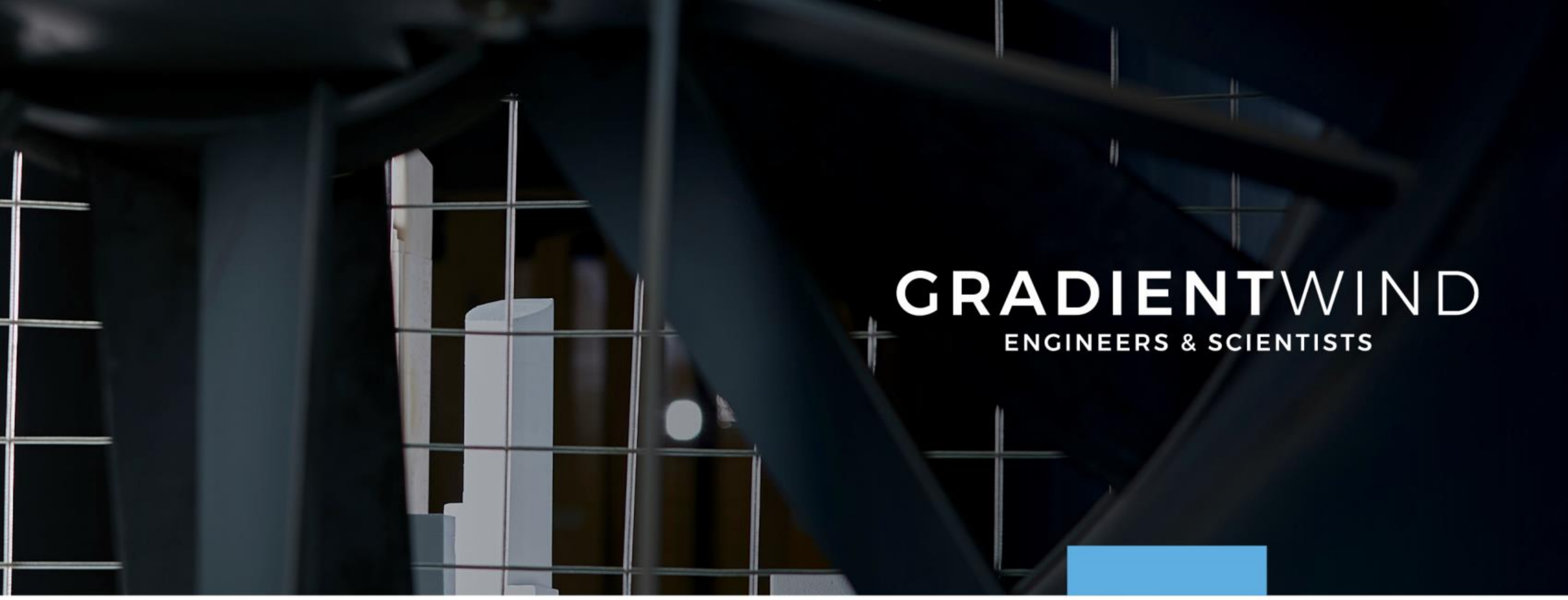
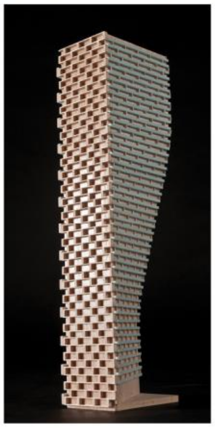
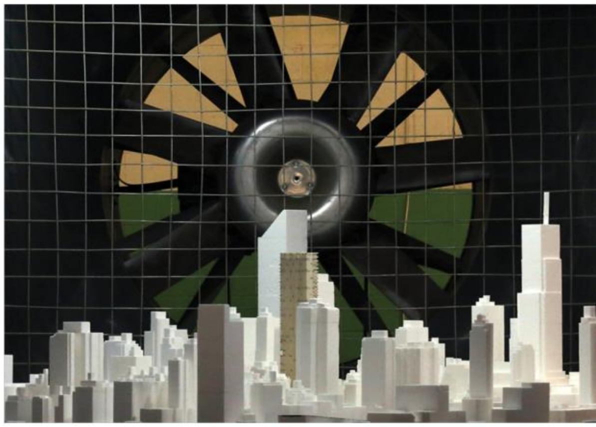


DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT

East Flats
301 Lett Street
Ottawa, Ontario

REPORT: 17-074 – Detailed Noise & Vibration





October 16, 2020

PREPARED FOR
Claridge Homes
2001-210 Gladstone Avenue
Ottawa, Ontario K2P 0Y6

PREPARED BY
Michael Lafortune, C.E.T., Environmental Scientist
Joshua Foster, P.Eng., Principal

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

EXECUTIVE SUMMARY

This report describes a detailed transportation noise and vibration feasibility assessment for a proposed multi-building, mixed-use development located at the southeast corner of the intersection of Booth Street and Fleet Street in Ottawa, Ontario (ref. Gradient Wind report GW17-074 – Transportation Noise & Vibration Feasibility Assessment dated April 27, 2018). The development comprises a 25-storey building (Tower 1) and a 30-storey building (Tower 2). The major sources of roadway noise are Booth Street, the Sir John A. Macdonald Parkway, Wellington Street, and the future Confederation Line Light Rail Transit (LRT) system. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) site plan drawings prepared by EVOQ Architecture in April 2020.

The results of the current analysis indicate that noise levels will range between 48 and 65 dBA during the daytime period (07:00-23:00) and between 40 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the north façade of Tower 1, which is nearest and most exposed to Sir John A. Macdonald Parkway. As plane of window noise levels do not exceed 65 dBA, standard OBC buildings components will be sufficient.

As per the requirements of the City of Ottawa Environmental Noise Control Guidelines (ENCG), resultant noise levels indicate that the development will require forced air heating with provision for air conditioning. Air conditioning, if installed, will allow occupants to keep windows closed and maintain a comfortable living environment. A Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Based on an offset distance of 60 metres between the Confederation Line LRT and the nearest building foundation, the estimated vibration levels at the nearest point of reception are expected to be 0.005 mm/s RMS (45.8 dBV) based on the FTA protocol. This calculation was conducted as part of the feasibility study for a building that is closer to the LRT line that the study site. Details of the calculation are provided in Appendix B. Since predicted vibration levels are below the criterion of 0.10 mm/s RMS, no mitigation will be required.

According to the United States Federal Transit Authority's vibration assessment protocol, ground borne noise can be estimated by subtracting 35 dB from the velocity vibration level in dBV. Since predicted vibration levels were found to be less than 0.10 mm/s RMS peak partial velocity (ppv), ground borne noise levels are also expected to be below the ground borne noise criteria of 35 dB.

With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. The study will determine noise impacts from rooftop mechanical units (i) of the surrounding, existing buildings on the proposed residential building, and (ii) of the proposed building on surrounding noise-sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) has been retained by Claridge Homes to undertake a transportation noise and vibration feasibility assessment for a proposed multi-building, mixed-use development located at the southeast corner of the intersection of Booth Street and Fleet Street in Ottawa, Ontario (ref. Gradient Wind report GW17-074 – Transportation Noise & Vibration Feasibility Assessment dated April 27, 2018). The original report (noted above) was prepared to satisfy the requirements for the zoning by-law amendment application submission for the entire development. Claridge Hopes is now moving forward with a Site Plan Control Application (SPA) submission for Tower 1 and 2.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings received from EVOQ Architecture in April 2020, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this detailed transportation noise and vibration assessment is the proposed two-building development comprising a 25-storey building (Tower 1) and a 30-storey building (Tower 2). Tower 1 is located at the north end of the subject site, and has a nearly rectangular planform at grade, with the long axis along Fleet Street. The building steps back from the south elevation at Level 2, and from the east elevation at Level 6. The building then rises with a uniform planform to Level 24. The mechanical penthouse at the top of the building is set back from the east and south elevations. Tower 2 has an 'L'-shaped planform at grade with the long axis along the south elevation. Similar to Tower 1, the building steps back from the north elevation at Level 2, and from the west elevation at Level 6, creating a large 5-storey podium with a common amenity terrace at Level 6. The building then rises with a uniform planform to Level 29. At Level 30, the mechanical penthouse at the top of the building is set back from the north and west elevations.

---

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

At grade, both buildings include lobby, office, residential unit, and amenity spaces, while Tower 1 also includes a daycare space and Tower 2 a design centre space. In Tower 2, Level 2 comprises residential units and a design studio space. Level 6 for both buildings includes indoor and outdoor amenity space. All other floors for both towers comprise residential units.

The site is surrounded on all sides by mixed-use land, primarily residential and open space. Outdoor amenity space is located atop the 5-storey podia of each building including a walkway and seating area located in between the two towers at grade. These amenity spaces are well sheltered from the surrounding roadway and LRT noise sources and were therefore excluded from the analysis. Balconies less than 4 m in depth are not considered as Outdoor Living Areas (OLA) as per the ENCG. The development site is located northeast of the Pimisi Transit Station. The major sources of roadway noise are Booth Street, the Sir John A. Macdonald Parkway, Wellington Street, and the future Confederation Line Light Rail Transit (LRT) system. Figure 1 illustrates a complete site plan with the surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway and LRT traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2 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 Transportation Noise

4.2.1 Criteria for Transportation Noise

For surface roadway and LRT traffic noise, 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 City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 45 and 40 dBA for living rooms and sleeping quarters, respectively, for roadway as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [3]

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 centres, 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[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125

environment[5]. 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 triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[6].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

4.2.2 Theoretical Transportation 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 and LRT traffic noise calculations were performed by treating each roadway and LRT segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise of 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split was taken to be 92% / 8%, respectively, for all streets.
- Absorptive and reflective intermediate ground surfaces based on specific source-receiver path ground characteristics.
- Site topography is accounted for in height parameters.
- Confederation Line LRT modeled as 4-car SRT source in STAMSON.
- Surrounding buildings are in some cases used as barrier when the line of sight between the source and receiver is broken by the buildings.
- Seven (7) receptors are selected to determine noise levels on Tower 1 and 2, with numbering of the receptors continued from the feasibility assessment.

---

[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.3 Transportation 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[7] 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. The LRT traffic counts are based on Gradient Wind's experience with the Confederation Line LRT project. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: TRANSPORTATION TRAFFIC DATA

Segment	Classification	Speed Limit (km/h)	Traffic Volumes
Sir John A. Macdonald Parkway	4-Lane Urban Arterial- Divided (4-UAD)	60	**35,000**
Booth Street	4-Lane Urban Arterial-Undivided (4-UAU)	50	**30,000**
Confederation Line LRT	4-Car SRT	50	**540/60***

* - Daytime/nighttime volumes

4.3 Ground Vibration & Ground-borne Noise

Transit 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 the 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 excitation of the ground, from a train for instance. Repetitive motion of the wheels on the track or rubber tires passing over an uneven surface causes vibrations to propagate through the soil. When they encounter a building, vibrations pass along the structure of the building beginning at

[7] City of Ottawa Transportation Master Plan, November 2013

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 cosmetic structural damage is (10 mm/s RMS or 112 dBV) at least one hundred times higher than the perception threshold level.

4.3.1 Vibration Criteria

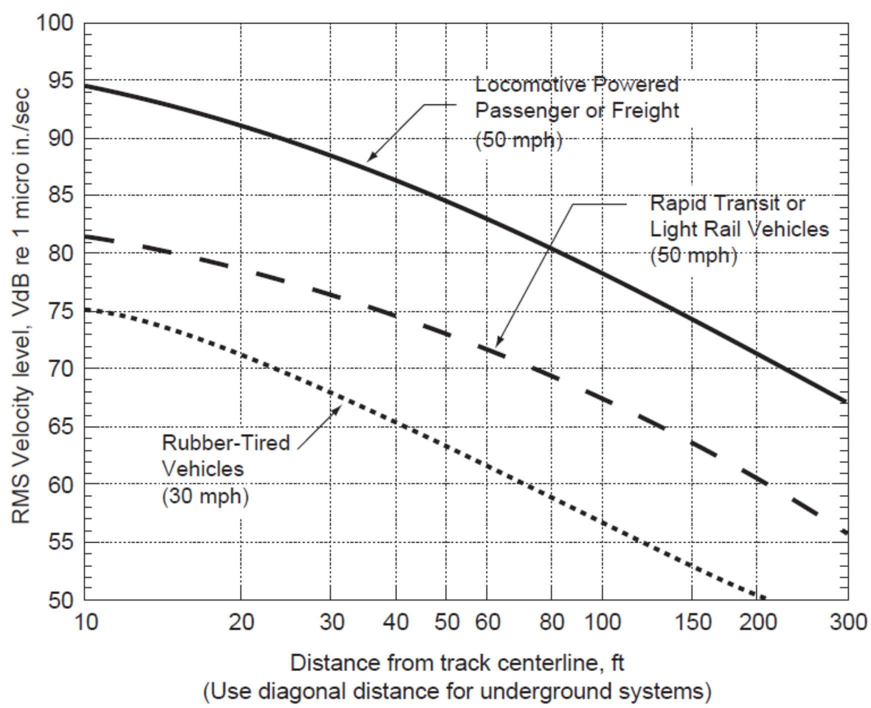
In the United States, the Federal Transportation Authority (FTA) has set vibration criteria for sensitive land use next to transit corridors. Similar standards have been developed by a partnership between the MOECC and the Toronto Transit Commission[8]. These standards indicate that the appropriate criteria for residential buildings are 0.1 mm/s RMS for vibrations. For main line railways, a document titled *Guidelines for New Development in Proximity to Railway Operations*[9], 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. As the main vibration source is due to a main line LRT corridor which has frequent events, the 0.10 mm/s RMS (72 dBV) vibration criteria and 35 dBA ground borne noise criteria were adopted for this study.

[8] MOEE/TTC Protocol for Noise and Vibration Assessment for the Proposed Yonge-Spadina Subway Loop, June 16, 1993

[9] Dialog and J.E. Coulter Associates Limited, prepared for The Federation of Canadian Municipalities and The Railway Associated of Canada, May 2013

4.3.2 Theoretical Ground Vibration Prediction Procedure

Potential vibration impacts of the existing LRT rail line were predicted using the FTA's Transit Noise and Vibration Impact Assessment[10] 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 below, 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 vehicles, conditions of the track, construction of the track and geology; as well as the structural type of the impacted building structures. Based on the setback distance of the closest building initial vibration levels were deduced from a curve for light rail trains at 50 miles per hour (mph) and applying an adjustment factor to account for an operational speed of 50 km/h (31 mph). Other factors considered; the track was assumed to be jointed with welds to minimize noise and vibration impacts of the new LRT.



FTA GENERALIZED CURVES OF VIBRATION LEVELS VERSUS DISTANCE (ADOPTED FROM FIGURE 10-1, FTA TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT)

[10] C. E. Hanson; D. A. Towers; and L. D. Meister, Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

5. RESULTS

5.1 Transportation Noise Levels

The results of the roadway and LRT traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION TRAFFIC

Receptor Number	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
		Day	Night
12	Tower 1 - North Façade - 1st floor	58	51
13	Tower 1 - North Façade - 25th floor	65	58
14	Tower 1 - West Façade - 25th floor	62	54
15	Tower 1 - South Façade - 25th floor	57	50
16	Tower 2 - West Façade - 25th floor	55	47
17	Tower 2 - South Façade - 1st floor	48	40
18	Tower 2 - South Façade - 25th floor	51	44

The results of the current analysis indicate that noise levels will range between 48 and 65 dBA during the daytime period (07:00-23:00) and between 40 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the north façade of Tower 1, which is nearest and most exposed to Sir John A. Macdonald Parkway and Wellington Street. As plane of window noise levels do not exceed 65 dBA, standard OBC buildings components will be sufficient.

5.2 Ground Vibration Levels

Based on an offset distance of 60 metres between the Confederation Line LRT and the nearest building foundation, the estimated vibration levels at the nearest point of reception are expected to be 0.005 mm/s RMS (45.8 dBV) based on the FTA protocol. This calculation was conducted as part of the feasibility study for a building that is closer to the LRT line that the study site. Details of the calculation are provided in Appendix B. Since predicted vibration levels are below the criterion of 0.10 mm/s RMS, no mitigation will be required.

According to the United States Federal Transit Authority's vibration assessment protocol, ground borne noise can be estimated by subtracting 35 dB from the velocity vibration level in dBV. Since predicted vibration levels were found to be less than 0.10 mm/s RMS peak partial velocity (ppv), ground borne noise levels are also expected to be below the ground borne noise criteria of 35 dB.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 48 and 65 dBA during the daytime period (07:00-23:00) and between 40 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the north façade of Tower 1, which is nearest and most exposed to Sir John A. Macdonald Parkway/Wellington Street. As plane of window noise levels do not exceed 65 dBA, standard OBC buildings components will be sufficient.

As per the requirements of the City of Ottawa Environmental Noise Control Guidelines (ENCG), resultant noise levels indicate that the development will require forced air heating with provision for air conditioning. Air conditioning, if installed, will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing roadway traffic may, on occasion, interfere with some activities of the dwelling occupants, as the sound levels exceed the sound level limits of the City and the Ministry of the Environment and Climate Change. To help address the need for sound attenuation, this development has been designed with forced air heating and provision for air conditioning. Air conditioning, if installed, will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment and Climate Change.*
>
> *To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features."*

Based on an offset distance of 60 metres between the Confederation Line LRT and the nearest building foundation, the estimated vibration levels at the nearest point of reception are expected to be 0.005 mm/s RMS (45.8 dBV) based on the FTA protocol. This calculation was conducted as part of the feasibility study for a building that is closer to the LRT line that the study site. Details of the calculation are provided in Appendix B. Since predicted vibration levels are below the criterion of 0.10 mm/s RMS, no mitigation will be required.

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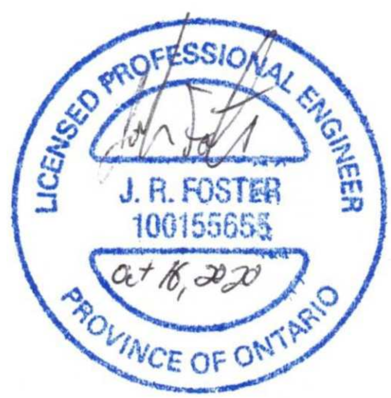
With regards to stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. The study will determine noise impacts from rooftop mechanical units (i) of the surrounding, existing buildings on the proposed residential building, and (ii) of the proposed building on surrounding noise-sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits.

This concludes our transportation noise and vibration 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.

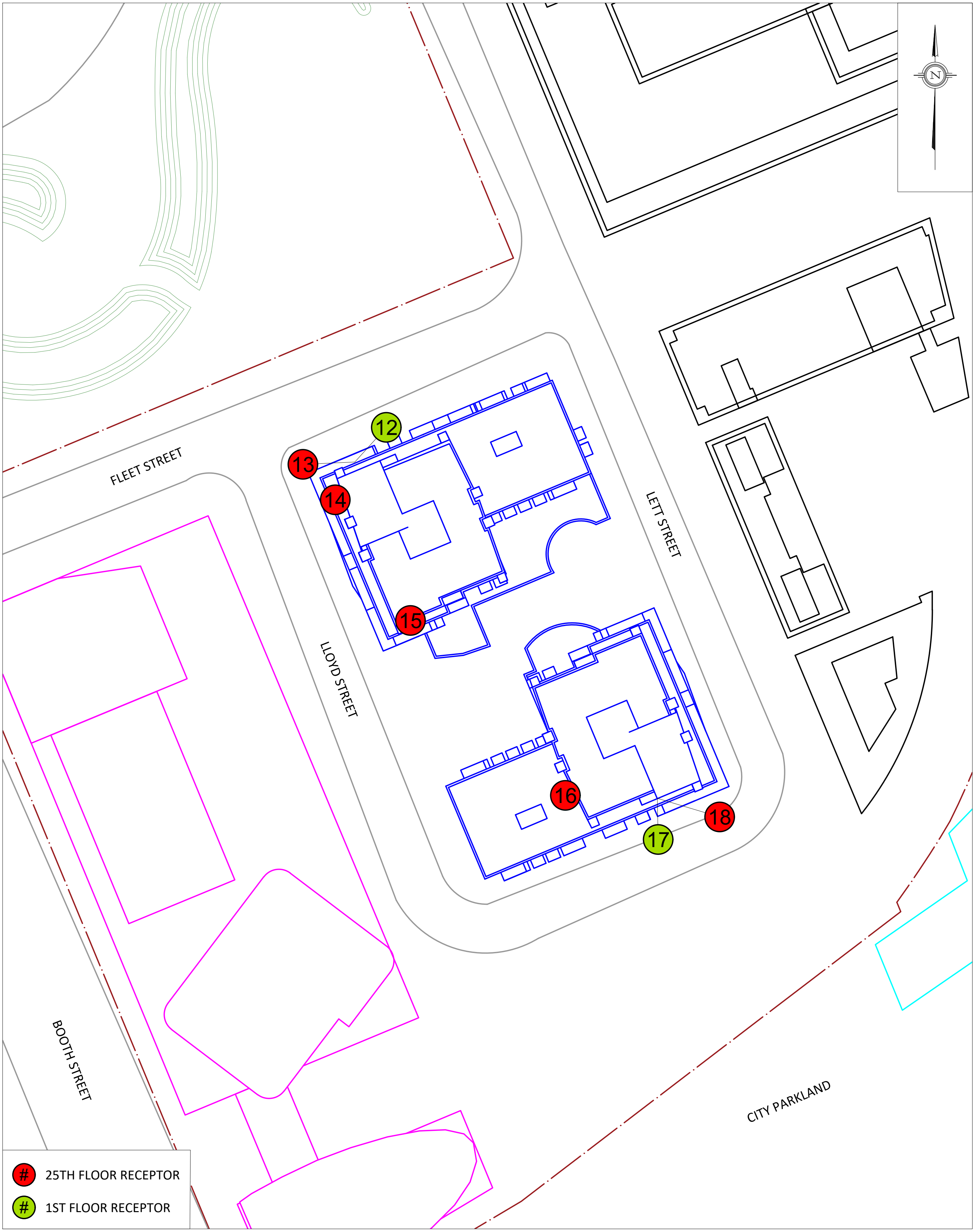


Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File 17-074-Detailed Noise & Vibration

GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT: EAST FLATS - TOWER 1 AND 2, OTTAWA DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT		DESCRIPTION: FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
	SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW17-074-1	
	DATE: OCTOBER 7, 2020	DRAWN BY: M.L.	



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PROJECT	EAST FLATS - TOWER 1 AND 2, OTTAWA DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW17-074-2
DATE	OCTOBER 7, 2020	DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS

GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT: EAST FLATS - TOWER 1 AND 2, OTTAWA DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT		DESCRIPTION: FIGURE 3: STAMSON INPUT PARAMETERS - RECEPTOR 12,13,15
	SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW17-074-3	
	DATE: OCTOBER 7, 2020	DRAWN BY: M.L.	

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PROJECT: EAST FLATS - TOWER 1 AND 2, OTTAWA DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT		DESCRIPTION: FIGURE 4: STAMSON INPUT PARAMETERS - RECEPTOR 14,17,18
SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW17-074-4	
DATE: OCTOBER 7, 2020	DRAWN BY: M.L.	

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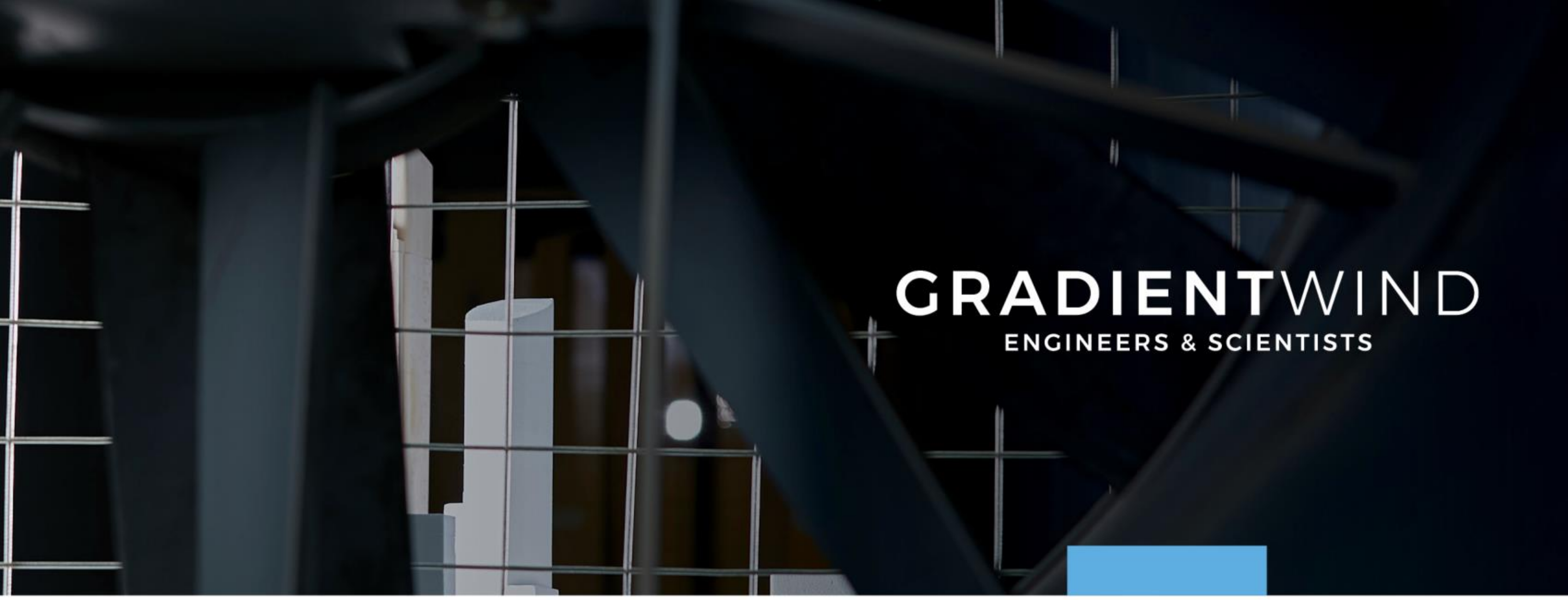
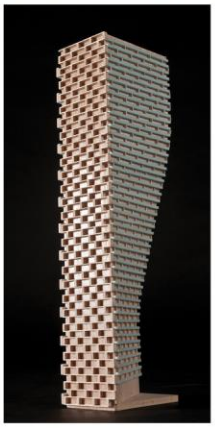
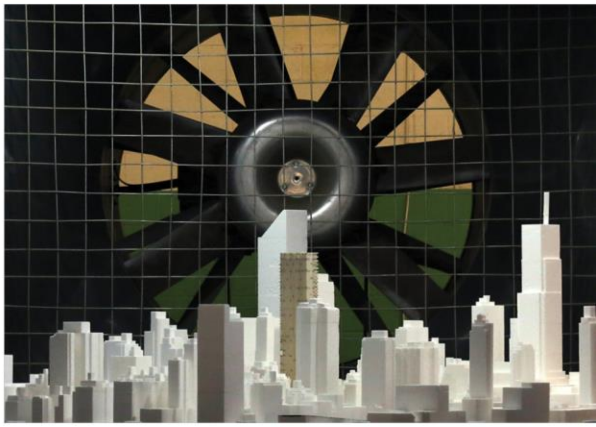
PROJECT		DESCRIPTION
EAST FLATS - TOWER 1 AND 2, OTTAWA DETAILED TRANSPORTATION NOISE & VIBRATION ASSESSMENT		FIGURE 5: STAMSON INPUT PARAMETERS - RECEPTOR 16
SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW17-074-5	
DATE: OCTOBER 7, 2020	DRAWN BY: M.L.	







APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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```
STAMSON 5.0        NORMAL REPORT        Date: 07-10-2020 15:19:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (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  :  95.00 / 95.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: John A (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 # 2: John A (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   -5.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 110.00 / 110.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: John A 2 (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 # 3: John A 2 (day/night)
------------------------------------------
Angle1   Angle2           :  13.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 108.00 / 108.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Booth (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.72 + 0.00) = 53.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
     0     90   0.66  71.49   0.00 -13.31  -4.47   0.00   0.00   0.00  53.72
--------------------------------------------------------------------------

Segment Leq : 53.72 dBA


Results segment # 2: John A (day)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.49 + 0.00) = 54.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     -5   0.66  73.68   0.00 -14.36  -4.82   0.00   0.00   0.00  54.49
--------------------------------------------------------------------------

Segment Leq : 54.49 dBA


Results segment # 3: John A 2 (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.34 + 0.00) = 52.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
    13     53   0.66  73.68   0.00 -14.23  -7.10   0.00   0.00   0.00  52.34
--------------------------------------------------------------------------

Segment Leq : 52.34 dBA

Total Leq All Segments: 58.38 dBA


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

Source height = 1.50 m

ROAD (0.00 + 46.12 + 0.00) = 46.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
     0     90   0.66  63.89   0.00 -13.31  -4.47   0.00   0.00   0.00  46.12
--------------------------------------------------------------------------

Segment Leq : 46.12 dBA
```

```
Results segment # 2: John A (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.90 + 0.00) = 46.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     -5   0.66  66.08   0.00 -14.36  -4.82   0.00   0.00   0.00  46.90
----------------------------------------------------------------------------

Segment Leq : 46.90 dBA


Results segment # 3: John A 2 (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 44.74 + 0.00) = 44.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    13     53   0.66  66.08   0.00 -14.23  -7.10   0.00   0.00   0.00  44.74
----------------------------------------------------------------------------

Segment Leq : 44.74 dBA

Total Leq All Segments: 50.78 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 58.38
                         (NIGHT): 50.78
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-10-2020 15:19:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r13.te              Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (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  :  95.00 / 95.00  m
Receiver height          :  73.50 / 73.50  m
Topography               :      1       (Flat/gentle slope; no barrier)
Reference angle          :   0.00
```

```
Road data, segment # 2: John A (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 # 2: John A (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   -5.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 110.00 / 110.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: John A 2 (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 # 3: John A 2 (day/night)
------------------------------------------
Angle1   Angle2           :  13.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 108.00 / 108.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Booth (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.46 + 0.00) = 60.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
     0     90   0.00  71.49   0.00  -8.02  -3.01   0.00   0.00   0.00  60.46
----------------------------------------------------------------------------

Segment Leq : 60.46 dBA


Results segment # 2: John A (day)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.76 + 0.00) = 61.76 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     -5   0.00  73.68   0.00  -8.65  -3.26   0.00   0.00   0.00  61.76
----------------------------------------------------------------------------

Segment Leq : 61.76 dBA


Results segment # 3: John A 2 (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.57 + 0.00) = 58.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    13     53   0.00  73.68   0.00  -8.57  -6.53   0.00   0.00   0.00  58.57
----------------------------------------------------------------------------

Segment Leq : 58.57 dBA

Total Leq All Segments: 65.23 dBA


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

Source height = 1.50 m

ROAD (0.00 + 52.87 + 0.00) = 52.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
     0     90   0.00  63.89   0.00  -8.02  -3.01   0.00   0.00   0.00  52.87
----------------------------------------------------------------------------

Segment Leq : 52.87 dBA
```

```
Results segment # 2: John A (night)
-----------------------------------

Source height = 1.50 m

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     -5   0.00  66.08   0.00  -8.65  -3.26   0.00   0.00   0.00  54.17
----------------------------------------------------------------------------

Segment Leq : 54.17 dBA


Results segment # 3: John A 2 (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.97 + 0.00) = 50.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    13     53   0.00  66.08   0.00  -8.57  -6.53   0.00   0.00   0.00  50.97
----------------------------------------------------------------------------

Segment Leq : 50.97 dBA

Total Leq All Segments: 57.63 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 65.23
                         (NIGHT): 57.63
```

```
STAMSON 5.0        NORMAL REPORT        Date: 09-06-2017 08:45:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r14.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (day/night)
---------------------------------------
Angle1   Angle2           : -74.00 deg   -31.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  92.00 / 92.00  m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -74.00 deg   Angle2 : -58.00 deg
Barrier height            : 135.00 m
Barrier receiver distance :  70.00 / 70.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Booth 2 (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -31.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  92.00 / 92.00  m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -31.00 deg   Angle2 : 4.00 deg
Barrier height            :  90.00 m
Barrier receiver distance :  73.00 / 73.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Booth (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 !       73.50 !       18.71 !        18.71

ROAD (0.00 + 33.10 + 55.37) = 55.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -74    -58   0.00  71.49   0.00  -7.88 -10.51   0.00   0.00 -20.00  33.10
-----------------------------------------------------------------------------
   -58    -31   0.00  71.49   0.00  -7.88  -8.24   0.00   0.00   0.00  55.37
-----------------------------------------------------------------------------

Segment Leq : 55.40 dBA


Results segment # 2: Booth 2 (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 !       73.50 !       16.37 !        16.37

ROAD (0.00 + 36.50 + 60.41) = 60.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -31      4   0.00  71.49   0.00  -7.88  -7.11   0.00   0.00 -20.00  36.50
-----------------------------------------------------------------------------
     4     90   0.00  71.49   0.00  -7.88  -3.21   0.00   0.00   0.00  60.41
-----------------------------------------------------------------------------

Segment Leq : 60.42 dBA

Total Leq All Segments: 61.61 dBA
```

```
Results segment # 1: Booth (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 !       73.50 !       18.71 !        18.71

ROAD (0.00 + 25.51 + 47.78) = 47.80 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -74    -58   0.00  63.89   0.00  -7.88 -10.51   0.00   0.00 -20.00  25.51
--------------------------------------------------------------------------
   -58    -31   0.00  63.89   0.00  -7.88  -8.24   0.00   0.00   0.00  47.78
--------------------------------------------------------------------------

Segment Leq : 47.80 dBA


Results segment # 2: Booth 2 (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 !       73.50 !       16.37 !        16.37

ROAD (0.00 + 28.90 + 52.81) = 52.83 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -31      4   0.00  63.89   0.00  -7.88  -7.11   0.00   0.00 -20.00  28.90
--------------------------------------------------------------------------
     4     90   0.00  63.89   0.00  -7.88  -3.21   0.00   0.00   0.00  52.81
--------------------------------------------------------------------------

Segment Leq : 52.83 dBA

Total Leq All Segments: 54.02 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 61.61
                         (NIGHT): 54.02
```

```
STAMSON 5.0        NORMAL REPORT        Date: 09-06-2017 08:46:30
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r15.te              Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (day/night)
---------------------------------------
Angle1   Angle2           : -66.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  94.00 / 94.00  m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -66.00 deg   Angle2 : -42.00 deg
Barrier height            : 135.00 m
Barrier receiver distance :  72.00 / 72.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Booth (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 !       73.50 !       18.35 !        18.35

ROAD (0.00 + 34.77 + 57.20) = 57.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -66    -42   0.00  71.49   0.00  -7.97  -8.75   0.00   0.00 -20.00  34.77
----------------------------------------------------------------------------
   -42      0   0.00  71.49   0.00  -7.97  -6.32   0.00   0.00   0.00  57.20
----------------------------------------------------------------------------

Segment Leq : 57.22 dBA

Total Leq All Segments: 57.22 dBA


Results segment # 1: Booth (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 !       73.50 !       18.35 !        18.35

ROAD (0.00 + 27.17 + 49.60) = 49.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -66    -42   0.00  63.89   0.00  -7.97  -8.75   0.00   0.00 -20.00  27.17
----------------------------------------------------------------------------
   -42      0   0.00  63.89   0.00  -7.97  -6.32   0.00   0.00   0.00  49.60
----------------------------------------------------------------------------

Segment Leq : 49.63 dBA

Total Leq All Segments: 49.63 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 57.22
                         (NIGHT): 49.63
```

```
STAMSON 5.0        NORMAL REPORT        Date: 09-06-2017 08:48:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r16.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (day/night)
---------------------------------------
Angle1   Angle2           : -55.00 deg   -25.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 107.00 / 107.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -55.00 deg   Angle2 : -29.00 deg
Barrier height            :  75.00 m
Barrier receiver distance :  86.00 / 86.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Booth 2 (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -25.00 deg   30.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 107.00 / 107.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -25.00 deg   Angle2 : 9.00 deg
Barrier height            : 135.00 m
Barrier receiver distance :  85.00 / 85.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Booth 3 (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth 3 (day/night)
-----------------------------------------
Angle1   Angle2           :  30.00 deg   53.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 107.00 / 107.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  30.00 deg   Angle2 : 53.00 deg
Barrier height            :  90.00 m
Barrier receiver distance :  89.00 / 89.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Booth (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 !       73.50 !       15.63 !        15.63

ROAD (0.00 + 34.55 + 46.43) = 46.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -55    -29   0.00  71.49   0.00  -8.53  -8.40   0.00   0.00 -20.00  34.55
----------------------------------------------------------------------------
   -29    -25   0.00  71.49   0.00  -8.53 -16.53   0.00   0.00   0.00  46.43
----------------------------------------------------------------------------

Segment Leq : 46.70 dBA


Results segment # 2: Booth 2 (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 !       73.50 !       16.30 !        16.30

ROAD (0.00 + 35.72 + 53.63) = 53.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -25      9   0.00  71.49   0.00  -8.53  -7.24   0.00   0.00 -20.00  35.72
----------------------------------------------------------------------------
     9     30   0.00  71.49   0.00  -8.53  -9.33   0.00   0.00   0.00  53.63
----------------------------------------------------------------------------

Segment Leq : 53.70 dBA
```

```
Results segment # 3: Booth 3 (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 !       73.50 !       13.61 !        13.61

ROAD (0.00 + 34.02 + 0.00) = 34.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    30     53   0.00  71.49   0.00  -8.53  -8.94   0.00   0.00 -20.00  34.02
----------------------------------------------------------------------------

Segment Leq : 34.02 dBA

Total Leq All Segments: 54.53 dBA


Results segment # 1: Booth (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 !       73.50 !       15.63 !        15.63

ROAD (0.00 + 26.96 + 38.83) = 39.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -55    -29   0.00  63.89   0.00  -8.53  -8.40   0.00   0.00 -20.00  26.96
----------------------------------------------------------------------------
   -29    -25   0.00  63.89   0.00  -8.53 -16.53   0.00   0.00   0.00  38.83
----------------------------------------------------------------------------

Segment Leq : 39.10 dBA
```

```
Results segment # 2: Booth 2 (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 !       73.50 !       16.30 !        16.30

ROAD (0.00 + 28.12 + 46.03) = 46.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -25      9   0.00  63.89   0.00  -8.53  -7.24   0.00   0.00 -20.00  28.12
----------------------------------------------------------------------------
     9     30   0.00  63.89   0.00  -8.53  -9.33   0.00   0.00   0.00  46.03
----------------------------------------------------------------------------

Segment Leq : 46.10 dBA


Results segment # 3: Booth 3 (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 !       73.50 !       13.61 !        13.61

ROAD (0.00 + 26.43 + 0.00) = 26.43 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    30     53   0.00  63.89   0.00  -8.53  -8.94   0.00   0.00 -20.00  26.43
----------------------------------------------------------------------------

Segment Leq : 26.43 dBA

Total Leq All Segments: 46.93 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 54.53
                         (NIGHT): 46.93
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-10-2020 14:19:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r17.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (day/night)
---------------------------------------
Angle1   Angle2           : -43.00 deg   -17.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 127.00 / 127.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -43.00 deg   Angle2 : -23.00 deg
Barrier height            :  75.00 m
Barrier receiver distance : 106.00 / 106.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Booth 2 (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -17.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 127.00 / 127.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -17.00 deg   Angle2 : 0.00 deg
Barrier height            : 135.00 m
Barrier receiver distance : 105.00 / 105.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Booth (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 32.67 + 47.44) = 47.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -43    -23   0.00  71.49   0.00  -9.28  -9.54   0.00   0.00 -20.00  32.67
-----------------------------------------------------------------------------
   -23    -17   0.00  71.49   0.00  -9.28 -14.77   0.00   0.00   0.00  47.44
-----------------------------------------------------------------------------

Segment Leq : 47.58 dBA


Results segment # 2: Booth 2 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 31.96 + 0.00) = 31.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -17      0   0.00  71.49   0.00  -9.28 -10.25   0.00   0.00 -20.00  31.96
-----------------------------------------------------------------------------

Segment Leq : 31.96 dBA

Total Leq All Segments: 47.70 dBA
```

```
Results segment # 1: Booth (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 25.07 + 39.85) = 39.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -43    -23   0.00  63.89   0.00  -9.28  -9.54   0.00   0.00 -20.00  25.07
----------------------------------------------------------------------------
   -23    -17   0.00  63.89   0.00  -9.28 -14.77   0.00   0.00   0.00  39.85
----------------------------------------------------------------------------

Segment Leq : 39.99 dBA


Results segment # 2: Booth 2 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 24.37 + 0.00) = 24.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -17      0   0.00  63.89   0.00  -9.28 -10.25   0.00   0.00 -20.00  24.37
----------------------------------------------------------------------------

Segment Leq : 24.37 dBA

Total Leq All Segments: 40.11 dBA
```

```
RT/Custom data, segment # 1: LRT (day/night)
--------------------------------------------
1 - 4-car SRT:
Traffic volume    :   540/60    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: LRT (day/night)
-------------------------------------
Angle1   Angle2           : -27.00 deg   50.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 119.00 / 119.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: LRT (day)
------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 41.61 + 0.00) = 41.61 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -27     50   0.66  60.51 -14.93  -3.97   0.00   0.00   0.00  41.61
----------------------------------------------------------------------

Segment Leq : 41.61 dBA

Total Leq All Segments: 41.61 dBA


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

Source height = 0.50 m

RT/Custom (0.00 + 35.08 + 0.00) = 35.08 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -27     50   0.66  53.98 -14.93  -3.97   0.00   0.00   0.00  35.08
----------------------------------------------------------------------

Segment Leq : 35.08 dBA

Total Leq All Segments: 35.08 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 48.65
                         (NIGHT): 41.29
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-10-2020 14:19:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r18.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Booth (day/night)
-----------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   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):  30000
    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: Booth (day/night)
---------------------------------------
Angle1   Angle2           : -43.00 deg   -17.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 127.00 / 127.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -43.00 deg   Angle2 : -23.00 deg
Barrier height            :  75.00 m
Barrier receiver distance : 106.00 / 106.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

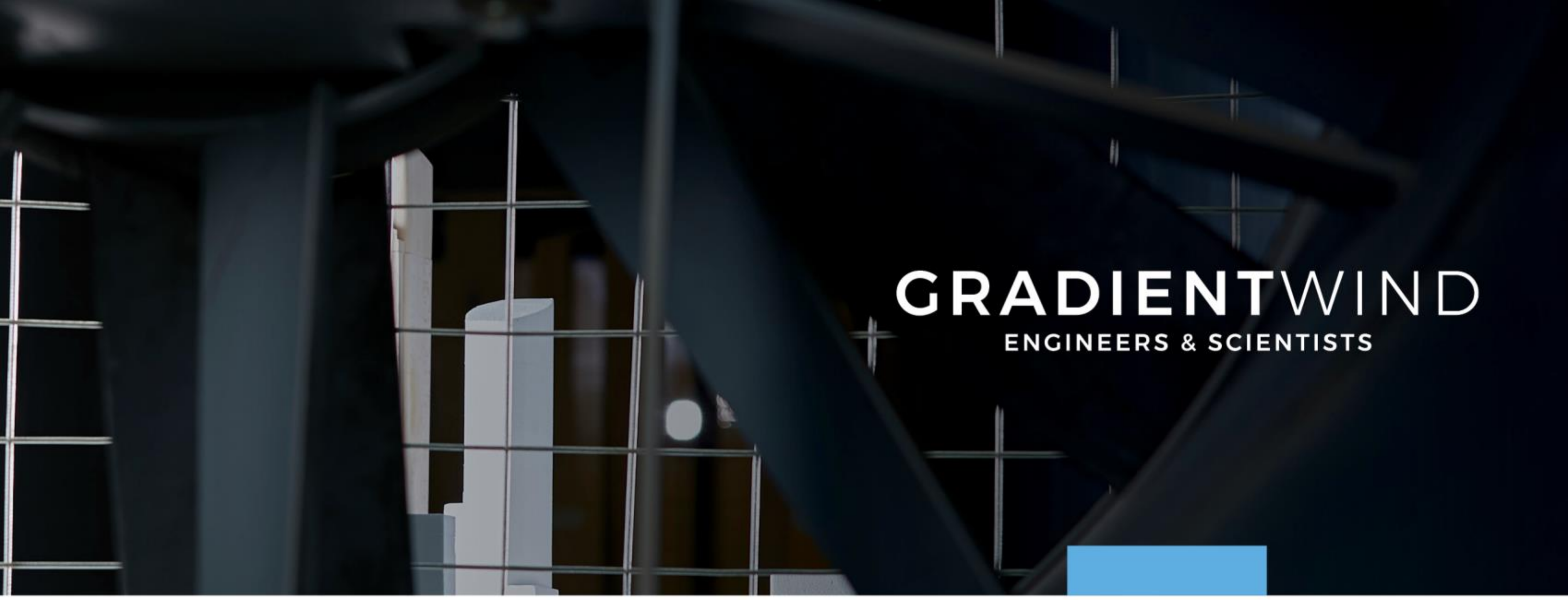
```
Road data, segment # 2: Booth 2 (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     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):  30000
    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: Booth 2 (day/night)
-----------------------------------------
Angle1   Angle2           : -17.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 127.00 / 127.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -17.00 deg   Angle2 : 0.00 deg
Barrier height            : 135.00 m
Barrier receiver distance : 105.00 / 105.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

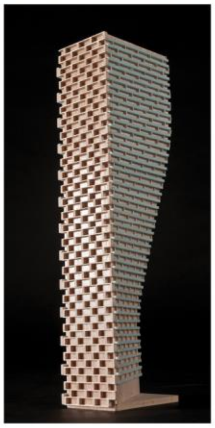
```
Results segment # 1: Booth (day)
--------------------------------

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 !       73.50 !       13.40 !        13.40

ROAD (0.00 + 32.67 + 47.44) = 47.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -43    -23   0.00  71.49   0.00  -9.28  -9.54   0.00   0.00 -20.00  32.67
----------------------------------------------------------------------------
   -23    -17   0.00  71.49   0.00  -9.28 -14.77   0.00   0.00   0.00  47.44
----------------------------------------------------------------------------

Segment Leq : 47.58 dBA


Results segment # 2: Booth 2 (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 !       73.50 !       13.97 !        13.97

ROAD (0.00 + 31.96 + 0.00) = 31.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -17      0   0.00  71.49   0.00  -9.28 -10.25   0.00   0.00 -20.00  31.96
----------------------------------------------------------------------------

Segment Leq : 31.96 dBA

Total Leq All Segments: 47.70 dBA
```

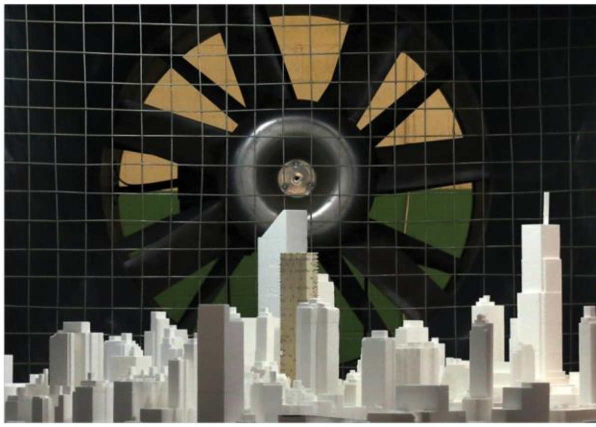
```
Results segment # 1: Booth (night)
----------------------------------

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 !       73.50 !       13.40 !        13.40

ROAD (0.00 + 25.07 + 39.85) = 39.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -43    -23   0.00  63.89   0.00  -9.28  -9.54   0.00   0.00 -20.00  25.07
----------------------------------------------------------------------------
   -23    -17   0.00  63.89   0.00  -9.28 -14.77   0.00   0.00   0.00  39.85
----------------------------------------------------------------------------

Segment Leq : 39.99 dBA


Results segment # 2: Booth 2 (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 !       73.50 !       13.97 !        13.97

ROAD (0.00 + 24.37 + 0.00) = 24.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -17      0   0.00  63.89   0.00  -9.28 -10.25   0.00   0.00 -20.00  24.37
----------------------------------------------------------------------------

Segment Leq : 24.37 dBA

Total Leq All Segments: 40.11 dBA
```

```
RT/Custom data, segment # 1: LRT (day/night)
--------------------------------------------
1 - 4-car SRT:
Traffic volume    :   540/60    veh/TimePeriod
Speed             :    50 km/h

Data for Segment # 1: LRT (day/night)
-------------------------------------
Angle1   Angle2           : -27.00 deg   50.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 119.00 / 119.00 m
Receiver height           :  73.50 / 73.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: LRT (day)
------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 47.83 + 0.00) = 47.83 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -27     50   0.00  60.51  -8.99  -3.69   0.00   0.00   0.00  47.83
----------------------------------------------------------------------

Segment Leq : 47.83 dBA

Total Leq All Segments: 47.83 dBA


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

Source height = 0.50 m

RT/Custom (0.00 + 41.30 + 0.00) = 41.30 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -27     50   0.00  53.98  -8.99  -3.69   0.00   0.00   0.00  41.30
----------------------------------------------------------------------

Segment Leq : 41.30 dBA

Total Leq All Segments: 41.30 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 50.77
                         (NIGHT): 43.75
```







APPENDIX B

FTA VIBRATION CALCULATIONS

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

GME17-074 14-Jun-17

Possible Vibration Impacts on East Flats
Perdicted using FTA General Assesment

Train Speed 50 km/h 31 mph

	Distance from C/L	
	(m)	(ft)
LRT	60.0	196.8

	Vibration	
From FTA Manual Fig 10-1		
Vibration Levels at distance from track	61	dBV re 1 micro in/sec
Adjustment Factors FTA Table 10-1		
Speed reference 50 mph	-4	Speed Limit of 50 km/h (31 mph)
Vehicle Parameters	0	Assume Soft primary suspension, Wheels run true
Track Condition	0	none
Track Treatments	0	none
Type of Transit Structure	-5	Station
Efficient vibration Propagation	0	Propagation through rock
Vibration Levels at Fdn	52	0.010
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	45.84783	dBV or 0.005 mm/s
Noise Level in dBA	10.84783	dBA

Table 10-1. Adjustment Factors for Generalized Predictions of Ground-Borne Vibration and Noise

Factors Affecting Vibration Source

Source Factor	Adjustment to Propagation Curve			Comment
		Reference Speed		
Speed	Vehicle Speed	50 mph	30 mph	Vibration level is approximately proportional to 20*log(speed/speed$_{ref}$). Sometimes the variation with speed has been observed to be as low as 10 to 15 log(speed/speed$_{ref}$).
	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. This can be prevented with wheel truing and slip-slide detectors to prevent the wheels from sliding on the track.
Track Conditions (not additive, apply greatest value only)				
Worn or Corrugated Track	+10 dB			If both the wheels and the track are worn, only one adjustment should be used. 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.
Special Trackwork	+10 dB			Wheel impacts at special trackwork will significantly increase vibration levels. The increase will be less at greater distances from the track.
Jointed Track or Uneven Road Surfaces	+5 dB			Jointed track can cause higher vibration levels than welded track. 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.

Table 10-1. Adjustment Factors for Generalized Predictions of Ground-Borne Vibration and Noise (Continued)

Factors Affecting Vibration Path		
Path Factor	**Adjustment to Propagation Curve**	**Comment**
Resiliently Supported Ties	-10 dB	Resiliently supported tie systems have been found to provide very effective control of low-frequency vibration.
Track Configuration (not additive, apply greatest value only)		
Type of Transit Structure	Relative to at-grade tie & ballast: Elevated structure -10 dB Open cut 0 dB	The general rule is 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.
	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 **<u>Dist.</u>** / **<u>Adjust.</u>** 50 ft +2 dB 100 ft +4 dB 150 ft +6 dB 200 ft +9 dB	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.
Coupling to building foundation	Wood Frame Houses -5 dB 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	The general rule is the heavier the building construction, the greater the coupling loss.
Factors Affecting Vibration Receiver		
Receiver Factor	**Adjustment to Propagation Curve**	**Comment**
Floor-to-floor attenuation	1 to 5 floors above grade: -2 dB/floor 5 to 10 floors above grade: -1 dB/floor	This factor accounts for dispersion and attenuation of the vibration energy as it propagates through a building.
Amplification due to resonances of floors, walls, and ceilings	+6 dB	The actual amplification will vary greatly depending on the type of construction. The amplification is lower near the wall/floor and wall/ceiling intersections.
Conversion to Ground-borne Noise		
Noise Level in dBA	Peak frequency of ground vibration: Low frequency (<30 Hz): -50 dB Typical (peak 30 to 60 Hz): -35 dB High frequency (>60 Hz): -20 dB	Use these adjustments to estimate the A-weighted sound level given the average vibration velocity level of the room surfaces. See text for guidelines for selecting low, typical or high frequency characteristics. Use the high-frequency adjustment for subway tunnels in rock or if the dominant frequencies of the vibration spectrum are known to be 60 Hz or greater.