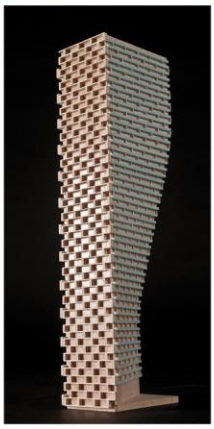
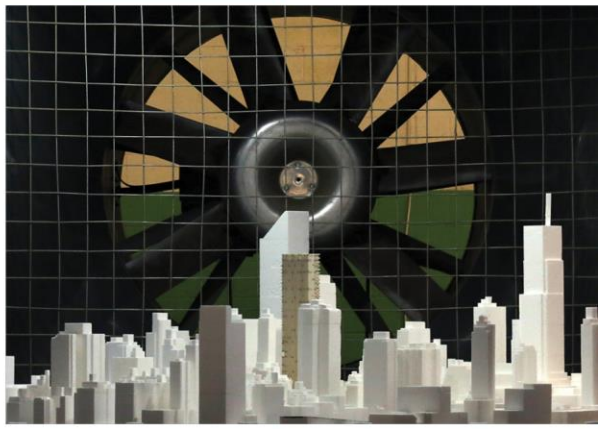
GRADIENTWIND
ENGINEERS & SCIENTISTS

ROADWAY TRAFFIC NOISE ASSESSMENT

3026 Solandt Road
Ottawa, Ontario

REPORT: GWE19-250 – Traffic Noise





January 13, 2020

PREPARED FOR

Colonnade BridgePort
Attn: Bonnie Martell
Development Manager
100 Argyle Avenue, Suite 200
Ottawa, Ontario
K2P 1B6

PREPARED BY

Efser Kara, MSc, LEED GA, Acoustic Scientist
Joshua Foster, P.Eng., Principal

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

EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken in support of the site plan application for a proposed development located at 3026 Solandt Road in Ottawa, Ontario. The development is a 5-storey office building. 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) site plan drawings prepared by N45 Architecture Inc. dated January 2020.

The results of the current analysis indicate that noise levels will range between 61 and 72 dBA during the daytime period (07:00-23:00) and between 54 and 65 dBA during the nighttime period (23:00-07:00) at Plane of Window (POW) receptors. The highest noise level (72 dBA) occurs at the southwest façade, which is the nearest and most exposed to March Road. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 8.

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 working environment. A Warning Clause[1] will also be required in all Lease, Purchase and Sale Agreements.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Colonnade BridgePort to undertake a roadway traffic noise assessment in support of the site plan application for a proposed office building at 3026 Solandt Road 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 N45 Architecture Inc. dated January 2020, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed 5-storey office building at 3026 Solandt Road in Ottawa, Ontario. The site is bounded by March Road to the southwest, Solandt Road to the northwest, and existing commercial buildings at the northeast and southeast of the proposed development. The building has a square layout with an area of 1860 m². A 12 m setback from the property line provides for green space at the northwest and southwest sides of the building and a walkway from the main entrance toward Solandt Road. A commercial patio is proposed on the southwest side of the building, however this is not considered an outdoor living area, because the outdoor space is associated with commercial purposed building.

The major sources of traffic noise are March Road to the southwest and Solandt Road to the northwest of the site. Figure 1 illustrates a complete site plan with the surrounding context.

[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

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 and 45 dBA for general offices and individual or semi-private offices respectively for roadway as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [4]

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[5]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[6]. 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[7].

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. It should however be noted there is no outdoor living areas associated with this development.

[4] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[5] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[6] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[7] MOECP, 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 Ministry of the Environment, Conservations and Parks' (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 roads 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 heights were taken to be 13.5 metres at Level 5 for the centre of the window (height to the 5th-floor slab + 1.5 metres).
- Noise receptors were strategically placed at 5 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figures 3-7.

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[8] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 summarizes the AADT values used for each roadway included in this assessment.

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
March Road	4 Lane Urban Arterial-Divided	80	**35,000**
Solandt Road	2 Lane Urban Collector	50	**8,000**

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[9] considers:

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

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

Based on published research[10], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, 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).

RESULTS AND DISCUSSION

4.4 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 – Southwest Façade	72	65
2	13.5	POW – 5th Floor – Southeast Façade	69	61
3	13.5	POW – 5th Floor – Northeast Façade	57	50
4	13.5	POW – 5th Floor – Northwest Façade	68	60
5	13.5	POW – 5th Floor – Southwest Façade	73	65

The results of the current analysis indicate that noise levels will range between 61 and 72 dBA during the daytime period (07:00-23:00) and between 54 and 65 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the southwest façade, which overviews and is most exposed to March Road.

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

4.5 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 and walls 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 the City of Ottawa requirements, detailed STC calculations will be required to be completed prior to building permit application. The STC requirements for the windows are summarized below for various units within the development (see Figure 8):

- **Windows**

(i) All windows should have a minimum STC of 30

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

- **Exterior Walls**

(i) All Exterior wall components will require a minimum STC of 45, which can be achieved with brick cladding or an acoustical equivalent commercial exterior wall system according to NRC test data[11]

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 window/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 that have a combination of glass thickness and inter-pane spacing. 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 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 working environment. In addition to ventilation requirements, Warning Clauses will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 5.

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

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 61 and 72 dBA during the daytime period (07:00-23:00) and between 54 and 65 dBA during the nighttime period (23:00-07:00). The highest noise level (72 dBA) occurs at the southwest façade, which is the nearest and most exposed to March Road. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 8.

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 working environment. The following Warning Clause[12] will also need to be placed on all Lease, Purchase and Sale Agreements, as summarized below:

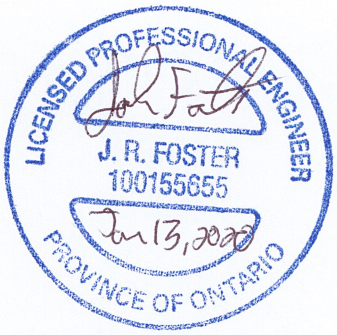
> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the office units, sound levels due to increasing roadway traffic may, on occasion, interfere with some activities of the dwelling occupants, as the sound levels exceed the sound level limits of the City and the Ministry of the Environment Conservation and Parks. To help address the need for sound attenuation, this development includes:*
>
> - *STC rated multi-pane glazing elements and spandrel panels*
> - *All façade: STC 30*
> - *STC rated exterior walls*
> - *All façade: STC 45*
>
> *This building has also been designed with a central air conditioning system. Air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment Conservation and Parks.*
>
> *To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features."*

[12] City of Ottawa Environmental Noise Control Guidelines, January 2016

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,

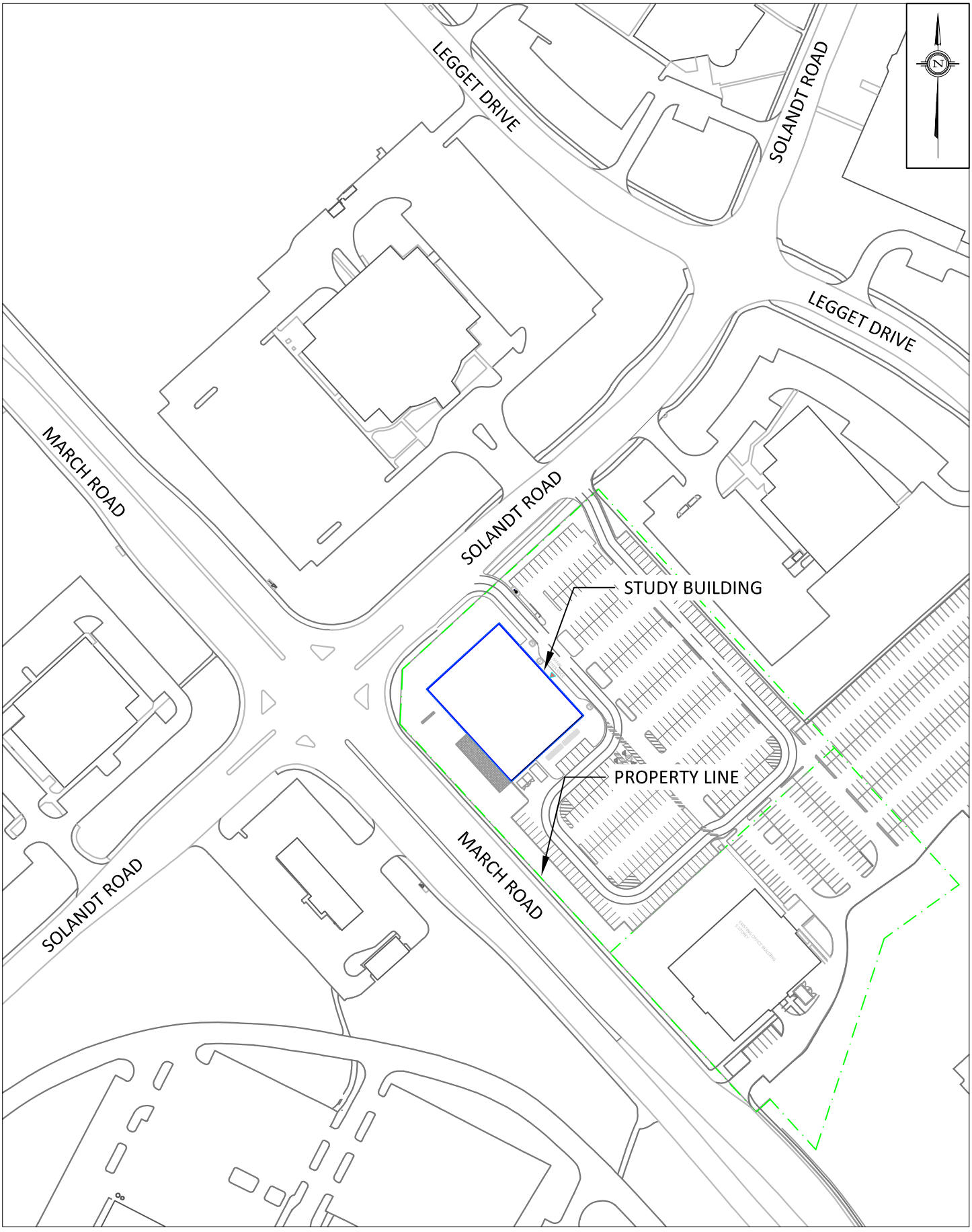
Gradient Wind Engineering Inc.



Efser Kara, MSc, LEED GA
Acoustic Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File# 19-250 – Roadway Traffic Noise Assessment



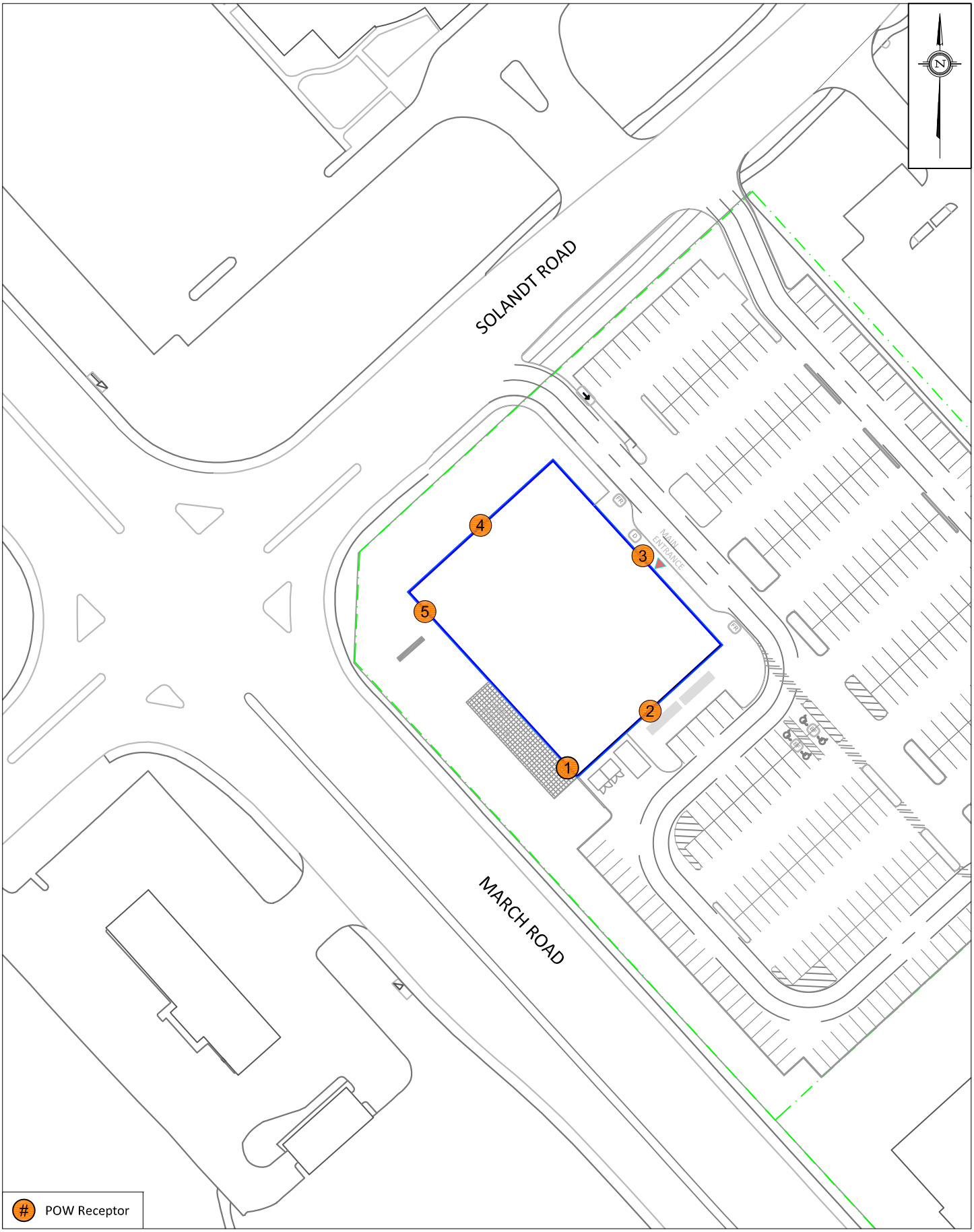
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE19-250-1
DATE	JANUARY 9, 2020
DRAWN BY	E.K.

DESCRIPTION

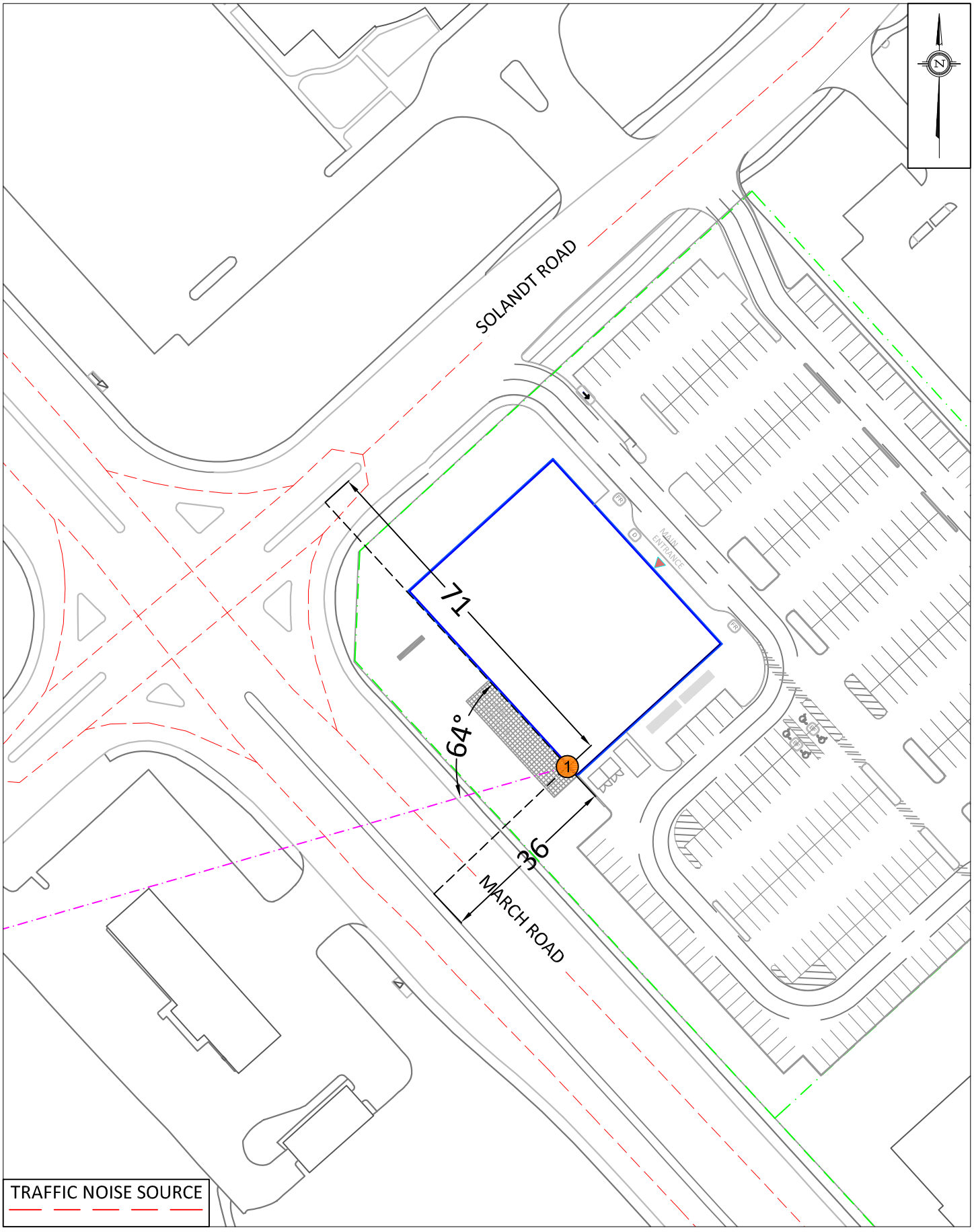
FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO. GWE19-250-2	FIGURE 2: RECEPTOR LOCATIONS
DATE	JANUARY 9, 2020	DRAWN BY E.K.	



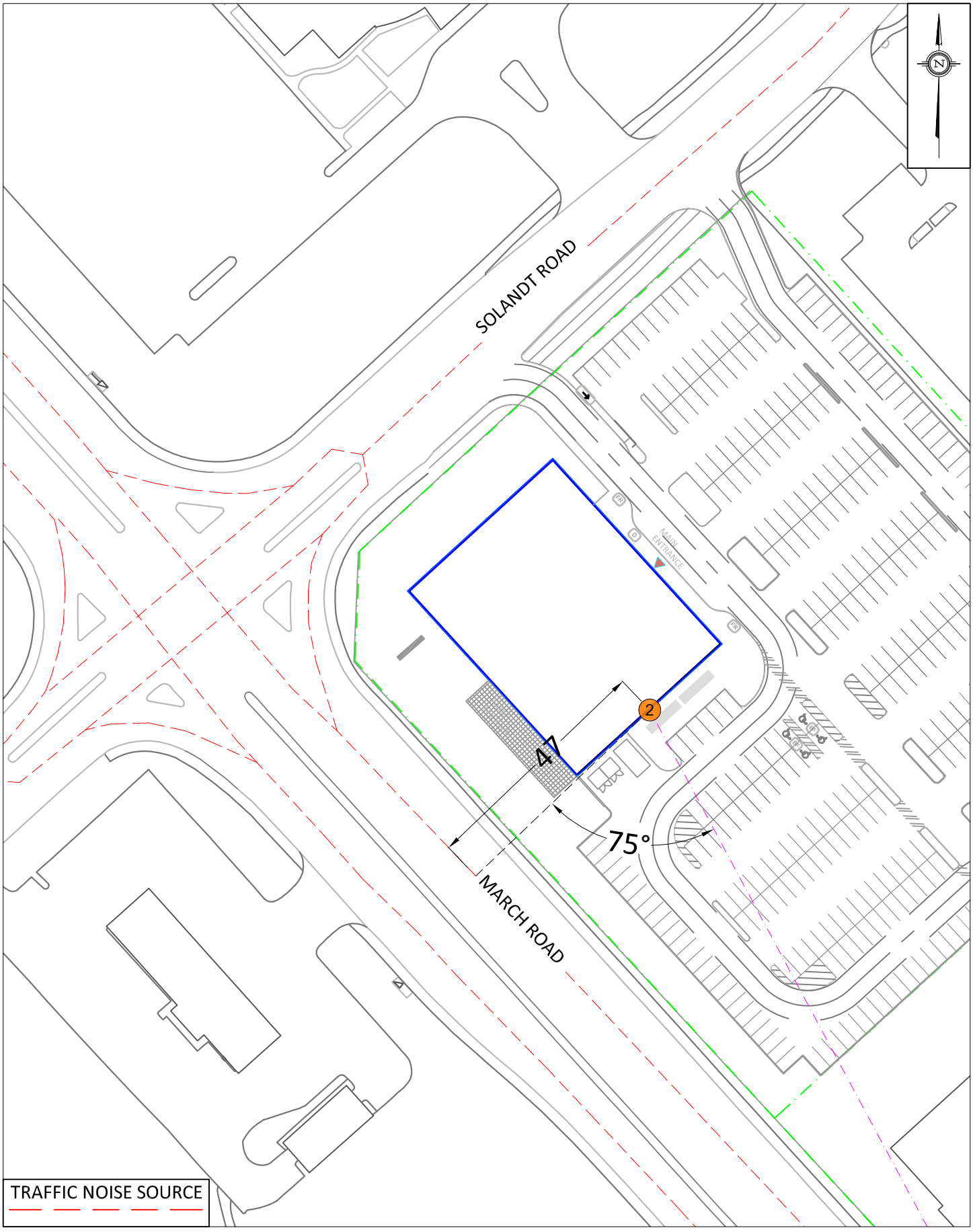
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-250-3
DATE	JANUARY 9, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 3:
STAMSON INPUT PARAMETERS
FOR RECEPTOR 1

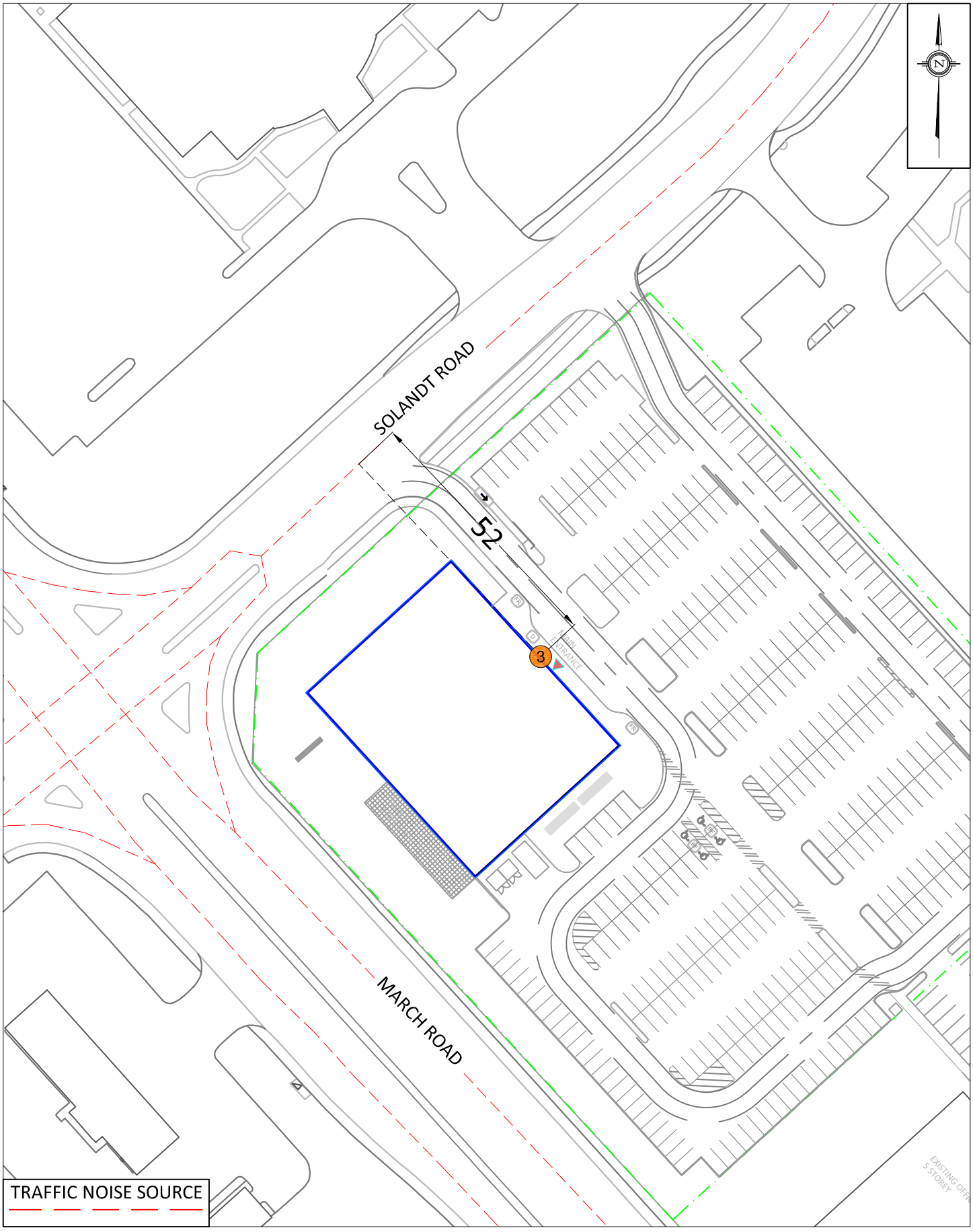


GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-250-4
DATE	JANUARY 9, 2020	DRAWN BY	E.K.

FIGURE 4:
STAMSON INPUT PARAMETERS
FOR RECEPTOR 2



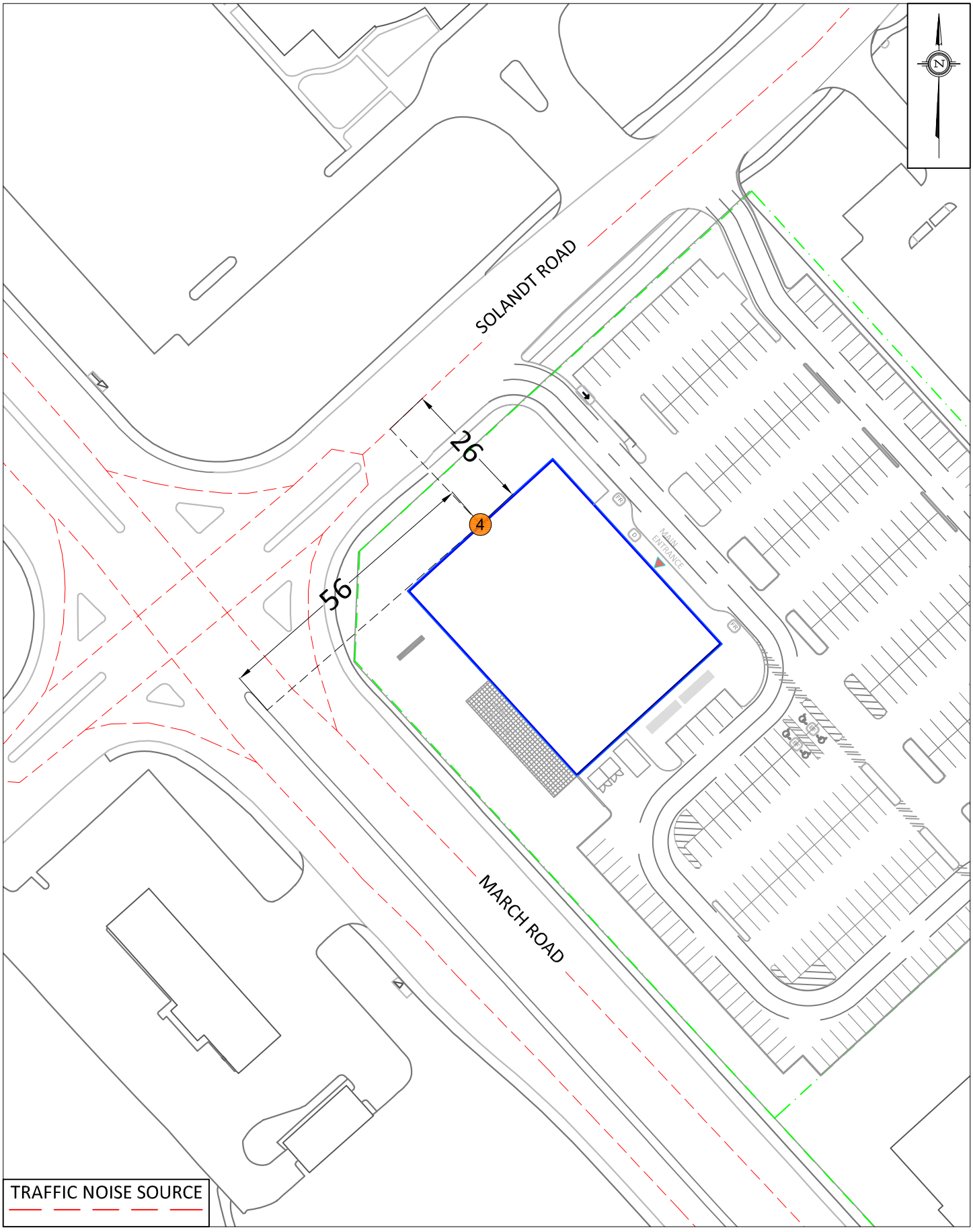
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-250-5
DATE	JANUARY 9, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 5:
STAMSON INPUT PARAMETERS
FOR RECEPTOR 3



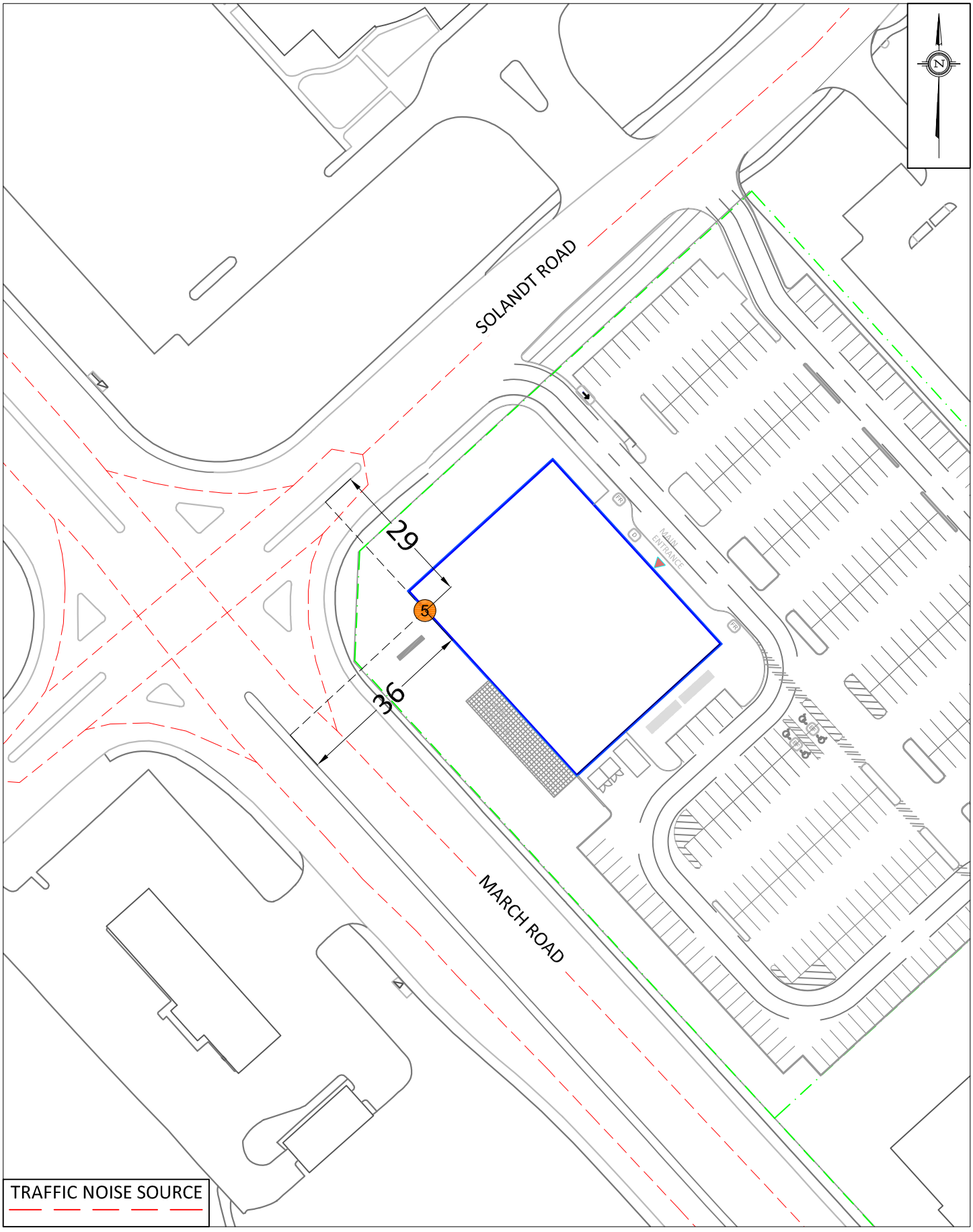
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-250-6
DATE	JANUARY 9, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 6:
STAMSON INPUT PARAMETERS
FOR RECEPTOR 4



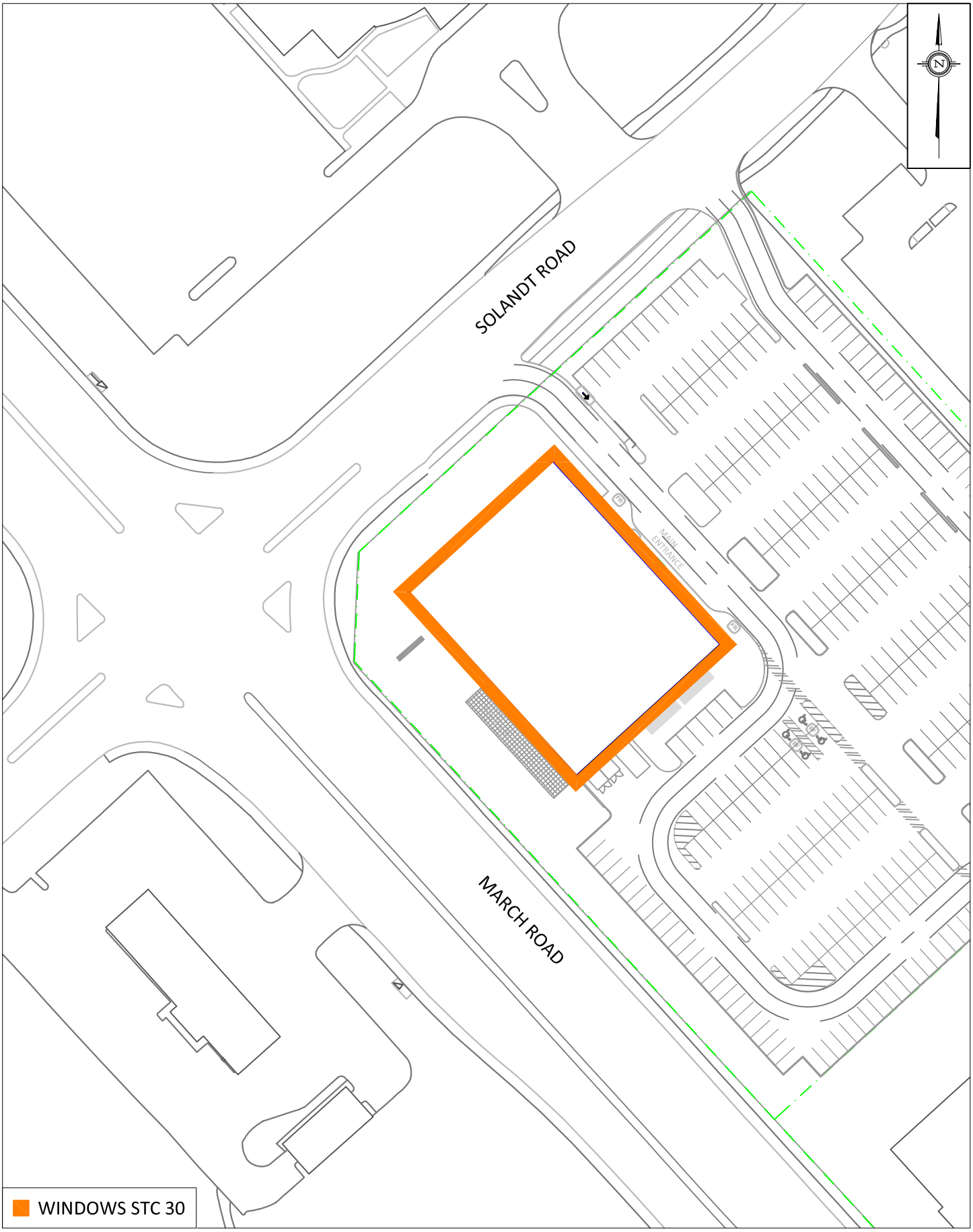
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-250-7
DATE	JANUARY 9, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 7:
STAMSON INPUT PARAMETERS
FOR RECEPTOR 5



GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	3026 SOLANDT ROAD, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-250-8
DATE	JANUARY 9, 2020	DRAWN BY	E.K.

FIGURE 8:
WINDOW STC REQUIREMENTS

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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

STAMSON 5.0 NORMAL REPORT Date: 08-01-2020 16:07:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: March Rd (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: March Rd (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  :  36.00 / 36.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Solandt Rd (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  :    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):   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: Solandt Rd (day/night)
--------------------------------------------
Angle1   Angle2           : -64.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  71.00 / 71.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: March Rd (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 72.36 + 0.00) = 72.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  76.17   0.00  -3.80   0.00   0.00   0.00   0.00
72.36
-------------------------------------------------------------------------------
--

Segment Leq : 72.36 dBA
```

```
Results segment # 2: Solandt Rd (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.51 + 0.00) = 54.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64      0   0.00  65.75   0.00  -6.75  -4.49   0.00   0.00   0.00
54.51
-------------------------------------------------------------------------
--

Segment Leq : 54.51 dBA

Total Leq All Segments: 72.43 dBA


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

Source height = 1.50 m

ROAD (0.00 + 64.77 + 0.00) = 64.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  68.57   0.00  -3.80   0.00   0.00   0.00   0.00
64.77
-------------------------------------------------------------------------
--

Segment Leq : 64.77 dBA
```

```
Results segment # 2: Solandt Rd (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.91 + 0.00) = 46.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -64      0   0.00  58.16   0.00  -6.75  -4.49   0.00   0.00   0.00
46.91
-------------------------------------------------------------------------
--

Segment Leq : 46.91 dBA

Total Leq All Segments: 64.84 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 72.43
                           (NIGHT): 64.84
```

STAMSON 5.0 NORMAL REPORT Date: 08-01-2020 16:11:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: March Rd (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: March Rd (day/night)
----------------------------------------------
Angle1   Angle2           : -75.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  36.00 / 36.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 68.56 + 0.00) = 68.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -75      0   0.00  76.17   0.00  -3.80  -3.80   0.00   0.00   0.00
68.56
-------------------------------------------------------------------------
--

Segment Leq : 68.56 dBA

Total Leq All Segments: 68.56 dBA


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

Source height = 1.50 m

ROAD (0.00 + 60.97 + 0.00) = 60.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -75      0   0.00  68.57   0.00  -3.80  -3.80   0.00   0.00   0.00
60.97
-------------------------------------------------------------------------
--

Segment Leq : 60.97 dBA

Total Leq All Segments: 60.97 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 68.56
                           (NIGHT): 60.97
```

STAMSON 5.0 NORMAL REPORT Date: 09-01-2020 10:42:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: Solandt Rd (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  :    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):   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: Solandt Rd (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  :  52.00 / 52.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 57.34 + 0.00) = 57.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  65.75   0.00  -5.40  -3.01   0.00   0.00   0.00
57.34
-------------------------------------------------------------------------
--

Segment Leq : 57.34 dBA

Total Leq All Segments: 57.34 dBA


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

Source height = 1.50 m

ROAD (0.00 + 49.75 + 0.00) = 49.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  58.16   0.00  -5.40  -3.01   0.00   0.00   0.00
49.75
-------------------------------------------------------------------------
--

Segment Leq : 49.75 dBA

Total Leq All Segments: 49.75 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 57.34
                           (NIGHT): 49.75
```

STAMSON 5.0 NORMAL REPORT Date: 08-01-2020 16:23:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: March Rd (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: March Rd (day/night)
----------------------------------------------
Angle1   Angle2           :   0.00 deg   61.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  56.00 / 56.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Solandt Rd (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  :    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):   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: Solandt Rd (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  :  26.00 / 26.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 65.75 + 0.00) = 65.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     61   0.00  76.17   0.00  -5.72  -4.70   0.00   0.00   0.00
65.75
-------------------------------------------------------------------------
--

Segment Leq : 65.75 dBA


Results segment # 2: Solandt Rd (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.36 + 0.00) = 63.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  65.75   0.00  -2.39   0.00   0.00   0.00   0.00
63.36
-------------------------------------------------------------------------
--

Segment Leq : 63.36 dBA

Total Leq All Segments: 67.73 dBA
```

```
Results segment # 1: March Rd (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     61   0.00  68.57   0.00  -5.72  -4.70   0.00   0.00   0.00
58.15
-------------------------------------------------------------------------
--

Segment Leq : 58.15 dBA


Results segment # 2: Solandt Rd (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.77 + 0.00) = 55.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  58.16   0.00  -2.39   0.00   0.00   0.00   0.00
55.77
-------------------------------------------------------------------------
--

Segment Leq : 55.77 dBA

Total Leq All Segments: 60.13 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 67.73
                           (NIGHT): 60.13
```

STAMSON 5.0 NORMAL REPORT Date: 08-01-2020 16:44:19
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: March Rd (day/night)
----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: March Rd (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  :  36.00 / 36.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Solandt Rd (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  :    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):   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: Solandt Rd (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  :  29.00 / 29.00  m
Receiver height           :  13.50 / 13.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 72.36 + 0.00) = 72.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  76.17   0.00  -3.80   0.00   0.00   0.00   0.00
72.36
-------------------------------------------------------------------------
--

Segment Leq : 72.36 dBA


Results segment # 2: Solandt Rd (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.88 + 0.00) = 59.88 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  65.75   0.00  -2.86  -3.01   0.00   0.00   0.00
59.88
-------------------------------------------------------------------------
--

Segment Leq : 59.88 dBA

Total Leq All Segments: 72.60 dBA
```

```
Results segment # 1: March Rd (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.77 + 0.00) = 64.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  68.57   0.00  -3.80   0.00   0.00   0.00   0.00
64.77
-------------------------------------------------------------------------------
--

Segment Leq : 64.77 dBA


Results segment # 2: Solandt Rd (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.28 + 0.00) = 52.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  58.16   0.00  -2.86  -3.01   0.00   0.00   0.00
52.28
-------------------------------------------------------------------------------
--

Segment Leq : 52.28 dBA

Total Leq All Segments: 65.01 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 72.60
                           (NIGHT): 65.01
```