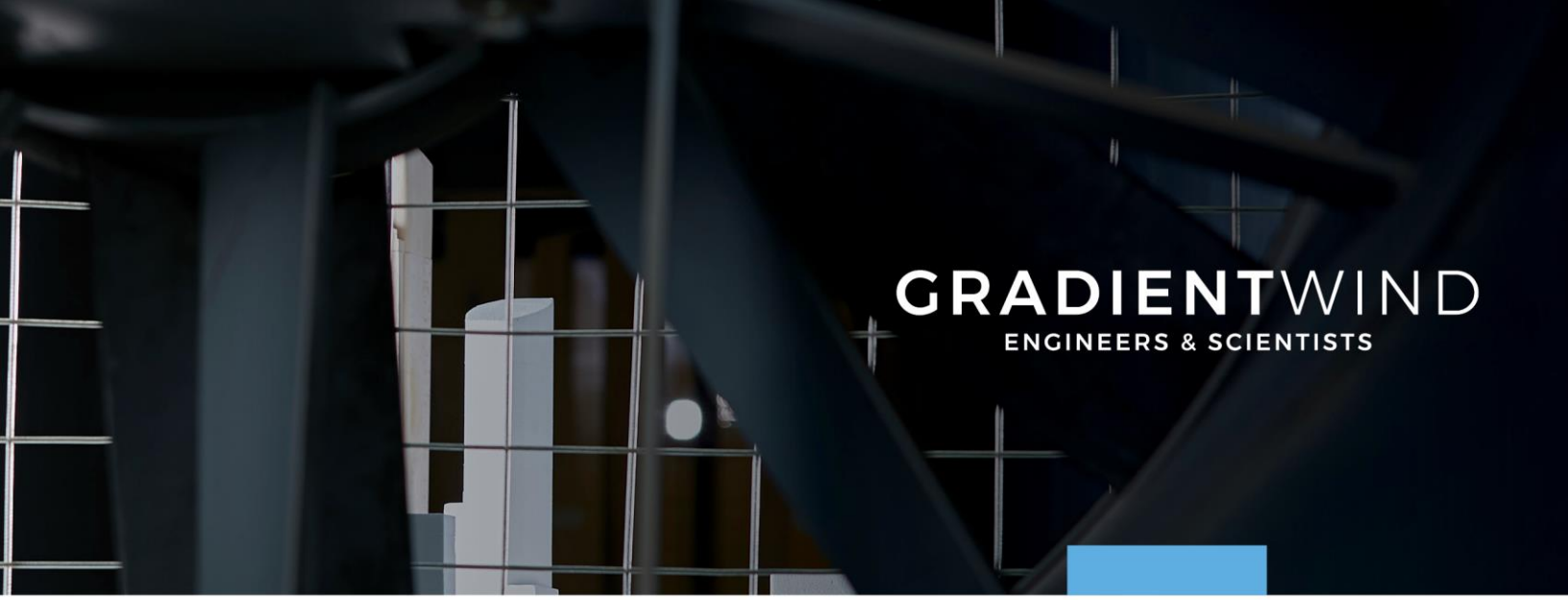

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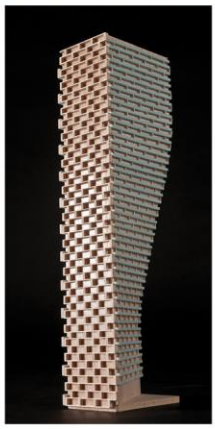
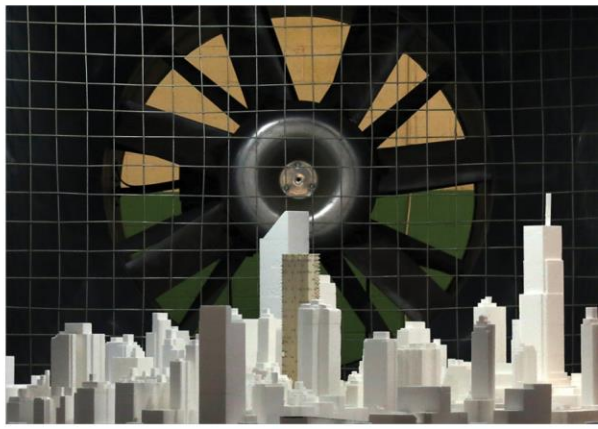
ROADWAY TRAFFIC NOISE ASSESSMENT

114 Isabella Street
Ottawa, Ontario

Report: 19-244-Traffic Noise





February 28, 2020

DRAFT

PREPARED FOR
Smart Debt Mortgages
110-150 Isabella Street
Ottawa, ON K1S 1V7

Attn: Chris Allard, AMP
chris@chrisallard.ca

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

EXECUTIVE SUMMARY

This report describes a detailed roadway traffic noise assessment performed for the proposed development located at 114 Isabella Street in Ottawa, Ontario. The development is a 7-storey, rectangular planform building. The major sources of roadway traffic noise are Highway 417 and Isabella Street running along the north perimeter of the site. The site is surrounded by midrise and lowrise residential buildings. 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) architectural drawings prepared by Project1 Studio.

The results of the current analysis indicate that noise levels will be 79 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 71 dBA during the nighttime period (23:00-07:00). The highest noise levels occur along the north façade, which is nearest and most exposed to Highway 417. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figures 6 and 7. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building when more information on the building assemblies is available.

The results of the calculations also indicate that the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. Warning clauses 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 Smart Debt Mortgages, to undertake a roadway traffic noise assessment study to satisfy the requirements for a site plan control application (SPA) submission for the proposed residential development located at 114 Isabella Street 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 Project1 Studio, dated February 11th, 2020, with future traffic volumes corresponding to roadway classification and theoretical roadway capacities.

2. TERMS OF REFERENCE

The subject site is located at 114 Isabella Street in Ottawa, and is situated on a parcel of land bordered by Isabella Street to the north, Metcalfe Street to the east, Pretoria Avenue to the south, and O'Connor Street to the west.

The subject site features a 7-storey building fronting Isabella Street. The building has a rectangular planform at grade, with a diagonal setback from the northwest corner at Level 3, followed by another small setback from the northwest corner at Level 5. The building is served by a mechanical penthouse on the roof level. Private balconies are provided on the south elevation. The main entrance is located at the northwest corner of the building, while a secondary entrance is located at the southeast corner. An exit is located at the northeast corner. The building comprises residential occupancy and includes an outdoor amenity area at grade, to the south of the proposed development.

The major sources of roadway traffic noise are Highway 417 and Isabella Street running along the north perimeter of the site. The site is surrounded by midrise and lowrise buildings which are mostly residential. Figure 1 illustrates the site plan with the surrounding context.

[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 (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	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[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 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. If these measures are not provided, prospective purchasers or tenants should be informed of potential noise problems by a warning clause.

[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

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. Highway 417 is elevated approximately 6 m above local grade.
- As the façade is narrow, one receptor was used on the front (north) façade, and one receptor at west and east facades (see Figures 3, 4, and 5). Since the rear façade and the backyard amenity space is blocked by the study building and the neighbouring buildings, traffic noise at these locations is not expected to exceed the ENCG criteria.
- Receptor heights were taken to be 19.5 m above grade at the centre of the window on Level 7 (height to the floor slab, 18 m + 1.5 metres). The receptor distances to roadway traffic and exposure angles are illustrated in Figures 3, 4, and 5.

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
Highway 417	6 Lane Freeway	100	**110,000**
Isabella Street	2-Lane Urban Arterial (2-UAU)	50	**15,000**

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 are achieved. 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 research8, 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).

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	19.5	POW North Façade – Level 7	79	71
2	19.5	POW East Façade – Level 7	76	68
3	19.5	POW West Façade – Level 7	76	68

The results of the current analysis indicate that noise levels will be 79 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 71 dBA during the nighttime period (23:00-07:00). The highest noise levels occur along the north façade, which is nearest and most exposed to Highway 417.

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 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

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

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 Figures 6 and 7):

- **Bedroom Windows**

(i) Bedroom windows facing north will require a minimum STC of 39

(ii) Bedroom windows facing east and west will require a minimum STC of 35

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

- **Living Room Windows**

(i) Living room windows facing north, east, and west will require a minimum STC of 35

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

Examples of glazing assemblies wihcih will meet the STC requirements are outlined below. Similar assemblies which meeth the STC requirments

Bedroom Windows – STC 39

- 6.35 mm laminated glass
- 12.7 mm air gap
- 6 mm glass

Bedroom Windows (east and west facades) and Living Room Windows – STC 35

- 6 mm glass
- 12.7 mm air gap
- 6 mm glass

- **Exterior Walls**

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

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

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 punched 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 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 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will be 79 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 71 dBA during the nighttime period (23:00-07:00). The highest noise levels occur along the north façade, which is nearest and most exposed to Highway 417. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figures 6 and 7. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building when more information on the building assemblies is available.

The results of the calculations also indicate that the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. Warning clauses will also be required in all Lease, Purchase and Sale Agreements:

"Purchasers/tenants are advised that sound levels due to increasing road and transitway traffic will interfere with outdoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment.

To help address the need for sound attenuation this development includes:

- *Multi-pane glazing with STC 39for north bedroom windows*
- *Multi-pane glazing with STC 35 for east and west bedrooms, and north, east, and west living rooms*
- *A minimum sound transmission class (STC) rating of 45 for north, east and west exterior walls*

To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features.

This dwelling unit has been supplied with a central air conditioning system and other measures 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 City and the Ministry of the Environment."

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.

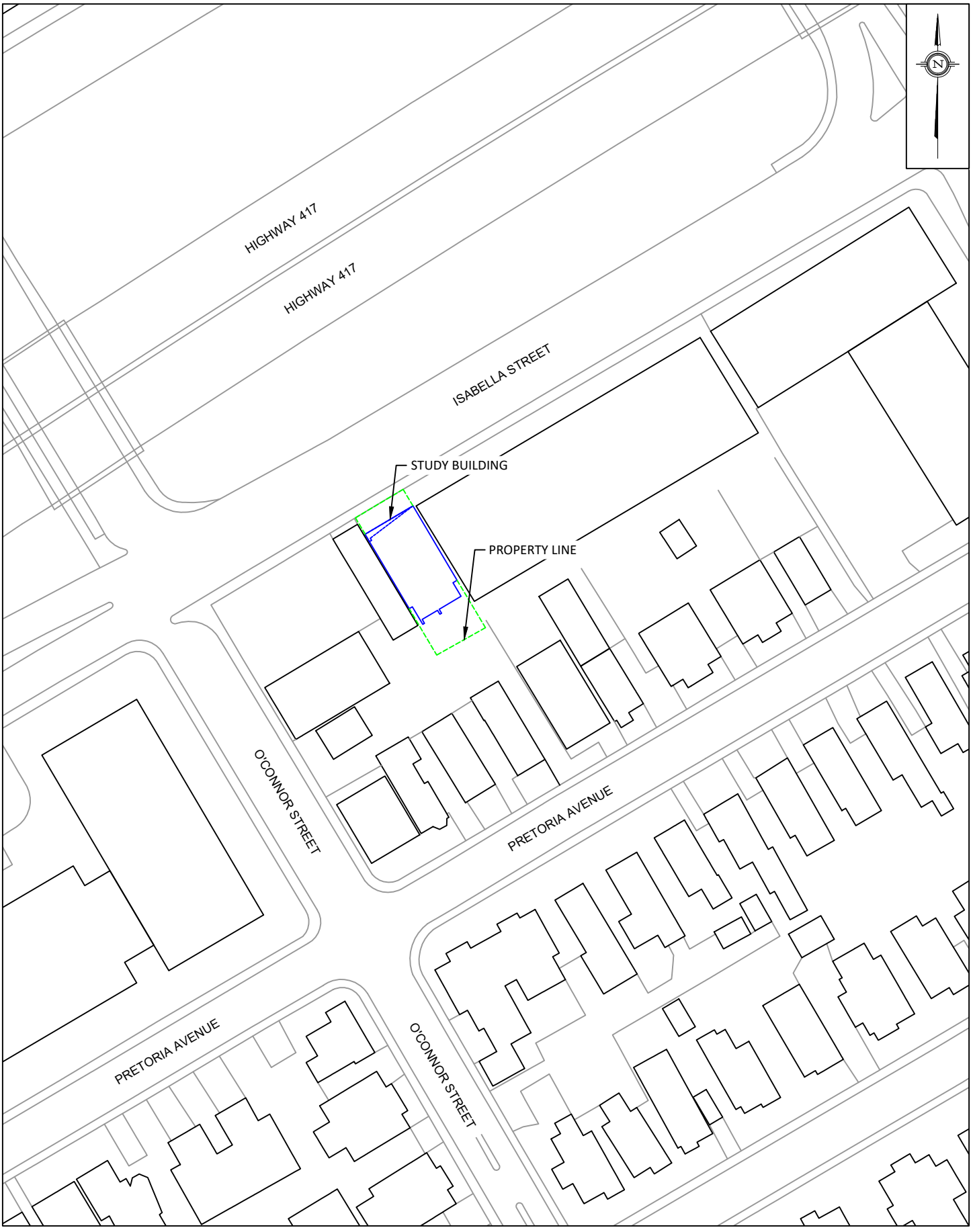
Sincerely,

Gradient Wind Engineering Inc.

Efser Kara, MSc, LEED GA
Acoustic Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #19-244-Traffic Noise



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PROJECT	114 ISABELLA STREET OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-244-1
DATE	FEBRUARY 21, 2020	DRAWN BY	E.K.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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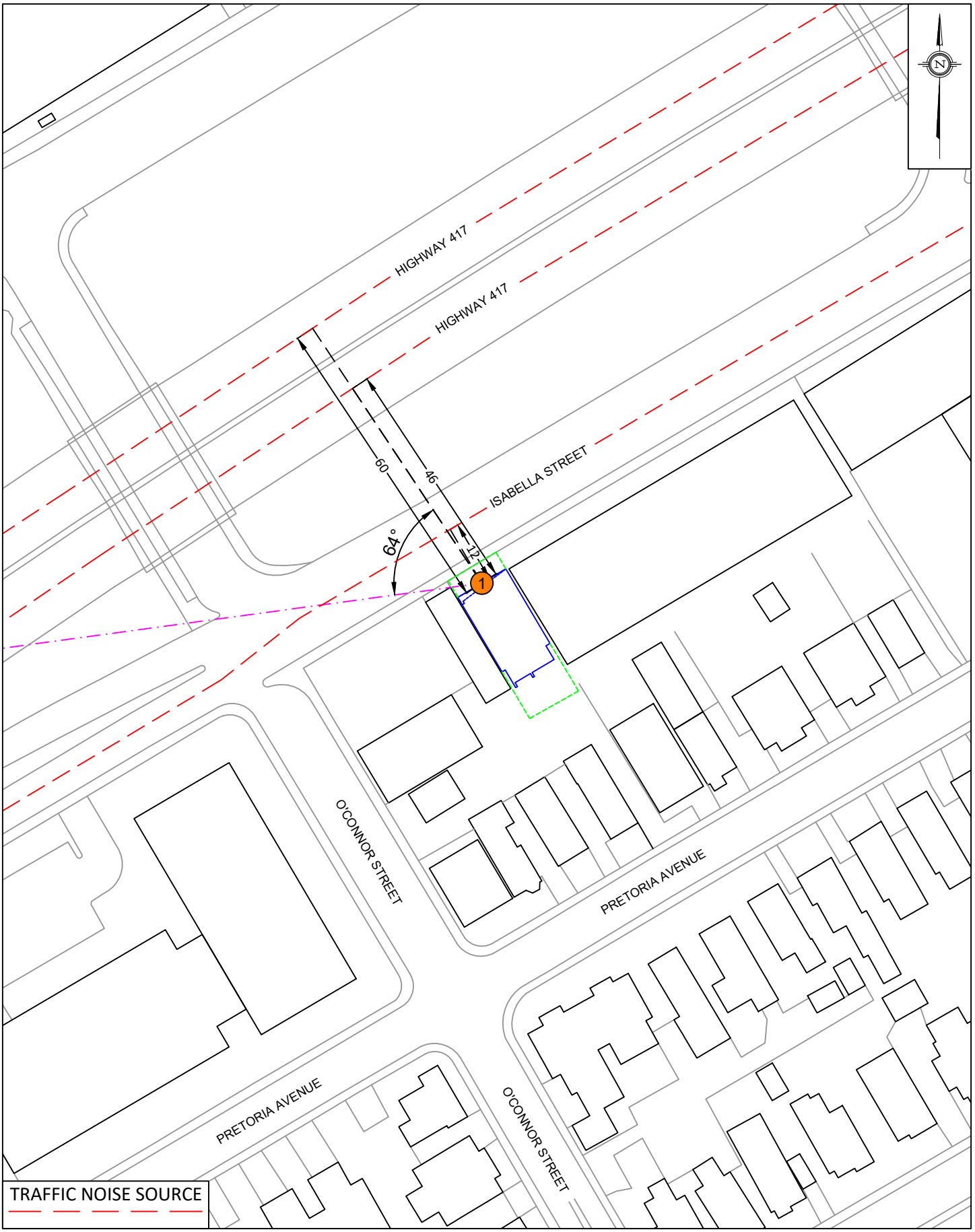
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-244-2
DATE	FEBRUARY 21, 2020	DRAWN BY	E.K.

FIGURE 2:
RECEPTOR LOCATIONS



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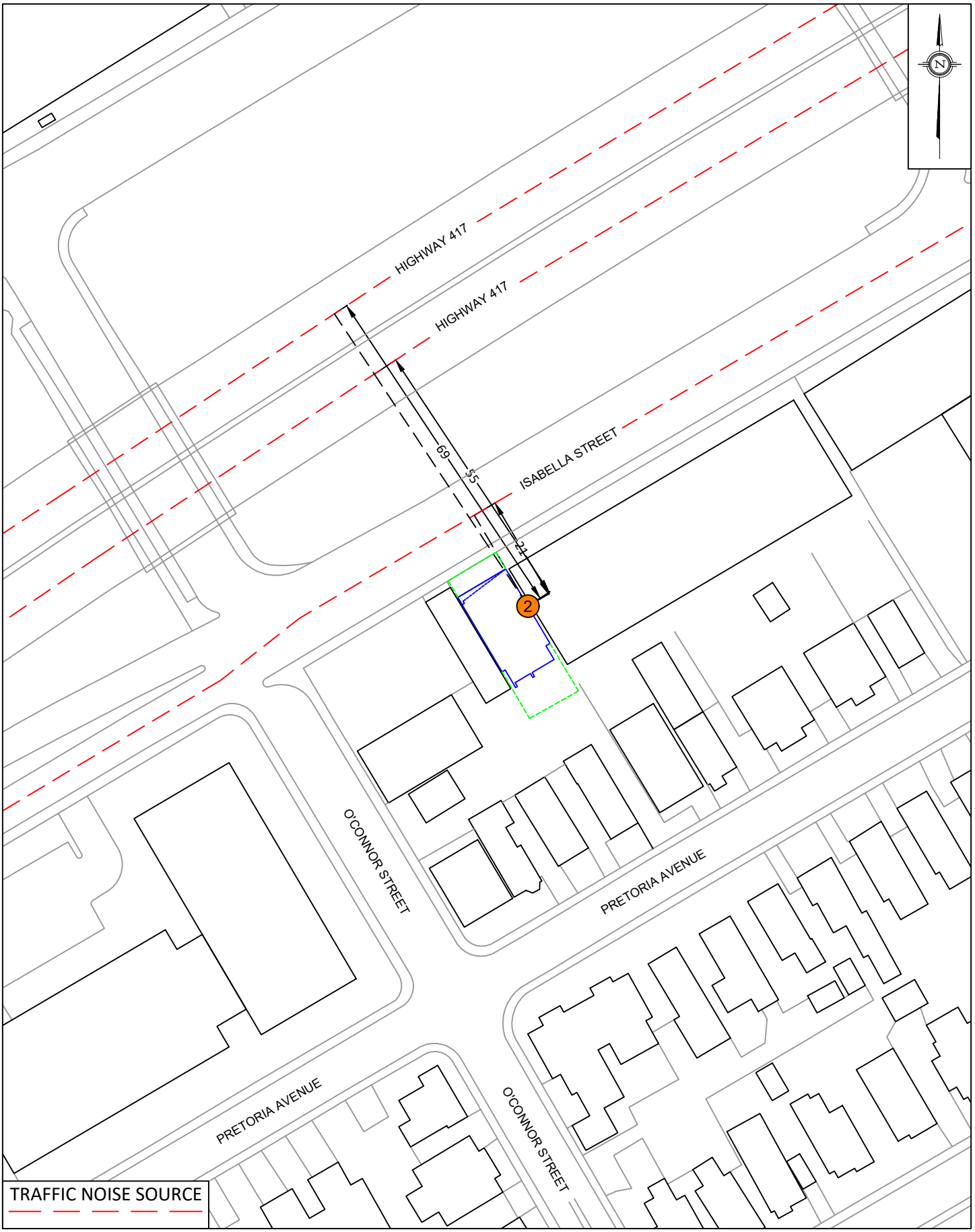
PROJECT	114 ISABELLA STREET OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-244-3
DATE	FEBRUARY 21, 2020	DRAWN BY	E.K.

FIGURE 3:
STAMSON INPUT PARAMETERS FOR RECEPTOR 1



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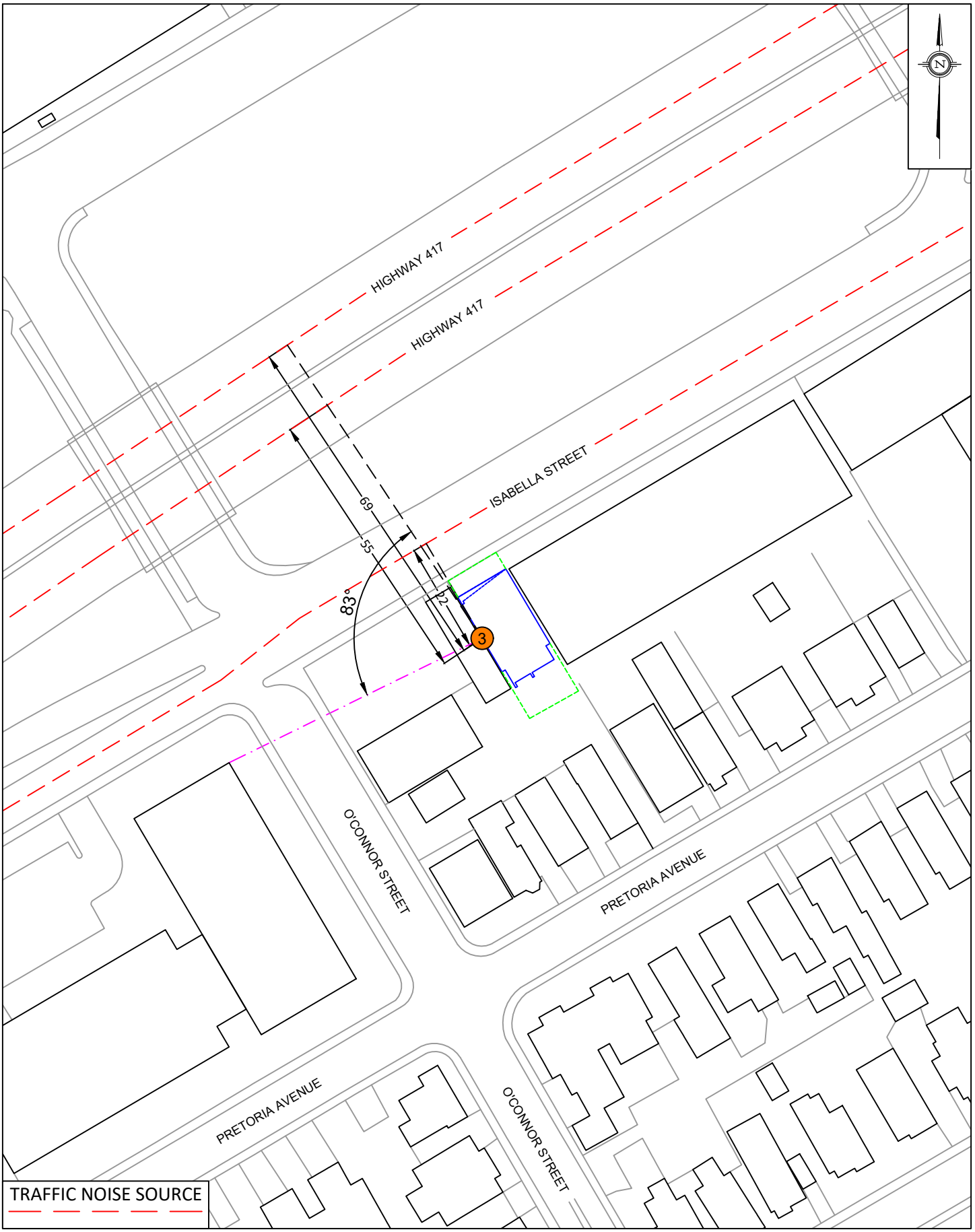
PROJECT	114 ISABELLA STREET OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-244-4
DATE	FEBRUARY 21, 2020	DRAWN BY	E.K.

FIGURE 4:
STAMSON INPUT PARAMETERS FOR RECEPTOR 2



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PROJECT	114 ISABELLA STREET OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION FIGURE 5: STAMSON INPUT PARAMETERS FOR RECEPTOR 3
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-244-5
DATE	FEBRUARY 21, 2020	DRAWN BY	E.K.

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PROJECT	114 ISABELLA STREET OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-244-6
DATE	FEBRUARY 21, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 6:
STC REQUIREMENTS
FOR BEDROOM WINDOWS

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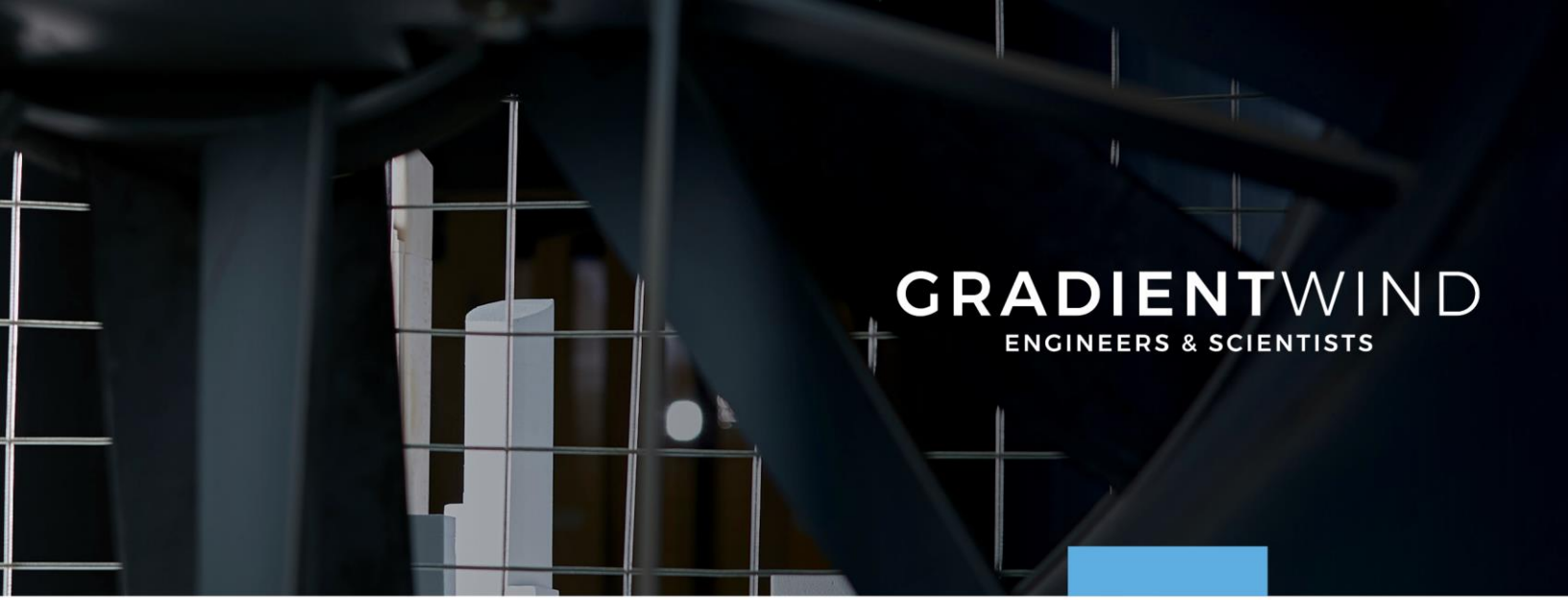
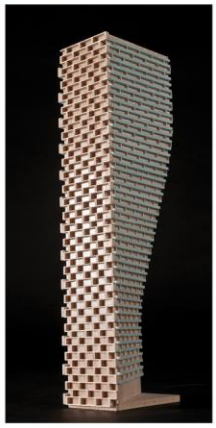
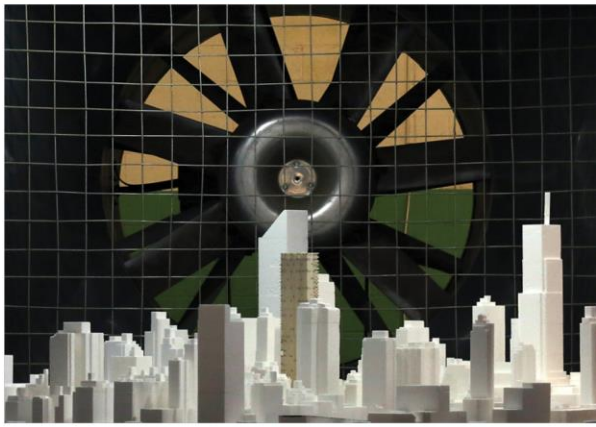
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-244-7
DATE	FEBRUARY 21, 2020
DRAWN BY	E.K.

DESCRIPTION

FIGURE 7:
STC REQUIREMENTS
FOR LIVING ROOM WINDOWS







APPENDIX A

STAMSON INPUT-OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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STAMSON 5.0 NORMAL REPORT Date: 20-02-2020 16:53:44
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r01.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Trans-Can-1 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
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: Trans-Can-1 (day/night)

Angle1 Angle2 : -64.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 60.00 / 60.00 m
Receiver height : 19.50 / 19.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -64.00 deg Angle2 : 90.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 59.90 / 59.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Road data, segment # 2: Isabella St (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 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: Isabella St (day/night)

Angle1 Angle2 : -64.00 deg 90.00 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 : 19.50 / 19.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Trans-Can-2 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 3: Trans-Can-2 (day/night)

Angle1 Angle2 : -64.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 46.00 / 46.00 m
Receiver height : 19.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -64.00 deg Angle2 : 90.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 45.90 / 45.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Results segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.52 ! 7.52

ROAD (0.00 + 73.45 + 0.00) = 73.45 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 80.15 0.00 -6.02 -0.68 0.00 0.00 -0.09 73.35*
-64 90 0.00 80.15 0.00 -6.02 -0.68 0.00 0.00 0.00 73.45
---

* Bright Zone !

Segment Leq : 73.45 dBA

Results segment # 2: Isabella St (day)

Source height = 1.50 m

ROAD (0.00 + 73.83 + 0.00) = 73.83 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 74.50 0.00 0.00 -0.68 0.00 0.00 0.00 73.83

Segment Leq : 73.83 dBA

Results segment # 3: Trans-Can-2 (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 ! 19.50 ! 1.52 ! 7.52

ROAD (0.00 + 74.60 + 0.00) = 74.60 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 80.15 0.00 -4.87 -0.68 0.00 0.00 -0.09 74.51*
-64 90 0.00 80.15 0.00 -4.87 -0.68 0.00 0.00 0.00 74.60
---

* Bright Zone !

Segment Leq : 74.60 dBA

Total Leq All Segments: 78.76 dBA

Results segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.52 ! 7.52

ROAD (0.00 + 65.85 + 0.00) = 65.85 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 72.55 0.00 -6.02 -0.68 0.00 0.00 -0.09 65.76*
-64 90 0.00 72.55 0.00 -6.02 -0.68 0.00 0.00 0.00 65.85
---

* Bright Zone !

Segment Leq : 65.85 dBA

Results segment # 2: Isabella St (night)

Source height = 1.50 m

ROAD (0.00 + 66.23 + 0.00) = 66.23 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 66.91 0.00 0.00 -0.68 0.00 0.00 0.00 66.23

Segment Leq : 66.23 dBA

Results segment # 3: Trans-Can-2 (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 ! 4.50 ! 1.49 ! 7.49

ROAD (0.00 + 67.01 + 0.00) = 67.01 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-64 90 0.00 72.55 0.00 -4.87 -0.68 0.00 0.00 -0.13 66.88*
-64 90 0.00 72.55 0.00 -4.87 -0.68 0.00 0.00 0.00 67.01
---

* Bright Zone !

Segment Leq : 67.01 dBA

Total Leq All Segments: 71.16 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 78.76
(NIGHT): 71.16

STAMSON 5.0 COMPREHENSIVE REPORT Date: 20-02-2020 17:17:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r02.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Trans-Can-1 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
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: Trans-Can-1 (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 : 69.00 / 69.00 m
Receiver height : 19.50 / 19.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 68.90 / 68.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Road data, segment # 2: Isabella St (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 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: Isabella St (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 15.00 / 15.00 m
Receiver height : 19.50 / 19.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Trans-Can-2 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 3: Trans-Can-2 (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 : 55.00 / 55.00 m
Receiver height : 19.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 54.90 / 54.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.51 ! 7.51

ROAD (0.00 + 70.51 + 0.00) = 70.51 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
0 90 0.00 80.15 0.00 -6.63 -3.01 0.00 0.00 -0.17 70.34*
0 90 0.00 80.15 0.00 -6.63 -3.01 0.00 0.00 0.00 70.51
---

* Bright Zone !

Segment Leq : 70.51 dBA

Segment # 2: Isabella St (day)

Source height = 1.50 m

ROAD (0.00 + 71.49 + 0.00) = 71.49 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
0 90 0.00 74.50 0.00 0.00 -3.01 0.00 0.00 0.00 71.49

Segment Leq : 71.49 dBA

Segment # 3: Trans-Can-2 (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 ! 19.50 ! 1.52 ! 7.52

ROAD (0.00 + 71.49 + 0.00) = 71.49 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
0 90 0.00 80.15 0.00 -5.64 -3.01 0.00 0.00 -0.16 71.33*
0 90 0.00 80.15 0.00 -5.64 -3.01 0.00 0.00 0.00 71.49
---

* Bright Zone !

Segment Leq : 71.49 dBA

Total Leq All Segments: 75.96 dBA

Segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.51 ! 7.51

ROAD (0.00 + 62.91 + 0.00) = 62.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	72.55	0.00	-6.63	-3.01	0.00	0.00	-0.17	62.74*
0	90	0.00	72.55	0.00	-6.63	-3.01	0.00	0.00	0.00	62.91

* Bright Zone !

Segment Leq : 62.91 dBA

Segment # 2: Isabella St (night)

Source height = 1.50 m

ROAD (0.00 + 63.90 + 0.00) = 63.90 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	66.91	0.00	0.00	-3.01	0.00	0.00	0.00	63.90

Segment Leq : 63.90 dBA

Segment # 3: Trans-Can-2 (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 ! 4.50 ! 1.49 ! 7.49

ROAD (0.00 + 63.90 + 0.00) = 63.90 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
0 90 0.00 72.55 0.00 -5.64 -3.01 0.00 0.00 -0.22 63.68*
0 90 0.00 72.55 0.00 -5.64 -3.01 0.00 0.00 0.00 63.90
---

* Bright Zone !

Segment Leq : 63.90 dBA

Total Leq All Segments: 68.37 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 75.96
(NIGHT): 68.37

STAMSON 5.0 NORMAL REPORT Date: 21-02-2020 09:48:11
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r03.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Trans-Can-1 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
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: Trans-Can-1 (day/night)

Angle1 Angle2 : -83.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 69.00 / 69.00 m
Receiver height : 19.50 / 19.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -83.00 deg Angle2 : 0.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 68.90 / 68.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Road data, segment # 2: Isabella St (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 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: Isabella St (day/night)

Angle1 Angle2 : -83.00 deg 0.00 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 : 19.50 / 19.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Trans-Can-2 (day/night)

Car traffic volume : 44528/3872 veh/TimePeriod *
Medium truck volume : 3542/308 veh/TimePeriod *
Heavy truck volume : 2530/220 veh/TimePeriod *
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 55000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 3: Trans-Can-2 (day/night)

Angle1 Angle2 : -83.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 55.00 / 55.00 m
Receiver height : 19.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -83.00 deg Angle2 : 0.00 deg
Barrier height : 1.00 m
Barrier receiver distance : 54.90 / 54.90 m
Source elevation : 6.00 m
Receiver elevation : 0.00 m
Barrier elevation : 6.00 m
Reference angle : 0.00

Results segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.51 ! 7.51

ROAD (0.00 + 70.16 + 0.00) = 70.16 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-83 0 0.00 80.15 0.00 -6.63 -3.36 0.00 0.00 -0.00 70.16*
-83 0 0.00 80.15 0.00 -6.63 -3.36 0.00 0.00 0.00 70.16
---

* Bright Zone !

Segment Leq : 70.16 dBA

Results segment # 2: Isabella St (day)

Source height = 1.50 m

ROAD (0.00 + 71.14 + 0.00) = 71.14 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-83 0 0.00 74.50 0.00 0.00 -3.36 0.00 0.00 0.00 71.14

Segment Leq : 71.14 dBA

Results segment # 3: Trans-Can-2 (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 ! 19.50 ! 1.52 ! 7.52

ROAD (0.00 + 71.14 + 0.00) = 71.14 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-83 0 0.00 80.15 0.00 -5.64 -3.36 0.00 0.00 -0.00 71.14*
-83 0 0.00 80.15 0.00 -5.64 -3.36 0.00 0.00 0.00 71.14
---

* Bright Zone !

Segment Leq : 71.14 dBA

Total Leq All Segments: 75.61 dBA

Results segment # 1: Trans-Can-1 (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 ! 19.50 ! 1.51 ! 7.51

ROAD (0.00 + 62.56 + 0.00) = 62.56 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-83	0	0.00	72.55	0.00	-6.63	-3.36	0.00	0.00	-0.00	62.56*
-83	0	0.00	72.55	0.00	-6.63	-3.36	0.00	0.00	0.00	62.56

* Bright Zone !

Segment Leq : 62.56 dBA

Results segment # 2: Isabella St (night)

Source height = 1.50 m

ROAD (0.00 + 63.55 + 0.00) = 63.55 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-83	0	0.00	66.91	0.00	0.00	-3.36	0.00	0.00	0.00	63.55

Segment Leq : 63.55 dBA

Results segment # 3: Trans-Can-2 (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 ! 4.50 ! 1.49 ! 7.49

ROAD (0.00 + 63.55 + 0.00) = 63.55 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-83 0 0.00 72.55 0.00 -5.64 -3.36 0.00 0.00 -0.03 63.52*
-83 0 0.00 72.55 0.00 -5.64 -3.36 0.00 0.00 0.00 63.55
---

* Bright Zone !

Segment Leq : 63.55 dBA

Total Leq All Segments: 68.02 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 75.61
(NIGHT): 68.02