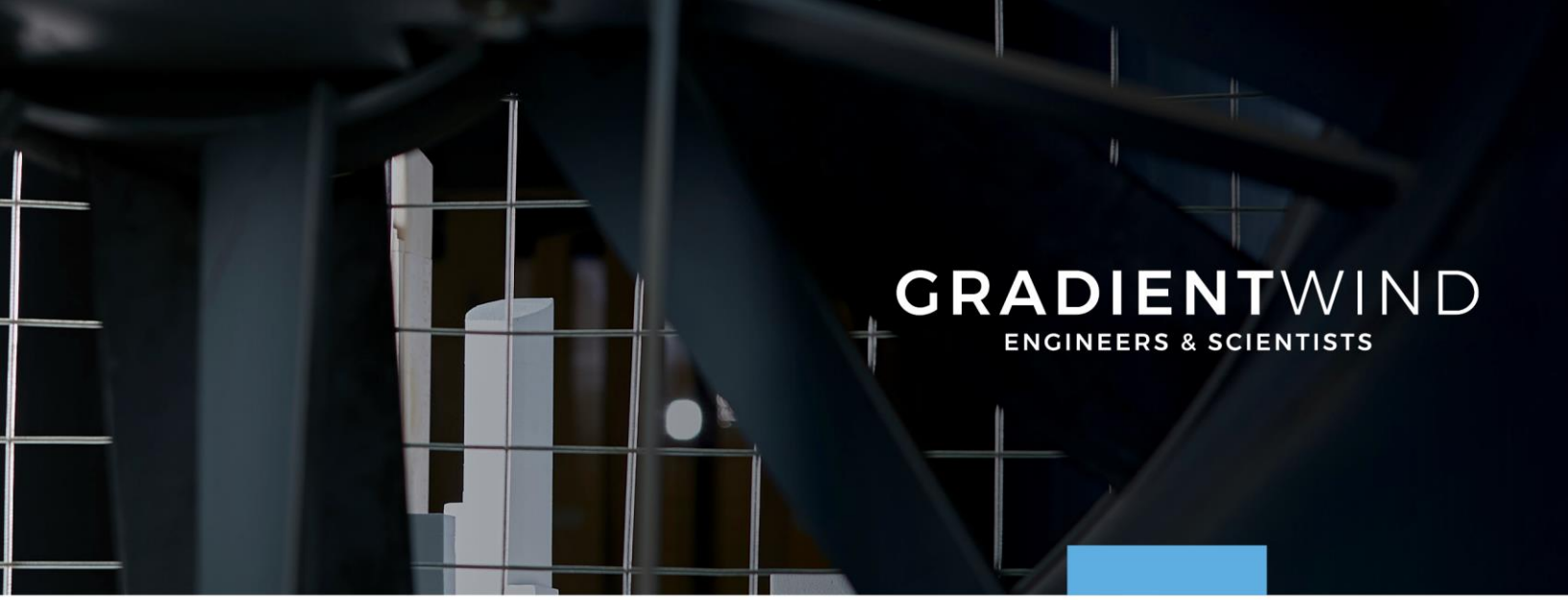
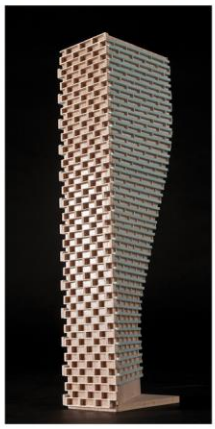


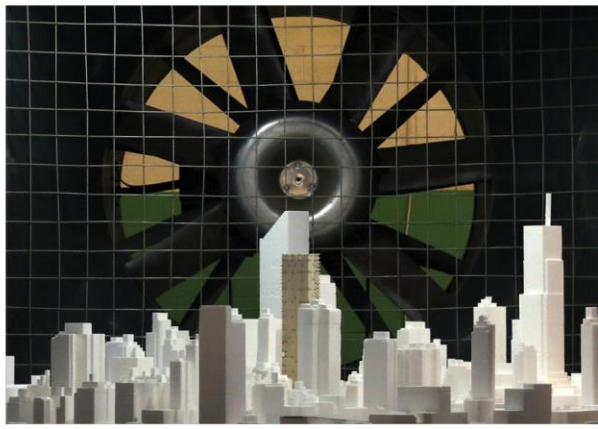
GRADIENTWIND
ENGINEERS & SCIENTISTS

ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT

267 O'Connor Street
Ottawa, Ontario

Report: 20-166 –T.Noise Feasibility





September 14, 2020

PREPARED FOR
Taggart Realty Management
225 Metcalfe Street
Ottawa, ON K2P 1P9

PREPARED BY
Samantha Phillips, B.Eng., Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment undertaken to satisfy the requirements for a zoning by-law amendment (ZBA) application submission for a proposed two-tower development located at 267 O'Connor Street in Ottawa, Ontario. The North Tower, of 30 storeys, is located at the northwest corner of the site, with the long axis oriented along MacLaren Street. The South Tower, of 28 storeys, is located at the southeast corner of the site, with the long axis oriented along Gilmour Street. A privately owned public space (P.O.P.S) is provided at the southwest corner of the site. The major sources of traffic noise are O'Connor Street to the west and Somerset Street West to the north. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings prepared by provided by Hobin Architecture Inc. in July 2020.

The results of the current analysis indicate that noise levels will range between 56 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA. Due to the limited information available at the time of the study, which was prepared for a zoning by-law amendment application submission, detailed STC calculations could not be performed at this time. A detailed review of window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the towers.

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. Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Taggart Realty Management to undertake a roadway traffic noise feasibility assessment to satisfy the requirements for a zoning by-law amendment (ZBA) application submission for a proposed two-tower development located at 267 O'Connor 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.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by Hobin Architecture Inc. in July 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 roadway traffic noise feasibility assessment is a proposed two-tower development located at 267 O'Connor Street in Ottawa, Ontario. The subject site is located on the west side of a parcel of land bounded by MacLaren Street to the north, Metcalfe Street to the east, Gilmour Street to the south, and O'Connor Street to the west.

The North Tower, of 30 storeys, is located at the northwest corner of the site, with the long axis oriented along MacLaren Street. The South Tower, of 28 storeys, is located at the southeast corner of the site, with the long axis oriented along Gilmour Street. Above four levels of shared underground parking, the ground floor of the North Tower features retail and amenity space fronting O'Connor Street with building support facilities, including a leasing office, bike room and lobby, in the remaining areas. The ground floor of the South Tower contains a lobby, amenity space and building support facilities. A ramp which provides access to below-grade parking from Gilmour Street is located at the southeast corner of the South Tower. A privately owned public space (P.O.P.S) is provided at the southwest corner of the site. All levels above grade are reserved from residential occupancy. At Level 5, the floorplate sets back at the north, west and south

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment, Conservation and Parks – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

elevations of the North Tower as well as the north, east and south elevations of the South Tower, and extend again at Level 7. Additionally, the floorplate extends at the west elevation of the South Tower to cover the grade-level area below. Levels 7 and above rise with a uniform planform.

As the balconies extend less than 4 metres from the façade, they do not require consideration as outdoor living areas (OLA) in this study. Furthermore, the grade-level P.O.P.S was not considered as an OLA, as it is not intended to provide a space for the quiet enjoyment of the outdoors for the residents.

The site is surrounded by a mixture of low and mid-rise buildings in al directions. The major sources of traffic noise are O'Connor Street to the west and Somerset Street West to the north. Although Metcalfe Street located east of the site is a nearby arterial roadway, it is located just beyond 100 metres of the study site and therefore is not included as sources influencing the study site as per ENCG Section 2.1. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) explore potential noise mitigation options, where required.

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, 45 and 40 dBA for retail space, living rooms and sleeping quarters, respectively, as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [3]

Type of Space	Time Period	L_{eq} (dBA)
General offices, reception areas, **retail stores**, etc.	07:00 – 23:00	50
Living/dining/den areas of **residences**, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which triggers the need

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

for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[6].

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.

4.2.2 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[7] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
O'Connor Street	2-Lane Urban Arterial (2-UAU)	50	**15,000**
Somerset Street West	2-Lane Urban Arterial (2-UAU)	50	**15,000**

4.2.3 Theoretical Roadway Noise Predictions

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

Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[7] City of Ottawa Transportation Master Plan, November 2013

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split for all streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- For select sources where appropriate, the receptors considered the proposed North Tower and surrounding, existing buildings as barrier, partially or fully obstructing exposure to the source as illustrated by exposure angles in Figures 3-4.
- Noise receptors were strategically placed at six (6) locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figures 3-4.

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
North Tower				
1	91.5	POW – Level 30, East Façade	56	48
2	91.5	POW – Level 30, North Façade	67	59
3	91.5	POW – Level 30, West Façade	69	61
4	91.5	POW – Level 30, South Façade	65	57
South Tower				
5	85.5	POW – Level 28, West Façade	66	58
6	85.5	POW – Level 28, South Façade	63	55

The results of the current analysis indicate that noise levels will range between 56 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (69 dBA) occurs at the west façade of the North Tower, which is nearest and most exposed to O'Connor Street.

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. Upgraded building components, including STC rated glazing elements and exterior walls, will be required where noise levels due to roadway traffic exceed 65 dBA, as discussed in Section 4.2.1. Results of the calculations also indicated that both towers will require 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 to be placed on all Lease, Purchase and Sale Agreements. Specific noise control measures can be developed once the design of the towers has progressed sufficiently, typically at the time of site plan approval.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 56 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA. Due to the limited information available at the time of the study, which was prepared for a zoning by-law amendment application submission, detailed STC calculations could not be performed at this time. A detailed review of window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the towers.

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. Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements.

This concludes our roadway traffic noise feasibility 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,

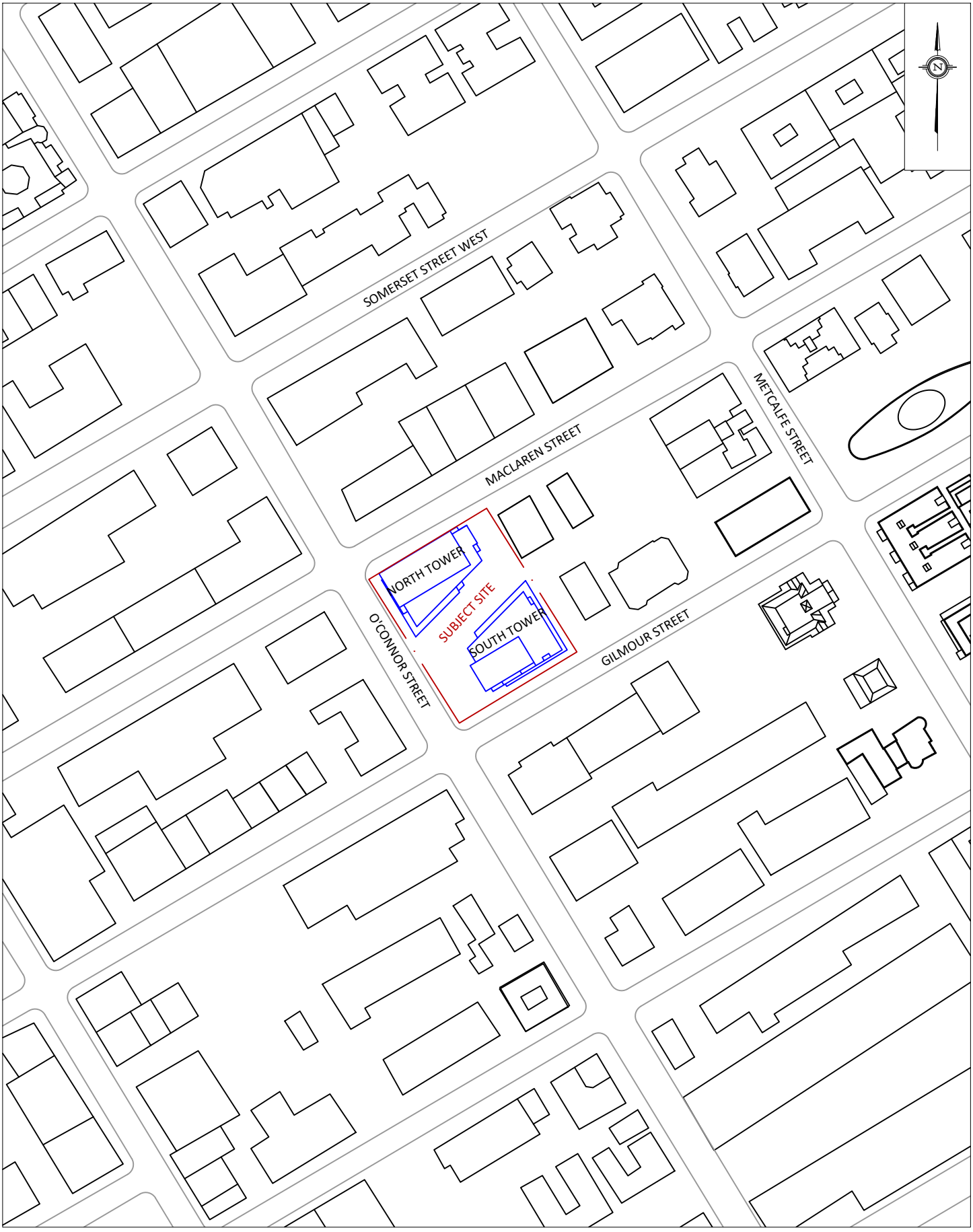
Gradient Wind Engineering Inc.

Samantha Phillips, B.Eng.
Environmental Scientist

LICENSED PROFESSIONAL ENGINEER
J. R. FOSTER
100155655
Sep 14, 2020
PROVINCE OF ONTARIO

Joshua Foster, P.Eng.
Principal

Gradient Wind File 20-166-T.Noise Feasibility



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PROJECT	267 O'CONNOR STREET, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	20-166-1
DATE	AUGUST 17, 2020
DRAWN BY	S.P.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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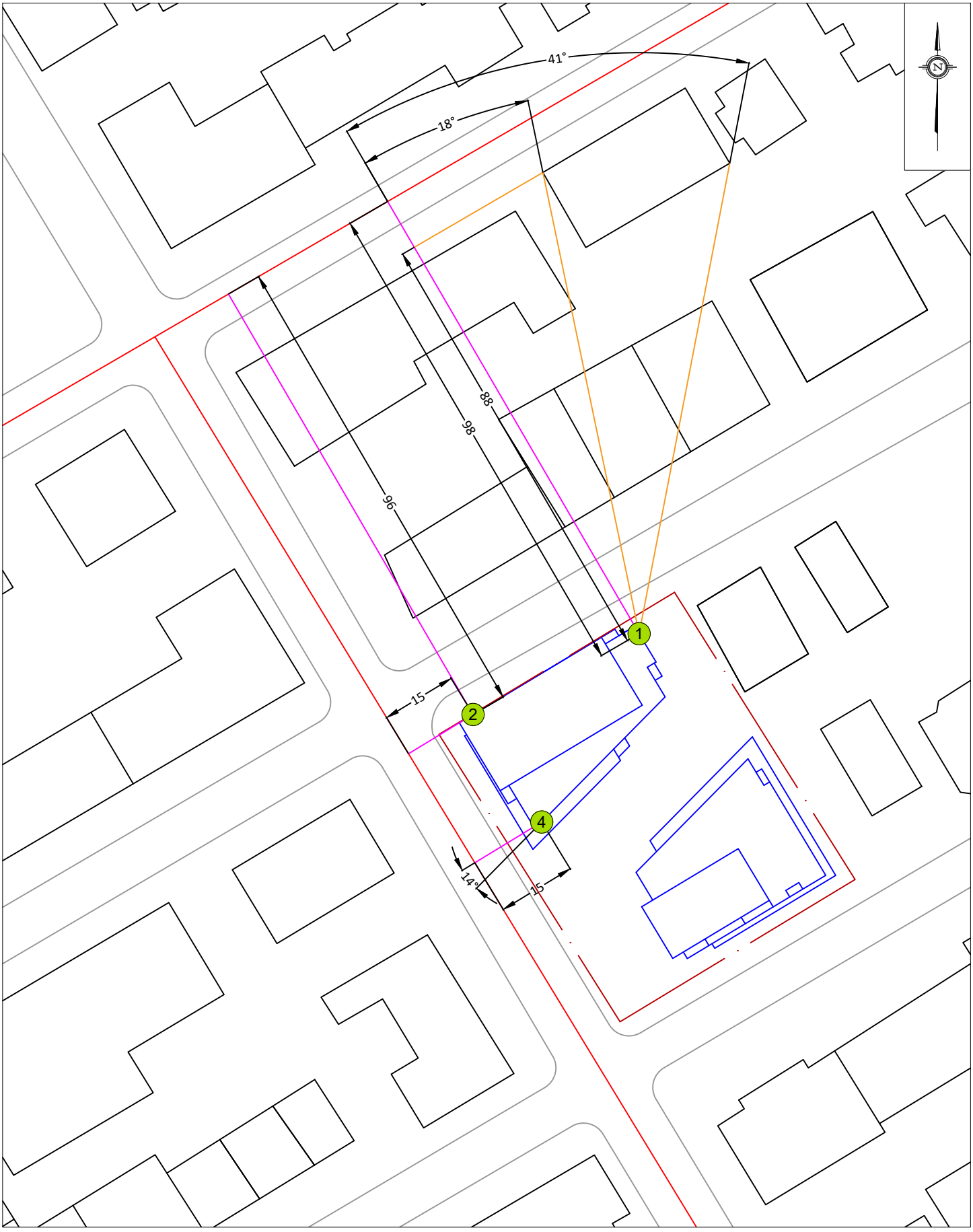
PROJECT	267 O'CONNOR STREET, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:500 (APPROX.)
DRAWING NO.	20-166-2
DATE	AUGUST 17, 2020
DRAWN BY	S.P.
DESCRIPTION	FIGURE 2: RECEPTOR LOCATIONS



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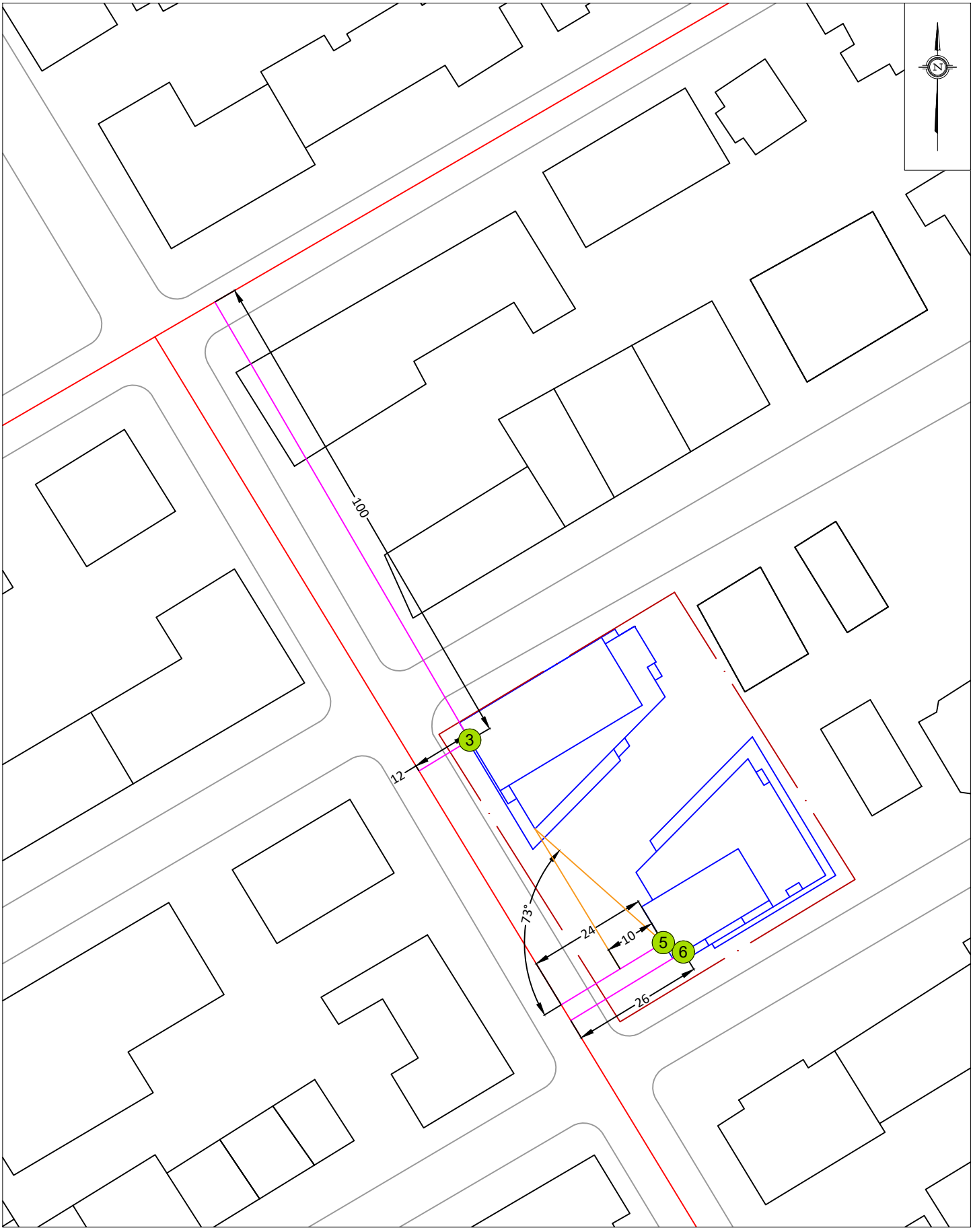
PROJECT	267 O'CONNOR STREET, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	20-166-3
DATE	AUGUST 17, 2020
DRAWN BY	S.P.

DESCRIPTION

FIGURE 3:
STAMSON INPUT PARAMETERS - RECEPTOR 1, 2, 4



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PROJECT	267 O'CONNOR STREET, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	20-166-4
DATE	AUGUST 17, 2020	DRAWN BY	S.P.

DESCRIPTION

FIGURE 4:
STAMSON INPUT PARAMETERS - RECEPTOR 3, 5, 6

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: 14-08-2020 15:53:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R1.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Somerset (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: Somerset (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  :  98.00 / 98.00  m
Receiver height           :  91.50 / 91.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  18.00 deg   Angle2 : 41.00 deg
Barrier height            :  32.00 m
Barrier receiver distance :  88.00 / 88.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Somerset (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 !       91.50 !       10.68 !        10.68

ROAD (50.33 + 31.39 + 54.68) = 56.05 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     18   0.00  68.48   0.00  -8.15 -10.00   0.00   0.00   0.00
50.33
-------------------------------------------------------------------------
--
    18     41   0.00  68.48   0.00  -8.15  -8.94   0.00   0.00 -20.00
31.39
-------------------------------------------------------------------------
--
    41     90   0.00  68.48   0.00  -8.15  -5.65   0.00   0.00   0.00
54.68
-------------------------------------------------------------------------
--

Segment Leq : 56.05 dBA

Total Leq All Segments: 56.05 dBA
```

```
Results segment # 1: Somerset (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 !       91.50 !       10.68 !        10.68

ROAD (42.73 + 23.80 + 47.08) = 48.45 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     18   0.00  60.88   0.00  -8.15 -10.00   0.00   0.00   0.00
42.73
-------------------------------------------------------------------------
--
    18     41   0.00  60.88   0.00  -8.15  -8.94   0.00   0.00 -20.00
23.80
-------------------------------------------------------------------------
--
    41     90   0.00  60.88   0.00  -8.15  -5.65   0.00   0.00   0.00
47.08
-------------------------------------------------------------------------
--

Segment Leq : 48.45 dBA

Total Leq All Segments: 48.45 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 56.05
                           (NIGHT): 48.45
```

```
STAMSON 5.0        NORMAL REPORT        Date: 14-08-2020 16:01:47
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R2.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: O'Connor (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: O'Connor (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           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Somerset (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: Somerset (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  :  96.00 / 96.00  m
Receiver height           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: O'Connor (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  68.48   0.00   0.00  -3.01   0.00   0.00   0.00
65.47
-------------------------------------------------------------------------
--

Segment Leq : 65.47 dBA


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

Source height = 1.50 m

ROAD (0.00 + 60.42 + 0.00) = 60.42 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  -8.06   0.00   0.00   0.00   0.00
60.42
-------------------------------------------------------------------------
--

Segment Leq : 60.42 dBA

Total Leq All Segments: 66.65 dBA
```

```
Results segment # 1: O'Connor (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  60.88   0.00   0.00  -3.01   0.00   0.00   0.00
57.87
-------------------------------------------------------------------------
--

Segment Leq : 57.87 dBA


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

Source height = 1.50 m

ROAD (0.00 + 52.82 + 0.00) = 52.82 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  -8.06   0.00   0.00   0.00   0.00
52.82
-------------------------------------------------------------------------
--

Segment Leq : 52.82 dBA

Total Leq All Segments: 59.05 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 66.65
                           (NIGHT): 59.05
```

```
STAMSON 5.0        NORMAL REPORT        Date: 14-08-2020 16:07:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R3.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: O'Connor (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: O'Connor (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  :  15.00 / 15.00  m
Receiver height           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Somerset (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: Somerset (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  : 100.00 / 100.00 m
Receiver height           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: O'Connor (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 68.48 + 0.00) = 68.48 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   0.00   0.00   0.00   0.00   0.00
68.48
-------------------------------------------------------------------------
--

Segment Leq : 68.48 dBA


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

Source height = 1.50 m

ROAD (0.00 + 57.23 + 0.00) = 57.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  68.48   0.00  -8.24  -3.01   0.00   0.00   0.00
57.23
-------------------------------------------------------------------------
--

Segment Leq : 57.23 dBA

Total Leq All Segments: 68.79 dBA
```

```
Results segment # 1: O'Connor (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.88 + 0.00) = 60.88 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   0.00   0.00   0.00   0.00   0.00
60.88
-------------------------------------------------------------------------
--

Segment Leq : 60.88 dBA


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

Source height = 1.50 m

ROAD (0.00 + 49.63 + 0.00) = 49.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  60.88   0.00  -8.24  -3.01   0.00   0.00   0.00
49.63
-------------------------------------------------------------------------
--

Segment Leq : 49.63 dBA

Total Leq All Segments: 61.19 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 68.79
                           (NIGHT): 61.19
```

```
STAMSON 5.0        NORMAL REPORT        Date: 14-08-2020 16:09:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: O'Connor (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: O'Connor (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   -14.00 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           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: O'Connor (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.74 + 0.00) = 64.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -14   0.00  68.48   0.00   0.00  -3.74   0.00   0.00   0.00
64.74
-------------------------------------------------------------------------
--

Segment Leq : 64.74 dBA

Total Leq All Segments: 64.74 dBA


Results segment # 1: O'Connor (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.14 + 0.00) = 57.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -14   0.00  60.88   0.00   0.00  -3.74   0.00   0.00   0.00
57.14
-------------------------------------------------------------------------
--

Segment Leq : 57.14 dBA

Total Leq All Segments: 57.14 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 64.74
                           (NIGHT): 57.14
```

```
STAMSON 5.0        NORMAL REPORT        Date: 16-08-2020 17:51:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R5.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: O'Connor (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: O'Connor (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  :  24.00 / 24.00  m
Receiver height           :  85.50 / 85.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  73.00 deg   Angle2 : 90.00 deg
Barrier height            :  93.00 m
Barrier receiver distance :  10.00 / 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: O'Connor (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 !       85.50 !       50.50 !        50.50

ROAD (66.01 + 39.08 + 0.00) = 66.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     73   0.00  68.48   0.00  -2.04  -0.43   0.00   0.00   0.00
66.01
-------------------------------------------------------------------------------
--
    73     90   0.00  68.48   0.00  -2.04 -10.25   0.00   0.00 -17.11
39.08
-------------------------------------------------------------------------------
--

Segment Leq : 66.02 dBA

Total Leq All Segments: 66.02 dBA
```

```
Results segment # 1: O'Connor (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 !       85.50 !       50.50 !        50.50

ROAD (58.41 + 31.48 + 0.00) = 58.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     73   0.00  60.88   0.00  -2.04  -0.43   0.00   0.00   0.00
58.41
-------------------------------------------------------------------------------
--
    73     90   0.00  60.88   0.00  -2.04 -10.25   0.00   0.00 -17.11
31.48
-------------------------------------------------------------------------------
--

Segment Leq : 58.42 dBA

Total Leq All Segments: 58.42 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 66.02
                           (NIGHT): 58.42
```

```
STAMSON 5.0         NORMAL REPORT         Date: 14-08-2020 16:32:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6.te                 Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: O'Connor (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: O'Connor (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  :  26.00 / 26.00  m
Receiver height           :  85.50 / 85.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: O'Connor (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.08 + 0.00) = 63.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  68.48   0.00  -2.39  -3.01   0.00   0.00   0.00
63.08
-------------------------------------------------------------------------
--

Segment Leq : 63.08 dBA

Total Leq All Segments: 63.08 dBA


Results segment # 1: O'Connor (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.48 + 0.00) = 55.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  60.88   0.00  -2.39  -3.01   0.00   0.00   0.00
55.48
-------------------------------------------------------------------------
--

Segment Leq : 55.48 dBA

Total Leq All Segments: 55.48 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 63.08
                           (NIGHT): 55.48
```