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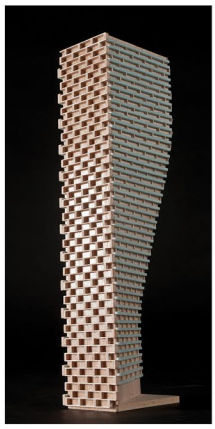
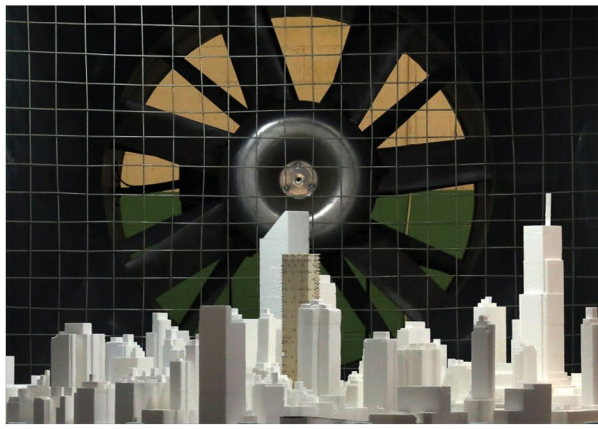
ROADWAY TRAFFIC NOISE ASSESSMENT

6600 Carrière Street
Ottawa, Ontario

GRADIENT WIND REPORT: 22-285 – Traffic Noise





September 30, 2022

PREPARED FOR

Provencher_Roy
47 Clarence Street, Suite 440
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PREPARED BY

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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken for the proposed development, known as MIFO, located at 6600 Carriere Street in Ottawa, Ontario. The proposed development comprises a three-storey cultural/community centre with a 'U'-shaped planform. The primary source of roadway traffic noise on the development is Carriere Street. 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) architectural drawings provided by Provencher_Roy in August 2022.

The results of the current analysis indicate that noise levels will range between 59 and 63 dBA during the daytime period (07:00-23:00) and between 52 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs at the north façade, which is nearest and most exposed to Carriere Street. Since noise levels are less than 65 dBA at all the building façades, standard building components in compliance with Ontario Building Code standards will be sufficient to attenuate noise levels indoors when windows are closed.

The noise levels predicted due to roadway traffic are expected to fall between 55 dBA and 65 dBA for the development. Therefore, the building will need forced air heating with provisions for central air conditioning as a minimum requirement which, if installed at the owner's discretion, will allow building occupants to keep windows closed and maintain a comfortable indoor environment. However, given the development layout, the building is expected to include central air conditioning in office and communal spaces for occupant comfort purposes. In addition to ventilation requirements, a Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Provencher_Roy to undertake a roadway traffic noise assessment for the proposed development, known as MIFO, located at 6600 Carriere Street 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[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings provided by Provencher_Roy in August 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 roadway traffic noise assessment is a proposed development comprising a three-storey cultural/community centre with a 'U'-shaped planform. At grade are a foyer, cafeteria, art gallery, gym, main hall, kitchen, and storage. The second floor contains additional storage, music rooms, studios, and multi-purpose rooms, and the third floor contains office space, meeting rooms, and a mechanical room. The site is surrounded by a mix of low-rise residential, commercial, and educational buildings. The primary source of roadway traffic noise on the development is Carriere Street. Figure 1 illustrates a complete site plan with the surrounding context.

As the building design progresses, the stationary noise impacts of the buildings on the surroundings would be considered at a future stage once the mechanical design has progressed and equipment has been selected. Stationary noise sources associated with the development could include rooftop air handling units and an emergency generator. Should noise levels from these units exceed the criteria established in NPC-300 and ENCG, noise from these sources can be controlled to acceptable limits by judicious selection of the equipment, locating the equipment on a high roof away from nearby residential receptors, and where necessary, installing silencers or noise screens.

[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

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 50 dBA for general offices and reception areas as listed in Table 1. Based on Gradient Wind's experience, more comfortable indoor noise levels should be targeted towards 47 to control peak noise and deficiencies in building envelope construction.

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 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].

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:

[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

- 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 10.6 metres above grade at the 3rd storey for the centre of the plane of window for Receptors 1-3.
- For select sources where appropriate, the receptor considered the surrounding existing and proposed buildings as a barrier partially or fully obstructing exposure to the sources as illustrated by exposure angles in Figure 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 3.

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[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. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Carriere Street	2-Lane Urban Collector Undivided (2-UCU)	40	**8,000**

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

5. ROADWAY TRAFFIC NOISE RESULTS

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	10.6	POW – 3rd Floor – East Façade	60	52
2	10.6	POW – 3rd Floor – North Façade	63	56
3	10.6	POW – 3rd Floor – West Façade	59	52

*Nighttime noise levels for the OLA are not considered as per ENCG

The results of the current analysis indicate that noise levels will range between 59 and 63 dBA during the daytime period (07:00-23:00) and between 52 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs at the north façade, which is nearest and most exposed to Carriere Street. Since noise levels are less than 65 dBA at the building façade, standard building components in compliance with Ontario Building Code standards will be sufficient to attenuate noise levels indoors when windows are closed.

The noise levels predicted due to roadway traffic are expected to fall between 55 dBA and 65 dBA for the development. Therefore, the building will need forced air heating with provisions for central air conditioning as a minimum requirement which, if installed at the owner's discretion, will allow building occupants to keep windows closed and maintain a comfortable indoor environment. However, given the development layout, the building is expected to include central air conditioning in office and communal spaces for occupant comfort purposes. In addition to ventilation requirements, a Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 59 and 63 dBA during the daytime period (07:00-23:00) and between 52 and 56 dBA during the nighttime period (23:00-07:00). The highest noise level (63 dBA) occurs at the north façade, which is nearest and most exposed to Carriere Street. Since noise levels are less than 65 dBA at all the building façades, standard building components in compliance with Ontario Building Code standards will be sufficient to attenuate noise levels indoors when windows are closed.

The noise levels predicted due to roadway traffic are expected to fall between 55 dBA and 65 dBA for the development. Therefore, the building will need forced air heating with provisions for central air conditioning as a minimum requirement which, if installed at the owner's discretion, will allow building occupants to keep windows closed and maintain a comfortable indoor environment. However, given the development layout, the building is expected to include central air conditioning in office and communal spaces for occupant comfort purposes. In addition to ventilation requirements, a Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

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

This concludes our roadway 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.

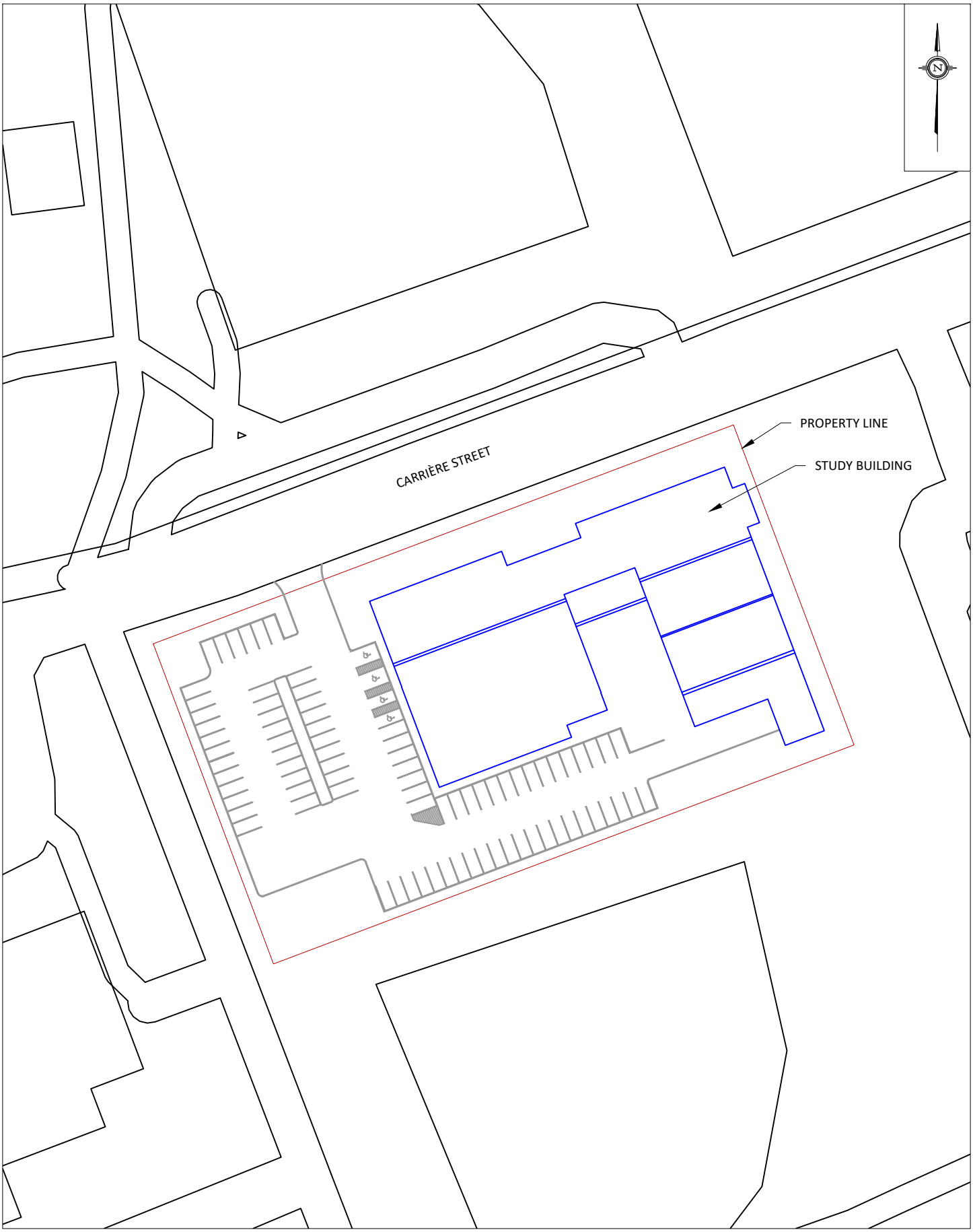
Sincerely,

Gradient Wind Engineering Inc.

Giuseppe Garro, MASc.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind Report #22-285



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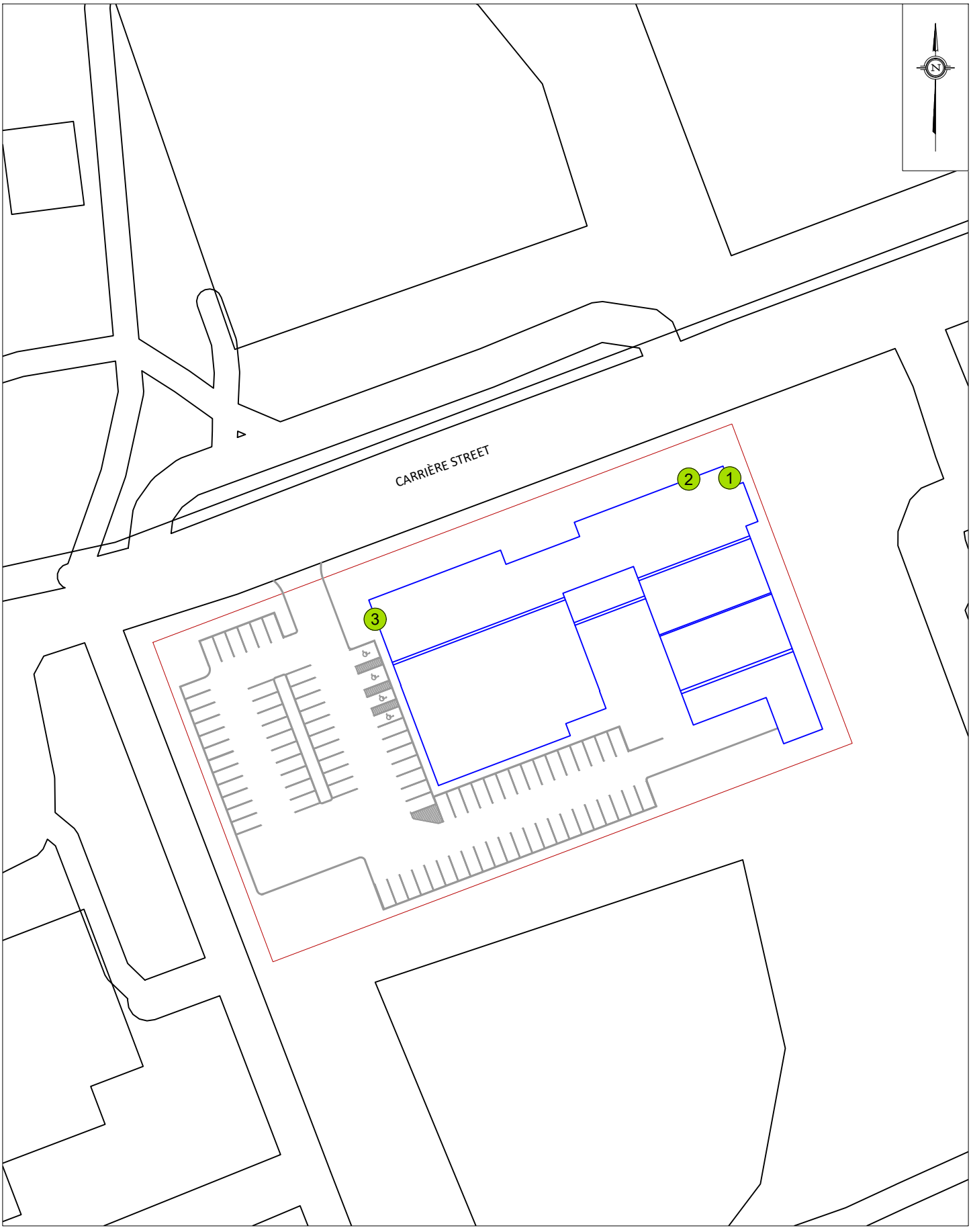
PROJECT	6600 CARRIÈRE STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-285-1
DATE	SEPTEMBER 29, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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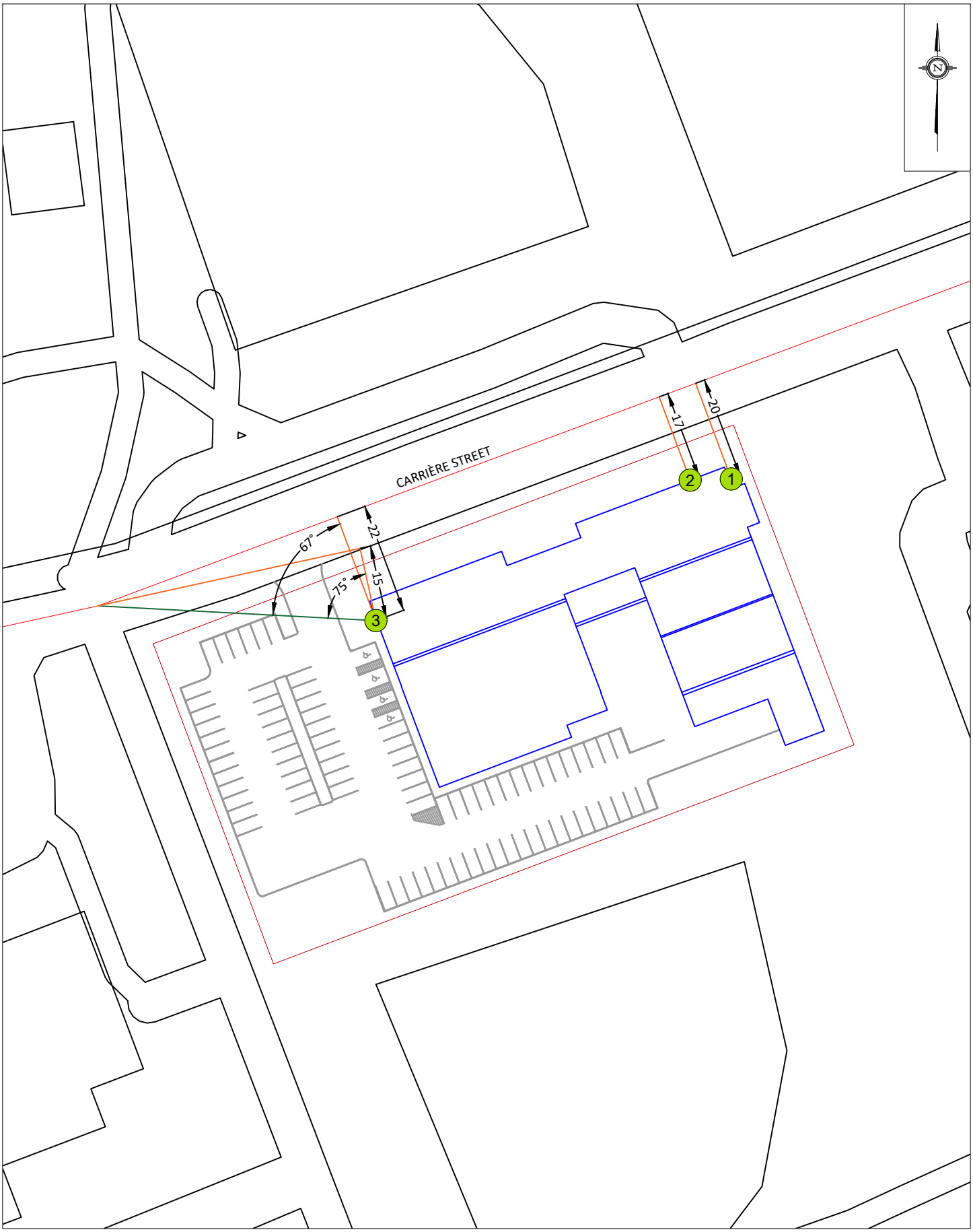
PROJECT	6600 CARRIÈRE STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-285-2
DATE	SEPTEMBER 29, 2022	DRAWN BY	G.G.

FIGURE 2:
RECEPTOR LOCATIONS



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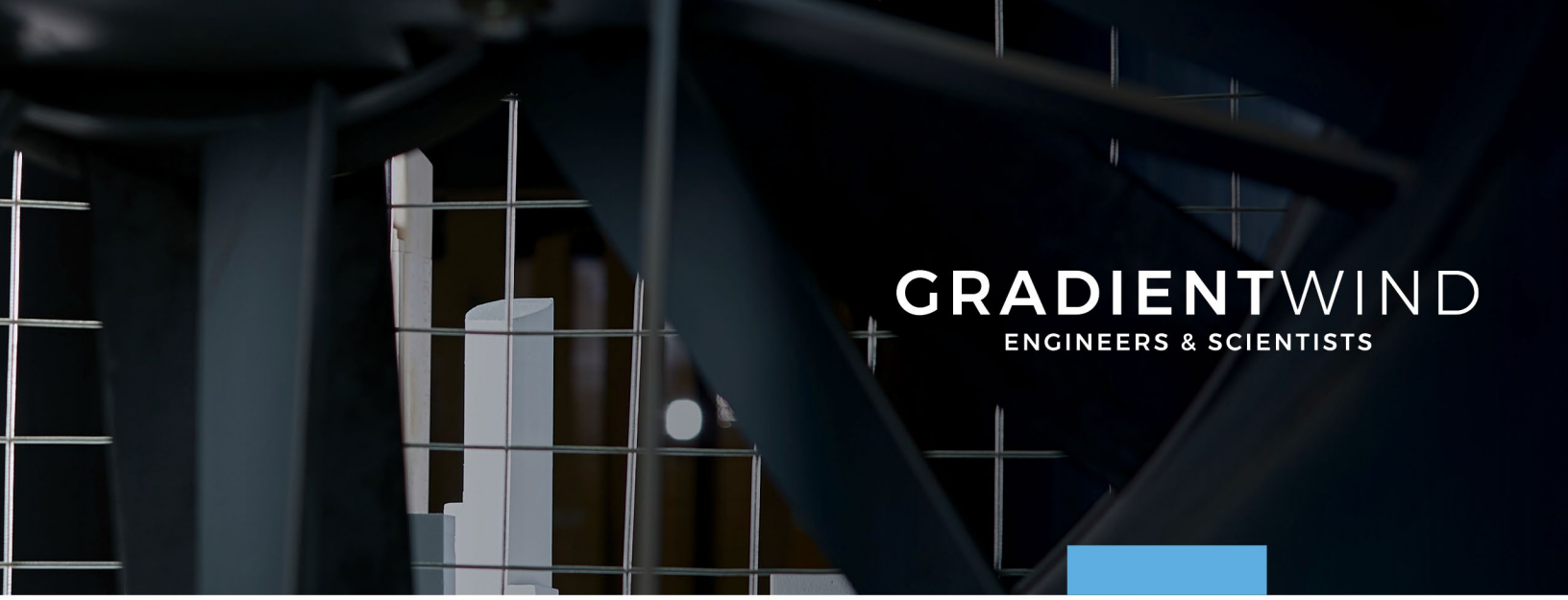
PROJECT	6600 CARRIÈRE STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO. GW22-285-3	FIGURE 3: STAMSON INPUT PARAMETERS
DATE	SEPTEMBER 29, 2022	DRAWN BY G.G.	



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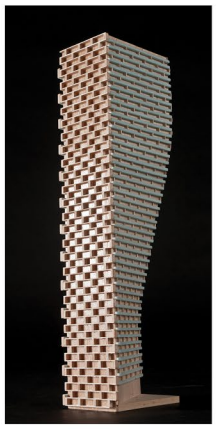

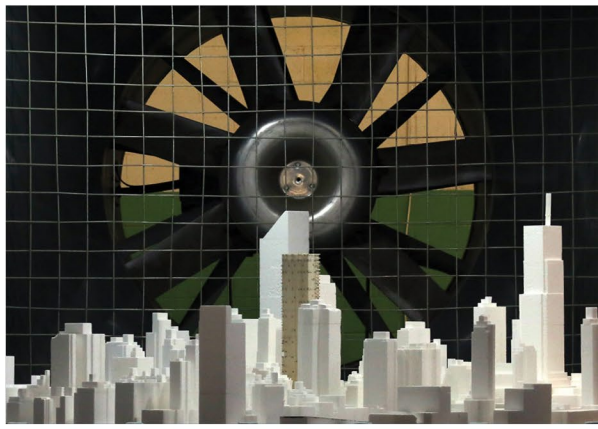

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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```
 STAMSON 5.0         NORMAL REPORT         Date: 29-09-2022 14:09:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: CS (day/night)
---------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: CS (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  :  20.00 / 20.00  m
Receiver height           :  10.60 / 10.60  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


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

Source height = 1.50 m

ROAD (0.00 + 59.70 + 0.00) = 59.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90    0.00  63.96   0.00  -1.25  -3.01   0.00   0.00   0.00
59.70
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 59.70 dBA

Total Leq All Segments: 59.70 dBA

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

Source height = 1.50 m

ROAD (0.00 + 52.10 + 0.00) = 52.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  56.36   0.00  -1.25  -3.01   0.00   0.00   0.00
52.10
-------------------------------------------------------------------------
--

Segment Leq : 52.10 dBA

Total Leq All Segments: 52.10 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 59.70
                           (NIGHT): 52.10
```

```
STAMSON 5.0         NORMAL REPORT         Date: 29-09-2022 14:09:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: CS (day/night)
---------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: CS (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  :  17.00 / 17.00  m
Receiver height           :  10.60 / 10.60  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

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

Source height = 1.50 m

ROAD (0.00 + 63.41 + 0.00) = 63.41 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.00  63.96   0.00  -0.54   0.00   0.00   0.00   0.00
63.41
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 63.41 dBA

Total Leq All Segments: 63.41 dBA

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

Source height = 1.50 m

ROAD (0.00 + 55.82 + 0.00) = 55.82 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  56.36   0.00  -0.54   0.00   0.00   0.00   0.00
55.82
-------------------------------------------------------------------------
--

Segment Leq : 55.82 dBA

Total Leq All Segments: 55.82 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 63.41
                           (NIGHT): 55.82
```

```
STAMSON 5.0         NORMAL REPORT         Date: 29-09-2022 14:10:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: CS1 (day/night)
---------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: CS1 (day/night)
-------------------------------------
Angle1   Angle2           : -90.00 deg   -75.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  10.60 / 10.60  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: CS2 (day/night)
---------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
```

```
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: CS2 (day/night)
-------------------------------------
Angle1   Angle2           : -67.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  22.00 / 22.00  m
Receiver height           :  10.60 / 10.60  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: CS1 (day)
------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.16 + 0.00) = 53.16 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -75   0.00  63.96   0.00   0.00 -10.79   0.00   0.00   0.00
53.16
-------------------------------------------------------------------------
--

Segment Leq : 53.16 dBA

Results segment # 2: CS2 (day)
------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.00 + 0.00) = 58.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -67      0   0.00  63.96   0.00  -1.66  -4.29   0.00   0.00   0.00
58.00
-------------------------------------------------------------------------
--

Segment Leq : 58.00 dBA

Total Leq All Segments: 59.23 dBA
```

```
Results segment # 1: CS1 (night)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 45.57 + 0.00) = 45.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -75   0.00  56.36   0.00   0.00 -10.79   0.00   0.00   0.00
45.57
-------------------------------------------------------------------------
--

Segment Leq : 45.57 dBA

Results segment # 2: CS2 (night)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.41 + 0.00) = 50.41 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -67      0   0.00  56.36   0.00  -1.66  -4.29   0.00   0.00   0.00
50.41
-------------------------------------------------------------------------
--

Segment Leq : 50.41 dBA

Total Leq All Segments: 51.64 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 59.23
                           (NIGHT): 51.64
```