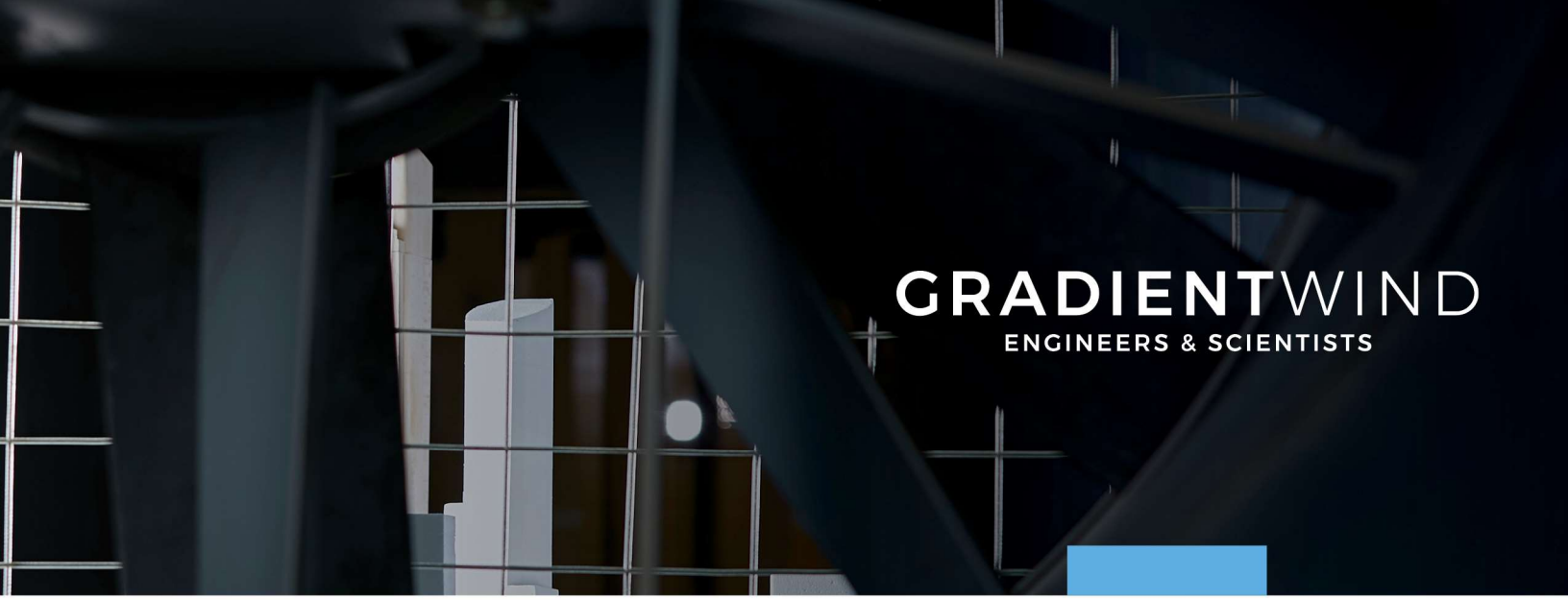

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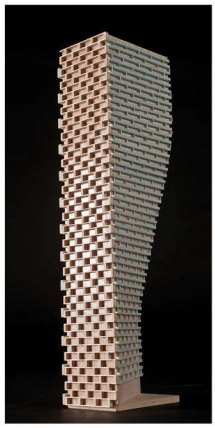
ROADWAY TRAFFIC NOISE ASSESSMENT

253 York Street and 78-80 Nelson Street
Ottawa, Ontario

REPORT: GW21-196 – Traffic Noise



July 5, 2021

PREPARED FOR
Smart Living Properties
226 Argyle Ave
Ottawa, Ontario
K2P 1B9

PREPARED BY
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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken in support of Site Plan Control Application (SPA) for a proposed residential development located at 253 York Street and 78-80 Nelson Street in Ottawa, Ontario. The development comprises an expansion of two existing recently renovated 3-storey multi-unit builds. 78-80 Nelson is an existing 12-unit rooming house, while 253 York is a 31-unit low-rise apartment building. A 3-storey addition is proposed to the west of 78-80 Nelson and 4-storey addition is proposed to the northeast of 253 York Street. An outdoor amenity area is anticipated on the ground level to the west side of the development. The major source of roadway traffic noise is King Edward Avenue, approximately 100 meters west of the site. 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 Ottawa Carleton Construction Ltd. dated May 2021.

The results of the current analysis indicate that noise levels will range between 51 and 57 dBA during the daytime period (07:00-23:00) and between 46 and 49 dBA during the nighttime period (23:00-07:00). The highest noise level (57 dBA) occurs at the west façades, which are nearest and most exposed to King Edward Avenue. Noise levels are not expected to exceed 65 dBA, therefore standard building components in conformance with the Ontario Building Code (OBC) will provide sufficient noise attenuation when windows and doors are closed.

The results also indicate that the building will require forced air heating with provisions for central air conditioning, which if installed at the owner's discretion, will allow building occupants to keep windows closed and maintain a comfortable living environment. It is expected that the development will include central air conditioning. A Warning Clause will be required to be placed on all Lease, Purchase, and Sale Agreements, as summarized in Section 6.

Noise levels at the ground level outdoor amenity on the west side of the development are expected to approach 51 dBA during the daytime period, which falls within the ENCG criteria for outdoor living areas. Therefore, noise control measures are not required.

With regards to stationary noise, impacts can generally be minimized by judicious selection and placement of the equipment. Due to the size of the development no large pieces of equipment are expected on the roof or around the building. The only exterior pieces of equipment would be small residential AC units which would comply with the MECP's noise guideline NPC-216 - Residential Air Conditioning and City of Ottawa Noise By-Law No. 2017-255.

There are no significant existing sources of stationary noise impacting the development.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Smart Living Properties to undertake a roadway traffic noise assessment in support of Site Plan Control Application (SPA) for proposed residential development at 253 York Street and 78-80 Nelson Street in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural and site plan drawings prepared by Ottawa Carleton Construction Ltd. dated May 2021, 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 residential development located at 253 York Street and 78-80 Nelson Street in Ottawa, Ontario. For the purpose of this assessment, the elevation facing York Street will be referred to as the south elevation. The subject site is located at the southeast corner of a rectangular parcel of land bounded by Nelson Street to the east and York Street to the south.

The proposed development comprises an expansion of two existing recently renovated 3-storey multi-unit builds. 78-80 Nelson is an existing 12-unit rooming house, while 253 York is a 31-unit low-rise apartment building. A 3-storey addition is proposed to the west of 78-80 Nelson and 4-storey addition is proposed to the northeast of 253 York Street. The proposal expands both buildings and connects them starting from the second storey. An outdoor amenity area is anticipated on the ground level to the west side of the development.

The site is surrounded by low-rise residential buildings to the west, north and east, and commercial buildings to the south. The major source of roadway traffic noise is King Edward Avenue, approximately 100 meters west of the site. Figure 1 illustrates a complete 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 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 45 and 40 dBA for living rooms and sleeping quarters respectively for roadway as listed in Table 1.

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

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[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[6].

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.

[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
[6] 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 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 streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be absorptive or reflective depending on specific source-receiver pathways.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Receptor height was taken to be 10.5 metres at Level 4 for the centre of the window (height to 3rd floor slab + 1.5 metres) for Receptors 1 & 2; 7.5 metres for Level 3 Receptors 3 & 4; and 1.5 metres for ground-level Receptor 5.
- Noise receptors were strategically placed at 5 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Appendix A Figures A1-A5.

4.2.3 Roadway Traffic Volumes

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

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volume
King Edward Avenue	6-Lane Urban Arterial Divided	40	**50,000**

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 and rail 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[8] 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

Based on published research[9], 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

[8] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[9] CMHC, Road & Rail Noise: Effects on Housing

information available at the time of the study, which was prepared for site plan approval, detailed floor layouts and building elevations have not been finalized; therefore, detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

5. 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	10.5	POW – 253 York Street – 4th Floor – South Façade	54	46
2	10.5	POW – 253 York Street – 4th Floor – West Façade	57	49
3	7.5	POW – 78-80 Nelson Street – 3rd Floor – West Façade	57	49
4	7.5	POW – 78-80 Nelson Street – 3rd Floor – North Façade	54	47
5	1.5	OLA – Ground Level Outdoor Amenity	51	N/A*

*Nighttime noise levels are not considered at OLA receptors, as per ENCG

The results of the current analysis indicate that noise levels will range between 51 and 57 dBA during the daytime period (07:00-23:00) and between 46 and 49 dBA during the nighttime period (23:00-07:00). The highest noise level (57 dBA) occurs at the west façades, which are nearest and most exposed to King Edward Avenue.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 51 and 57 dBA during the daytime period (07:00-23:00) and between 46 and 49 dBA during the nighttime period (23:00-07:00). The highest noise level (57 dBA) occurs at the west façades, which are nearest and most exposed to King Edward Avenue. Noise levels are not expected to exceed 65 dBA, therefore standard building components in conformance with the Ontario Building Code (OBC) will provide sufficient noise attenuation when windows and doors are closed.

The results also indicate that the building will require forced air heating with provisions for central air conditioning, which if installed at the owner's discretion, will allow building occupants to keep windows closed and maintain a comfortable living environment. It is expected that the development will include central air conditioning. The following Warning Clause[10] will be required to be placed on all Lease, Purchase or Sale Agreements:

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

Noise levels at the ground level outdoor amenity on the west side of the development are expected to approach 51 dBA during the daytime period, which falls within the ENCG criteria for outdoor living areas. Therefore, noise control measures are not required.

With regards to stationary noise, impacts can generally be minimized by judicious selection and placement of the equipment. Due to the size of the development no large pieces of equipment are expected on the roof or around the building. The only exterior pieces of equipment would be small residential AC units which would comply with the MECP's noise guideline NPC-216 - Residential Air Conditioning and City of Ottawa Noise By-Law No. 2017-255.

There are no significant existing sources of stationary noise impacting the development.

[10] 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.

Tanyon Matheson-Fitchett, B.Eng.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #21-196

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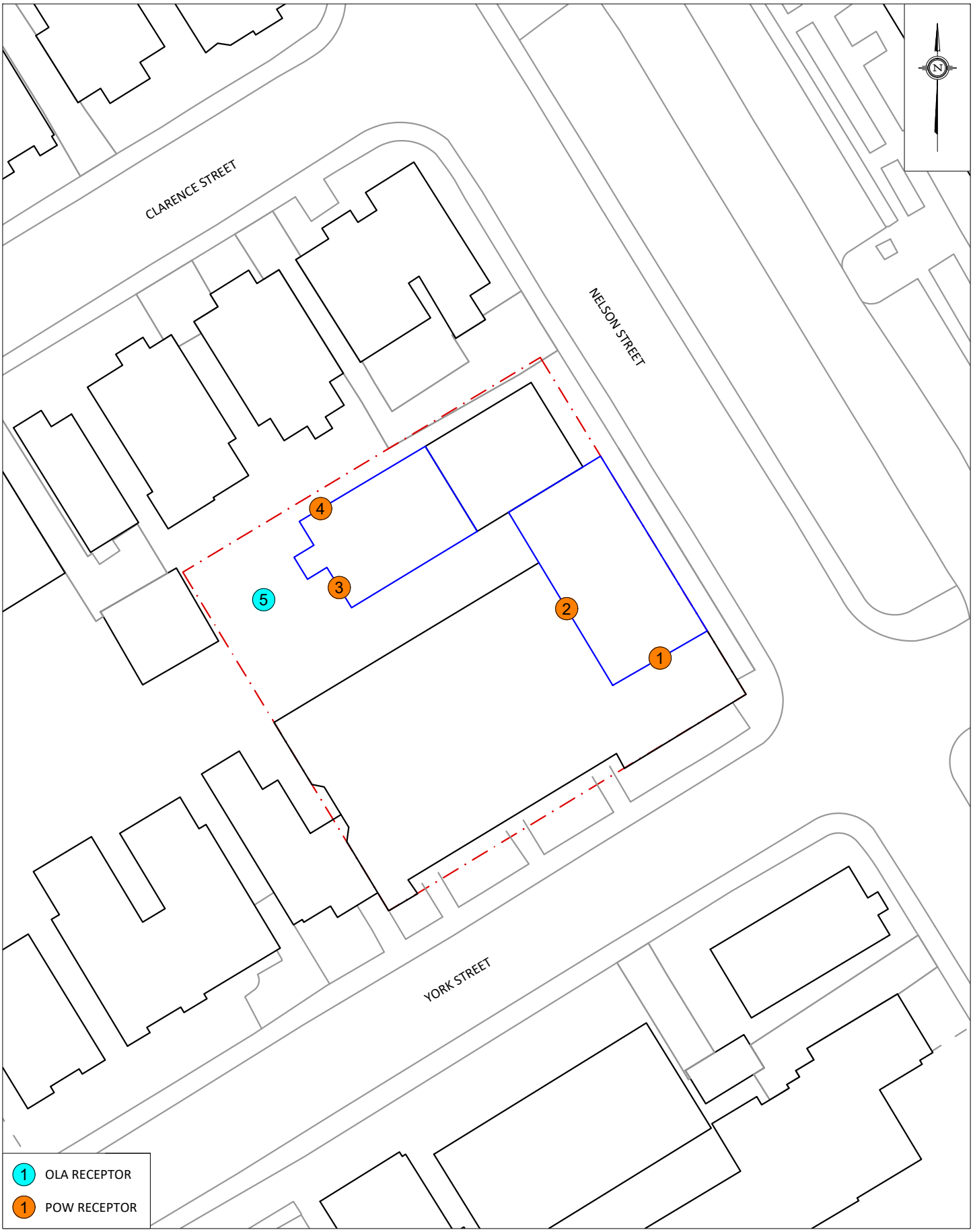
PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW21-196-1
DATE	JUNE 21, 2021	DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW21-196-2
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS

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APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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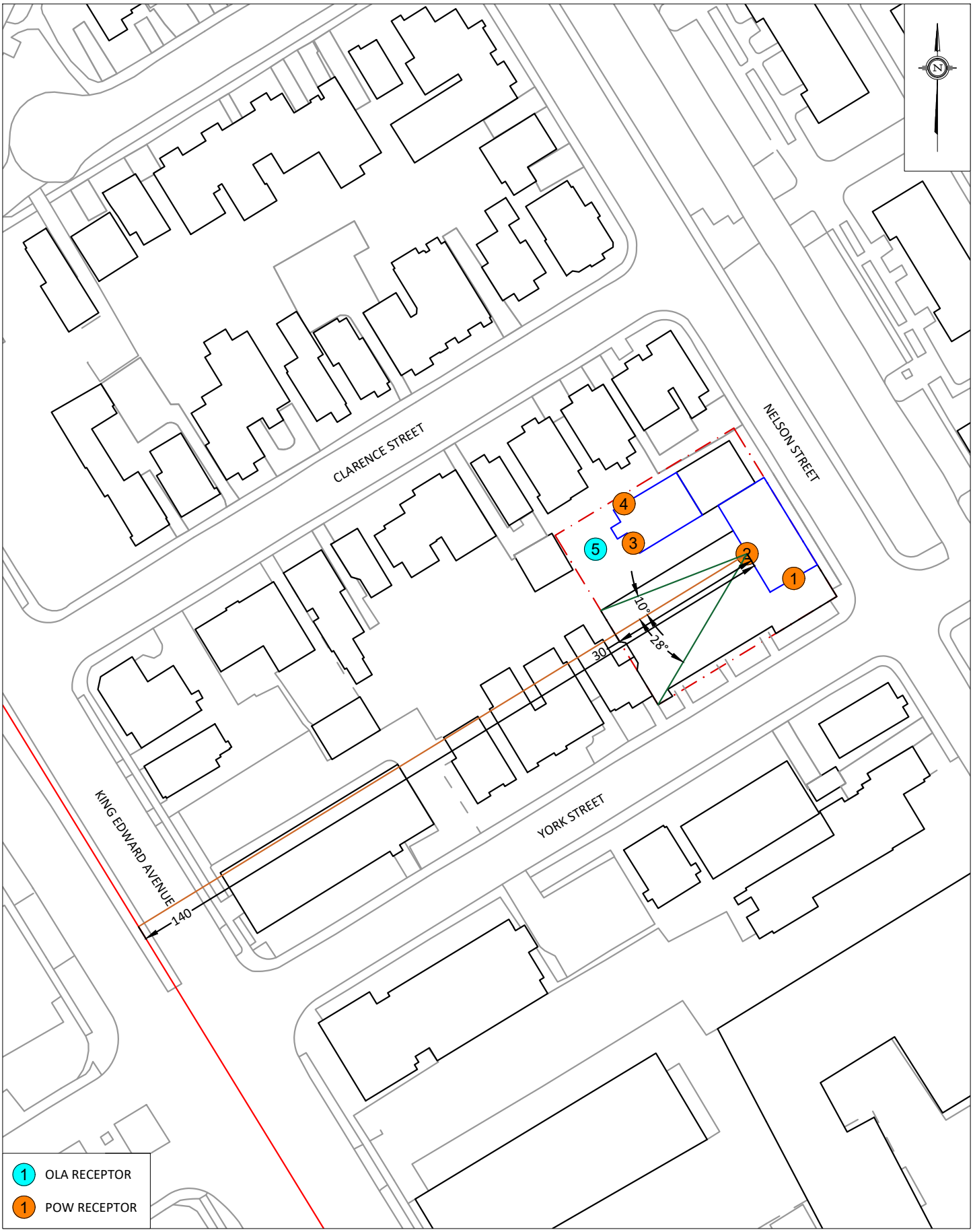
PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-196-A1
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE A1:
RECEPTOR 1 STAMSON INPUT PARAMETERS



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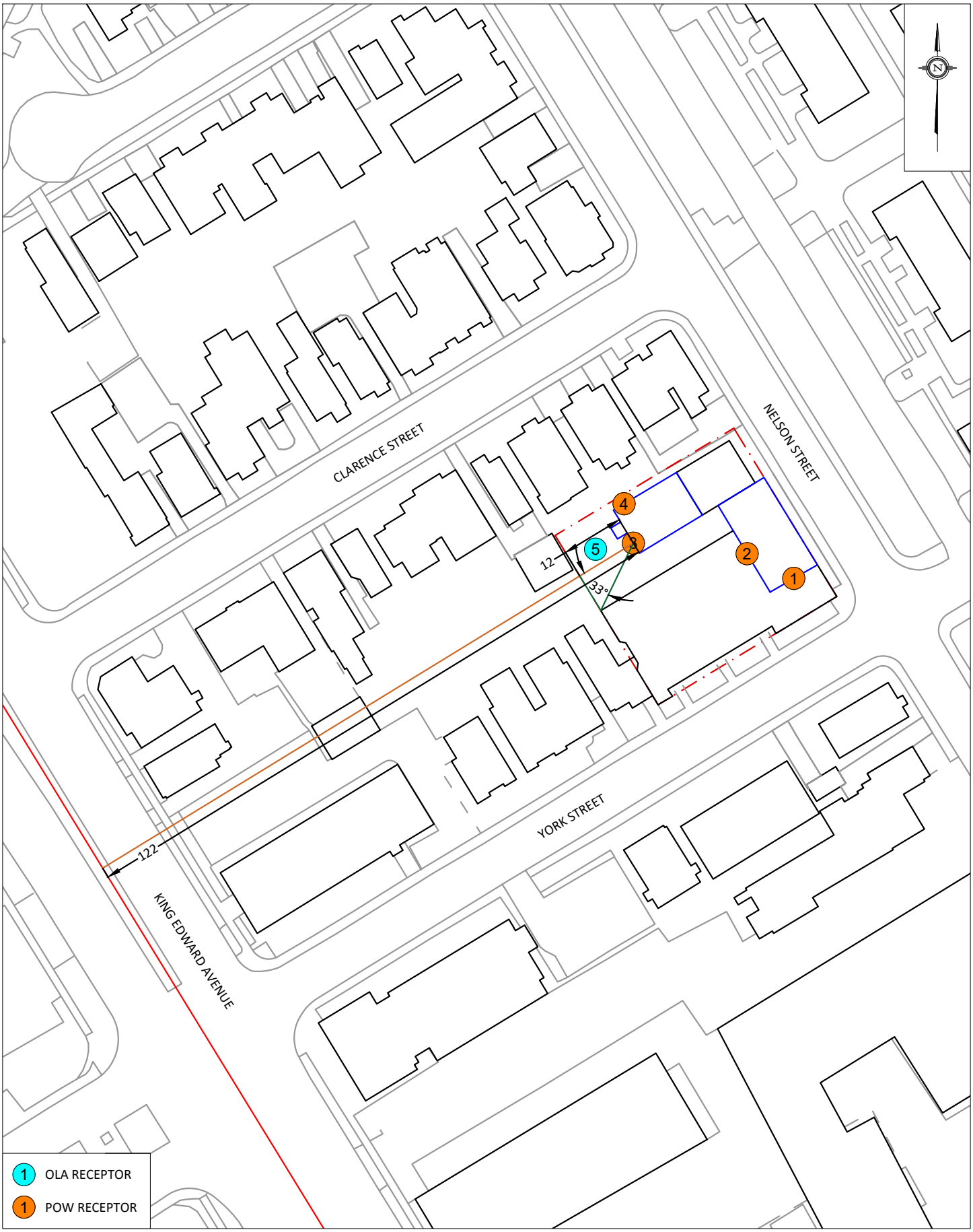
PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-196-A2
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE A2:
RECEPTOR 2 STAMSON INPUT PARAMETERS



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PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-196-A3
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE A3:
RECEPTOR 3 STAMSON INPUT PARAMETERS

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SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-196-A4
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE A4:
RECEPTOR 4 STAMSON INPUT PARAMETERS

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PROJECT	253 YORK STREET AND 78-80 NELSON STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-196-A5
DATE	JUNE 21, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE A5:
RECEPTOR 5 STAMSON INPUT PARAMETERS

```
STAMSON 5.0        NORMAL REPORT        Date: 21-06-2021 15:07:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Ed (day/night)
-------------------------------------------
Car traffic volume  : 40480/3520  veh/TimePeriod  *
Medium truck volume :  3220/280   veh/TimePeriod  *
Heavy truck volume  :  2300/200   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  50000
    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: King Ed (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      3 / 3
House density             :     40 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 146.00 / 146.00 m
Receiver height           :  10.50 / 10.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -11.00 deg   Angle2 : 0.00 deg
Barrier height            :   9.00 m
Barrier receiver distance :  36.00 / 36.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Ed (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 !       10.50 !        8.28 !          8.28

ROAD (53.48 + 44.41 + 0.00) = 53.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -11   0.00  71.91   0.00  -9.88  -3.58   0.00  -4.98   0.00  53.48
-------------------------------------------------------------------------------
   -11      0   0.00  71.91   0.00  -9.88 -12.14   0.00  -4.98   0.00  44.91
   -11      0   0.00  71.91   0.00  -9.88 -12.14   0.00   0.00  -5.48  44.41
-------------------------------------------------------------------------------

Segment Leq : 53.98 dBA

Total Leq All Segments: 53.98 dBA
```

```
Results segment # 1: King Ed (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 !       10.50 !        8.28 !          8.28

ROAD (45.88 + 36.81 + 0.00) = 46.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -11   0.00  64.32   0.00  -9.88  -3.58   0.00  -4.98   0.00  45.88
-------------------------------------------------------------------------------
   -11      0   0.00  64.32   0.00  -9.88 -12.14   0.00  -4.98   0.00  37.32
   -11      0   0.00  64.32   0.00  -9.88 -12.14   0.00   0.00  -5.48  36.81
-------------------------------------------------------------------------------

Segment Leq : 46.39 dBA

Total Leq All Segments: 46.39 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.98
                           (NIGHT): 46.39
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-06-2021 15:05:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Ed (day/night)
-------------------------------------------
Car traffic volume  : 40480/3520  veh/TimePeriod  *
Medium truck volume :  3220/280   veh/TimePeriod  *
Heavy truck volume  :  2300/200   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  50000
    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: King Ed (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      3 / 3
House density             :     50 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 140.00 / 140.00 m
Receiver height           :  10.50 / 10.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -28.00 deg   Angle2 : 10.00 deg
Barrier height            :   9.00 m
Barrier receiver distance :  30.00 / 30.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Ed (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 !       10.50 !        8.57 !          8.57

ROAD (52.00 + 49.88 + 53.11) = 56.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -28   0.00  71.91   0.00  -9.70  -4.63   0.00  -5.58   0.00  52.00
-------------------------------------------------------------------------------
   -28     10   0.00  71.91   0.00  -9.70  -6.75   0.00  -5.58   0.00  49.88
   -28     10   0.00  71.91   0.00  -9.70  -6.75   0.00   0.00  -5.20  50.26
-------------------------------------------------------------------------------
    10     90   0.00  71.91   0.00  -9.70  -3.52   0.00  -5.58   0.00  53.11
-------------------------------------------------------------------------------

Segment Leq : 56.63 dBA

Total Leq All Segments: 56.63 dBA
```

```
Results segment # 1: King Ed (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 !       10.50 !        8.57 !          8.57

ROAD (44.41 + 42.28 + 45.51) = 49.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -28   0.00  64.32   0.00  -9.70  -4.63   0.00  -5.58   0.00  44.41
-------------------------------------------------------------------------------
   -28     10   0.00  64.32   0.00  -9.70  -6.75   0.00  -5.58   0.00  42.28
   -28     10   0.00  64.32   0.00  -9.70  -6.75   0.00   0.00  -5.20  42.67
-------------------------------------------------------------------------------
    10     90   0.00  64.32   0.00  -9.70  -3.52   0.00  -5.58   0.00  45.51
-------------------------------------------------------------------------------

Segment Leq : 49.03 dBA

Total Leq All Segments: 49.03 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.63
                           (NIGHT): 49.03
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-06-2021 15:13:51
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Ed (day/night)
-------------------------------------------
Car traffic volume  : 40480/3520  veh/TimePeriod  *
Medium truck volume :  3220/280   veh/TimePeriod  *
Heavy truck volume  :  2300/200   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  50000
    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: King Ed (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      3 / 3
House density             :     50 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 122.00 / 122.00 m
Receiver height           :   7.50 / 7.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -33.00 deg
Barrier height            :   9.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Ed (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 !        7.50 !        6.91 !          6.91

ROAD (0.00 + 49.74 + 55.56) = 56.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -33   0.00  71.91   0.00  -9.10  -4.99   0.00  -5.60   0.00  52.22
   -90    -33   0.00  71.91   0.00  -9.10  -4.99   0.00   0.00  -8.08  49.74
-------------------------------------------------------------------------------
   -33     90   0.00  71.91   0.00  -9.10  -1.65   0.00  -5.60   0.00  55.56
-------------------------------------------------------------------------------

Segment Leq : 56.57 dBA

Total Leq All Segments: 56.57 dBA
```


```
Results segment # 1: King Ed (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 !        7.50 !        6.91 !          6.91

ROAD (0.00 + 42.14 + 47.96) = 48.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -33   0.00  64.32   0.00  -9.10  -4.99   0.00  -5.60   0.00  44.62
   -90    -33   0.00  64.32   0.00  -9.10  -4.99   0.00   0.00  -8.08  42.14
-------------------------------------------------------------------------------
   -33     90   0.00  64.32   0.00  -9.10  -1.65   0.00  -5.60   0.00  47.96
-------------------------------------------------------------------------------

Segment Leq : 48.97 dBA

Total Leq All Segments: 48.97 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.57
                           (NIGHT): 48.97
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-06-2021 15:23:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Ed (day/night)
-------------------------------------------
Car traffic volume  : 40480/3520  veh/TimePeriod  *
Medium truck volume :  3220/280   veh/TimePeriod  *
Heavy truck volume  :  2300/200   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  50000
    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: King Ed (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      3 / 3
House density             :     50 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 125.00 / 125.00 m
Receiver height           :   7.50 / 7.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 54.10 + 0.00) = 54.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  71.91   0.00  -9.21  -3.01   0.00  -5.60   0.00  54.10
-------------------------------------------------------------------------------

Segment Leq : 54.10 dBA

Total Leq All Segments: 54.10 dBA

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

Source height = 1.50 m

ROAD (0.00 + 46.50 + 0.00) = 46.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  64.32   0.00  -9.21  -3.01   0.00  -5.60   0.00  46.50
-------------------------------------------------------------------------------

Segment Leq : 46.50 dBA

Total Leq All Segments: 46.50 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.10
                           (NIGHT): 46.50
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-06-2021 15:39:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Ed (day/night)
-------------------------------------------
Car traffic volume  : 40480/3520  veh/TimePeriod  *
Medium truck volume :  3220/280   veh/TimePeriod  *
Heavy truck volume  :  2300/200   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  50000
    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: King Ed (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      3 / 3
House density             :     40 %
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 115.00 / 115.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 50.77 + 0.00) = 50.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.66  71.91   0.00 -14.68  -1.46   0.00  -5.00   0.00  50.77
-------------------------------------------------------------------------------

Segment Leq : 50.77 dBA

Total Leq All Segments: 50.77 dBA

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

Source height = 1.50 m

ROAD (0.00 + 43.18 + 0.00) = 43.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.66  64.32   0.00 -14.68  -1.46   0.00  -5.00   0.00  43.18
-------------------------------------------------------------------------------

Segment Leq : 43.18 dBA

Total Leq All Segments: 43.18 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 50.77
                           (NIGHT): 43.18
```