
                           (NIGHT): 53.50
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:31:50
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r8.te                  Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Richmond (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  :    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):  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 # 1: Richmond (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 152.00 / 152.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -57.00 deg   Angle2 : -3.00 deg
Barrier height            :  54.40 m
Barrier receiver distance :  16.00 / 16.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 2: Byron (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
```

```
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 191.00 / 191.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -57.00 deg   Angle2 : -3.00 deg
Barrier height            :  54.40 m
Barrier receiver distance :  16.00 / 16.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: Richmond (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       17.40 !       15.73 !        15.73

ROAD (51.05 + 33.19 + 55.55) = 56.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -57   0.00  68.48   0.00 -10.06  -7.37   0.00   0.00   0.00  51.05
-------------------------------------------------------------------------------
   -57     -3   0.00  68.48   0.00 -10.06  -5.23   0.00   0.00 -20.00  33.19
-------------------------------------------------------------------------------
    -3     90   0.00  68.48   0.00 -10.06  -2.87   0.00   0.00   0.00  55.55
-------------------------------------------------------------------------------

Segment Leq : 56.89 dBA

Results segment # 2: Byron (day)
--------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
```

```
-------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       17.40 !       16.07 !        16.07

ROAD (45.54 + 27.68 + 50.04) = 51.38 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -57   0.00  63.96   0.00 -11.05  -7.37   0.00   0.00   0.00  45.54
-------------------------------------------------------------------------------
   -57     -3   0.00  63.96   0.00 -11.05  -5.23   0.00   0.00 -20.00  27.68
-------------------------------------------------------------------------------
    -3     90   0.00  63.96   0.00 -11.05  -2.87   0.00   0.00   0.00  50.04
-------------------------------------------------------------------------------

Segment Leq : 51.38 dBA

Total Leq All Segments: 57.97 dBA

Results segment # 1: Richmond (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
-------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       17.40 !       15.73 !        15.73

ROAD (43.46 + 25.60 + 47.96) = 49.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -57   0.00  60.88   0.00 -10.06  -7.37   0.00   0.00   0.00  43.46
-------------------------------------------------------------------------------
   -57     -3   0.00  60.88   0.00 -10.06  -5.23   0.00   0.00 -20.00  25.60
-------------------------------------------------------------------------------
    -3     90   0.00  60.88   0.00 -10.06  -2.87   0.00   0.00   0.00  47.96
-------------------------------------------------------------------------------

Segment Leq : 49.30 dBA

Results segment # 2: Byron (night)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
-------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
```

```
-----------+------------+------------+-------------
       1.50 !       17.40 !       16.07 !        16.07

ROAD (37.95 + 20.08 + 42.44) = 43.78 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -57   0.00  56.36   0.00 -11.05  -7.37   0.00   0.00   0.00  37.95
-------------------------------------------------------------------------------
   -57     -3   0.00  56.36   0.00 -11.05  -5.23   0.00   0.00 -20.00  20.08
-------------------------------------------------------------------------------
    -3     90   0.00  56.36   0.00 -11.05  -2.87   0.00   0.00   0.00  42.44
-------------------------------------------------------------------------------

Segment Leq : 43.78 dBA

Total Leq All Segments: 50.37 dBA

RT/Custom data, segment # 1: O-Train (day/night)
-----------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 170.00 / 170.00 m
Receiver height           :  17.40 / 17.40  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -57.00 deg   Angle2 : -3.00 deg
Barrier height            :  54.40 m
Barrier receiver distance :  16.00 / 16.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       17.40 !       15.81 !        15.81

RT/Custom (37.83 + 19.97 + 42.33) = 43.67 dBA
```

```
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -57   0.00  55.74 -10.54  -7.37   0.00   0.00   0.00  37.83
-------------------------------------------------------------------
   -57     -3   0.00  55.74 -10.54  -5.23   0.00   0.00 -20.00  19.97
-------------------------------------------------------------------
    -3     90   0.00  55.74 -10.54  -2.87   0.00   0.00   0.00  42.33
-------------------------------------------------------------------

Segment Leq : 43.67 dBA

Total Leq All Segments: 43.67 dBA

Results segment # 1: O-Train (night)
-----------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       17.40 !       15.81 !        15.81

RT/Custom (33.60 + 15.74 + 38.10) = 39.44 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -57   0.00  51.52 -10.54  -7.37   0.00   0.00   0.00  33.60
-------------------------------------------------------------------
   -57     -3   0.00  51.52 -10.54  -5.23   0.00   0.00 -20.00  15.74
-------------------------------------------------------------------
    -3     90   0.00  51.52 -10.54  -2.87   0.00   0.00   0.00  38.10
-------------------------------------------------------------------

Segment Leq : 39.44 dBA

Total Leq All Segments: 39.44 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.12
                           (NIGHT): 50.71
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:32:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r9.te                    Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
----------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 128.00 / 128.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 143.00 / 143.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 191.00 / 191.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.35 + 0.00) = 61.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  73.68   0.00  -9.31  -3.01   0.00   0.00   0.00  61.35
-------------------------------------------------------------------------------

Segment Leq : 61.35 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 57.00 + 0.00) = 57.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  68.48   0.00  -9.79  -1.69   0.00   0.00   0.00  57.00
-------------------------------------------------------------------------------

Segment Leq : 57.00 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.22 + 0.00) = 51.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  63.96   0.00 -11.05  -1.69   0.00   0.00   0.00  51.22
-------------------------------------------------------------------------------

Segment Leq : 51.22 dBA

Total Leq All Segments: 63.01 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.76 + 0.00) = 53.76 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  66.08   0.00  -9.31  -3.01   0.00   0.00   0.00  53.76
-------------------------------------------------------------------------------

Segment Leq : 53.76 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.40 + 0.00) = 49.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  60.88   0.00  -9.79  -1.69   0.00   0.00   0.00  49.40
-------------------------------------------------------------------------------

Segment Leq : 49.40 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 43.62 + 0.00) = 43.62 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     32   0.00  56.36   0.00 -11.05  -1.69   0.00   0.00   0.00  43.62
-------------------------------------------------------------------------------

Segment Leq : 43.62 dBA

Total Leq All Segments: 55.41 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   32.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 170.00 / 170.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 43.51 + 0.00) = 43.51 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     32   0.00  55.74 -10.54  -1.69   0.00   0.00   0.00  43.51
-------------------------------------------------------------------------

Segment Leq : 43.51 dBA

Total Leq All Segments: 43.51 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 39.28 + 0.00) = 39.28 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     32   0.00  51.52 -10.54  -1.69   0.00   0.00   0.00  39.28
-------------------------------------------------------------------------

Segment Leq : 39.28 dBA

Total Leq All Segments: 39.28 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.05
                           (NIGHT): 55.52
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:32:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r10.te                 Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 171.00 / 171.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.11 + 0.00) = 63.11 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  73.68   0.00 -10.57   0.00   0.00   0.00   0.00  63.11
-------------------------------------------------------------------------------

Segment Leq : 63.11 dBA

Total Leq All Segments: 63.11 dBA


Results segment # 1: MacDonald (night)
---------------------------------------
```

```
Source height = 1.50 m

ROAD (0.00 + 55.51 + 0.00) = 55.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  66.08   0.00 -10.57   0.00   0.00   0.00   0.00  55.51
-------------------------------------------------------------------------------

Segment Leq : 55.51 dBA

Total Leq All Segments: 55.51 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.11
                           (NIGHT): 55.51
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:32:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r11.te                 Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 188.00 / 188.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           :  58.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 110.00 / 110.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           :  58.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 149.00 / 149.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.69 + 0.00) = 59.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  73.68   0.00 -10.98  -3.01   0.00   0.00   0.00  59.69
-------------------------------------------------------------------------------

Segment Leq : 59.69 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 52.33 + 0.00) = 52.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    58     90   0.00  68.48   0.00  -8.65  -7.50   0.00   0.00   0.00  52.33
-------------------------------------------------------------------------------

Segment Leq : 52.33 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.48 + 0.00) = 46.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    58     90   0.00  63.96   0.00  -9.97  -7.50   0.00   0.00   0.00  46.48
-------------------------------------------------------------------------------

Segment Leq : 46.48 dBA

Total Leq All Segments: 60.59 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.09 + 0.00) = 52.09 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  66.08   0.00 -10.98  -3.01   0.00   0.00   0.00  52.09
-------------------------------------------------------------------------------

Segment Leq : 52.09 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 44.73 + 0.00) = 44.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    58     90   0.00  60.88   0.00  -8.65  -7.50   0.00   0.00   0.00  44.73
-------------------------------------------------------------------------------

Segment Leq : 44.73 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 38.89 + 0.00) = 38.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    58     90   0.00  56.36   0.00  -9.97  -7.50   0.00   0.00   0.00  38.89
-------------------------------------------------------------------------------

Segment Leq : 38.89 dBA

Total Leq All Segments: 52.99 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           :  58.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 128.00 / 128.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 38.93 + 0.00) = 38.93 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
    58     90   0.00  55.74  -9.31  -7.50   0.00   0.00   0.00  38.93
-------------------------------------------------------------------------

Segment Leq : 38.93 dBA

Total Leq All Segments: 38.93 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m
```

```
RT/Custom (0.00 + 34.70 + 0.00) = 34.70 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
    58     90   0.00  51.52  -9.31  -7.50   0.00   0.00   0.00  34.70
-------------------------------------------------------------------------

Segment Leq : 34.70 dBA

Total Leq All Segments: 34.70 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.62
                           (NIGHT): 53.06
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:32:59
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r12.te                 Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Richmond (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  :    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):  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 # 1: Richmond (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   58.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 100.00 / 100.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Byron (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   58.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 139.00 / 139.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Richmond (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.39 + 0.00) = 59.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     58   0.00  68.48   0.00  -8.24  -0.85   0.00   0.00   0.00  59.39
-------------------------------------------------------------------------------

Segment Leq : 59.39 dBA

Results segment # 2: Byron (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.44 + 0.00) = 53.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     58   0.00  63.96   0.00  -9.67  -0.85   0.00   0.00   0.00  53.44
-------------------------------------------------------------------------------

Segment Leq : 53.44 dBA

Total Leq All Segments: 60.37 dBA

Results segment # 1: Richmond (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.79 + 0.00) = 51.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     58   0.00  60.88   0.00  -8.24  -0.85   0.00   0.00   0.00  51.79
-------------------------------------------------------------------------------

Segment Leq : 51.79 dBA

Results segment # 2: Byron (night)
```

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

Source height = 1.50 m

ROAD (0.00 + 45.84 + 0.00) = 45.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     58   0.00  56.36   0.00  -9.67  -0.85   0.00   0.00   0.00  45.84
-------------------------------------------------------------------------------

Segment Leq : 45.84 dBA

Total Leq All Segments: 52.77 dBA

RT/Custom data, segment # 1: O-Train (day/night)
-----------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   58.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 118.00 / 118.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: O-Train (day)
---------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 45.94 + 0.00) = 45.94 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     58   0.00  55.74  -8.96  -0.85   0.00   0.00   0.00  45.94
-------------------------------------------------------------------------

Segment Leq : 45.94 dBA

Total Leq All Segments: 45.94 dBA

Results segment # 1: O-Train (night)
-----------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 41.71 + 0.00) = 41.71 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
```

```
-------------------------------------------------------------------------
   -90     58    0.00  51.52  -8.96  -0.85   0.00   0.00   0.00  41.71
-------------------------------------------------------------------------

Segment Leq : 41.71 dBA

Total Leq All Segments: 41.71 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.53
                           (NIGHT): 53.10
```

```
STAMSON 5.0          NORMAL REPORT          Date: 27-10-2023 13:29:51
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4wall1.te              Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 178.00 / 178.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  50.85 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  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 # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 129.00 / 129.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 171.00 / 171.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
```

```
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 55.59 + 0.00) = 55.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  73.68   0.00 -10.74   0.00   0.00   0.00  -7.34  55.59
-------------------------------------------------------------------------------

Segment Leq : 55.59 dBA

Results segment # 2: Richmond (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 47.50 + 0.00) = 47.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  68.48   0.00  -9.34  -3.74   0.00   0.00  -7.89  47.50
-------------------------------------------------------------------------------

Segment Leq : 47.50 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
```

```
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+------------+------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 43.57 + 0.00) = 43.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  63.96   0.00 -10.57  -3.74   0.00   0.00  -6.07  43.57
-------------------------------------------------------------------------------

Segment Leq : 43.57 dBA

Total Leq All Segments: 56.45 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+------------+------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 47.99 + 0.00) = 47.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  66.08   0.00 -10.74   0.00   0.00   0.00  -7.34  47.99
-------------------------------------------------------------------------------

Segment Leq : 47.99 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+------------+------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 39.91 + 0.00) = 39.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  60.88   0.00  -9.34  -3.74   0.00   0.00  -7.89  39.91
-------------------------------------------------------------------------------

Segment Leq : 39.91 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 35.98 + 0.00) = 35.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  56.36   0.00 -10.57  -3.74   0.00   0.00  -6.07  35.98
-------------------------------------------------------------------------------

Segment Leq : 35.98 dBA

Total Leq All Segments: 48.85 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 148.00 / 148.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
```

```
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 35.01 + 0.00) = 35.01 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  55.74  -9.94  -3.74   0.00   0.00  -7.05  35.01
-------------------------------------------------------------------

Segment Leq : 35.01 dBA

Total Leq All Segments: 35.01 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 30.78 + 0.00) = 30.78 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  51.52  -9.94  -3.74   0.00   0.00  -7.05  30.78
-------------------------------------------------------------------

Segment Leq : 30.78 dBA

Total Leq All Segments: 30.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.48
                           (NIGHT): 48.92
```

STAMSON 5.0 NORMAL REPORT Date: 27-10-2023 13:30:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4wall2.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: MacDonald (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: MacDonald (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 178.00 / 178.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  51.25 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 2: Richmond (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  :    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):  15000
```

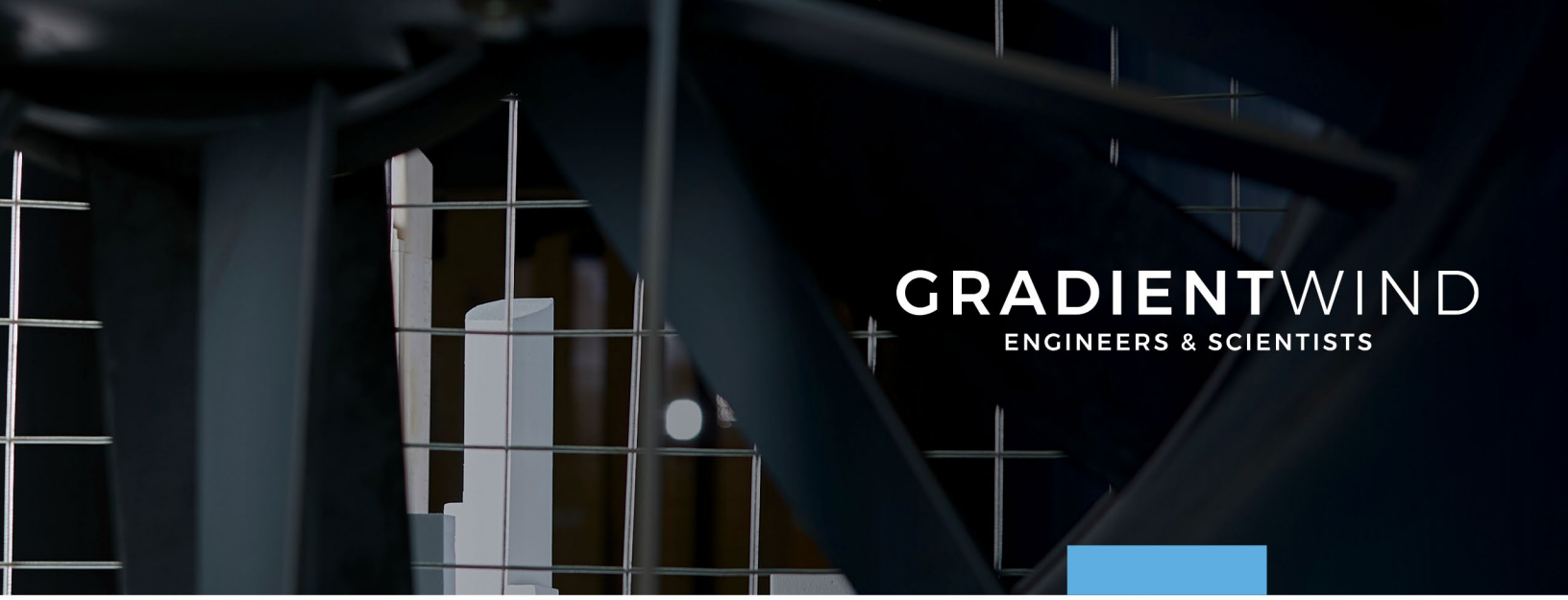
```
    Percentage of Annual Growth         :   0.00
    Number of Years of Growth           :   0.00
    Medium Truck % of Total Volume      :   7.00
    Heavy Truck  % of Total Volume      :   5.00
    Day (16 hrs) % of Total Volume      :  92.00

Data for Segment # 2: Richmond (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 129.00 / 129.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Road data, segment # 3: Byron (day/night)
-----------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 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):   8000
    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: Byron (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 171.00 / 171.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
```

```
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: MacDonald (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 54.17 + 0.00) = 54.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  73.68   0.00 -10.74   0.00   0.00   0.00  -8.76  54.17
-------------------------------------------------------------------------------

Segment Leq : 54.17 dBA

Results segment # 2: Richmond (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 47.50 + 0.00) = 47.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  68.48   0.00  -9.34  -3.74   0.00   0.00  -7.89  47.50
-------------------------------------------------------------------------------

Segment Leq : 47.50 dBA

Results segment # 3: Byron (day)
--------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
```

```
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 43.57 + 0.00) = 43.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  63.96   0.00 -10.57  -3.74   0.00   0.00  -6.07  43.57
-------------------------------------------------------------------------------

Segment Leq : 43.57 dBA

Total Leq All Segments: 55.32 dBA

Results segment # 1: MacDonald (night)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       49.85 !        49.85

ROAD (0.00 + 46.58 + 0.00) = 46.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  66.08   0.00 -10.74   0.00   0.00   0.00  -8.76  46.58
-------------------------------------------------------------------------------

Segment Leq : 46.58 dBA

Results segment # 2: Richmond (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.16 !        48.16

ROAD (0.00 + 39.91 + 0.00) = 39.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  60.88   0.00  -9.34  -3.74   0.00   0.00  -7.89  39.91
-------------------------------------------------------------------------------

Segment Leq : 39.91 dBA
```

```
Results segment # 3: Byron (night)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       51.25 !       48.92 !        48.92

ROAD (0.00 + 35.98 + 0.00) = 35.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -14   0.00  56.36   0.00 -10.57  -3.74   0.00   0.00  -6.07  35.98
-------------------------------------------------------------------------------

Segment Leq : 35.98 dBA

Total Leq All Segments: 47.73 dBA

RT/Custom data, segment # 1: O-Train (day/night)
------------------------------------------------
1 - 4-car SRT:
Traffic volume    :   180/34    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 148.00 / 148.00 m
Receiver height           :  51.25 / 51.25  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -14.00 deg
Barrier height            :  49.75 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
```

```
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 35.01 + 0.00) = 35.01 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  55.74  -9.94  -3.74   0.00   0.00  -7.05  35.01
-------------------------------------------------------------------

Segment Leq : 35.01 dBA

Total Leq All Segments: 35.01 dBA

Results segment # 1: O-Train (night)
------------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       51.25 !       48.51 !        48.51

RT/Custom (0.00 + 30.78 + 0.00) = 30.78 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------
   -90    -14   0.00  51.52  -9.94  -3.74   0.00   0.00  -7.05  30.78
-------------------------------------------------------------------

Segment Leq : 30.78 dBA

Total Leq All Segments: 30.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.36
                           (NIGHT): 47.81
```



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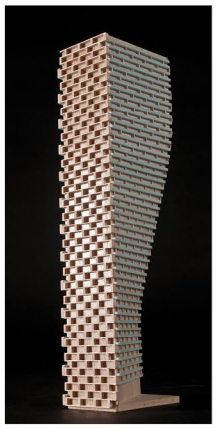

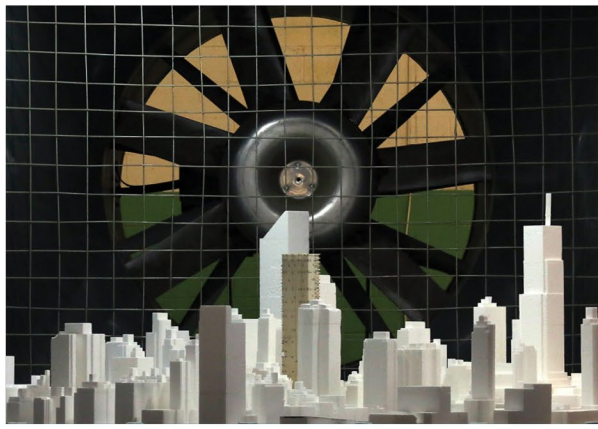

APPENDIX B

FTA VIBRATION CALCULATIONS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

GME23-243 24-Oct-23

Possible Vibration Impacts on 30 Cleary Avenue
Predicted using FTA General Assesment

Train Speed 50 km/h 31 mph

	Distance from C/L	
	(m)	(ft)
CN	115.0	377.3

Vibration

From FTA Manual Fig 10-1

Vibration Levels at distance from track	53	dBV re 1 micro in/sec

Adjustment Factors FTA Table 10-1

Speed reference 50 mph	0	Speed Limit of 50 km/h (31 mph)
Vehicle Parameters	0	Assume Soft primary suspension, Wheels run true
Track Condition	0	Jointed Track
Track Treatments	0	Floating Slab Trackbed
Type of Transit Structure	0	Open cut
Efficient vibration Propagation	0	Propagation through rock
Vibration Levels at Fdn	53	0.011
Coupling to Building Foundation	-10	Large Massonry on Piles
Floor to Floor Attenuation	-2.0	Ground Floor Ocupied
Amplification of Floor and Walls	6	
Total Vibration Level	47	dBV or 0.006 mm/s
Noise Level in dBA	12	dBA

Table 6-11 Source Adjustment Factors for Generalized Predictions of GB Vibration and Noise

Source Factor	Adjustment to Propagation Curve			Comment
Speed	Vehicle Speed	Reference Speed 50 mph	Reference Speed 30 mph	Vibration level is approximately proportional to 20log(speed/speed$_{ref}$), see Eq. 6-4.
	60 mph	+1.6 dB	+6.0 dB	
	50 mph	0.0 dB	+4.4 dB	
	40 mph	-1.9 dB	+2.5 dB	
	30 mph	-4.4 dB	0.0 dB	
	20 mph	-8.0 dB	-3.5 dB	
Vehicle Parameters (not additive, apply greatest value only)				
Vehicle with stiff primary suspension	+8 dB			Transit vehicles with stiff primary suspensions have been shown to create high vibration levels. Include this adjustment when the primary suspension has a vertical resonance frequency greater than 15 Hz.
Resilient Wheels	0 dB			Resilient wheels do not generally affect ground-borne vibration except at frequencies greater than about 80 Hz.
Worn Wheels or Wheels with Flats	+10 dB			Wheel flats or wheels that are unevenly worn can cause high vibration levels.
Track Conditions (not additive, apply greatest value only)				
Worn or Corrugated Track	+10 dB			Corrugated track is a common problem. Mill scale* on new rail can cause higher vibration levels until the rail has been in use for some time. If there are adjustments for vehicle parameters and the track is worn or corrugated, only include one adjustment.
Special Trackwork within 200 ft	+10 dB (within 100 ft) +5 dB (between 100 and 200 ft)			Wheel impacts at special trackwork will greatly increase vibration levels. The increase will be less at greater distances from the track. Do not include an adjustment for special trackwork more than 200 ft away.
Jointed Track	+5 dB			Jointed track can cause higher vibration levels than welded track.
Uneven Road Surfaces	+5 dB			Rough roads or expansion joints are sources of increased vibration for rubber-tire transit.
Track Treatments (not additive, apply greatest value only)				
Floating Slab Trackbed	-15 dB			The reduction achieved with a floating slab trackbed is strongly dependent on the frequency characteristics of the vibration.
Ballast Mats	-10 dB			Actual reduction is strongly dependent on frequency of vibration.
High-Resilience Fasteners	-5 dB			Slab track with track fasteners that are very compliant in the vertical direction can reduce vibration at frequencies greater than 40 Hz.

*Mill scale on a new rail is a slightly corrugated condition caused by certain steel mill techniques.

Table 6-12 Path Adjustment Factors for Generalized Predictions of GB Vibration and Noise

Path Factor	Adjustment to Propagation Curve			Comment
Resiliently Supported Ties (Low-Vibration Track, LVT)	-10 dB			Resiliently supported tie systems have been found to provide very effective control of low-frequency vibration.
Track Structure (not additive, apply greatest value only)				
Type of Transit Structure	Relative to at-grade tie & ballast:			In general, the heavier the structure, the lower the vibration levels. Putting the track in cut may reduce the vibration levels slightly. Rock-based subways generate higher-frequency vibration.
		Elevated structure	-10 dB	
		Open cut	0 dB	
	Relative to bored subway tunnel in soil:			
		Station	-5 dB	
		Cut and cover	-3 dB	
		Rock-based	-15 dB	
Ground-borne Propagation Effects				
Geologic conditions that promote efficient vibration propagation	Efficient propagation in soil		+10 dB	Refer to the text for guidance on identifying areas where efficient propagation is possible.
	Propagation in rock layer	Dist.	Adjust.	The positive adjustment accounts for the lower attenuation of vibration in rock compared to soil. It is generally more difficult to excite vibrations in rock than in soil at the source.
		50 ft	+2 dB	
		100 ft	+4 dB	
		150 ft	+6 dB	
		200 ft	+9 dB	
Coupling to building foundation	Wood-Frame Houses		-5 dB	In general, the heavier the building construction, the greater the coupling loss.
	1-2 Story Masonry		-7 dB	
	3-4 Story Masonry		-10 dB	
	Large Masonry on Piles		-10 dB	
	Large Masonry on Spread Footings		-13 dB	
	Foundation in Rock		0 dB	