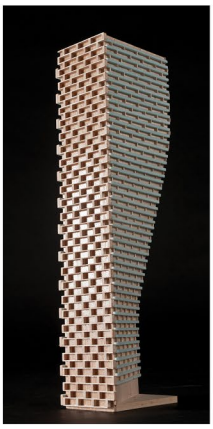


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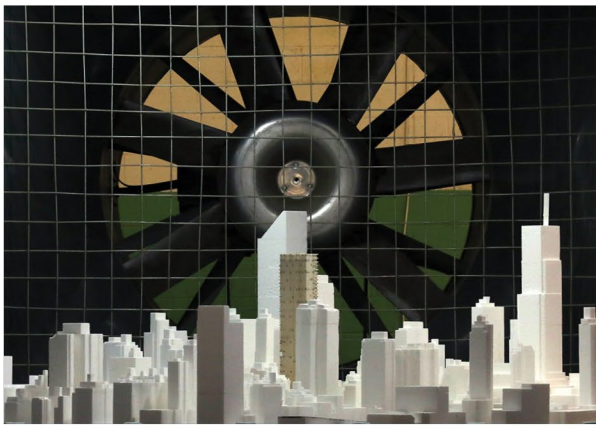
ROADWAY TRAFFIC NOISE ASSESSMENT

454-462 Cumberland Avenue
Burlington, Ontario

REPORT: 23-203 – Traffic Noise







September 7, 2023

PREPARED FOR

Traditions Seniors Housing Ltd.
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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment for the proposed development, located at 454-462 Cumberland Avenue Burlington, Ontario. Primary sources of noise impacting the site include roadway traffic generated by Cumberland Avenue and New Street. There are no railway or subway lines within 75 m of the site and as such vibration study is not required. 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) requirements; (ii) noise level criteria as specified by the MECP NPC-300 guidelines; (iii) future vehicular traffic volumes based on projected roadway traffic counts from The City of Burlington's 2018 Annual Average Daily Traffic (AADT) counts; and (iv) architectural drawings received from MCL Architects and Planers, provided in August 2023.

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 57 and 70 dBA during the daytime period (07:00-23:00), and 50 and 64 dBA during the nighttime period (23:00-07:00). The highest roadway traffic noise levels will occur along the southeast façade, which nearest to Cumberland Avenue and New Street. Results of the roadway traffic noise calculations indicate that updated building components and internal ventilation such as central air conditioning will be required. Additionally, a Type D Warning Clause will be required on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Additionally, noise levels predicted at the Outdoor Living Areas (OLA) of the development, exceed NPC-300 sound level limits. Therefore, noise control measures will be required to reduce the L_{eq} to below 60 dBA where technically and administratively feasible. Investigation into a noise barrier indicated that noise levels at OLA can be reduced to 60 dBA with a 1.5 m, tall noise barrier around the perimeter of the ground-level courtyard. The barrier must be constructed from materials having a minimum surface density of 20 kg/m^2 and contain no gaps. Additionally, a Type B Warning Clause will be required for all units, as the noise level exceeds 55 dBA but remains below 60 dBA with mitigation, as summarized in Section 6.

With regard to off-site stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from proposed rooftop mechanical equipment serving the proposed building on to surrounding noise-sensitive areas and the development itself. Typically, off-site stationary noise levels can be controlled by judicious selection and placement of the equipment and the introduction of silencers or noise screens where needed. The building will be designed so noise impact from the building is compliant with NPC-300 sound level limits.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Traditions Seniors Housing Ltd. to undertake a roadway traffic noise assessment in support of Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBA) applications for the proposed development, located at 454-462 Cumberland Avenue in Burlington, Ontario. This report summarizes the methodology, results, and recommendations related to roadway traffic noise. Gradient Wind's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic.

The assessment was performed based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP) Environmental Noise Guidelines (NPC 300). Noise calculations were based on draft site plan drawings provided by Traditions Seniors Housing in August 2023, with future traffic volumes corresponding to the City of Burlington's 2018 Annual Average Daily Traffic (AADT).

2. TERMS OF REFERENCE

The focus of this roadway traffic noise assessment is a proposed development located at 454-462 Cumberland Avenue in Burlington, Ontario. The proposed development comprises a seven-storey residential building plus one level of below-grade parking. Site access is located along the north and east street frontages. Additionally, an outdoor street patio is proposed on the northwest corner of the building. Residential entry and lobby vestibule are located on the east side of the building which leads to indoor amenities and a dining area north of the floorplan. The west and south sides of the ground floor contain residential occupancies. Levels two to six contain residential occupancies featuring a central indoor amenity and dining area on each floor. Lastly, level seven features an outdoor terrace along the west elevation as well as an indoor amenity. This proposal is based on drawings prepared by MCL Architects, dated January 31, 2023.

Primary sources of noise impacting the site include roadway traffic along Cumberland Avenue and New Street. Please note, that as the study site is not within 75 meters (m) of any existing or proposed light and/or heavy rail systems, ground vibrations will not be required. Figure 1 illustrates a complete site plan with the surrounding context.

3. OBJECTIVES

The principal objective of this work is to calculate the future noise levels on the study site produced by local roadway traffic and explore the potential for noise mitigation where required, as specified by the MECP Noise Control Guidelines – NPC-300, outlined in Section 4 of this report. Noise calculations are based on the initial concept plan provided by Traditions Seniors Housing Ltd. with future traffic volumes corresponding to the City of Burlington's 2018 Annual Average Daily Traffic (AADT).

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 Ministry of the Environment, Conservation and Parks (MECP) Environmental Noise Guidelines (NPC 300) specifies that the recommended indoor noise limit range, which is relevant to this study, is 45 and 40 dBA for retail, living rooms and sleeping quarters, respectively, as listed in Table 1.

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

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. NPC-300 dictates if the nighttime sound level outside the bedroom or living/dining room windows exceeds 60 dBA or the daytime sound level outside the bedroom or living/dining area windows exceeds 65 dBA., building components, including windows, walls and doors, should be designed to comply with the sound level limits listed in Table 1.

An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window can provide a minimum 20 dBA noise reduction[2]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[3]. Therefore, where noise levels exceed 55 dBA during daytime and 50 dBA at 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.

The sound level criterion for outdoor living areas (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation should be provided to reduce noise levels where

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

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.

4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using the MECP computerized noise assessment program, STAMSON 5.04. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road 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,
- The day/night split was taken to be 90% / 10% respectively for all streets.
- Receptor heights have been taken to be 18.7 m, 16 m and 1.5 m above grade, representative of the 7th-level Plane of Window (POW), 7th-level Outdoor Amenity Area, 6th-level Plane of Window (POW), and at-grade amenity areas, respectively.
- Reflective ground surfaces were used due to source-receiver ground path characteristics.
- The study site was treated as having flat or gently sloping topography.
- 7 receptors were strategically placed throughout the study area.

4.2.3 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness, and interior finish details. For example, brick veneer walls can achieve STC 50 or more. Standard commercially-sided exterior metal stud walls have around STC 45. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40, depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

As per Section 4.2, when daytime noise levels from road sources at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[4] 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[5], 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. The anticipated STC requirements for windows can be estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels + safety factor).

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

4.2.4 Roadway Traffic Volumes

NPC-300 dictates that noise calculations should consider future sound levels based on a roadway's mature state of development, which is considered to be projections for 10 years into the future. The City of Burlington shares the Average Annual Daily Traffic (AADT) values for Cumberland Avenue and New Street on their open data portal (https://navburl-burlington.opendata.arcgis.com/datasets/aadt-counts-2018/explore). These values were projected 15 years into the future traffic volumes, which were determined based on a typical growth rate of 2% per year, corresponding to 3,586 for Cumberland Avenue and 18,850 for New Street (see Appendix C). Table 2 summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Roadway	Roadway Traffic Data	Speed Limit (km/h)	2018 AADT Traffic Volumes	2033 Projected Volumes
Cumberland Avenue	2-Lane Urban Collector (2-UC)	40	**3,364**	**3,586**
New Street	4-Lane Urban Arterial (4-UA)	60	**17,684**	**18,850**

* Daytime and nighttime volumes based on correspondence with the City of Burlington

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway noise calculations are summarized in Table 3 below.

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	18.7	POW – Southeast Facade	70	64
2	18.7	POW – Northeast Facade	67	60
3	18.7	POW – Northwest Facade	57	50
4	18.7	POW – Northeast Facade	64	58
5	18.7	OLA – Level 7 Outdoor Amenity	64	57
6	16	POW – Southwest Facade	64	58
7	1.5	OLA – Ground Outdoor Amenity	61	55

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 57 and 70 dBA during the daytime period (07:00-23:00), and 50 and 64 dBA during the nighttime period (23:00-07:00). The highest roadway traffic noise levels will occur nearest to New Street.

Results of the roadway traffic noise calculations also indicate that the outdoor living area (OLA) to the southwest of the site will exceed 55 dBA during the daytime period. As previously mentioned, noise control measures will be required to reduce the Leq to below 60 dBA.

5.2 Noise Control Measures

5.2.1 Upgraded Building Components

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4 for building components. At the time of this study, window schedules, wall assemblies, and room layouts have not been finalized. Therefore, detailed STC calculations could not be performed at this time. 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 + safety factor). The estimated STC requirements for the windows are summarized below for various units within the development (see Figure 3):

TABLE 6: NOISE CONTROL REQUIREMENTS

Façade	Floor Number	Window STC (Bedroom/Living Room)	Exterior Wall STC	Warning Clauses	A/C
Southeast	2-6	33/28	45	Yes	Yes
Northeast	2-6	30/25	45	Yes	Yes

5.2.2 Noise Barrier Investigation

Results indicate that the noise levels at OLA can be reduced to 60 dBA with a 1.5 m, 2 m, and 2.5 m high noise barrier (minimum surface density of 20 kg/m² and without any gaps), respectively. Additionally, a Type B Warning Clause will be required for both outdoor amenity areas, as noise level exceeds 55 dBA but remains below 60 dBA with mitigation, as summarized in Section 6.

TABLE 5: NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Location	Daytime L_{eq} Noise Levels (dBA)			
		No Barrier	With 1.5m Barrier	With 2.0m barrier	With 2.5m barrier
7	Level 1 Outdoor Living Area	61	**59**	58	57

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 57 and 70 dBA during the daytime period (07:00-23:00), and 50 and 64 dBA during the nighttime period (23:00-07:00). The highest roadway traffic noise levels will occur nearest to New Street and Cumberland Avenue. Results of the roadway traffic noise calculations indicate that dwellings exposed to or near New Street and Cumberland Avenue will require updated building components and internal ventilation such as central air conditioning. The following Type D Warning Clause will also be required on all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

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

Additionally, noise levels predicted at the Outdoor Living Areas (OLA) of the development, exceed NPC-300 sound level limits. Therefore, noise control measures will be required to reduce the Leq to below 60 dBA where technical and administratively feasible. Investigation into a noise barrier indicated that noise levels at OLA can be reduced to 60 dBA with a 1.5 m, tall noise barrier around the perimeter of the ground-level courtyard. The barrier must be constructed from materials having a minimum surface density of 20 kg/m^2 and contain no gaps. Additionally, a Type B Warning Clause[8] will be required for both outdoor amenity areas, as noise level exceeds 55dBA but remains below 60 dBA, as summarized below:

Type B:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road and rail traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."*

With regards to off-site stationary noise impacts, a stationary noise study will be performed once mechanical plans for the proposed building become available. This study would assess the impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas. Typically, off-site stationary noise levels can be controlled by judicious selection and placement of the equipment and the introduction of silencers or noise screens where needed. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below NPC-300 limits.

This concludes our roadway 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,

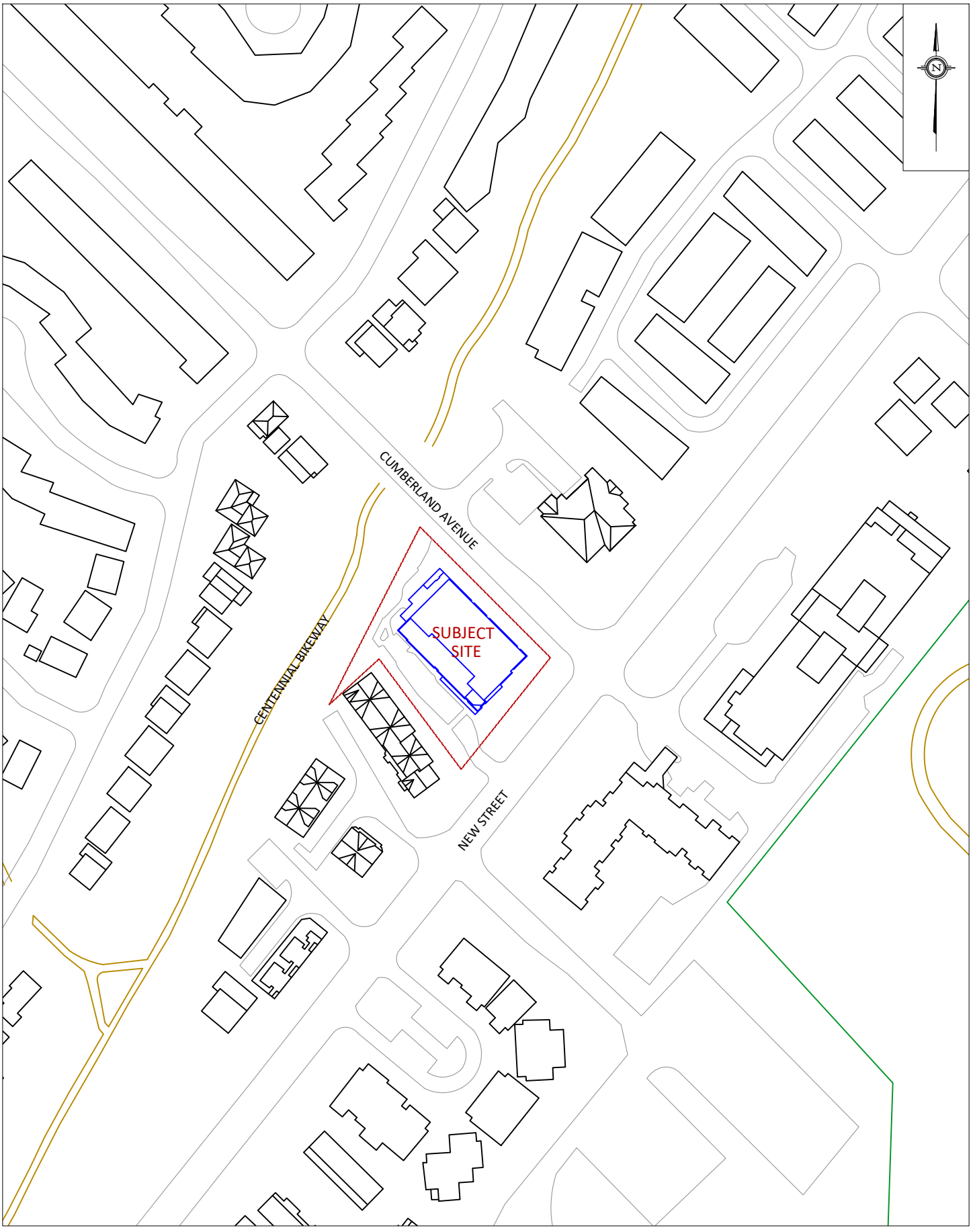
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Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #23-203 – Traffic Noise



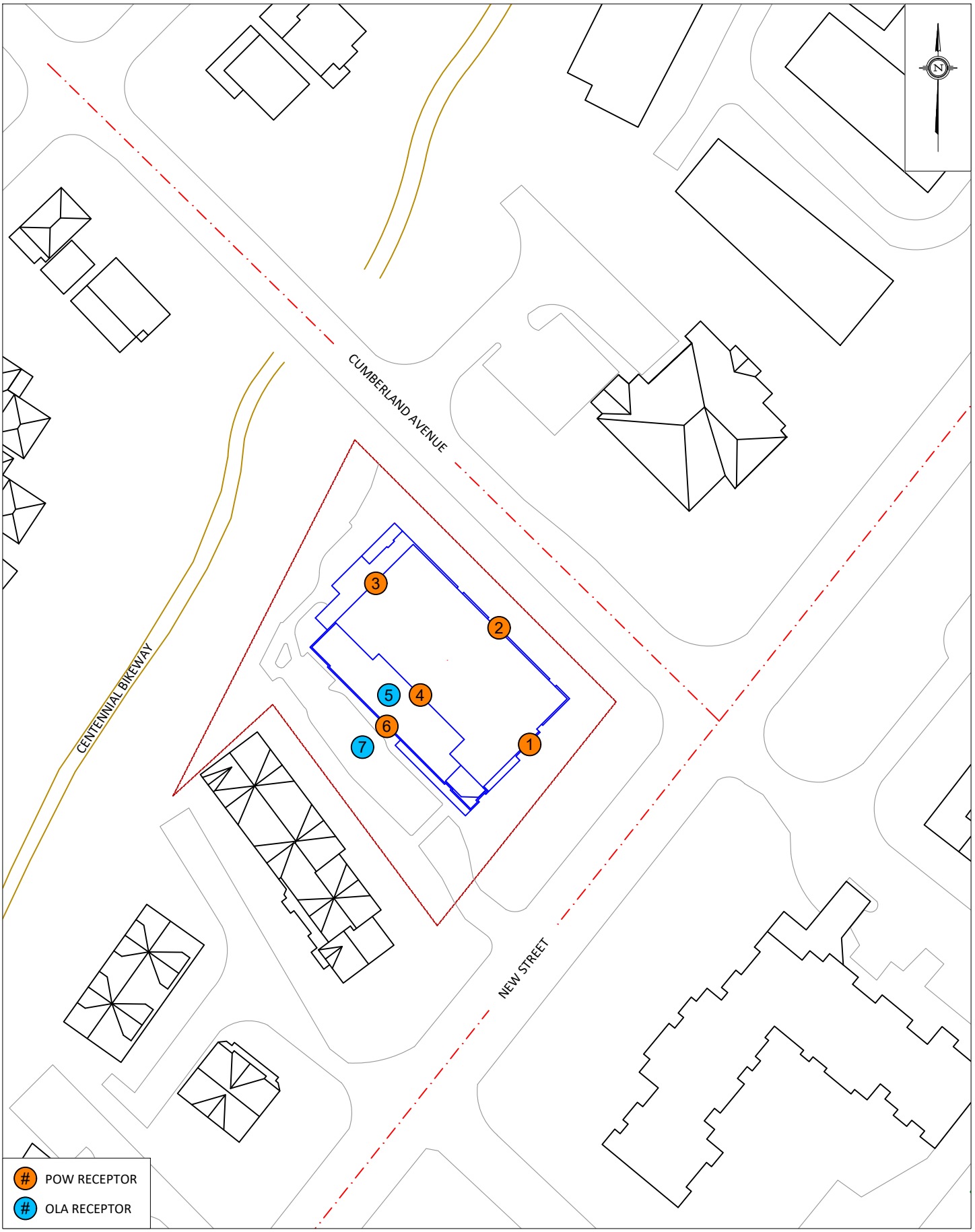
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PROJECT	454-462 CUMBERLAND AVENUE, BURLINGTON TRAFFIC NOISE STUDY
SCALE	1:2000
DRAWING NO.	23-203-NOISE-FIG1
DATE	SEPTEMBER 1, 2023
DRAWN BY	B.P.

DESCRIPTION

FIGURE 1:
PROPOSED SITE PLAN AND SURROUNDING CONTEXT

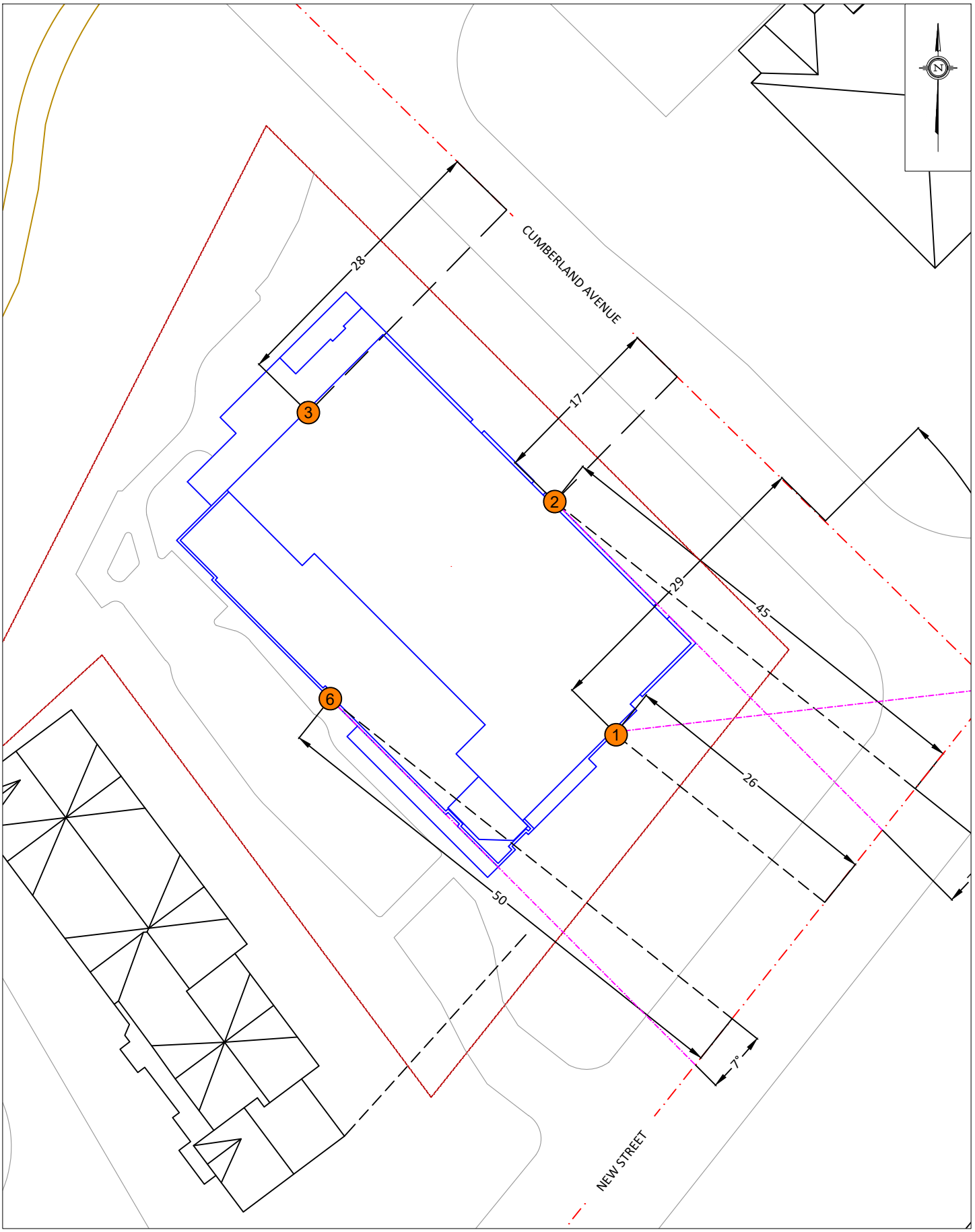


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SCALE	1:1000 (APPROX.)	DRAWING NO. 23-203-NOISE-FIG2
DATE	SEPTEMBER 1, 2023	DRAWN BY B.P.

FIGURE 2:
RECEPTOR LOCATIONS



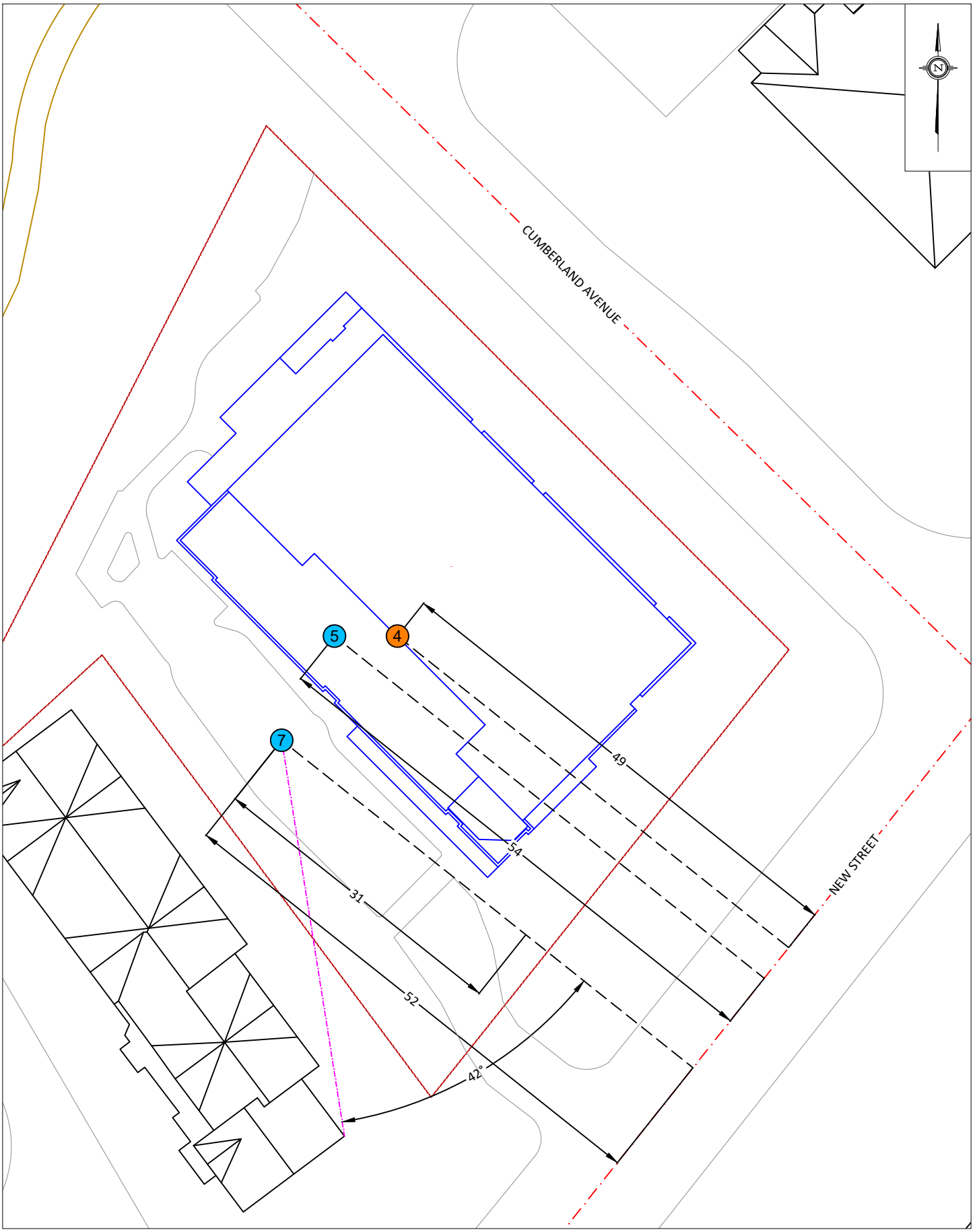
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SCALE	1:500 (APPROX.)
DRAWING NO.	23-203-NOISE-FIG3
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DESCRIPTION

FIGURE 3:
STAMSON INPUT DATA FOR RECEPTORS 1, 2, 3, & 6



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SCALE	1:500 (APPROX.)	DRAWING NO.	23-203-NOISE-FIG4
DATE	SEPTEMBER 1, 2023	DRAWN BY	B.P.

FIGURE 4:
STAMSON INPUT DATA FOR RECEPTORS 4, 5, & 7

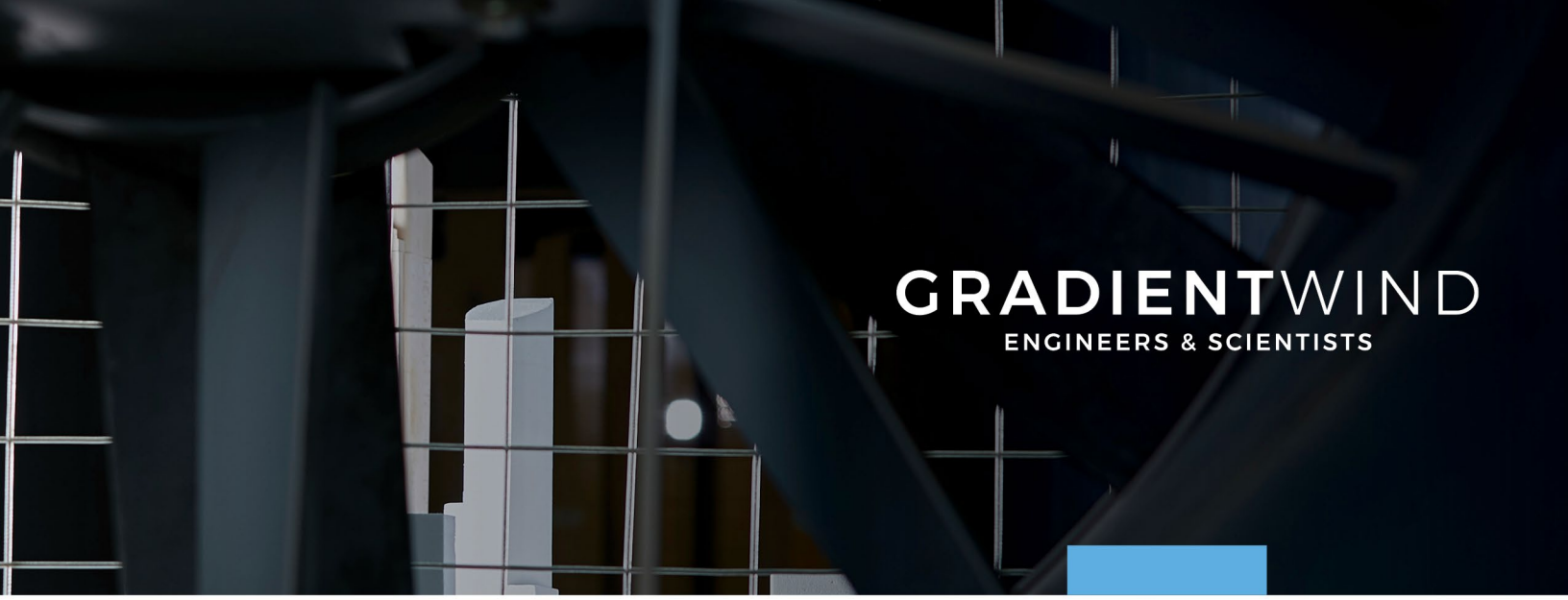


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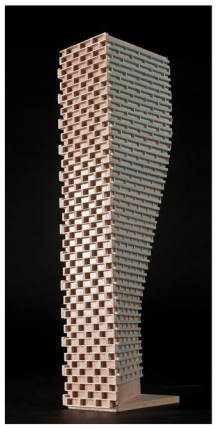
PROJECT	454-462 CUMBERLAND AVENUE, BURLINGTON TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:500 (APPROX.)	DRAWING NO.	23-203-NOISE-FIG5
DATE	SEPTEMBER 1, 2023	DRAWN BY	B.P.

FIGURE 5:
WINDOW STC REQUIREMENTS

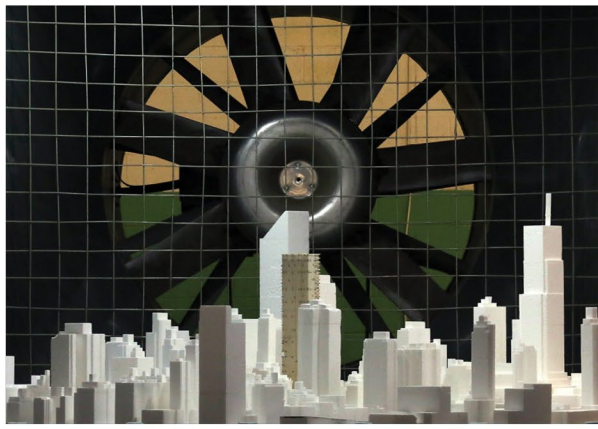


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APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:09:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: NEW STREET (day/night)
----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  26.00 / 26.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: CUMBERLAND (day/night)
----------------------------------------------
Car traffic volume  :  3586/398   veh/TimePeriod  *
Medium truck volume :   204/23    veh/TimePeriod  *
Heavy truck volume  :   285/32    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):   3364
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 2: CUMBERLAND (day/night)
--------------------------------------------
Angle1   Angle2           :   0.00 deg   38.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  29.00 / 29.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 70.18 + 0.00) = 70.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  72.57   0.00  -2.39   0.00   0.00   0.00   0.00
70.18
-------------------------------------------------------------------------
--

Segment Leq : 70.18 dBA


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

Source height = 1.63 m

ROAD (0.00 + 52.63 + 0.00) = 52.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     38   0.00  62.25   0.00  -2.86  -6.75   0.00   0.00   0.00
52.63
-------------------------------------------------------------------------
--

Segment Leq : 52.63 dBA

Total Leq All Segments: 70.26 dBA
```

```
Results segment # 1: NEW STREET (night)
----------------------------------------

Source height = 1.63 m

ROAD (0.00 + 63.66 + 0.00) = 63.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  66.04   0.00  -2.39   0.00   0.00   0.00   0.00
63.66
-------------------------------------------------------------------------------
--

Segment Leq : 63.66 dBA


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

Source height = 1.63 m

ROAD (0.00 + 46.14 + 0.00) = 46.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     38   0.00  55.76   0.00  -2.86  -6.75   0.00   0.00   0.00
46.14
-------------------------------------------------------------------------------
--

Segment Leq : 46.14 dBA

Total Leq All Segments: 63.74 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 70.26
                           (NIGHT): 63.74
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:13:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: NEW STREET (day/night)
----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (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  :  45.00 / 45.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: CUMBERLAND (day/night)
----------------------------------------------
Car traffic volume  :  3586/398   veh/TimePeriod  *
Medium truck volume :   204/23    veh/TimePeriod  *
Heavy truck volume  :   285/32    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):   3364
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 2: CUMBERLAND (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  :  17.00 / 17.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 64.79 + 0.00) = 64.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  72.57   0.00  -4.77  -3.01   0.00   0.00   0.00
64.79
-------------------------------------------------------------------------
--

Segment Leq : 64.79 dBA


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

Source height = 1.63 m

ROAD (0.00 + 61.70 + 0.00) = 61.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  62.25   0.00  -0.54   0.00   0.00   0.00   0.00
61.70
-------------------------------------------------------------------------
--

Segment Leq : 61.70 dBA

Total Leq All Segments: 66.52 dBA
```

```
Results segment # 1: NEW STREET (night)
---------------------------------------

Source height = 1.63 m

ROAD (0.00 + 58.26 + 0.00) = 58.26 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  66.04   0.00  -4.77  -3.01   0.00   0.00   0.00
58.26
-------------------------------------------------------------------------
--

Segment Leq : 58.26 dBA


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

Source height = 1.63 m

ROAD (0.00 + 55.21 + 0.00) = 55.21 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  55.76   0.00  -0.54   0.00   0.00   0.00   0.00
55.21
-------------------------------------------------------------------------
--

Segment Leq : 55.21 dBA

Total Leq All Segments: 60.01 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 66.52
                           (NIGHT): 60.01
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:16:25
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: CUMBERLAND (day/night)
-----------------------------------------------
Car traffic volume  :  3586/398   veh/TimePeriod  *
Medium truck volume :   204/23    veh/TimePeriod  *
Heavy truck volume  :   285/32    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):   3364
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: CUMBERLAND (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  :  28.00 / 28.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 56.53 + 0.00) = 56.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  62.25   0.00  -2.71  -3.01   0.00   0.00   0.00
56.53
-------------------------------------------------------------------------
--

Segment Leq : 56.53 dBA

Total Leq All Segments: 56.53 dBA


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

Source height = 1.63 m

ROAD (0.00 + 50.04 + 0.00) = 50.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  55.76   0.00  -2.71  -3.01   0.00   0.00   0.00
50.04
-------------------------------------------------------------------------
--

Segment Leq : 50.04 dBA

Total Leq All Segments: 50.04 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.53
                           (NIGHT): 50.04
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:19:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: NEW STREET (day/night)
-----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (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  :  49.00 / 49.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 64.42 + 0.00) = 64.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  72.57   0.00  -5.14  -3.01   0.00   0.00   0.00
64.42
-------------------------------------------------------------------------
--

Segment Leq : 64.42 dBA

Total Leq All Segments: 64.42 dBA


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

Source height = 1.63 m

ROAD (0.00 + 57.89 + 0.00) = 57.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  66.04   0.00  -5.14  -3.01   0.00   0.00   0.00
57.89
-------------------------------------------------------------------------
--

Segment Leq : 57.89 dBA

Total Leq All Segments: 57.89 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.42
                           (NIGHT): 57.89
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:26:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: NEW STREET (day/night)
----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (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  :  54.00 / 54.00  m
Receiver height           :  18.70 / 18.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 64.00 + 0.00) = 64.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  72.57   0.00  -5.56  -3.01   0.00   0.00   0.00
64.00
-------------------------------------------------------------------------
--

Segment Leq : 64.00 dBA

Total Leq All Segments: 64.00 dBA


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

Source height = 1.63 m

ROAD (0.00 + 57.47 + 0.00) = 57.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  66.04   0.00  -5.56  -3.01   0.00   0.00   0.00
57.47
-------------------------------------------------------------------------
--

Segment Leq : 57.47 dBA

Total Leq All Segments: 57.47 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.00
                           (NIGHT): 57.47
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:31:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

```
Road data, segment # 1: NEW STREET (day/night)
----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (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  :  50.00 / 50.00  m
Receiver height           :  16.00 / 16.00  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.63 m

ROAD (0.00 + 64.33 + 0.00) = 64.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  72.57   0.00  -5.23  -3.01   0.00   0.00   0.00
64.33
-------------------------------------------------------------------------
--

Segment Leq : 64.33 dBA

Total Leq All Segments: 64.33 dBA


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

Source height = 1.63 m

ROAD (0.00 + 57.81 + 0.00) = 57.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     90   0.00  66.04   0.00  -5.23  -3.01   0.00   0.00   0.00
57.81
-------------------------------------------------------------------------
--

Segment Leq : 57.81 dBA

Total Leq All Segments: 57.81 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.33
                           (NIGHT): 57.81
```

STAMSON 5.0 NORMAL REPORT Date: 08-09-2023 16:34:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: NEW STREET (day/night)
----------------------------------------------
Car traffic volume  : 18850/2094  veh/TimePeriod  *
Medium truck volume :  1071/119   veh/TimePeriod  *
Heavy truck volume  :  1499/167   veh/TimePeriod  *
Posted speed limit  :    60 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):  17684
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  15.00
    Medium Truck % of Total Volume     :   5.00
    Heavy Truck  % of Total Volume     :   7.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: NEW STREET (day/night)
--------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  52.00 / 52.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  42.00 deg   Angle2 : 90.00 deg
Barrier height            :   6.00 m
Barrier receiver distance :  31.00 / 31.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

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

Source height = 1.63 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.63 !        1.50 !        1.58 !         1.58

ROAD (60.85 + 50.38 + 0.00) = 61.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     42   0.00  72.57   0.00  -5.40  -6.32   0.00   0.00   0.00
60.85
-------------------------------------------------------------------------------
--
    42     90   0.00  72.57   0.00  -5.40  -5.74   0.00   0.00 -11.05
50.38
-------------------------------------------------------------------------------
--

Segment Leq : 61.22 dBA

Total Leq All Segments: 61.22 dBA
```

```
Results segment # 1: NEW STREET (night)
---------------------------------------

Source height = 1.63 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.63 !        1.50 !        1.58 !         1.58

ROAD (54.33 + 43.85 + 0.00) = 54.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     42   0.00  66.04   0.00  -5.40  -6.32   0.00   0.00   0.00
54.33
-------------------------------------------------------------------------------
--
    42     90   0.00  66.04   0.00  -5.40  -5.74   0.00   0.00 -11.05
43.85
-------------------------------------------------------------------------------
--

Segment Leq : 54.70 dBA

Total Leq All Segments: 54.70 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.22
                           (NIGHT): 54.70
```