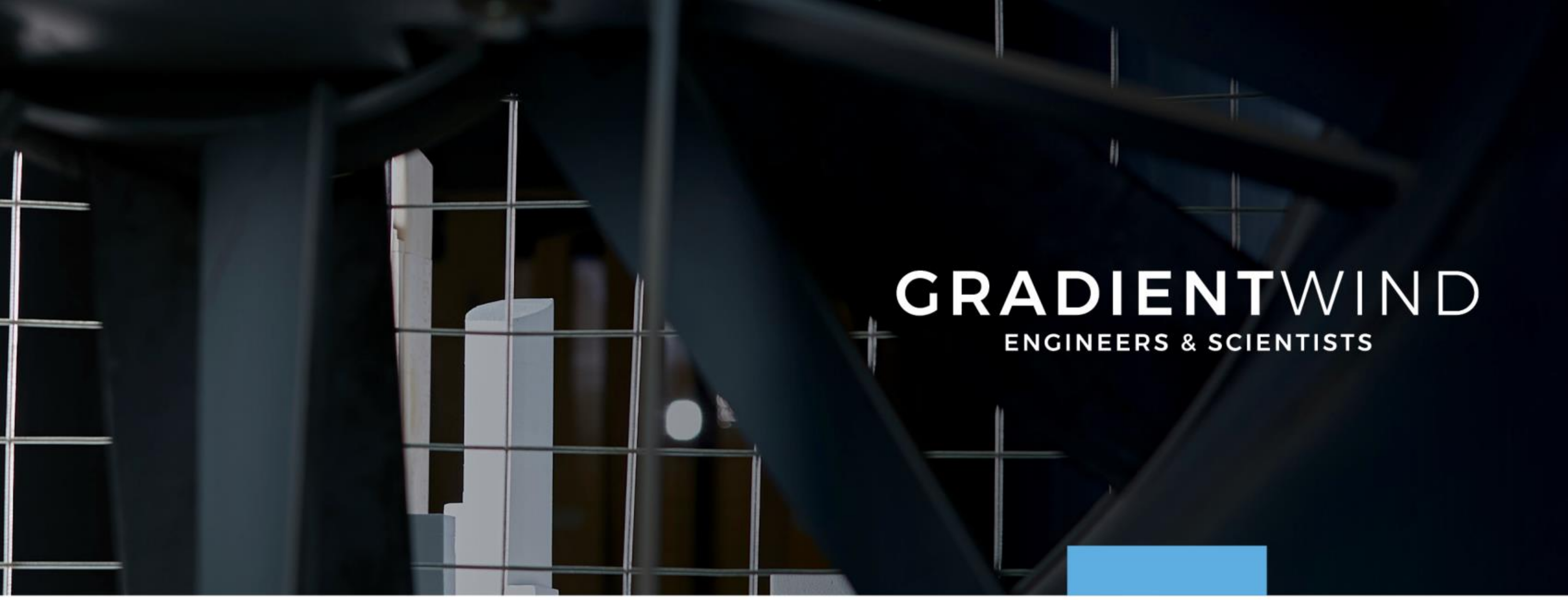
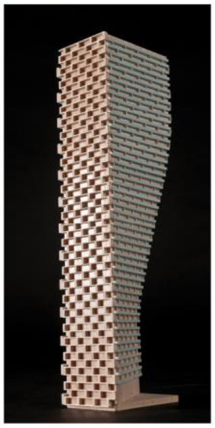
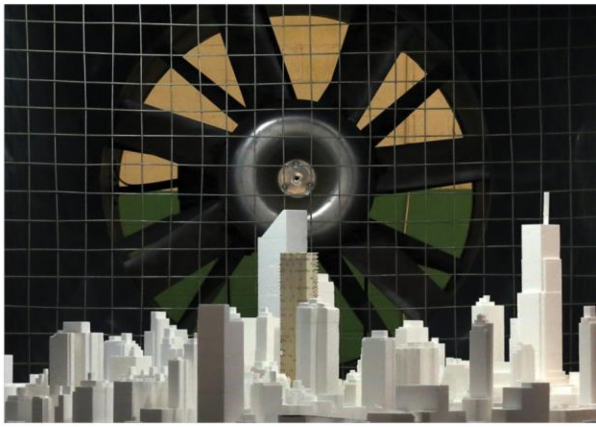


TRANSPORTATION NOISE ASSESSMENT

601 Laurier Avenue
Ottawa, Ontario

REPORT: 24-134 – Transportation Noise





September 18, 2024

PREPARED FOR
Heritage Investments Limited
1010 Polytek, Unit 5
Gloucester, ON K1J 9H8

PREPARED BY
Benjamin Page, AdvDip. Junior 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 transportation noise assessment in support of a Site Plan Control (SPC) application for the proposed residential development located at 601 Laurier Avenue West in Ottawa, Ontario. The development comprises a 28-storey residential building, inclusive of a 6-storey podium, topped by a mechanical penthouse (MPH). The primary sources of transportation noise include Bronson Avenue, Laurier Avenue, Slater Street, Albert Street, and the O-Train Line 1 (Confederation Line) light rail transit (LRT). As the study site is not located within 75 metres (m) of LRT or a railway, a ground vibrations assessment will not be required. Figure 1 illustrates a complete site plan with the 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; (iv) architectural drawings provided by Project1 Studio in July 2024.

The results of the current analysis indicate that noise levels will range between 57 and 65 dBA during the daytime period (07:00-23:00) and 57 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the east and west façades, which are the most exposed to the transportation noise sources. Figures 5 and 6 illustrate daytime and nighttime noise contours of the site 4.5 m above grade.

The results indicate that standard building components, which meet Ontario Building Code standards, will be sufficient to attenuate indoor sound levels from traffic, as as noise levels predicted due to roadway traffic do not exceed the criteria listed in ENCG for building components. However, as noise levels fall between 55 dBA and 65 dBA during the daytime period, the development will need forced air heating with provisions for central air conditioning, as a minimum requirement. Generally this type of building provides air conditioning inside each suite. The provided air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. If air condinitng is provided, A Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Noise levels at the ground floor and level 7 outdoor amenities are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1.1 m to 2.5 m above the walking surface. The results of the investigation proved that noise levels at the level 7 terrace can be reduced to 55 dBA by implementing a 1.1 m tall barrier surrounding the north, east, south, and southwest perimeter. Noise levels at the ground floor outdoor amenity can be reduced to 57 dBA by implementing a 2.5 m tall barrier surrounding the north, east. and west perimeters. Further noise reduction would not justify the cost of installing such a high wall and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible. Therefore, it is advised that the barrier be raised no less than 2.5 m above the walking surface for the ground floor amenity. Figure 4 illustrates the barrier requirements.

The guard must be constructed from materials having a minimum surface density of 20 kg/m^2 (STC rating of 30) and contain no gaps. The design of the guardrail will conform to the requirements outlined in Part 5 of the ENCG.

With regard to stationary noise impacts from proposed mechanical systems on the building, they will be designed to ensure compliance with the ENCG sound level limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary, noise screens and silencers can be placed into the design. It is recommended a stationary noise study be conducted once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Heritage Investments Limited to undertake a transportation noise assessment in support of a Site Plan Control (SPC) application for the proposed residential development located at 601 Laurier Avenue West in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local transportation noise sources.

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 provided by Project1 Studio in July 2024, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The subject site is located at 601 Laurier Avenue West in Ottawa, situated to the northeast of the intersection of Laurier Avenue West and Cambridge Street North. Throughout this report, Laurier Avenue West is referred to as project south. An existing 3-storey residential building to the east is to be retained. The proposed development comprises a 28-storey residential building, inclusive of a 6-storey podium, topped by a mechanical penthouse (MPH).

Above three underground parking levels, the ground floor of the proposed development comprises a near triangular planform and includes a main entrance and indoor amenities near the southeast corner, residential units at the southwest corner and along the north elevation, and shared building support spaces to the east. An outdoor amenity is located to the northeast. Access to the underground parking levels is provided by a ramp via a drive aisle perpendicular to Laurier Avenue West. Levels 2-6 are reserved for residential use, while Level 7 includes an indoor amenity to the east and residential units throughout the remainder of the level. The building steps back from the east and south elevations at Levels 5 and 7

[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

and at the northeast corner at Level 8. A common amenity terrace is accommodated within the noted setbacks at Level 7. Levels 8-28 rise with a typical planform and are reserved for residential occupancy.

Considering Laurier Avenue West as project south, the site surroundings include the Tech Wall Dog Park and the Nanny Goat Hill Community Garden to the east-northeast, the existing low-rise building to the east within the subject site, high-rise residential buildings from the east clockwise to the southeast, a mix of low- and mid-rise buildings from the southeast clockwise to the south, the Bruyère - Hôpital Saint-Vincent Hospital to the south-southwest, low-rise buildings to the southwest and northeast, and high-rise residential buildings to the north. Notably, the Ādisōke - Ottawa Central Library is under construction at 555 Albert Street, approximately 100 m to the northwest.

The primary sources of transportation noise include Bronson Avenue, Laurier Avenue, Slater Street, Albert Street, and the O-Train Line 1 (Confederation Line) light rail. As the study site is not located within 75 metres (m) of any above or below-grade rail lines, a ground vibrations assessment will not be required. Figure 1 illustrates a complete site plan with surrounding context.

With regard to stationary noise impacts from proposed mechanical systems on the building, they will be designed to ensure compliance with the ENCG sound level limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary, noise screens and silencers can be placed into the design. It is recommended a stationary noise study be conducted once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local road and railway traffic, (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 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For surface roadway 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 [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 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 (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation should be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion. Furthermore, noise levels at the OLA must not exceed 60 dBA if mitigation can be technically and administratively achieved.

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.2 Theoretical Roadway Noise Predictions

The impact of transportation noise sources on the development was determined by computer modelling. Transportation noise source modelling is based on the software program *Predictor-Lima* which utilizes the United States Federal Highway Administration's Traffic Noise Model (TNM) to represent the roadway line sources. The TNM model is also being accepted in the updated Environmental Guide for Noise of Ontario, 2021 by the Ministry of Transportation (MTO)[7]. This computer program can represent three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. A set of comparative calculations were performed in the current Ontario traffic noise prediction model STAMSON for comparisons to Predictor simulation results. The STAMSON model is, however, older and requires each receptor to be calculated separately. STAMSON also does not accurately account for building reflections and multiple screening elements, and curved road geometry. A total of 6 receptor locations were identified around the site, as illustrated in Figure 2.

Roadway noise calculations were performed by treating each segment as separate line sources of noise, and by using existing and proposed building locations as noise barriers. 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 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split for all streets was taken to be 92%/8%, respectively.
- 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.
- Slater Street and Albert Street are located approximately 8 and 16 meters below local grade, respectively.
- The subway line is located approximately 16 meters below the local grade.
- For select sources where appropriate, receptors considered the proposed and/or existing buildings as a barrier partially or fully obstructing exposure to the source as illustrated by receptor distances and exposure angles in Figure 3.
- Noise receptors were strategically placed at 6 locations around the study area (see Figure 2).

[7] Ministry of Transportation Ontario, "*Environmental Guide for Noise*", August 2021, pg. 16

4.2.1 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[8] 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 volumes were obtained by analyzing the arrival/departure information for nearby Pimisi station and projection the traffic volumes into the future assuming a growth rate of 2.5% over 10 years. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: TRANSPORTATION TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Bronson Avenue	4-Lane Urban Arterial-Undivided (4-UAU)	50	**30,000**
Laurier Avenue	2-Lane Urban Arterial (2-UAU)	50	**15,000**
Slater Street	2-Lane Urban Arterial (2-UAU)	50	**15,000**
Albert Street	2-Lane Urban Arterial (2-UAU)	50	**15,000**
O-Train Line 1 (Confederation Line)	Light Rail Transit	70	**485/76***

*Daytime/Nighttime traffic volumes

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

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

cladding, thickness and interior finish details. For example, brick veneer walls can achieve STC 50 or more. Standard commercially-sided exterior metal stud walls have around STC 45. 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.

As per Section 4.2, when daytime noise levels from road 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[9] 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 vary according to the intended use of a space

Based on published research[10], 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, detailed floor layouts and building elevations have not been finalized; 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).

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

5. RESULTS AND DISCUSSION

5.1 Transportation Noise Levels

The results of the transportation noise calculations are summarized in Table 3 below.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Total Noise Level (dBA)	
			Day	Night
R1	83.5	POW – 28th Floor West Façade	**65**	**57**
R2	83.5	POW – 28th Floor Northeast Façade	**64**	**57**
R3	83.5	POW – 28th Floor East Façade	**65**	**57**
R4	83.5	POW – 28th Floor Southwest Façade	**64**	**57**
R5	20.5	OLA – 7th Floor East	**57**	**N/A***
R6	1.5	OLA – Ground Floor Northeast	**64**	**N/A***

*Noise levels during the nighttime are not considered as per ENCG

The results of the current analysis indicate that noise levels will range between 57 and 65 dBA during the daytime period (07:00-23:00) and 57 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the east and west façades, which are the most exposed to the transportation noise sources. Figures 5 and 6 illustrate daytime and nighttime noise contours of the site 4.5 m above grade.

Table 4 shows a comparison in results between Predictor-Lima and STAMSON. Noise levels calculated in STAMSON were found to have a good correlation with Predictor-Lima and variability between the two programs was within an acceptable level of ±0-3 dBA. STAMSON input parameters are shown in Appendix A.

TABLE 4: RESULTS OF STAMSON/PREDICTOR-LIMA CORRELATION

Receptor ID	Receptor Height (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)		PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night	Day	Night
R2	83.5	POW – 28th Floor Northeast Façade	67	60	64	57
R3	83.5	POW – 28th Floor East Façade	68	60	65	57

5.2 Noise Control Measures

The results indicate that standard building components, which meet Ontario Building Code standards, will be sufficient to attenuate indoor sound levels from traffic, as noise levels predicted due to roadway traffic do not exceed the criteria listed in ENCG for building components However, as noise levels fall between 55 dBA and 65 dBA during the daytime period, the development will need forced air heating with provisions for central air conditioning, as a minimum requirement. Generally, this type of building provides air conditioning inside each suite. The provided air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. If air conditioning is provided, A Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

The results also indicate that predicted noise levels at the outdoor amenities (Receptors 5 and 6) are expected to be 57 and 64 dBA respectively. As noise levels exceed the criteria listed in ENCG for outdoor living areas, as discussed in Section 4.2, noise mitigation at the OLAs is required.

5.3 Noise Barrier Calculation

Noise levels at the ground floor and level 7 outdoor amenities are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1.1 m to 2.5 m above the walking surface (see Table 4). The preferred barrier heights for the amenity spaces are associated with the noise levels in **bold** font. Results of the investigation proved that noise levels at the level 7 terrace can be reduced to 55 dBA by implementing a 1.1 m tall barrier surrounding the north, east, south, and southwest perimeter. Noise levels at the ground floor outdoor amenity can be reduced to 57 dBA by implementing a 2.5 m tall barrier surrounding the north, east. and west perimeters. Further noise reduction would not justify the cost of installing such a high wall and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible. Therefore, it is advised that the barrier be raised no less than 2.5 m above the walking surface for the ground floor amenity. Figure 4 illustrates the barrier requirements.

TABLE 4: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)				
			No Barrier	With 1.1 m Barrier	With 1.5 m Barrier	With 2 m Barrier	With 2.5 m Barrier
R5	20.5	OLA – 7th Floor East	57	**55**	53	52	52
R6	1.5	OLA – Ground Floor Northeast	64	61	59	58	**57**

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 57 and 65 dBA during the daytime period (07:00-23:00) and 57 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs at the east and west façades, which are most exposed to the transportation sources. Figures 5 and 6 illustrate daytime and nighttime noise contours of the site 4.5 m above grade.

The results indicate that standard building components, which meet Ontario Building Code standards, will be sufficient to attenuate indoor sound levels from traffic, as noise levels predicted due to roadway traffic do not exceed the criteria listed in ENCG for building components. However, as noise levels fall between 55 dBA and 65 dBA during the daytime period, the development will need forced air heating with provisions for central air conditioning, as a minimum requirement. Generally, this type of building provides air conditioning inside each suite. The provided air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. If air conditioning is provided, A Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized below.

Type D Warning Clause:

> *"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 ground floor and level 7 outdoor amenities are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1.1 m to 2.5 m above the walking surface. The results of the investigation proved that noise levels at the level 7 terrace can be reduced to 55 dBA by implementing a 1.1 m tall barrier surrounding the north, east, south, and southwest perimeter. Noise levels at the ground floor outdoor amenity can be reduced to 57 dBA by implementing a 2.5 m tall barrier surrounding the north, east. and west perimeters. Further noise reduction would not justify the cost of installing such a high wall and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible. Therefore, it is advised that the barrier be raised no less than 2.5 m above the walking surface for the ground floor amenity. Figure 4 illustrates the barrier requirements.

The guard must be constructed from materials having a minimum surface density of 20 kg/m^2 (STC rating of 30) and contain no gaps. The design of the guardrail will conform to the requirements outlined in Part 5 of the ENCG.

With regard to stationary noise impacts from proposed mechanical systems on the building, they will be designed to ensure compliance with the ENCG sound level limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary, noise screens and silencers can be placed into the design. It is recommended a stationary noise study be conducted once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas.

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.

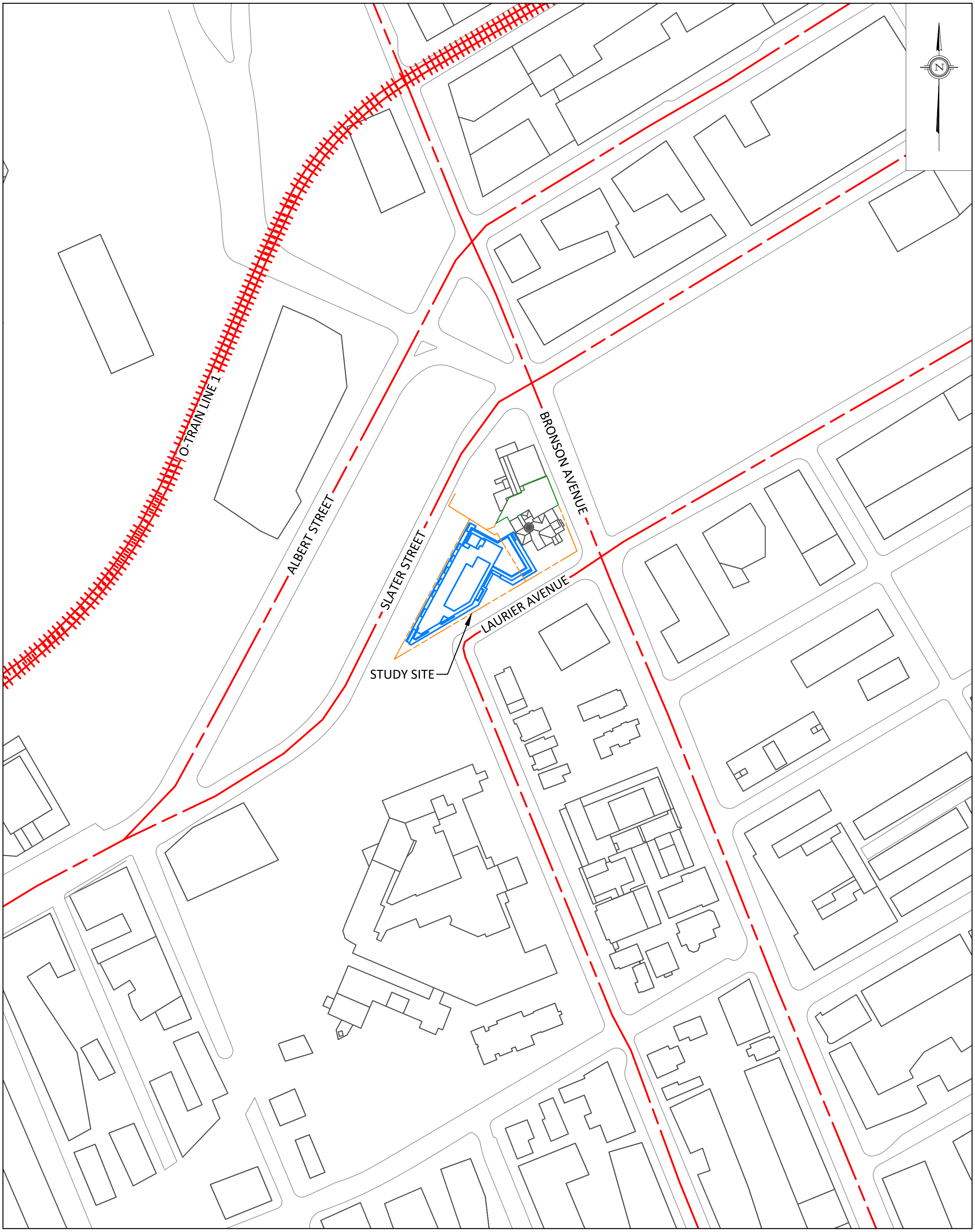
Sincerely,

Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
J. R. FOSTER
100155655
Sep 18, 2024
PROVINCE OF ONTARIO

Benjamin Page, AdvDip.
Junior Environmental Scientist
Gradient Wind File #24-134-Transportation Noise

Joshua Foster, P.Eng.
Principal

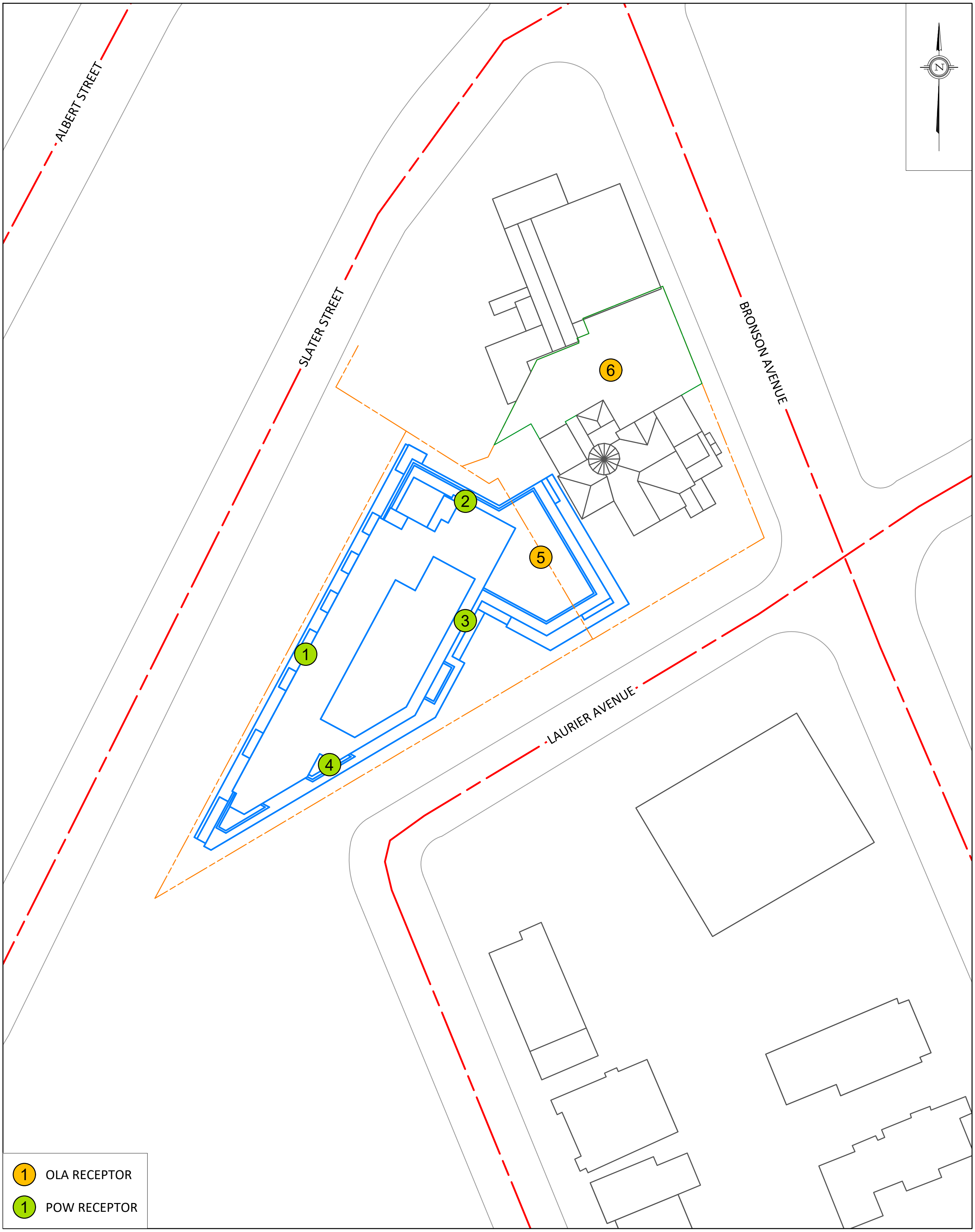


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	601 LAURIER AVENUE, OTTAWA TRANSPORTATION NOISE STUDY		
SCALE	1:2500	DRAWING NO.	24-134-NOISE-FIG1
DATE	SEPTEMBER 18, 2024	DRAWN BY	B.P.

DESCRIPTION

FIGURE 1:
PROPOSED SITE PLAN AND SURROUNDING CONTEXT

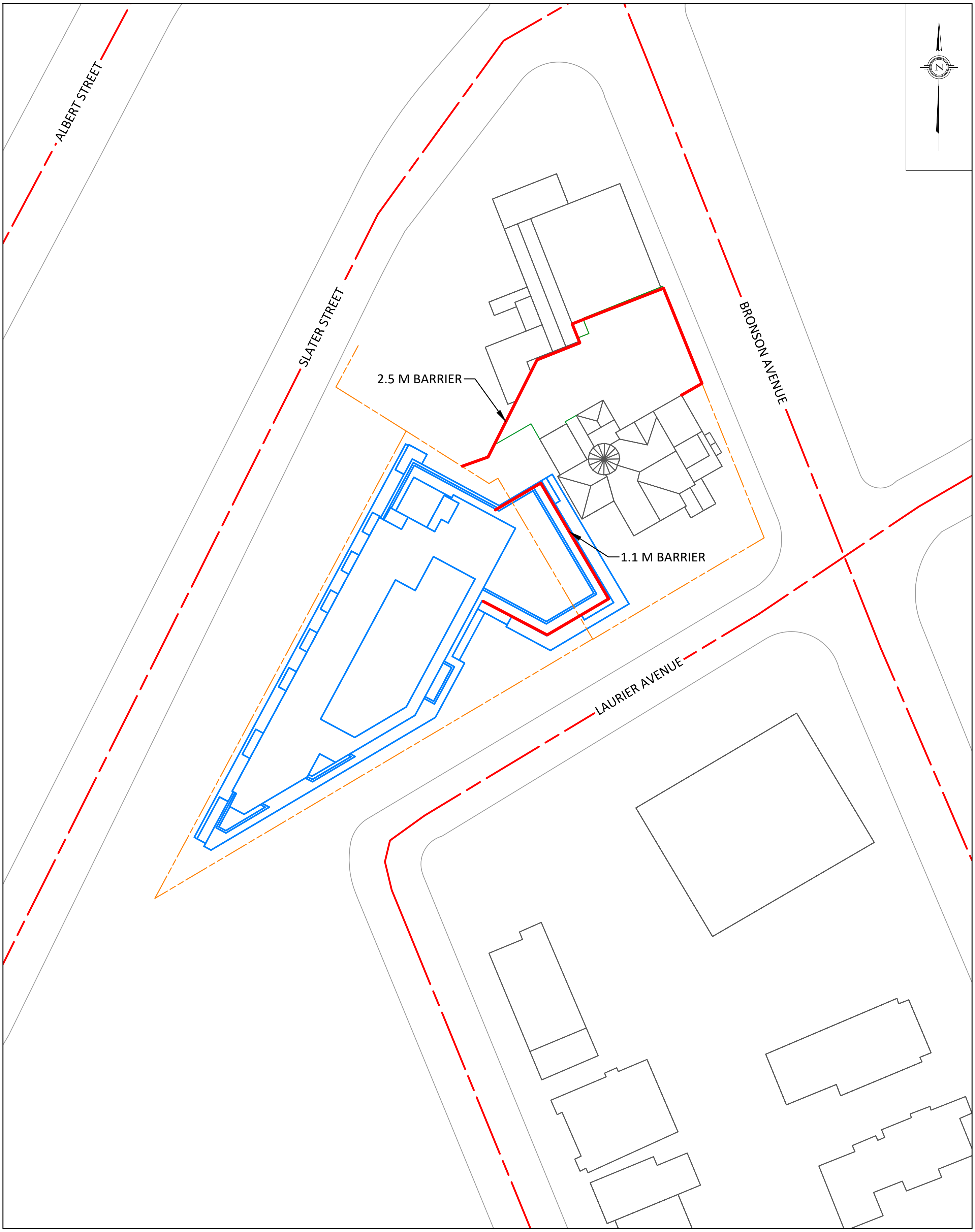


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT: 601 LAURIER AVENUE, OTTAWA TRANSPORTATION NOISE STUDY		DESCRIPTION: FIGURE 2: RECEPTOR LOCATIONS
SCALE: 1:750	DRAWING NO.: 24-134-NOISE-FIG2	
DATE: SEPTEMBER 18, 2024	DRAWN BY: B.P.	

GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	601 LAURIER AVENUE, OTTAWA TRANSPORTATION NOISE STUDY
SCALE	1:1500
DRAWING NO.	24-134-NOISE-FIG3
DATE	SEPTEMBER 18, 2024
DRAWN BY	B.P.
DESCRIPTION	FIGURE 3: STAMSON 5.04 INPUT DATA RECEPTORS 2 & 3



GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	601 LAURIER AVENUE, OTTAWA TRANSPORTATION NOISE STUDY		
SCALE	1:750	DRAWING NO.	24-134-NOISE-FIG4
DATE	SEPTEMBER 18, 2024	DRAWN BY	B.P.

DESCRIPTION

FIGURE 4:
BARRIER LOCATIONS

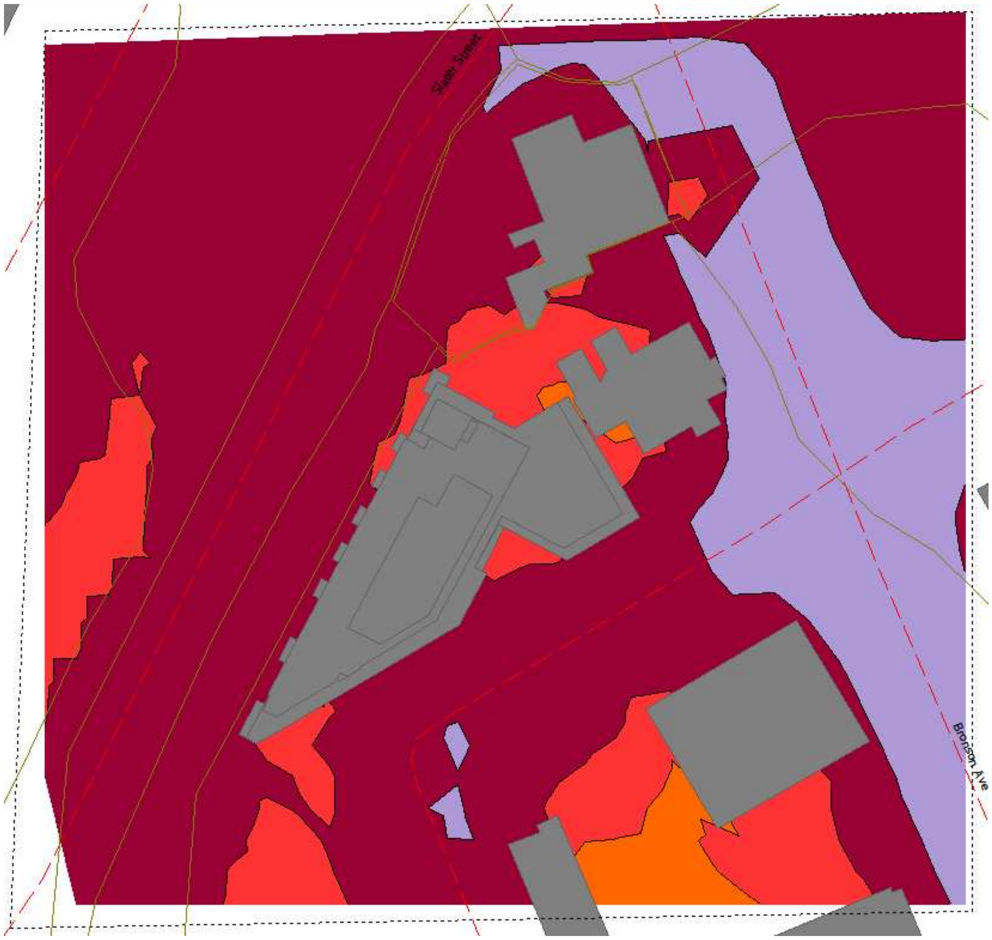


FIGURE 5: DAYTIME TRANSPORTATION NOISE CONTOURS (4.5 M ABOVE GRADE)

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

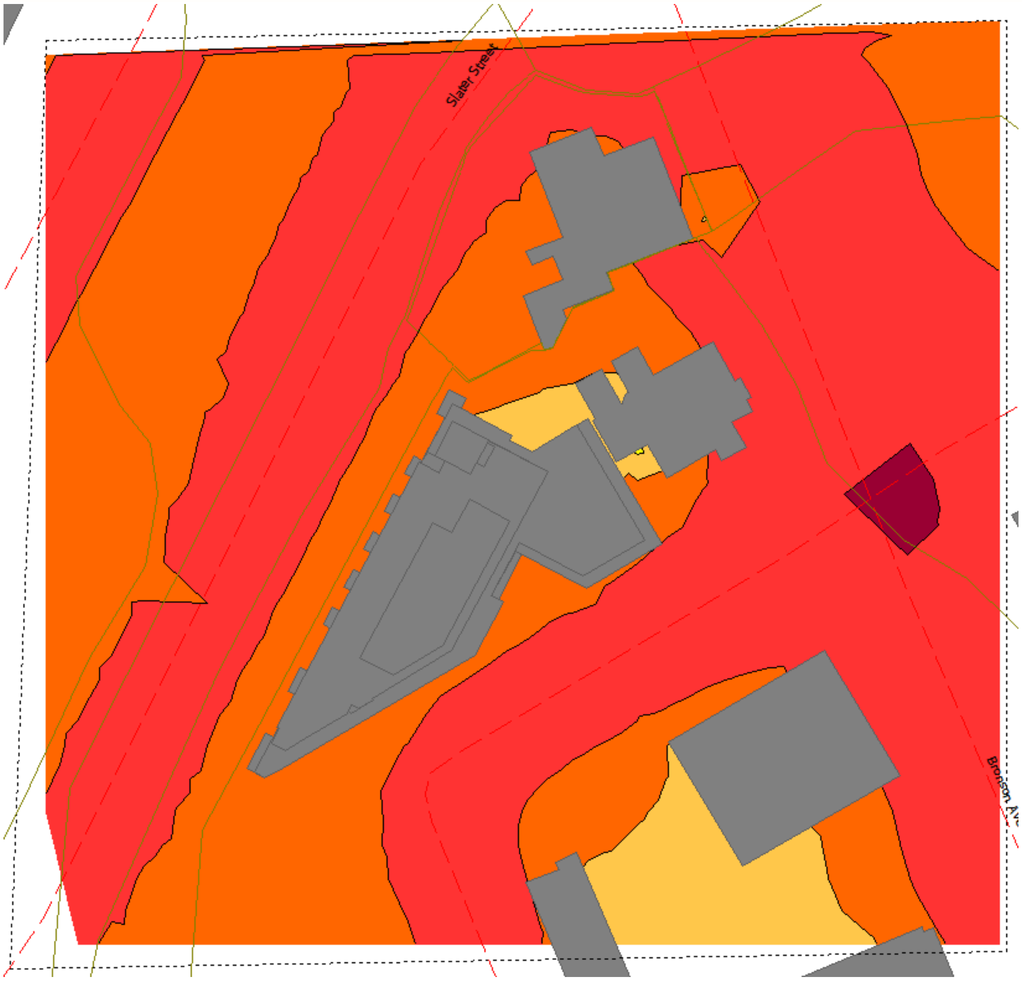
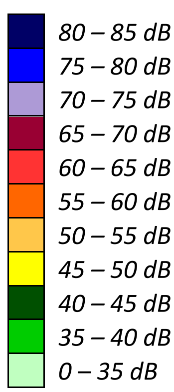
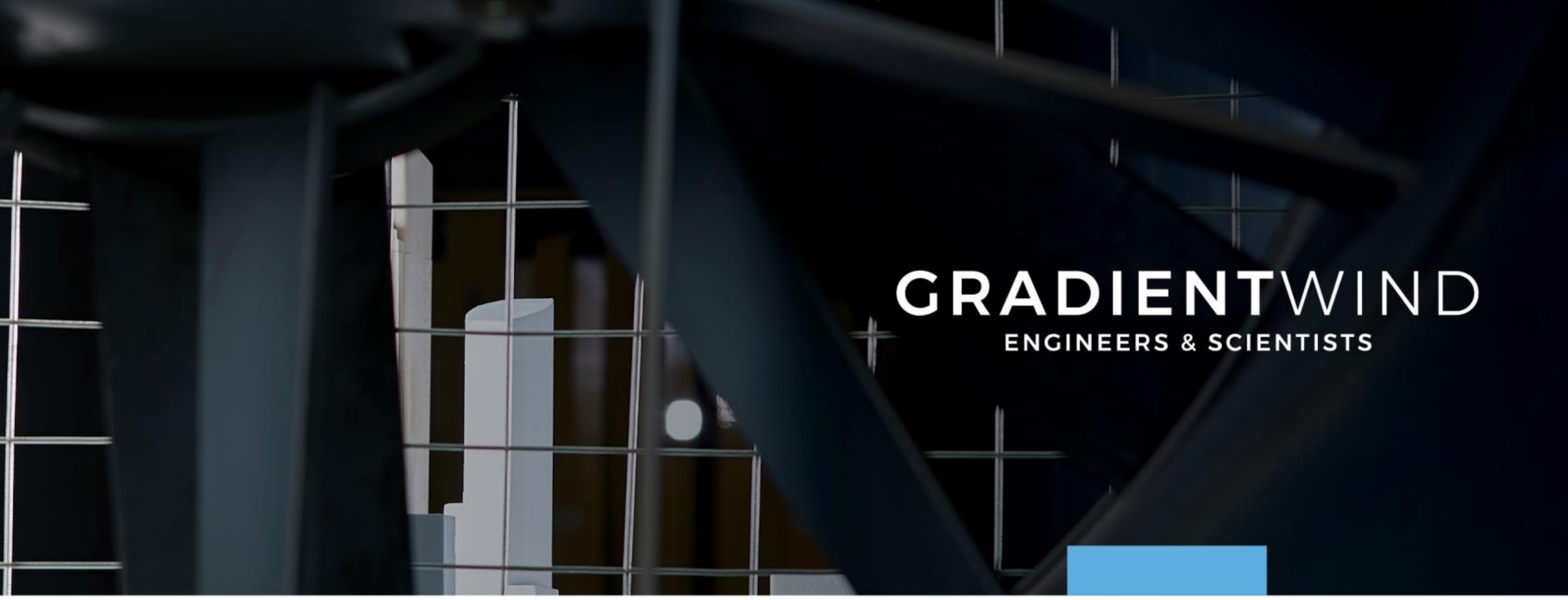
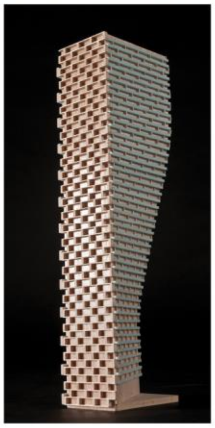
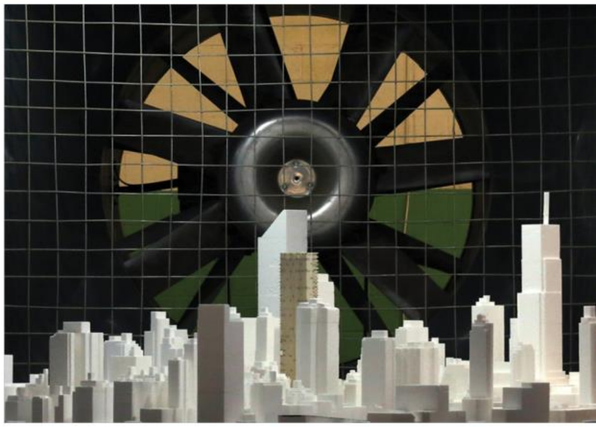


FIGURE 6: NIGHTTIME TRANSPORTATION NOISE CONTOURS (4.5 M ABOVE GRADE)









APPENDIX A
STAMSON 5.04 – INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 19-07-2024 12:33:11
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R2.te               Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Bronson Ave (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: Bronson Ave (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   50.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     25 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  49.00 / 49.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Slater St (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: Slater St (day/night)
-------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  30.00 / 30.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      3       (Elevated; no barrier)
Elevation                 :   8.00 m
Reference angle           :   0.00

Road data, segment # 3: Albert St (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 # 3: Albert St (day/night)
-------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     35 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  78.00 / 78.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      3       (Elevated; no barrier)
Elevation                 :  16.00 m
Reference angle           :   0.00

Road data, segment # 4: Laurier Ave (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 # 4: Laurier Ave (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   -31.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     25 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  36.00 / 36.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Bronson Ave (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.06 + 0.00) = 64.06 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     50   0.00  71.49   0.00  -5.14  -1.09   0.00  -1.20   0.00  64.06
-----------------------------------------------------------------------------

Segment Leq : 64.06 dBA

Results segment # 2: Slater St (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.46 + 0.00) = 62.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
     0     90   0.00  68.48   0.00  -3.01  -3.01   0.00   0.00   0.00  62.46
-----------------------------------------------------------------------------

Segment Leq : 62.46 dBA

Results segment # 3: Albert St (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.61 + 0.00) = 56.61 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
     0     90   0.00  68.48   0.00  -7.16  -3.01   0.00  -1.70   0.00  56.61
-----------------------------------------------------------------------------

Segment Leq : 56.61 dBA
```

```
Results segment # 4: Laurier Ave (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.63 + 0.00) = 58.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90    -31   0.00  68.48   0.00  -3.80  -4.84   0.00  -1.20   0.00  58.63
-----------------------------------------------------------------------------

Segment Leq : 58.63 dBA

Total Leq All Segments: 67.40 dBA

Results segment # 1: Bronson Ave (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.46 + 0.00) = 56.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     50   0.00  63.89   0.00  -5.14  -1.09   0.00  -1.20   0.00  56.46
-----------------------------------------------------------------------------

Segment Leq : 56.46 dBA

Results segment # 2: Slater St (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.86 + 0.00) = 54.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
     0     90   0.00  60.88   0.00  -3.01  -3.01   0.00   0.00   0.00  54.86
-----------------------------------------------------------------------------

Segment Leq : 54.86 dBA

Results segment # 3: Albert St (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.01 + 0.00) = 49.01 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
     0     90   0.00  60.88   0.00  -7.16  -3.01   0.00  -1.70   0.00  49.01
-----------------------------------------------------------------------------

Segment Leq : 49.01 dBA
```

```
Results segment # 4: Laurier Ave (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.04 + 0.00) = 51.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90    -31   0.00  60.88   0.00  -3.80  -4.84   0.00  -1.20   0.00  51.04
----------------------------------------------------------------------------

Segment Leq : 51.04 dBA

Total Leq All Segments: 59.80 dBA

RT/Custom data, segment # 1: LRT (day/night)
--------------------------------------------
1 - 4-car SRT:
Traffic volume    :   485/76    veh/TimePeriod
Speed             :    70  km/h

Data for Segment # 1: LRT (day/night)
-------------------------------------
Angle1   Angle2           :   5.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      2 / 2
House density             :     40 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 154.00 / 154.00 m
Receiver height           :  83.50 / 83.50  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :   5.00 deg   Angle2 : 31.00 deg
Barrier height            :  17.00 m
Elevation                 :  16.00 m
Barrier receiver distance :  95.00 / 95.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: LRT (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 !        83.50 !        32.30 !         32.30

RT/Custom (0.00 + 40.98 + 44.54) = 46.13 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     5     31   0.00  62.97 -10.11  -8.40   0.00  -3.47   0.00  40.98
     5     31   0.00  62.97 -10.11  -8.40   0.00   0.00   0.00  44.45*
     5     31   0.00  62.97 -10.11  -8.40   0.00   0.00   0.00  44.45
----------------------------------------------------------------------
    31     90   0.00  62.97 -10.11  -4.84   0.00  -3.47   0.00  44.54
----------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 46.13 dBA

Total Leq All Segments: 46.13 dBA

Results segment # 1: LRT (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 !        83.50 !        32.30 !         32.30

RT/Custom (0.00 + 35.94 + 39.50) = 41.09 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     5     31   0.00  57.93 -10.11  -8.40   0.00  -3.47   0.00  35.94
     5     31   0.00  57.93 -10.11  -8.40   0.00   0.00   0.00  39.41*
     5     31   0.00  57.93 -10.11  -8.40   0.00   0.00   0.00  39.41
----------------------------------------------------------------------
    31     90   0.00  57.93 -10.11  -4.84   0.00  -3.47   0.00  39.50
----------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 41.09 dBA

Total Leq All Segments: 41.09 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.43
                         (NIGHT): 59.86
```

```
STAMSON 5.0        NORMAL REPORT        Date: 19-07-2024 12:05:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R3.te                 Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Bronson Ave (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: Bronson Ave (day/night)
---------------------------------------------
Angle1   Angle2           : -40.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     45 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  55.00 / 55.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -40.00 deg   Angle2 : 31.00 deg
Barrier height            :  16.00 m
Barrier receiver distance :  20.00 / 20.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Laurier Ave (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: Laurier Ave (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     20 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  21.00 / 21.00  m
Receiver height           :  83.50 / 83.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Bronson Ave (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 !        83.50 !        53.68 !         53.68

ROAD (0.00 + 59.41 + 58.60) = 62.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -40     31   0.00  71.49   0.00  -5.64  -4.04   0.00  -2.40   0.00  59.41
   -40     31   0.00  71.49   0.00  -5.64  -4.04   0.00   0.00   0.00  61.81*
   -40     31   0.00  71.49   0.00  -5.64  -4.04   0.00   0.00   0.00  61.81
----------------------------------------------------------------------------
    31     90   0.00  71.49   0.00  -5.64  -4.84   0.00  -2.40   0.00  58.60
----------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 62.03 dBA
```

```
Results segment # 2: Laurier Ave (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 66.12 + 0.00) = 66.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00  -1.46   0.00   0.00  -0.90   0.00  66.12
----------------------------------------------------------------------------

Segment Leq : 66.12 dBA

Total Leq All Segments: 67.55 dBA

Results segment # 1: Bronson Ave (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 !       83.50 !       53.68 !        53.68

ROAD (0.00 + 51.81 + 51.01) = 54.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -40     31   0.00  63.89   0.00  -5.64  -4.04   0.00  -2.40   0.00  51.81
   -40     31   0.00  63.89   0.00  -5.64  -4.04   0.00   0.00   0.00  54.21*
   -40     31   0.00  63.89   0.00  -5.64  -4.04   0.00   0.00   0.00  54.21
----------------------------------------------------------------------------
    31     90   0.00  63.89   0.00  -5.64  -4.84   0.00  -2.40   0.00  51.01
----------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 54.44 dBA

Results segment # 2: Laurier Ave (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.52 + 0.00) = 58.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00  -1.46   0.00   0.00  -0.90   0.00  58.52
----------------------------------------------------------------------------

Segment Leq : 58.52 dBA

Total Leq All Segments: 59.95 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.55
                         (NIGHT): 59.95
```