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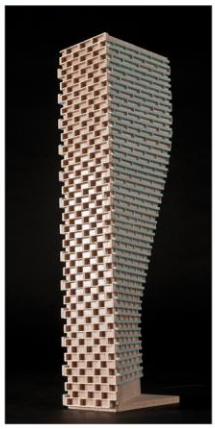
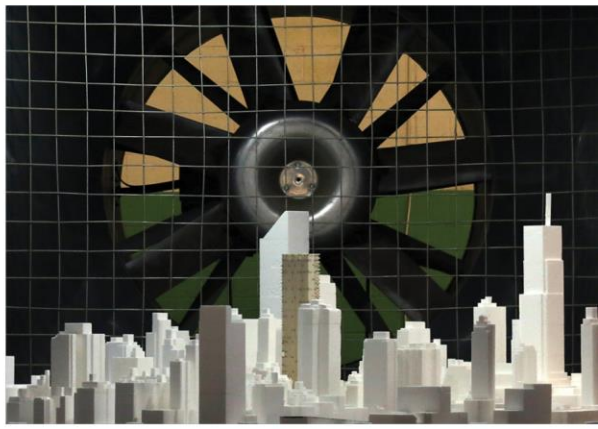
TRANSPORTATION NOISE FEASIBILITY ASSESSMENT

1137 Ogilvie Road
Ottawa, Ontario

REPORT: 24-126-Transportation Noise Feasibility





July 15, 2024

PREPARED FOR
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EXECUTIVE SUMMARY

This report describes a transportation noise feasibility assessment for the proposed mixed-use residential development located at 1137 Ogilvie Road in Ottawa, Ontario. The proposed development comprises a 24-storey mixed-use residential building, inclusive of a 4-storey podium, topped with a mechanical penthouse (MPH). The primary sources of traffic noise impacting the site are Ogilvie Road and Cummings Avenue. Figure 1 illustrates a site plan with the surrounding context.

The assessment is based on (i) theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP) NPC-300 guidelines[1], Ministry of Transportation Ontario (MTO)[2], and City of Ottawa Environmental Noise Control Guidelines (ENCG)[3] guidelines; (ii) future traffic volumes corresponding to roadway classifications, theoretical roadway capacities, and recent satellite imagery; and (iii) architectural drawings prepared by Roderick Lahey Architect Inc. in June 2024.

The results of the current analysis indicate that noise levels will range between 46 and 66 dBA during the daytime period (07:00-23:00) and between 49 and 59 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 66 dBA) occurs along the development's south-facing façade, which is nearest and most exposed to Ogilvie Road. Figures 5 and 6 illustrate daytime and nighttime noise contours for all sources at 4.5 m above grade.

As a result, upgraded building components and central air conditioning will be required, as noise levels predicted due to roadway traffic exceed the criteria of 65 dBA during the daytime listed in ENCG. As noise levels just exceed 65 dBA during the daytime, standard OBC-compliant windows with a rating of STC 30 are required along the south façade of the tower and the podium. This will be sufficient in reducing indoor noise levels at or below the ENCG criterion for noise-sensitive spaces. All units will require air conditioning. In addition, A Type D Warning Clause will also be required to be placed on all Lease, Purchase and Sale Agreements for all units.

[1] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[2] Ministry of Transportation Ontario, "*Environmental Guide for Noise*", August 2021
[3] City of Ottawa Environmental Noise Control Guidelines, January 2016

The results also indicate that noise levels at the Level 5 amenity terraces are expected to be between 46 dBA and 60 dBA. As noise levels exceed the criteria listed in ENCG for outdoor living areas, as discussed in Section 4.2, noise mitigation at the OLAs is required. Detailed mitigation measures would be the subject of a detailed noise assessment during the site plan approval stage.

With regard to stationary noise impacts, the building will be designed to ensure compliance with the ENCG sound level limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary, noise screens and silencers can be placed into the design. It is recommended a stationary noise study be conducted 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.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by TCU Development Corp. to undertake a transportation noise feasibility assessment to satisfy Zoning By-Law Amendment (ZBLA) application submission requirements for the proposed mixed-use residential development located at 1137 Ogilvie Road in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to a transportation noise feasibility assessment investigating exterior noise levels 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) NPC-300 guidelines[4], Ministry of Transportation Ontario (MTO)[5], and City of Ottawa Environmental Noise Control Guidelines (ENCG)[6] guidelines. Noise calculations were based on architectural drawings prepared by Roderick Lahey Architect Inc. in June 2024, with future traffic volumes corresponding to roadway classifications, theoretical roadway capacities, and recent satellite imagery.

2. TERMS OF REFERENCE

The subject site is located at 1137 Ogilvie Road in Ottawa, situated at the northeast corner of the intersection of Ogilvie Road and Cummings Avenue. Throughout this report, Ogilvie Road is considered as project south. The proposed development comprises a 24-storey mixed-use residential building, inclusive of a 4-storey podium, topped with a mechanical penthouse (MPH). A parking ramp leading to two underground parking levels, an unloading move-in move-out area, and a drop-off/pick-up area are located to the north, east, and west of the subject site, respectively. Access to the noted areas is provided by drive aisles perpendicular to Cummings Avenue.

The ground floor of the proposed development includes a commercial space along the south elevation, a residential main entrance to the west, shared building support spaces to the east, and indoor amenities throughout the remainder of the level. An exterior commercial terrace space and an exterior amenity

[4] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[5] Ministry of Transportation Ontario, "*Environmental Guide for Noise*", August 2021
[6] City of Ottawa Environmental Noise Control Guidelines, January 2016

(entry courtyard) are provided at the southeast corner and to the west. Levels 2-24 are reserved for residential occupancy. At Level 2, the building cantilevers over the drive aisle to the north. Setbacks from the north elevation at Level 2 and from all elevations at Level 5 accommodate private terraces.

The site is surrounded by low-rise commercial buildings with surface parking lots from the east-southeast clockwise to the south, a high-rise building to the south, a gas station to the west, low-rise residential dwellings from the west clockwise to the north, and a forested area from the north-northeast clockwise to the east. The primary sources of traffic noise impacting the site are Ogilvie Road and Cummings Avenue. Figure 1 illustrates a site plan with the surrounding context.

With regard to stationary noise impacts, the building will be designed to ensure compliance with the ENCG sound level limits. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary, noise screens and silencers can be placed into the design. It is recommended a stationary noise study be conducted 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.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the study buildings produced by local transportation sources, and (ii) determine whether exterior noise levels 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 Transportation Noise

4.2.1 Criteria for Transportation Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time-varying noise level over a period of time. For roadways, 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 reception areas, residence living rooms and sleeping quarters respectively, as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [7]

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, **sleeping quarters**, 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

[7] Adapted from ENCG 2016 – Tables 2.2b and 2.2c

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[8]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[9]. 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 normally triggers the need for forced air heating with provision for central air conditioning. Where noise levels due to roadway traffic exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[10].

For designated Outdoor Living Areas (OLAs), the sound level limit is 55 dBA during the daytime period. An excess above the limit of 5 dBA is acceptable only in cases where the required noise control measures are not feasible for technical, economic or administrative reasons.

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[11] 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.

[8] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[9] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[10] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[11] City of Ottawa Transportation Master Plan, November 2013

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway/Transit Class	Speed Limit (km/h)	AADT Count
Ogilvie Road	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**
Cummings Avenue	2-Lane Major Collector (2-UMCU)	50	**12,000**

4.2.3 Theoretical Roadway Noise Predictions

The impact of transportation noise sources on the development was determined by computer modelling. Transportation noise source modelling is based on the software program *Predictor-Lima* which utilizes the United States Federal Highway Administration's Traffic Noise Model (TNM) to represent the roadway line sources. This computer program can represent three-dimensional surfaces and the first reflections of sound waves over a suitable spectrum for human hearing. A set of comparative calculations were performed in the free field environment for comparisons to the current Ontario traffic noise prediction model STAMSON. The STAMSON model is however older and requires each receptor to be calculated separately. STAMSON also does not accurately account for building reflections and multiple screening elements, and curved road geometry. Noise levels were found to be within an imperceptible level of 0-3 dBA of those predicted in Predictor. A total of 7 receptor locations were identified around the site, as illustrated in Figure 2.

Roadway noise calculations were performed by treating each transportation segment as separate line sources of noise, and by using existing building locations as noise barriers. 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 for all streets was taken to be 92%/8%, respectively.
- Default 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, receptors considered the proposed and/or existing buildings as a barrier partially or fully obstructing exposure to the source as illustrated by exposure angles in Figure 3.

5. RESULTS AND DISCUSSION

5.1 Transportation Noise Levels

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

TABLE 3: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Total Noise Level (dBA)	
			Day	Night
R1	75.4	POW - Level 24 South Façade	**66**	**59**
R2	75.4	POW - Level 24 West Façade	**63**	**56**
R3	75.4	POW - Level 24 North Façade	**56**	**49**
R4	75.4	POW - Level 24 East Façade	**60**	**52**
R5	16.5	OLA – Level 5 Southeast Terrace	**60**	**N/A***
R6	16.5	OLA – Level 5 Southwest Terrace	**57**	**N/A***
R7	16.5	OLA – Level 5 North Terrace	**46**	**N/A***

*Noise levels during the nighttime are not considered for OLAs

The results of the current analysis indicate that noise levels will range between 46 and 66 dBA during the daytime period (07:00-23:00) and between 49 and 59 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 66 dBA) occurs along the development's south-facing façade, which is nearest and most exposed to Ogilvie Road. Figures 5 and 6 illustrate daytime and nighttime noise contours for all sources at 4.5 m above grade.

Table 4 shows a comparison in results between Predictor-Lima and STAMSON. Noise levels calculated in STAMSON were found to have a good correlation with Predictor-Lima and variability between the two programs was within an acceptable level of ±0-3 dBA. Sample calculations are presented in Appendix A.

TABLE 4: RESULTS OF STAMSON/PREDICTOR-LIMA CORRELATION

Receptor ID	Receptor Location	Receptor Height Above Grade/Roof (m)	PREDICTOR-LIMA Noise Level (dBA)		STAMSON 5.04 Noise Level (dBA)	
			Day	Night	Day	Night
R6	OLA – Level 5 Southwest Terrace	16.5	57	N/A*	58	N/A*
R7	OLA – Level 5 North Terrace	16.5	46	N/A*	49	N/A*

*Noise levels during the nighttime are not considered for OLAs

5.2 Noise Control Measures

The results indicate that upgraded building components and central air conditioning will be required, as noise levels predicted due to roadway traffic exceed the criteria of 65 dBA during the daytime listed in ENCG. As noise levels just exceed 65 dBA during the daytime, standard OBC-compliant windows with a rating of STC 30 are required along the south façade of the Tower and the podium (See Figure 4). This will be sufficient in reducing indoor noise levels at or below the ENCG criterion for noise-sensitive spaces. All units will require air conditioning. In addition, A Type D Warning Clause will also be required to be placed on all Lease, Purchase and Sale Agreements for all units.

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6. CONCLUSIONS AND RECOMMENDATIONS

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This concludes our 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.

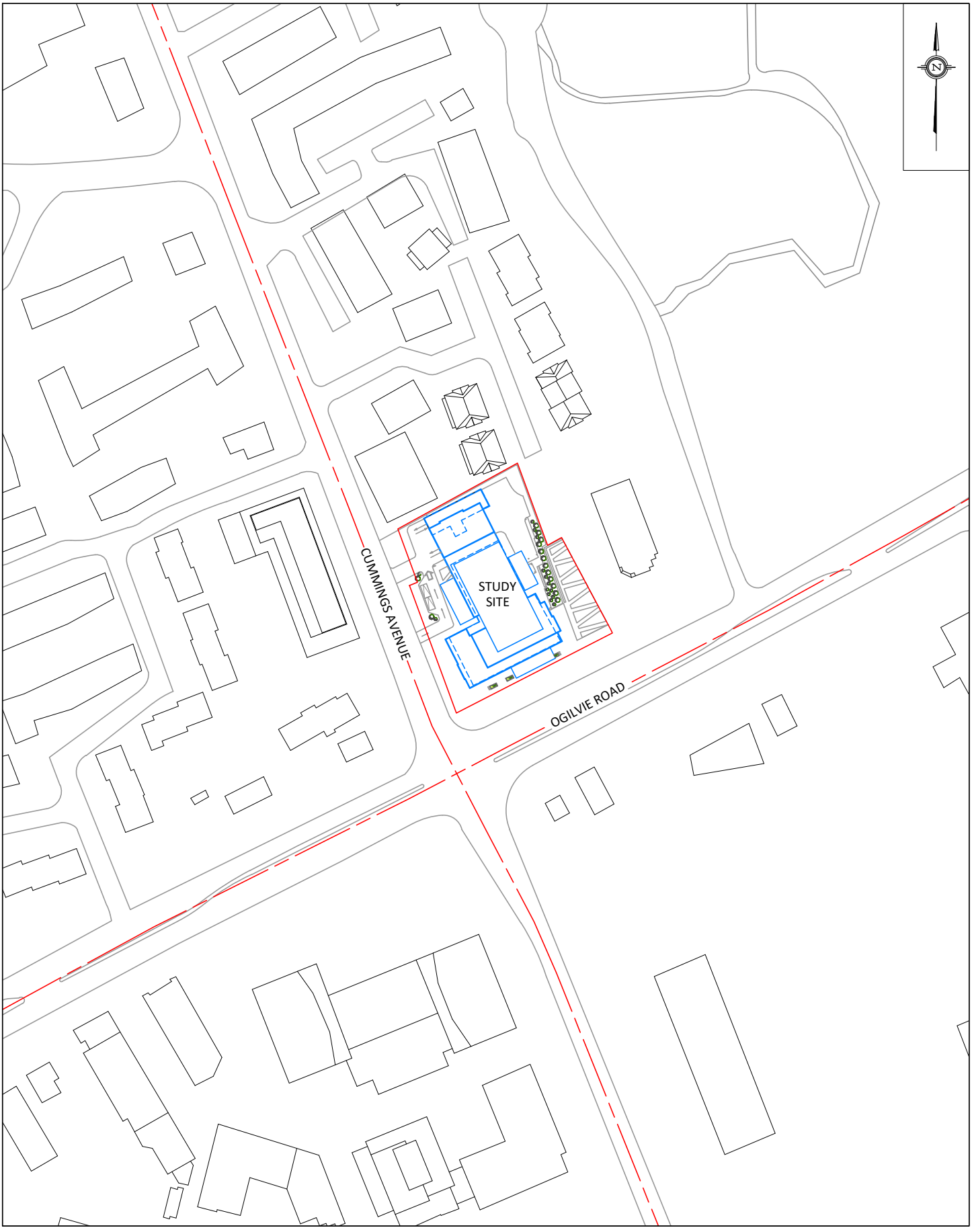
Sincerely,

Gradient Wind Engineering Inc.

Benjamin Page, AdvDip.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #24-126-Transportation Noise Feasibility



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PROJECT	1137 OGILVIE ROAD, OTTAWA TRANSPORTATION NOISE FEASIBILITY STUDY
SCALE	1:2000
DRAWING NO.	24-126-NOISE-FIG1
DATE	JULY 15, 2024
DRAWN BY	B.P.

DESCRIPTION

FIGURE 1:
PROPOSED SITE PLAN AND SURROUNDING CONTEXT

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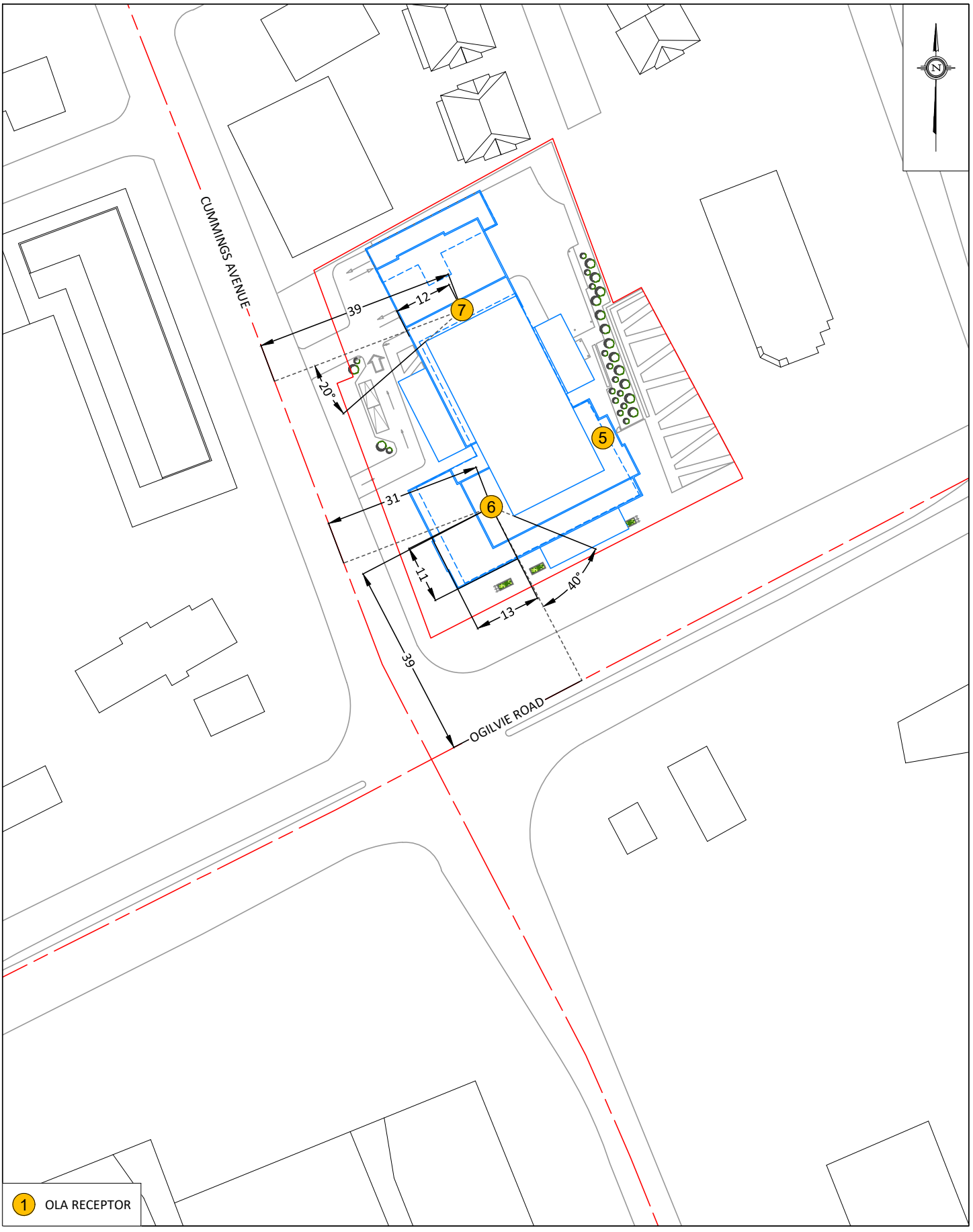
PROJECT	1137 OGILVIE ROAD, OTTAWA TRANSPORTATION NOISE FEASIBILITY STUDY
SCALE	1:500
DRAWING NO.	24-126-NOISE-FIG2
DATE	JULY 15, 2024
DRAWN BY	B.P.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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PROJECT	1137 OGILVIE ROAD, OTTAWA TRANSPORTATION NOISE FEASIBILITY STUDY
SCALE	1:1000
DRAWING NO.	24-126-NOISE-FIG3
DATE	JULY 15, 2024
DRAWN BY	B.P.

DESCRIPTION

FIGURE 3:
STAMSON 5.04 INPUT DATA

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PROJECT	1137 OGILVIE ROAD, OTTAWA TRANSPORTATION NOISE FEASIBILITY STUDY		DESCRIPTION
SCALE	1:500	DRAWING NO. 24-126-NOISE-FIG4	FIGURE 4: STC REQUIREMENTS
DATE	JULY 15, 2024	DRAWN BY B.P.	

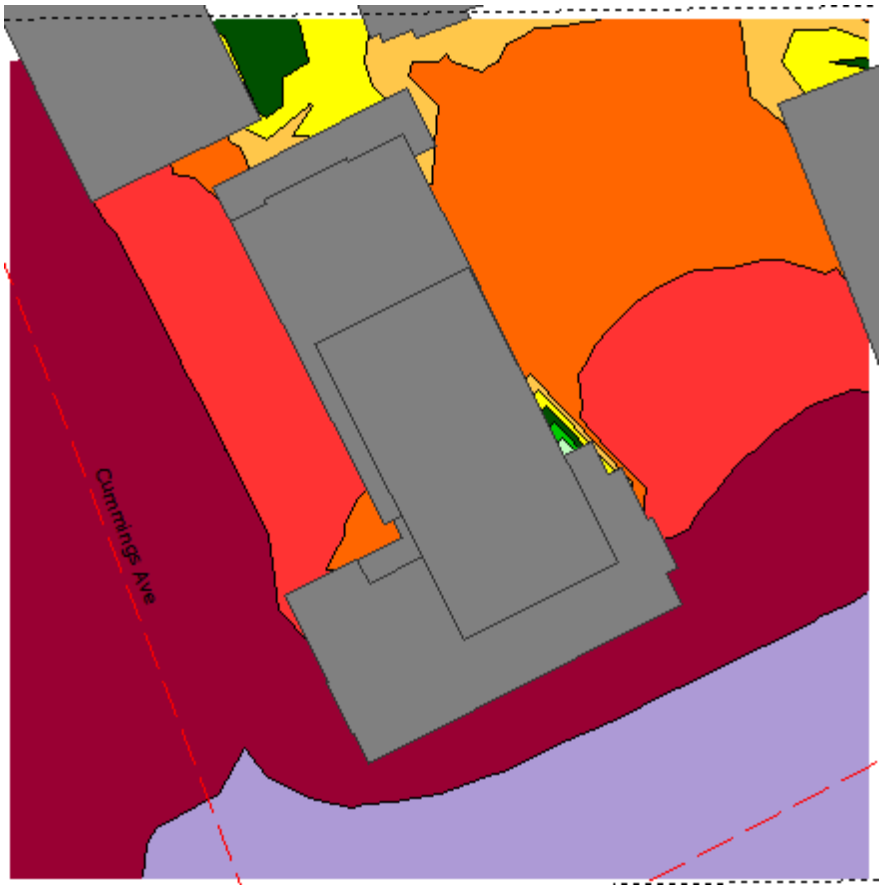


FIGURE 5: DAYTIME NOISE CONTOURS (4.5M ABOVE GRADE)

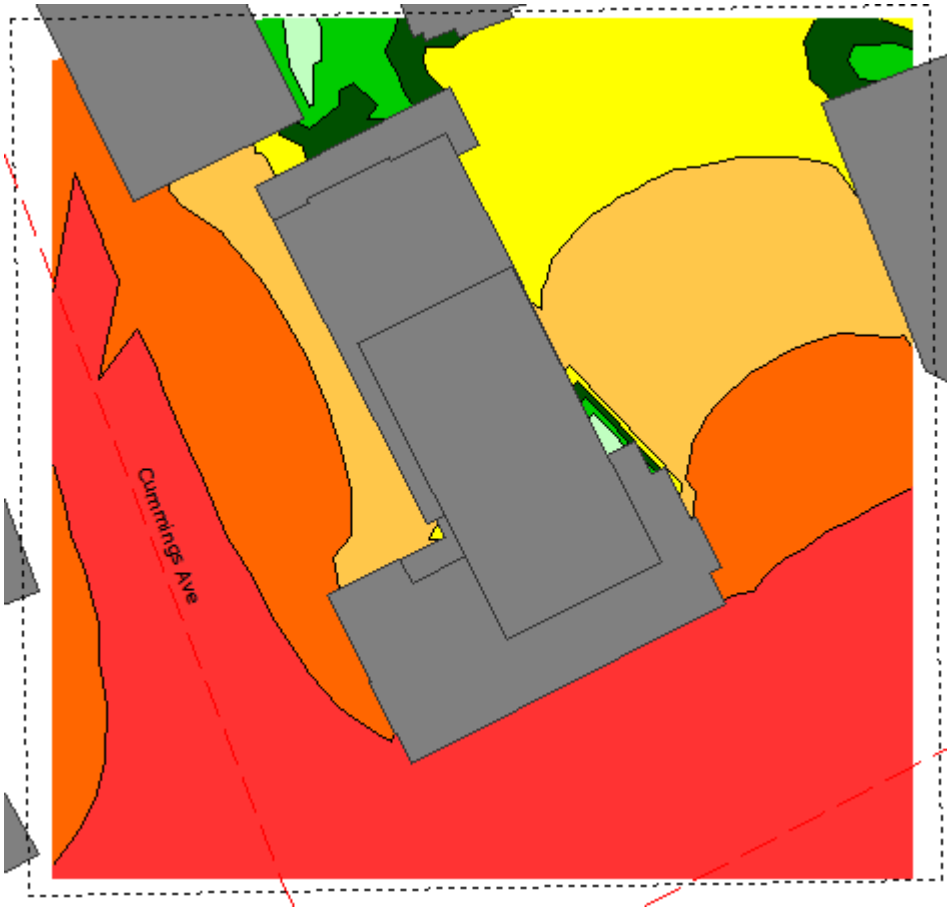
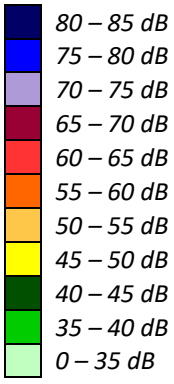


FIGURE 6: NIGHTTIME NOISE CONTOURS (4.5M ABOVE GRADE)



APPENDIX A
STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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STAMSON 5.0 NORMAL REPORT Date: 03-07-2024 13:24:44
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R6.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Ogilvie Rd (day/night)

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 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): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Ogilvie Rd (day/night)

Angle1 Angle2 : -40.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 39.00 / 39.00 m
Receiver height : 16.50 / 16.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -40.00 deg Angle2 : 90.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 11.00 / 11.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Road data, segment # 2: Cummings Ave (day/night)

Car traffic volume : 9715/845 veh/TimePeriod *
Medium truck volume : 773/67 veh/TimePeriod *
Heavy truck volume : 552/48 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): 12000
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: Cummings Ave (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  :  31.00 / 31.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  15.00 m
Barrier receiver distance :  13.00 / 13.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: Ogilvie Rd (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 !       16.50 !       12.27 !        12.27

ROAD (0.00 + 56.72 + 0.00) = 56.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -40     90   0.00  73.68   0.00  -4.15  -1.41   0.00   0.00 -11.39  56.72
-------------------------------------------------------------------------------

Segment Leq : 56.72 dBA

Results segment # 2: Cummings Ave (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 !       16.50 !       10.21 !        10.21

ROAD (0.00 + 50.30 + 0.00) = 50.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  67.51   0.00  -3.15   0.00   0.00   0.00 -14.06  50.30
-------------------------------------------------------------------------------

Segment Leq : 50.30 dBA

Total Leq All Segments: 57.61 dBA
```

```
Results segment # 1: Ogilvie Rd (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 !       16.50 !       12.27 !        12.27

ROAD (0.00 + 49.12 + 0.00) = 49.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -40     90   0.00  66.08   0.00  -4.15  -1.41   0.00   0.00 -11.39  49.12
-------------------------------------------------------------------------------

Segment Leq : 49.12 dBA

Results segment # 2: Cummings Ave (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 !       16.50 !       10.21 !        10.21

ROAD (0.00 + 42.70 + 0.00) = 42.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  59.91   0.00  -3.15   0.00   0.00   0.00 -14.06  42.70
-------------------------------------------------------------------------------

Segment Leq : 42.70 dBA

Total Leq All Segments: 50.01 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.61
                           (NIGHT): 50.01
```

STAMSON 5.0 NORMAL REPORT Date: 03-07-2024 13:29:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R7.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Cummings Ave (day/night)

Car traffic volume : 9715/845 veh/TimePeriod *
Medium truck volume : 773/67 veh/TimePeriod *
Heavy truck volume : 552/48 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): 12000
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: Cummings Ave (day/night)

Angle1 Angle2 : -20.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 39.00 / 39.00 m
Receiver height : 16.50 / 16.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -20.00 deg Angle2 : 90.00 deg
Barrier height : 15.00 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: Cummings Ave (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	16.50	11.88	11.88

ROAD (0.00 + 49.44 + 0.00) = 49.44 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-20	90	0.00	67.51	0.00	-4.15	-2.14	0.00	0.00	-11.79	49.44

```
Segment Leq : 49.44 dBA

Total Leq All Segments: 49.44 dBA

Results segment # 1: Cummings Ave (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 !       16.50 !       11.88 !        11.88

ROAD (0.00 + 41.84 + 0.00) = 41.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -20     90   0.00  59.91   0.00  -4.15  -2.14   0.00   0.00 -11.79  41.84
-------------------------------------------------------------------------------

Segment Leq : 41.84 dBA

Total Leq All Segments: 41.84 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 49.44
                           (NIGHT): 41.84
```