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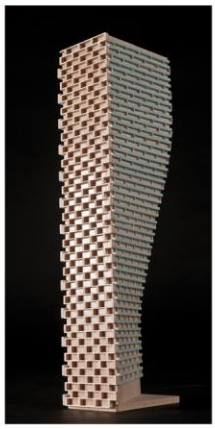
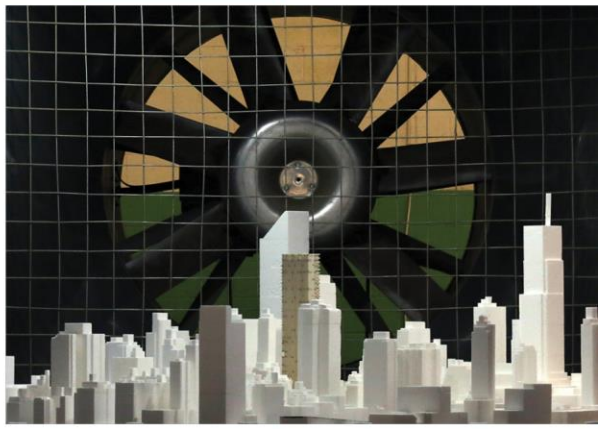
ROADWAY TRAFFIC NOISE ASSESSMENT

98-100 Bearbrook Road
Ottawa, Ontario

Report: 21-404-Traffic Noise R1





May 23, 2023

PREPARED FOR

Landric Homes
63 Montreal Road E.
Gatineau, QC J8M 1K3

PREPARED BY

Michael Lafortune, C.E.T., Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a detailed roadway traffic noise assessment performed for the proposed residential development located at 98-100 Bearbrook Road in Ottawa, Ontario, in support of a Site Plan Control (SPA) application. The proposed development consists of a 9-storey residential building with two underground parking levels. The major sources of roadway traffic noise are Bearbrook Road and Innes Road. Figure 1 illustrates the 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) drawings prepared by Rossmann Architecture, dated January 2022.

The results of the current analysis indicate that noise levels will range between 56 and 66 dBA during the daytime period (07:00-23:00) and between 49 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (66 dBA) occurs at the east building façade which is nearest and most exposed to Bearbrook Road. Upgraded building components will be required where noise levels exceed 65 dBA during the daytime period or 60 dBA during the nighttime period as illustrated in Figure 3.

Since noise levels exceed 65 dBA at the Plane of Window (POW) receptor on the east building façade, central air-conditioning will be required so that windows can be kept closed and a quiet living environment maintained. Additionally, a Type D Warning Clause will be required on all Lease, Purchase, and Sale Agreements.

Noise levels at the rooftop terrace OLA fall below 55 dBA during the daytime period, therefore, no mitigation is required.

With regard to stationary noise impacts, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed buildings become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed buildings on surrounding noise sensitive areas. This study will include recommendations for any noise control

measures that may be necessary to ensure noise levels fall below ENCG limits. In general, noise impacts can be minimized by judicious selection and placement of the equipment, such as placing rooftop equipment close to the centre of the roof which is out of the sight line with nearby noise sensitive properties.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Landric Homes to undertake a detailed roadway traffic noise study for the proposed development located at 98-100 Bearbrook Road in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic.

This assessment is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and the Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by Rossmann Architecture, dated January 2022, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The proposed development comprises a nine-storey residential buildings with Bearbrook Road to the east and Innes Road to the south. The building comprises of two levels of below-grade parking and outdoor parking to the south of the building. All levels of the building comprise of residential units. There is a rooftop terrace serving as an Outdoor Living Area (OLA), other balconies and private terraces must have a minimum depth of 4 m from the building façade to be considered an OLA. The study site is surrounded by low-rise residential buildings. The major sources of roadway traffic noise are Bearbrook Road and Innes Road. Figure 1 illustrates the site plan with the surrounding context.

With regard to stationary noise impacts, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed buildings become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed buildings on surrounding noise sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits. In general, noise impacts can be minimized by judicious selection and placement of the equipment, such as placing rooftop

[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

equipment close to the centre of the roof which is out of the sight line with nearby noise sensitive properties.

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 (ENCG) 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 level 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 sound pressure 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 vehicular traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time-varying noise level over a period of time. For roadways and LRT, 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. Based on Gradient Wind's experience, more comfortable indoor noise levels should be targeted, towards 42 and 37, respectively, to control peak noise and deficiencies in building envelope construction.

TABLE 1: INDOOR SOUND LEVEL CRITERIA

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[3]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[4]. 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[5].

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 but are less than 60 dBA, mitigation is recommended to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion. If these measures are not provided, prospective purchasers or tenants should be informed of

[3] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[4] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

potential noise problems by a warning clause. If noise levels at OLAs exceed 60 dBA, mitigation must be provided.

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 a separate line source 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 absorptive due to the presence of soft ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Four (4) receptor locations were chosen at the façades of the study buildings as Plane of Window (POW) receptors and one (1) receptor location was chosen at the rooftop terrace as an Outdoor Living Area (OLA) receptor (see Figure 2).
- Receptor heights were taken to be 25.5 metres at level 9 for the centre of the window.
- For select sources, where appropriate, the proposed building was considered as a barrier, partially or fully obstructing exposure to the source.
- Receptor distances and exposure angles are illustrated in Figure A1.

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[6] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes

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

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
Innes Road	2-Lane Urban Arterial (2-UAU)	50	**15,000**
Bearbrook Road	2-Lane Major Collector (2-UMCU)	40	**12,000**

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 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[7] 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

[7] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

Based on published research[8], 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).

5. ROADWAY TRAFFIC NOISE 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	25.5	POW – 9th Level – North Façade	61	53
2	25.5	POW – 9th Level – East Façade	66	58
3	25.5	POW – 9th Level – South Façade	64	56
4	25.5	POW – 9th Level – West Façade	56	49
5	29.4	OLA– Rooftop Outdoor Amenity	53	N/A*

*OLA noise levels during the nighttime period are not considered as per ENCG.

The results of the current analysis indicate that noise levels will range between 56 and 66 dBA during the daytime period (07:00-23:00) and between 49 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (66 dBA) occurs at the east façade, which is nearest and most exposed to Bearbrook Road.

[8] CMHC, Road & Rail Noise: Effects on Housing

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

Bedroom Windows

(i) Bedroom windows facing east will require a minimum STC of 30.

(ii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2012) requirements.

Living Room Windows

(i) Living room windows facing east will require a minimum STC of 25

(ii) All other living room windows are to satisfy Ontario Building Code (OBC 2012) requirements.

Exterior Walls

(i) Exterior wall components facing east will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[9].

The STC requirements apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a punch window and 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, such as those proposed, will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window 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

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

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.

The 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 56 and 66 dBA during the daytime period (07:00-23:00) and between 49 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (66 dBA) occurs at the east building façade which is nearest and most exposed to Bearbrook Road. Upgraded building components will be required since noise levels predicted due to roadway traffic exceed 65 dBA during the daytime period at the east façade as illustrated in Figure 3.

Since noise levels exceed 65 dBA at the Plane of Window (POW) receptors, the building will require central air-conditioning so that windows can be kept closed and a quiet living environment maintained. Additionally, a Type D Warning Clause will be required on all Lease, Purchase, and Sale Agreements.

Type D

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

Noise levels at the rooftop terrace OLA fall below 55 dBA during the daytime period, therefore, no mitigation is required.

With regard to stationary noise impacts, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed buildings become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed buildings on surrounding noise sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits. In general, noise impacts

can be minimized by judicious selection and placement of the equipment, such as placing rooftop equipment close to the centre of the roof which is out of the sight line with nearby noise sensitive properties.

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.

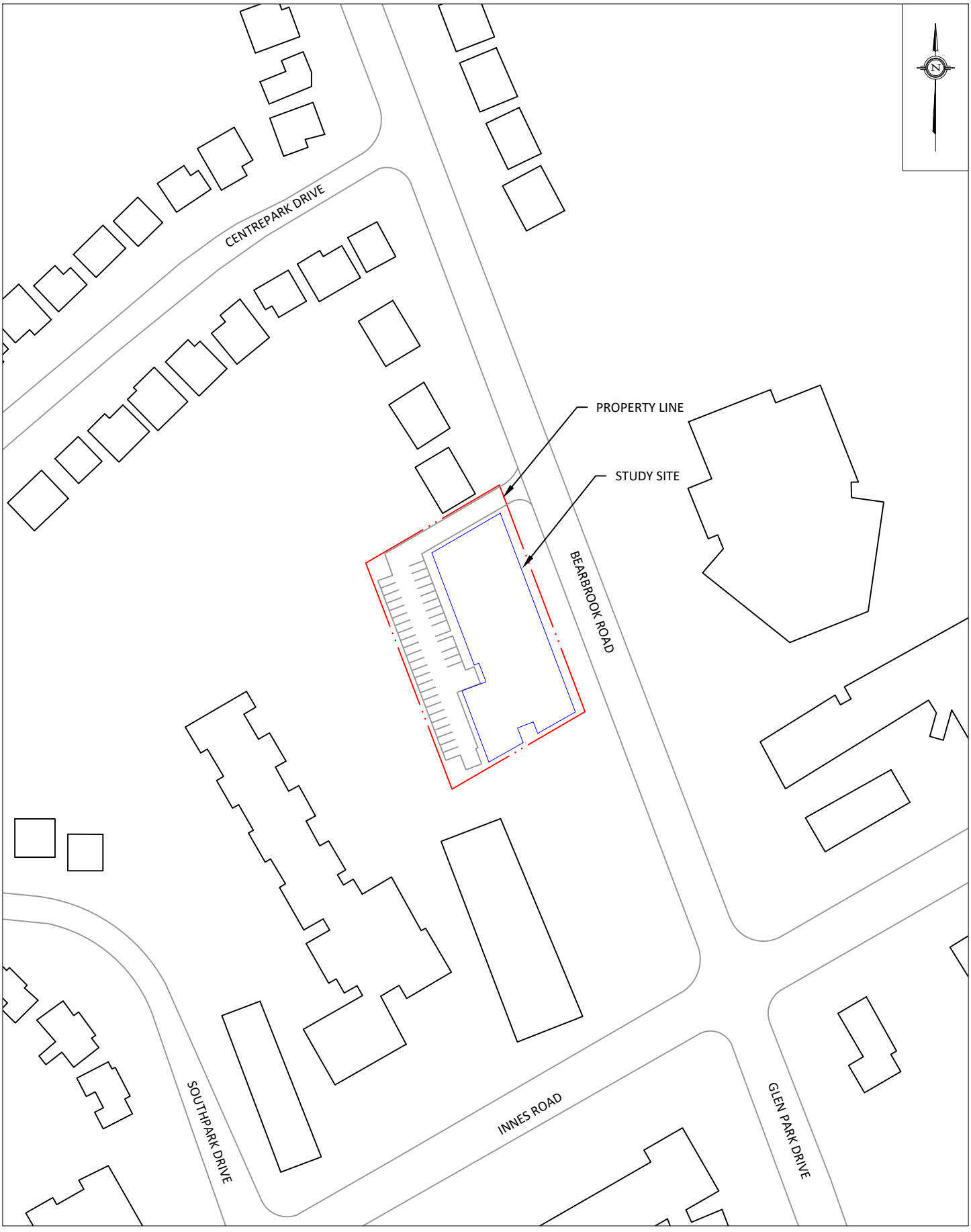
Sincerely,

Gradient Wind Engineering Inc.

Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File 21-404 - Traffic Noise R1



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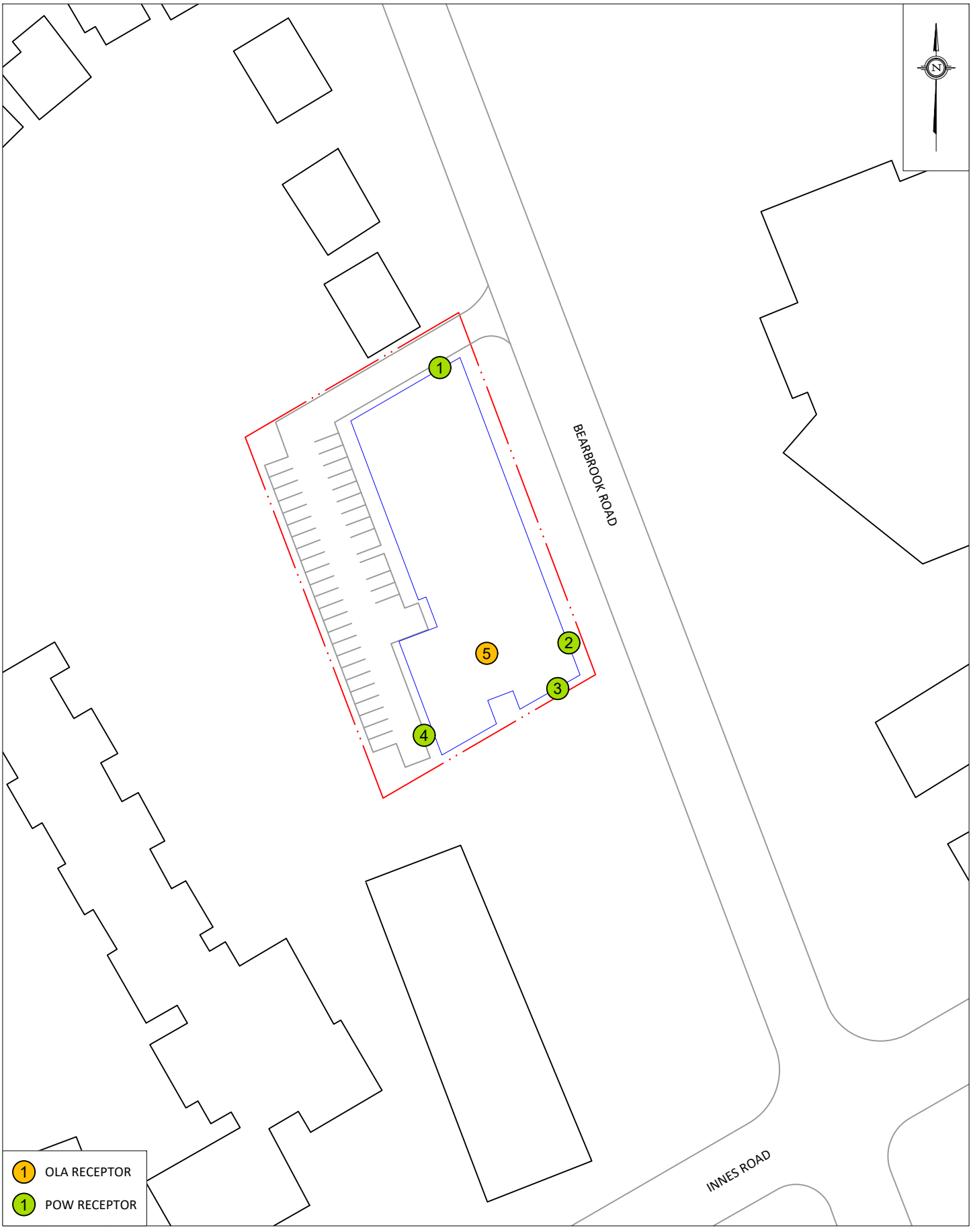
PROJECT	BEARBROOK ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1600 (APPROX.)
DRAWING NO.	GW21-404-1
DATE	JANUARY 20, 2022
DRAWN BY	C.A.
DESCRIPTION	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT



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SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-404-2
DATE	JANUARY 20, 2022
DRAWN BY	C.A.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATION

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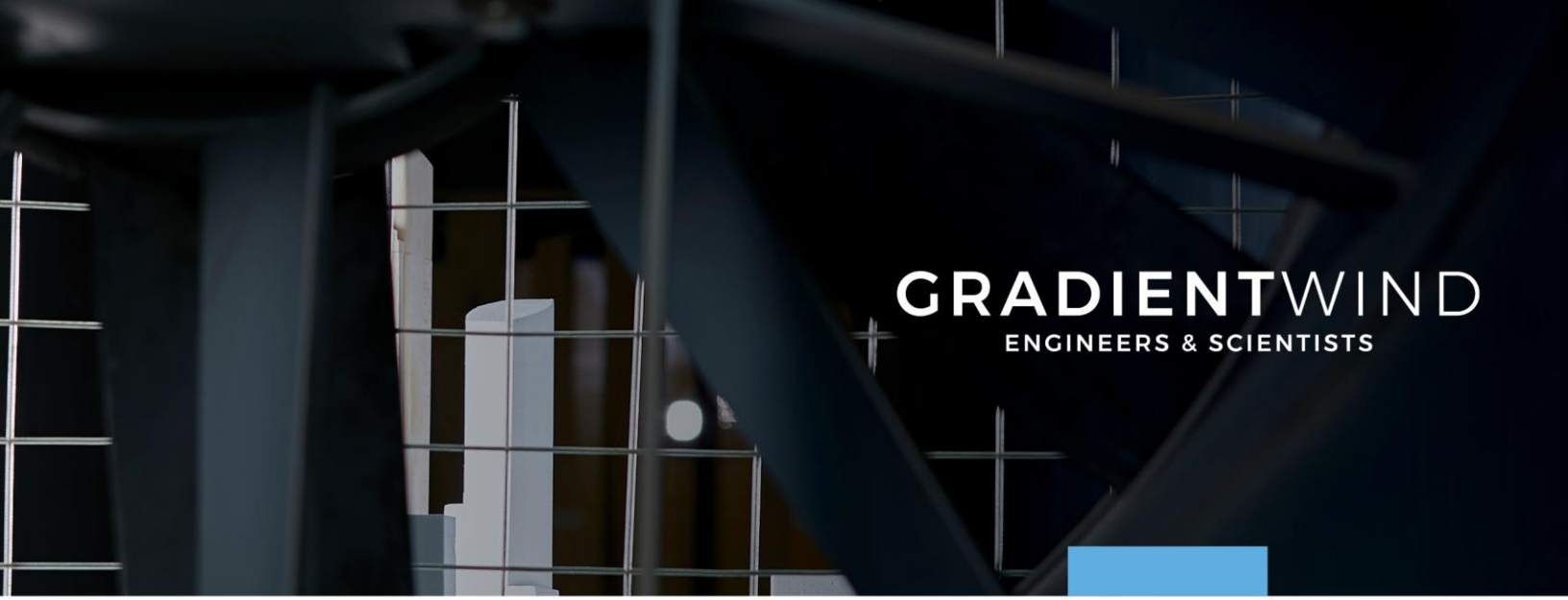
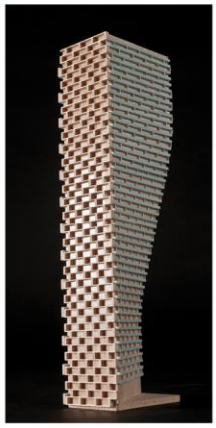
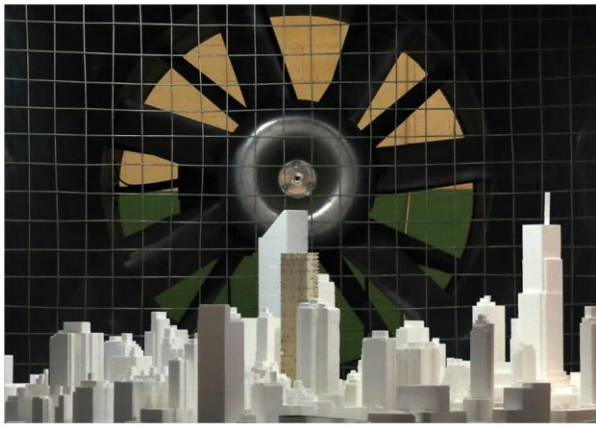
SCALE	1:640 (APPROX.)	DRAWING NO.	GW21-404-3
DATE	JANUARY 20, 2022	DRAWN BY	C.A.

FIGURE 3:
WINDOW STC RATINGS







APPENDIX A

STAMSON INPUT-OUTPUT DATA

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

```
STAMSON 5.0        NORMAL REPORT        Date: 20-01-2022 10:51:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1:  (day/night)
-----------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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:  (day/night)
---------------------------------
Angle1   Angle2           : -90.00 deg   -9.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  21.00 / 21.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 60.79 + 0.00) = 60.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     -9   0.00  65.72   0.00  -1.46  -3.47   0.00   0.00   0.00
60.79
-------------------------------------------------------------------------
------

Segment Leq : 60.79 dBA

Total Leq All Segments: 60.79 dBA


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

Source height = 1.50 m

ROAD (0.00 + 53.19 + 0.00) = 53.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     -9   0.00  58.12   0.00  -1.46  -3.47   0.00   0.00   0.00
53.19
-------------------------------------------------------------------------
------

Segment Leq : 53.19 dBA

Total Leq All Segments: 53.19 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 60.79
                           (NIGHT): 53.19
```

```
STAMSON 5.0        NORMAL REPORT        Date: 20-01-2022 10:51:32
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: bearbrook (day/night)
----------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: bearbrook (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: innes (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: innes (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   9.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 109.00 / 109.00 m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00


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

Source height = 1.50 m

ROAD (0.00 + 65.17 + 0.00) = 65.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     90   0.00  65.72   0.00  -0.54   0.00   0.00   0.00   0.00
65.17
-------------------------------------------------------------------------
------

Segment Leq : 65.17 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 57.27 + 0.00) = 57.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90      9   0.00  68.48   0.00  -8.61  -2.60   0.00   0.00   0.00
57.27
-------------------------------------------------------------------------
------

Segment Leq : 57.27 dBA

Total Leq All Segments: 65.82 dBA


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

Source height = 1.50 m

ROAD (0.00 + 57.57 + 0.00) = 57.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     90   0.00  58.12   0.00  -0.54   0.00   0.00   0.00   0.00
57.57
-------------------------------------------------------------------------
------

Segment Leq : 57.57 dBA
```

```
Results segment # 2: innes (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.67 + 0.00) = 49.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90      9   0.00  60.88   0.00  -8.61  -2.60   0.00   0.00   0.00
49.67
-------------------------------------------------------------------------
------

Segment Leq : 49.67 dBA

Total Leq All Segments: 58.22 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 65.82
                           (NIGHT): 58.22
```

```
STAMSON 5.0         NORMAL REPORT         Date: 20-01-2022 10:51:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: bearbrook (day/night)
----------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: bearbrook (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   8.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  22.00 / 22.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: innes (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: innes (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 102.00 / 109.00 m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 61.41 + 0.00) = 61.41 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90      8   0.00  65.72   0.00  -1.66  -2.64   0.00   0.00   0.00
61.41
-------------------------------------------------------------------------
------

Segment Leq : 61.41 dBA


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

Source height = 1.50 m

ROAD (0.00 + 60.15 + 0.00) = 60.15 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  -8.33   0.00   0.00   0.00   0.00
60.15
-------------------------------------------------------------------------
------

Segment Leq : 60.15 dBA

Total Leq All Segments: 63.84 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 53.81 + 0.00) = 53.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90      8   0.00  58.12   0.00  -1.66  -2.64   0.00   0.00   0.00
53.81
-------------------------------------------------------------------------
------

Segment Leq : 53.81 dBA


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

Source height = 1.50 m

ROAD (0.00 + 52.27 + 0.00) = 52.27 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  -8.61   0.00   0.00   0.00   0.00
52.27
-------------------------------------------------------------------------
------

Segment Leq : 52.27 dBA

Total Leq All Segments: 56.12 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 63.84
                           (NIGHT): 56.12
```

```
STAMSON 5.0        NORMAL REPORT        Date: 20-01-2022 10:51:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Innes (day/night)
-----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Innes (day/night)
---------------------------------------
Angle1   Angle2           :   9.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 109.00 / 109.00 m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 56.40 + 0.00) = 56.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
     9     90   0.00  68.48   0.00  -8.61  -3.47   0.00   0.00   0.00
56.40
-------------------------------------------------------------------------
------

Segment Leq : 56.40 dBA

Total Leq All Segments: 56.40 dBA


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

Source height = 1.50 m

ROAD (0.00 + 48.80 + 0.00) = 48.80 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
     9     90   0.00  60.88   0.00  -8.61  -3.47   0.00   0.00   0.00
48.80
-------------------------------------------------------------------------
------

Segment Leq : 48.80 dBA

Total Leq All Segments: 48.80 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 56.40
                           (NIGHT): 48.80

STAMSON 5.0        NORMAL REPORT        Date: 31-01-2022 18:14:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT
```

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


Road data, segment # 1: bearbrook (day/night)
-----------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: bearbrook (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  33.00 / 33.00  m
Receiver height           :  29.40 / 25.50  m
Topography                :      2       (Flat/gentle slope; with
barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  27.90 m
Barrier receiver distance :  16.00 / 16.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

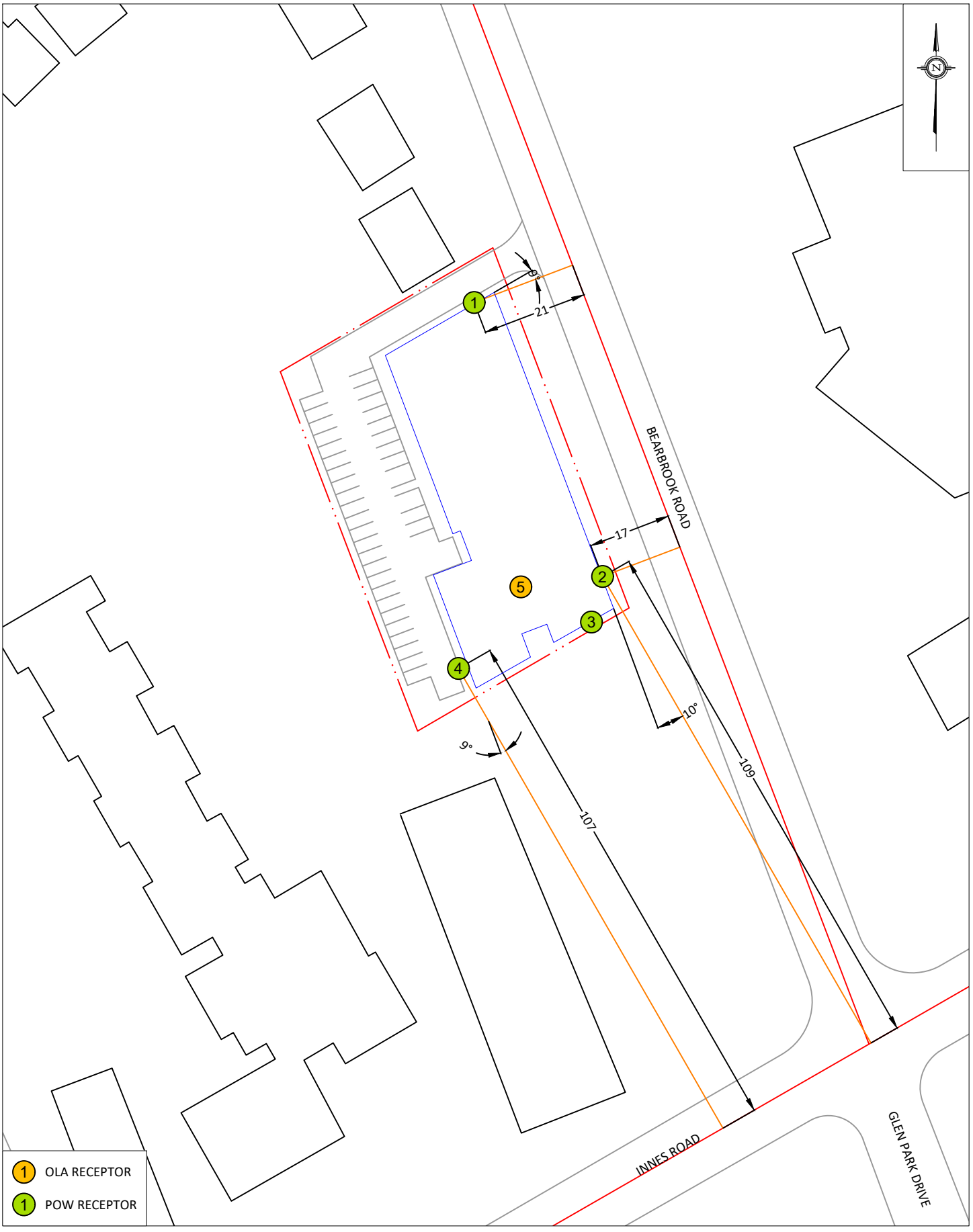
```
Road data, segment # 2: innes (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     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: innes (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 115.00 / 109.00 m
Receiver height           :  29.40 / 25.50  m
Topography                :      2       (Flat/gentle slope; with
barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  27.90 m
Barrier receiver distance :  13.00 / 10.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: bearbrook (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 !       29.40 !       15.87 !        15.87

ROAD (0.00 + 44.71 + 0.00) = 44.71 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     90   0.00  65.72   0.00  -3.42   0.00   0.00   0.00 -17.58
44.71
-------------------------------------------------------------------------
------

Segment Leq : 44.71 dBA
```

```
Results segment # 2: innes (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 !       29.40 !       26.25 !        26.25

ROAD (0.00 + 52.01 + 0.00) = 52.01 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  -8.85   0.00   0.00   0.00  -7.62
52.01
-------------------------------------------------------------------------
------

Segment Leq : 52.01 dBA

Total Leq All Segments: 52.75 dBA
```

```
Results segment # 1: bearbrook (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 !       25.50 !       13.86 !        13.86

ROAD (0.00 + 36.36 + 0.00) = 36.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
------
   -90     90   0.00  58.12   0.00  -3.42   0.00   0.00   0.00 -18.34
36.36
-------------------------------------------------------------------------
------

Segment Leq : 36.36 dBA
```

```
Results segment # 2: innes (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 !       25.50 !       23.30 !        23.30

ROAD (0.00 + 38.26 + 0.00) = 38.26 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  -8.61   0.00   0.00   0.00 -14.01
38.26
-------------------------------------------------------------------------
------

Segment Leq : 38.26 dBA

Total Leq All Segments: 40.42 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 52.75
                           (NIGHT): 40.42
```



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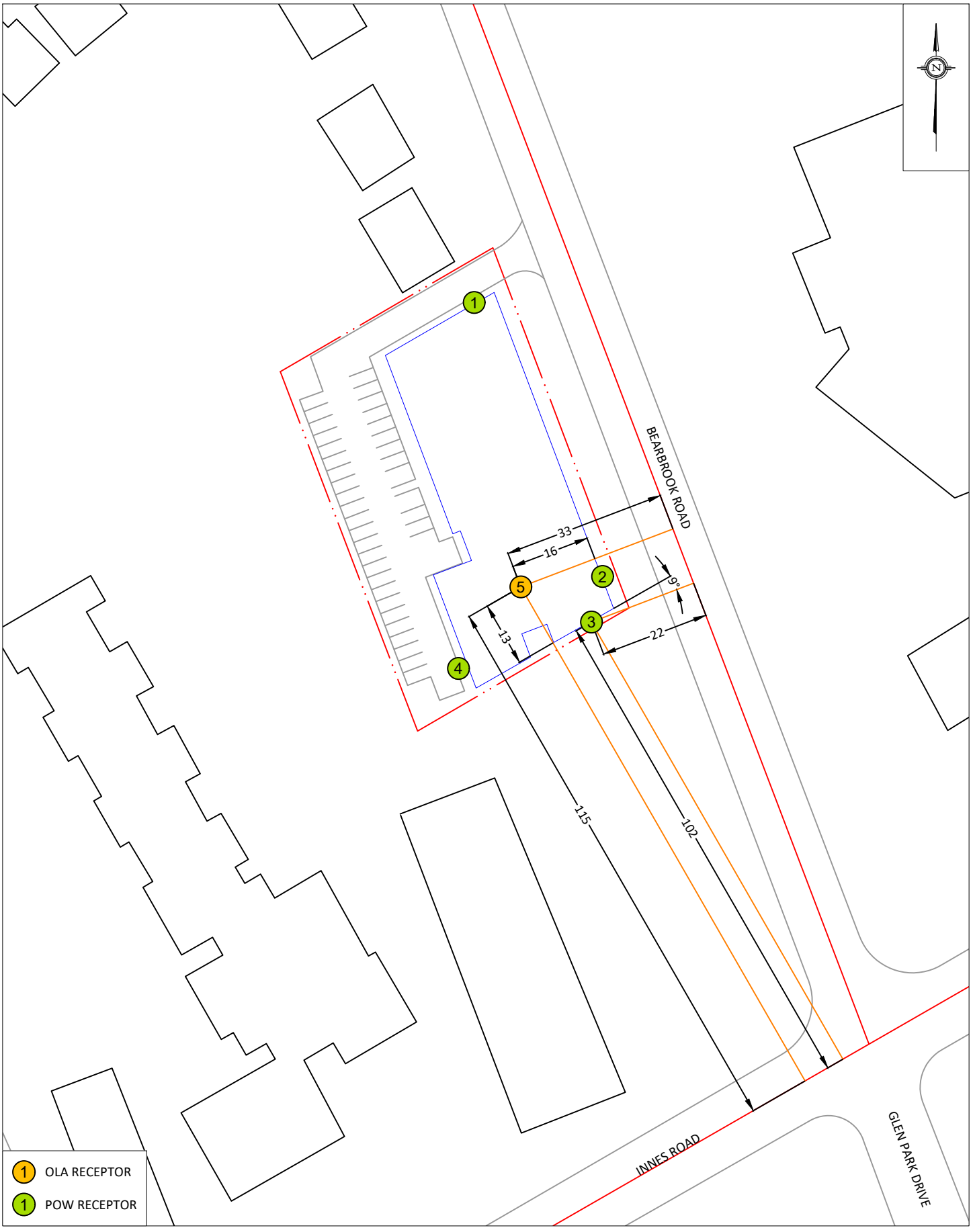
PROJECT	BEARBROOK ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-404-A1
DATE	JANUARY 20, 2022
DRAWN BY	C.A.

DESCRIPTION

FIGURE A1:
STAMSON INPUT PARAMETERS



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PROJECT	BEARBROOK ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW21-404-A2
DATE	JANUARY 20, 2022	DRAWN BY	C.A.

FIGURE A2:
STAMSON INPUT PARAMETERS