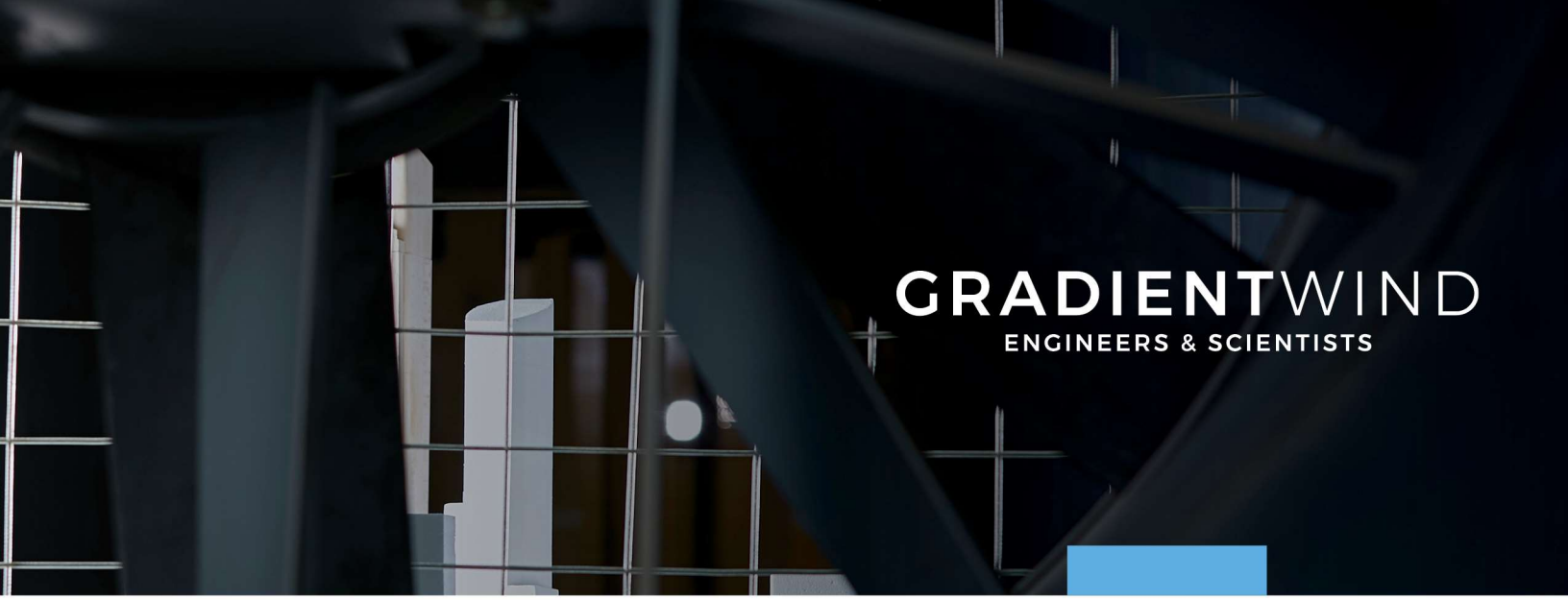

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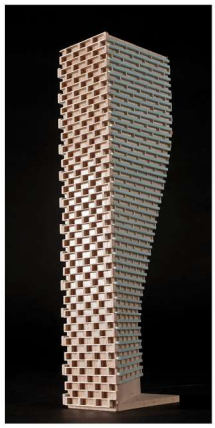
ROADWAY TRAFFIC NOISE ASSESSMENT

273-289 Bell Street South
Ottawa, Ontario

REPORT: GW22-026– Traffic Noise



April 7, 2022

PREPARED FOR
GAVCAP Properties Inc.
67 Kingsway Crescent
Toronto, ON M8X 2R5

PREPARED BY
Tanyon Matheson-Fitchett, B.Eng., Junior Environmental Scientist
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127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

EXECUTIVE SUMMARY

This report describes a traffic noise assessment undertaken in support of a Site Plan Control application (SPA) for a proposed development located at 273-289 Bell Street South in Ottawa, Ontario. For the purposes of this study, the elevation facing Bell Street South will be referred to as the west elevation. The proposed development is a six-storey 49-unit residential building comprised of two sections on its east and west sides, linked by corridors on the north and south sides. An inset is located on the southwest corner at levels 2 and above.

The major source of traffic noise is the Queensway (Highway 417), located approximately 50 meters to the north. As there are no railways or light rail transit systems within 75 meters of the proposed development, a ground vibration assessment is not required. Vibration from rubber-tired vehicle traffic on the Queensway are not expected to exceed the threshold of human perception at the subject site. 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; and (iv) architectural drawings prepared by Edge Architects Ltd. dated March 2022.

The results of the current analysis indicate that noise levels will range between 76 and 80 dBA during the daytime period (07:00-23:00) and between 68 and 72 dBA during the nighttime period (23:00-07:00). The highest noise level (80 dBA) occurs at the north façade, which is nearest and most exposed to the expressway. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as illustrated in Figure 3 and described in Section 5.2. Note, high noise levels are received on the north façade due to direct exposure to the expressway (80 dBA daytime and 72 dBA nighttime). Therefore, windows to noise-sensitive rooms (ie. bedrooms) should be avoided along the north façade.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. A 'Type D'

Warning Clause[1] will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6:

With regards to stationary noise impacts from the building on the surroundings and itself, noise can be controlled by judicious selection of the mechanical equipment and its placement on a high roof or in a mechanical penthouse. Where necessary noise screens, silencers, or acoustic louvers can be incorporated into the design to ensure compliance with the ENCG sound level limits. A stationary noise study will be performed once mechanical plans for the proposed building become available. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels meet ENCG criteria.

[1] MECP, Environmental Noise Guidelines, NPC 300

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by GAVCAP Properties Inc. to undertake a roadway traffic noise assessment for a proposed development located at 273-289 Bell Street South in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[2] and Ministry of the Environment, Conservation and Parks (MECP)[3] guidelines. Noise calculations were based on architectural drawings prepared by Edge Architects Ltd. dated March 2022, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed development at 273-289 Bell Street South in Ottawa, Ontario. For the purposes of this study, the elevation facing Bell Street South will be referred to as the west elevation. The study site is located on a block bounded by Bell Street South to the west, Arthur Lane South to the east, Plymouth Street to the south and the Queensway (Highway 417) to the north.

The proposed development is a six-storey 49-unit residential building comprised of two sections on its east and west sides, linked by corridors on the north and south sides. An inset is located on the southwest corner at levels 2 and above. The building's ground floor comprises residential units, and common areas on the west side, and vehicle parking on the east side. The main building access point is featured on the southwest corner, while access to vehicle parking is on the east side. The site is surrounded by low-rise residential buildings in the east, south and west directions, with the Queensway located directly to the north. A 5.0 meter-tall noise barrier is under development along the southern edge of the Queensway (Highway 417) in between the roadway and the subject site[4].

[2] City of Ottawa Environmental Noise Control Guidelines, January 2016
[3] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[4] Highway 417 Bronson Avenue Interchange Operational Improvements, Detail Design - City of Ottawa -Section 3.2.6 - October 2020

The major source of traffic noise is the Queensway (Highway 417), located approximately 50 meters to the north. As there are no railways or light rail transit systems within 75 meters of the proposed development, a ground vibration assessment is not required. Vibration from rubber-tired vehicle traffic on the Queensway are not expected to exceed the threshold of human perception at the subject site. 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 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 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 (ROAD) [5]

Type of Space	Time Period	Leq (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[6]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[7]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which 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[8].

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.

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

4.2.2 Theoretical Roadway Noise Predictions

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

Roadway traffic noise calculations were performed by treating each roadway segment as 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 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.
- Receptor height was taken to be 13.5 metres at Level 5 for the centre of the window (height to the 5th floor slab + 1.5 metres) for POW Receptors 1-3.
- Noise receptors were strategically placed at 3 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figure 4.
- The Queensway (Highway 417) is elevated 2.0 meters above average site grade.
- A 5.0-meter-tall barrier runs along the southern edge of the Queensway (Highway 417) between the roadway and the subject site.

4.2.3 Roadway Traffic Volumes

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

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Queensway (Highway 417)	8 Lane Expressway	100	**146,664**

4.3 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, 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 and rail sources) at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[10] considers:

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

Based on published research[11], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited

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

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).

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway 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 ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
1	13.5	POW – 5th Floor – West Façade	76	68
2	13.5	POW – 5th Floor – North Façade	80	72
3	13.5	POW – 5th Floor – East Façade	76	68

*Nighttime noise levels are not considered at OLA receptors, as per ENCG criteria

The results of the current analysis indicate that noise levels will range between 76 and 80 dBA during the daytime period (07:00-23:00) and between 68 and 72 dBA during the nighttime period (23:00-07:00). The highest noise level (80 dBA) occurs at the north façade, which is nearest and most exposed to the expressway.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3, 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). As per city of Ottawa requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type.

Note, high noise levels are received on the north façade due to direct exposure to the expressway (80 dBA daytime and 72 dBA nighttime). Therefore, windows to noise-sensitive rooms (ie. bedrooms) should not be placed along the north façade. Exterior cladding on this façade must achieve a minimum of STC 45, as described below.

The STC requirements for the windows are summarized below for various units within the development (see Figure 3):

- **Bedroom Windows**

(i) Bedroom windows should not be placed on the north façade, if provided a minimum STC 40 would be required.

(ii) Bedroom windows facing east and west will require a minimum STC of 38

(iii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Living Room Windows**

(i) Living room windows facing north will require a minimum STC of 38

(ii) Living room windows facing east and west will require a minimum STC of 34

(iii) All other living room windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Exterior Walls**

(i) Exterior wall components on the north, east and west façades will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[12]

The STC requirements apply to windows, doors, spandrel panels, curtainwall, and window wall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a punch window and stud wall system is used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however, several manufacturers and various combinations of window components will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window

[12] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 76 and 80 dBA during the daytime period (07:00-23:00) and between 68 and 72 dBA during the nighttime period (23:00-07:00). The highest noise level (80 dBA) occurs at the north façade, which is nearest and most exposed to the expressway. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as illustrated in Figure 3 and described in Section 5.2. Note, high noise levels are received on the north façade due to direct exposure to the expressway (80 dBA daytime and 72 dBA nighttime). Therefore, windows to noise-sensitive rooms (ie. bedrooms) should be avoided along the north façade.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following 'Type D' Warning Clause[13] will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"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."*

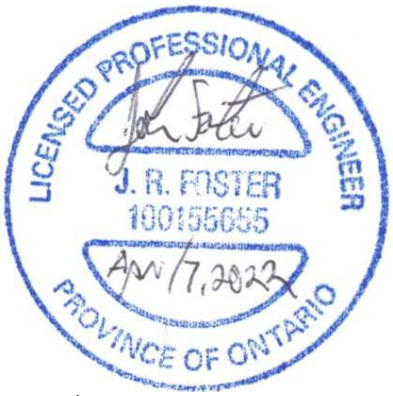
With regards to stationary noise impacts from the building on the surroundings and itself, noise can be controlled by judicious selection of the mechanical equipment and its placement on a high roof or in a mechanical penthouse. Where necessary noise screens, silencers, or acoustic louvers can be incorporated into the design to ensure compliance with the ENCG sound level limits. A stationary noise study will be performed once mechanical plans for the proposed building become available. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels meet ENCG criteria.

[13] MECP, Environmental Noise Guidelines, NPC 300

This concludes our traffic noise 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.



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Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File # 22-026 - T.Noise

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PROJECT	273-289 BELL STREET SOUTH, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:700 (APPROX.)	DRAWING NO.	GW22-026-1
DATE	APRIL 5, 2022	DRAWN BY	T.M.F.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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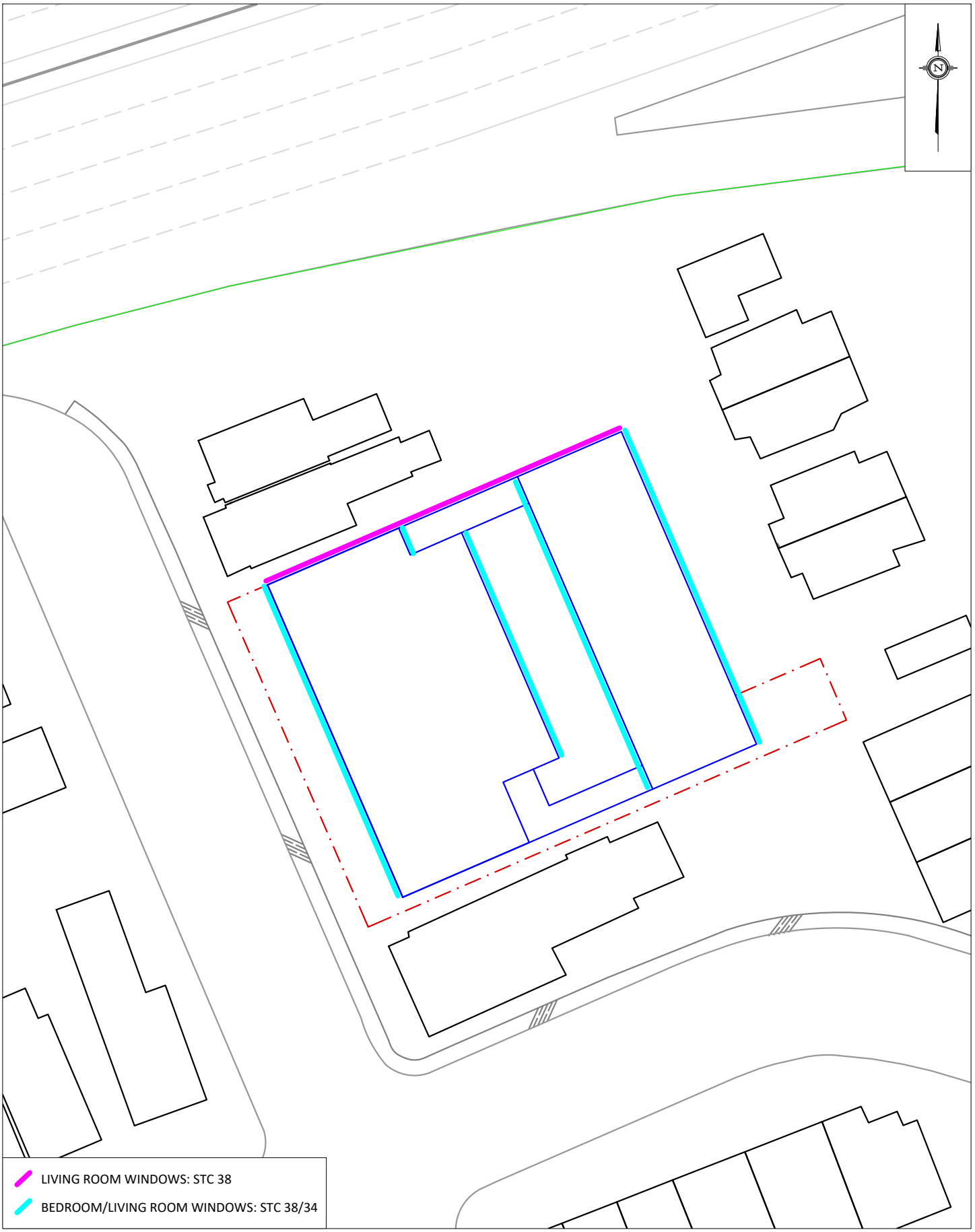
PROJECT	273-289 BELL STREET SOUTH, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:700 (APPROX.)
DRAWING NO.	GW22-026-2
DATE	APRIL 5, 2022
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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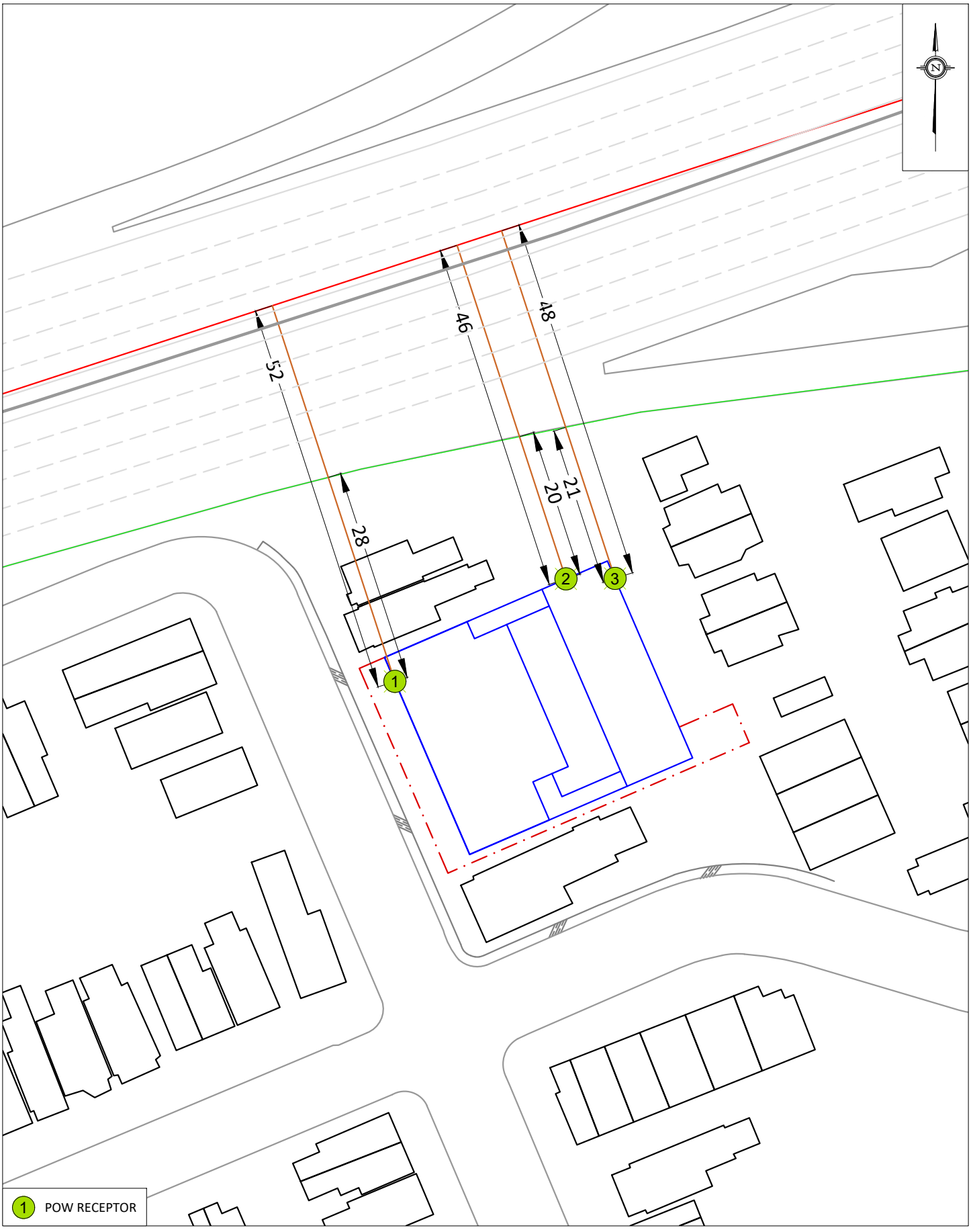
PROJECT	273-289 BELL STREET SOUTH, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:700 (APPROX.)	DRAWING NO.	GW22-026-3
DATE	APRIL 5, 2022	DRAWN BY	T.M.F.

FIGURE 3:
WINDOW STC REQUIREMENTS



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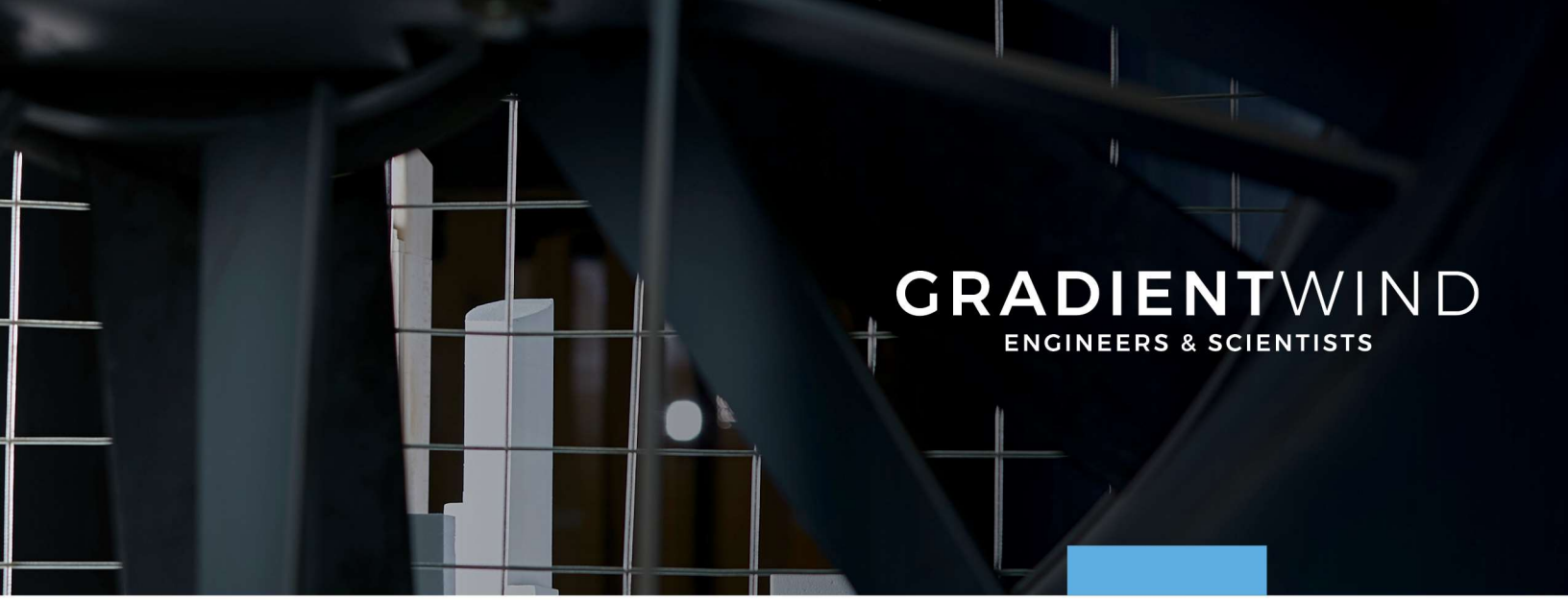
PROJECT	273-289 BELL STREET SOUTH, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:700 (APPROX.)	DRAWING NO.	GW22-026-4
DATE	APRIL 5, 2022	DRAWN BY	T.M.F.

FIGURE 4:
STAMSON PARAMETER INPUTS RECEPTORS 1-3



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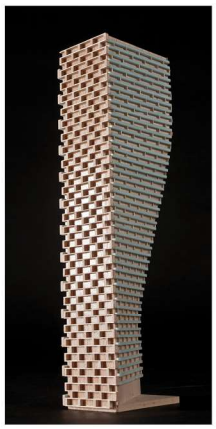

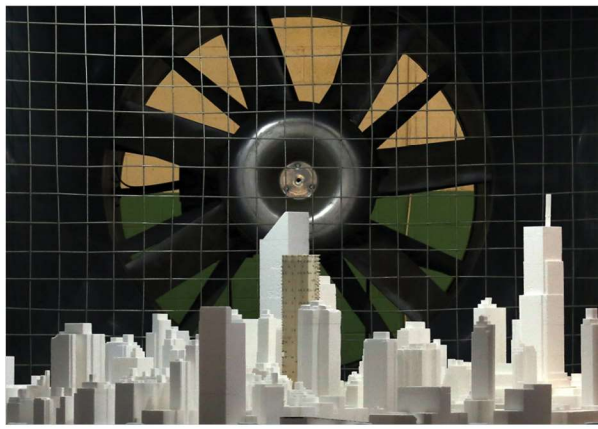

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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```
STAMSON 5.0        NORMAL REPORT        Date: 25-03-2022 15:15:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway417 (day/night)
-----------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: Highway417 (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  52.00 / 52.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   5.00 m
Barrier receiver distance :  28.00 / 28.00  m
Source elevation          :   2.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Highway417 (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 !       13.50 !        8.11 !         8.11

ROAD (0.00 + 76.00 + 0.00) = 76.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  84.41   0.00  -5.40  -3.01   0.00   0.00  -0.24  75.76*
   -90      0   0.00  84.41   0.00  -5.40  -3.01   0.00   0.00   0.00  76.00
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 76.00 dBA

Total Leq All Segments: 76.00 dBA
```

```
Results segment # 1: Highway417 (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 !       13.50 !        8.11 !         8.11

ROAD (0.00 + 68.40 + 0.00) = 68.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  76.81   0.00  -5.40  -3.01   0.00   0.00  -0.24  68.17*
   -90      0   0.00  76.81   0.00  -5.40  -3.01   0.00   0.00   0.00  68.40
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 68.40 dBA

Total Leq All Segments: 68.40 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 76.00
                           (NIGHT): 68.40
```

```
STAMSON 5.0        NORMAL REPORT        Date: 25-03-2022 15:15:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway417 (day/night)
----------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: Highway417 (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   5.00 m
Barrier receiver distance :  20.00 / 20.00  m
Source elevation          :   2.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Highway417 (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 !       13.50 !        9.15 !          9.15

ROAD (0.00 + 79.54 + 0.00) = 79.54 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  84.41   0.00  -4.87   0.00   0.00   0.00  -0.12  79.42*
   -90     90   0.00  84.41   0.00  -4.87   0.00   0.00   0.00   0.00  79.54
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 79.54 dBA

Total Leq All Segments: 79.54 dBA
```

```
Results segment # 1: Highway417 (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 !       13.50 !        9.15 !          9.15

ROAD (0.00 + 71.94 + 0.00) = 71.94 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  76.81   0.00  -4.87   0.00   0.00   0.00  -0.12  71.83*
   -90     90   0.00  76.81   0.00  -4.87   0.00   0.00   0.00   0.00  71.94
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 71.94 dBA

Total Leq All Segments: 71.94 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 79.54
                           (NIGHT): 71.94
```

```
STAMSON 5.0         NORMAL REPORT         Date: 25-03-2022 15:20:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Highway417 (day/night)
----------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: Highway417 (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  :  48.00 / 48.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :   0.00 deg   Angle2 : 90.00 deg
Barrier height            :   5.00 m
Barrier receiver distance :  21.00 / 21.00  m
Source elevation          :   2.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Highway417 (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 !       13.50 !        9.12 !          9.12

ROAD (0.00 + 76.35 + 0.00) = 76.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  84.41   0.00  -5.05  -3.01   0.00   0.00  -0.12  76.22*
     0     90   0.00  84.41   0.00  -5.05  -3.01   0.00   0.00   0.00  76.35
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 76.35 dBA

Total Leq All Segments: 76.35 dBA
```

```
Results segment # 1: Highway417 (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 !       13.50 !        9.12 !          9.12

ROAD (0.00 + 68.75 + 0.00) = 68.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  76.81   0.00  -5.05  -3.01   0.00   0.00  -0.12  68.63*
     0     90   0.00  76.81   0.00  -5.05  -3.01   0.00   0.00   0.00  68.75
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 68.75 dBA

Total Leq All Segments: 68.75 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 76.35
                           (NIGHT): 68.75
```