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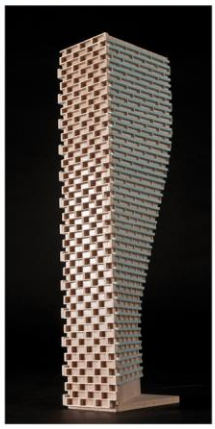
ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT

861 Clyde Avenue North
Ottawa, Ontario

Report: 20-213-T.Noise Feasibility



November 27, 2020

PREPARED FOR
Claridge Homes
210 Gladstone Avenue
Ottawa, ON K2P 0Y6

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

EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment undertaken to satisfy the requirements for a Zoning By-law Amendment (ZBA) application submission for a proposed multi-building development located at 861 Clyde Avenue North in Ottawa, Ontario. The development comprises three 30-storey (plus a mechanical penthouse) residential towers labelled Towers A, B and F, three 25-storey (plus a mechanical penthouse) residential towers labelled Towers C, D and E, and an 8-storey residential building labelled Building G. A public park is proposed for the northwest corner of the site. The major source of roadway traffic noise is Highway 417 to the south, with minor influence from Carling Avenue to the north. Figure 1 illustrates a complete site plan with surrounding context.

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

The results of the current analysis indicate that noise levels at the building façades will range between 51 and 77 dBA during the daytime period (07:00-23:00) and between 43 and 70 dBA during the nighttime period (23:00-07:00). The highest noise level (77 dBA) occurs at the south façade of the towers and podiums, which are nearest and most exposed to Highway 417.

Upgraded building components will be required for all residential towers where noise levels exceed 65 dBA. Based on the results, Building G is not expected to require upgraded building components as it is largely sheltered from Highway 417 by the adjacent towers on site. Due to the limited information available at the time of the study, which was prepared for a ZBA application submission, detailed STC calculations could not be performed at this time. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of each building.

Results of the calculations also indicate that all residential towers will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a

comfortable living environment. Warning Clauses will also be required be placed on all Lease, Purchase and Sale Agreements for all towers. Building G is not expected to require forced air heating with provisions for central air conditioning as it is largely sheltered from Highway 417 by the adjacent towers on site, resulting in POW noise levels below 55 dBA.

The results indicate that noise levels at the Level 3 outdoor amenity areas are between 27 dBA and 70 dBA. The highest noise level at an outdoor amenity area occurs at the east side of Tower E at Level 3, as the area is largely directly exposed to Highway 417. Alternatively, the area at Level 3 to the north of Tower C is well sheltered from Highway 417 by the towers. If areas with noise levels exceeding 55 dBA are to be designated as amenity areas used for the quiet enjoyment of the outdoors, noise control measures will be required to reduce the daytime L_{eq} to below 60 dBA and as close to 55 dBA as feasibly possible. A detailed barrier investigation will be performed in the subsequent detailed noise study.

A detailed noise assessment will be required at the time of site plan approval to determine specific noise control measures for each building.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Claridge Homes to undertake a roadway traffic noise feasibility assessment, to satisfy the requirements for a Zoning By-law Amendment (ZBA) application submission, for a proposed multi-building development located at 861 Clyde Avenue North in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings provided by EVOQ Architecture in September 2020, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is a proposed multi-building development located at 861 Clyde Avenue North in Ottawa, Ontario. The subject site is located at the south side of a parcel of land bounded by Clyde Avenue North to the west, Carling Avenue to the north, Churchill Avenue North to the northeast, and Highway 417 to the southwest. Throughout this report, the Highway 417 elevation is referred to as the south elevation.

Rendering, North Perspective
(Courtesy of EVOQ Architecture)

The development comprises three 30-storey (plus a mechanical penthouse) residential towers labelled Towers A, B and F, three 25-storey (plus a mechanical penthouse) residential towers labelled Towers C, D

[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

and E, and an 8-storey residential building labelled Building G. Towers A through F are aligned northeast-to-southwest along the south perimeter of the site, while Building G is located centrally at the north side of the site. At grade, a public park is proposed at the northwest corner of the site and a landscaped pedestrian walkway is proposed along the south perimeter of the site situated between the towers and Highway 417.

Towers A and B share a 6-storey podium, Towers C and D share a 6-storey podium, and Towers E and F each include separate 6-storey podia. Additionally, Tower C, Tower D and Building G share a large, common 2-storey podium, in which its rooftop provides exterior pedestrian access to the third floor of the noted buildings from a staircase at the northwest corner. Similarly, Towers E and F share a common 2-storey podium, accessible by a staircase at the southeast corner. A bridge at the north side of the site, to the west of Building G, provides pedestrian access between the rooftop of the 2-storey podia. The interior space of the 2-storey podia, as well as Levels 1 and 2 of the 6-storey podium shared between Towers A and B, includes vehicular parking at the south side and centre of the floorplan surrounded by commercial units, indoor amenity space, lobbies, and townhomes in the remaining spaces. Indoor amenity spaces at provided at Level 3 of each tower, while the floors above are largely reserved for residential units.

Internal driveways, extending along the north side of the site and the south side of the proposed public park, provide access to the site from Clyde Avenue North and Churchill Avenue North. The driveways intersect the 6-storey podium of Tower F and separate the 2-storey podia. The vehicular entrances to the parking lots are provided at the east side of the shared podium of Towers A and B, the east and west side of the shared podium of Towers C and D, and the west side of Tower E. Two bridges are provided at the south side of Level 2 between the podia, as well as at Level 2 between the blocks of townhomes.

As the balconies serving the residential units extend less than 4 metres from the façade, they do not require consideration as outdoor living areas (OLA) in this study. Outdoor amenity areas have been considered at Level 3 adjacent to Towers C an E. As per ENCG, parks are not defined as OLAs or noise sensitive spaces, therefore, the noise levels in these areas have not been evaluated in this assessment.

The site is surrounded by low-rise buildings in all directions, with a cluster of isolated mid-rise buildings to the northeast. The major source of roadway traffic noise is Highway 417 to the south, with minor influence from Carling Avenue to the north. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

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

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For surface roadway traffic noise, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 50, 45 and 40 dBA for retail space, living rooms and sleeping quarters, respectively, for roadway traffic as listed in Table 1.

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

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[6].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

4.2.2 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway

[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] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[7] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Highway 417	8-Lane Freeway	100	**146,664**
Carling Avenue	6-Lane Arterial (Divided)	60	**50,000**

4.2.3 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs: Predictor-Lima and STAMSON 5.04. To provide a general understanding of noise across the site, the employed software program was Predictor-Lima, which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid was placed across the subject site, along with a number of discrete receptors at key sensitive areas. Although this program is useful for outputting noise contours, it is not the approved calculation method for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the MECP computerized noise assessment program, STAMSON 5.04, at five sample receptor locations. Receptor distances and exposure angles are illustrated in Figure 3. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as a separate line source of noise, and by using existing buildings as noise barriers. In addition to the traffic volumes summarized in Table 1, theoretical noise predictions were based on the following parameters:

- The day/night split was taken to be 92%/8% respectively for all streets.

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

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be flat/gentle slope surrounding the subject site.
- Highway 417 was considered to be sloping up from the southeast corner of the subject site towards to the southwest corner of the site, as well as from the southeast corner towards the east, each with a change in elevation of 5 metres. At the southeast corner of the site, Highway 417 is considered to be at grade.
- For select sources where appropriate, the receptors considered the proposed buildings and surrounding, existing buildings as barriers, partially or fully obstructing exposure to the source.
- Noise receptors were strategically placed at 20 locations around the study area, see Figure 2. For several POW receptors, the noise levels were calculated at various heights along the respective building façade.
- Receptor distances and exposure angles used in the STAMSON calculations are illustrated in Figure 3.

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the current analysis indicate that noise levels at the building façades will range between 51 and 77 dBA during the daytime period (07:00-23:00) and between 43 and 70 dBA during the nighttime period (23:00-07:00). The highest noise level (77 dBA) occurs at the south façade of the towers and podiums, which are nearest and most exposed to Highway 417. Figures 4 through 7 illustrate daytime and nighttime noise contours throughout the site at heights of 1.5 m and 70 m above grade.

The noise levels predicted due to roadway traffic exceed to criteria listed in Section 4.2 for building components. Upgraded building components, including STC rated glazing elements and exterior walls, will be required where noise levels due to roadway traffic exceed 65 dBA, as discussed in Section 4.2.1. Results also indicate that Towers A to F will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required to be placed on all Lease, Purchase,

and Sale Agreements. Specific noise control measures can be developed once the design of the buildings has progressed sufficiently, typically at the time of the site plan control application.

The results indicate that noise levels at the Level 3 outdoor amenity areas are between 27 dBA and 70 dBA. The highest noise level at an outdoor amenity area occurs at the east side of Tower E at Level 3, as the area is largely directly exposed to Highway 417. Alternatively, the area at Level 3 to the north of Tower C is well sheltered from Highway 417 by the towers.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Noise Level (dBA)	
			Day	Night
Tower A				
R1	16.5	POW – West Façade of Podium	72	64
R2	28.5	POW – West Façade of Tower	74	67
	49.5		74	66
	91.5		74	66
R3	28.5	POW – South Façade of Tower	77	70
	49.5		77	69
	91.5		77	69
R4	28.5	POW – East Façade of Tower	75	68
	49.5		75	67
	91.5		75	67
R5	16.5	POW – South Façade of Podium	77	70
Tower B				
R6	28.5	POW – West Façade of Tower	75	68
	49.5		75	67
	91.5		74	67
R7	28.5	POW – East Façade of Tower	74	66
	49.5		73	66
	91.5		73	65
Tower C				
R8	25.3	POW – West Façade of Tower	75	68
	49.3		75	68
	76.3		75	67

TABLE 3 CONT.: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Noise Level (dBA)	
			Day	Night
Tower C				
R9	25.3	POW – East Façade of Tower	74	67
	49.3		74	66
	76.3		73	66
R10	7.5	OLA – Level 3 Amenity Area	27	N/A*
Tower D				
R11	25.3	POW – South Façade of Tower	77	70
	49.3		77	69
	76.3		77	69
R12	16.5	POW – East Façade of Podium	73	65
Tower E				
R13	25.3	POW – West Façade of Tower	75	67
	49.3		75	67
	76.3		74	67
R14	7.5	OLA – Level 3 Amenity Area	70	N/A*
Tower F				
R15	28.5	POW – South Façade of Tower	77	69
	49.5		76	69
	91.5		76	69
R16	28.5	POW – East Façade of Tower	75	68
	49.5		75	67
	91.5		74	66
R17	16.5	POW – East Façade of Podium	75	68
R18	28.5	POW – North Façade of Tower	65	58
	49.5		65	57
	91.5		66	58
R19	10.5	POW – South Façade of Podium	59	52
Building G				
R20	27.5	POW – South Façade	51	43

* Noise levels at the OLAs during the nighttime period are not considered as per the ENCG

Table 4 below shows a comparison between the calculated noise levels using Predictor-Lima and STAMSON. Noise levels calculated in STAMSON were found to have good correlation with Predictor-Lima and variability between the two programs was within an acceptable level of ±1-4 dBA. Appendix A includes the STAMSON 5.04 input and output data.

TABLE 4: RESULT CORRELATION BETWEEN PREDICTOR AND STAMSON

Receptor Number	Receptor Location	Receptor Height (m)	STAMSON 5.04 Noise Level (dBA)		PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night	Day	Night
R5	POW – South Façade of Podium Shared with Towers A & B	16.5	80	72	77	70
R8	POW – West Façade of Tower C	25.3	78	71	75	68
R11	POW – South Façade of Tower D	25.3	81	73	77	70
R17	POW – East Façade of Podium of Tower F	16.5	78	70	75	68
R18	POW – North Façade of Tower F	91.5	65	57	66	58

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels at the building façades will range between 51 and 77 dBA during the daytime period (07:00-23:00) and between 43 and 70 dBA during the nighttime period (23:00-07:00). The highest noise level (77 dBA) occurs at the south façade of the towers and podiums, which are nearest and most exposed to Highway 417.

Upgraded building components will be required for all residential towers where noise levels exceed 65 dBA. Based on the results, Building G is not expected to require upgraded building components as it is largely sheltered from Highway 417 by the adjacent towers on site, resulting in POW noise levels below the criteria of 65 dBA. Due to the limited information available at the time of the study, which was prepared for a ZBA application submission, detailed STC calculations could not be performed at this time. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of each building.

Results of the calculations also indicate that all residential towers will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. Warning Clauses will also be required be placed on all Lease, Purchase and Sale Agreements for all towers. Building G is not expected to require forced air heating with provisions for air conditioning as it is largely sheltered from Highway 417 by the adjacent towers on site, resulting in POW noise levels below 55 dBA.

The results indicate that noise levels at the Level 3 outdoor amenity areas are between 27 dBA and 70 dBA. The highest noise level at an outdoor amenity area occurs at the east side of Tower E at Level 3, as the area is largely directly exposed to Highway 417. Alternatively, the area at Level 3 to the north of Tower C is well sheltered from Highway 417 by the towers. If areas exceeding 55 dBA are to be designated as amenity areas used for the quiet enjoyment of the outdoors, noise control measures will be required to reduce the daytime L_{eq} to below 60 dBA and as close to 55 dBA as feasibly possible. A detailed barrier investigation will be performed in the subsequent detailed noise study.

A detailed noise assessment will be required at the time of site plan approval to determine specific noise control measures for each building.

This concludes our roadway traffic noise feasibility assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

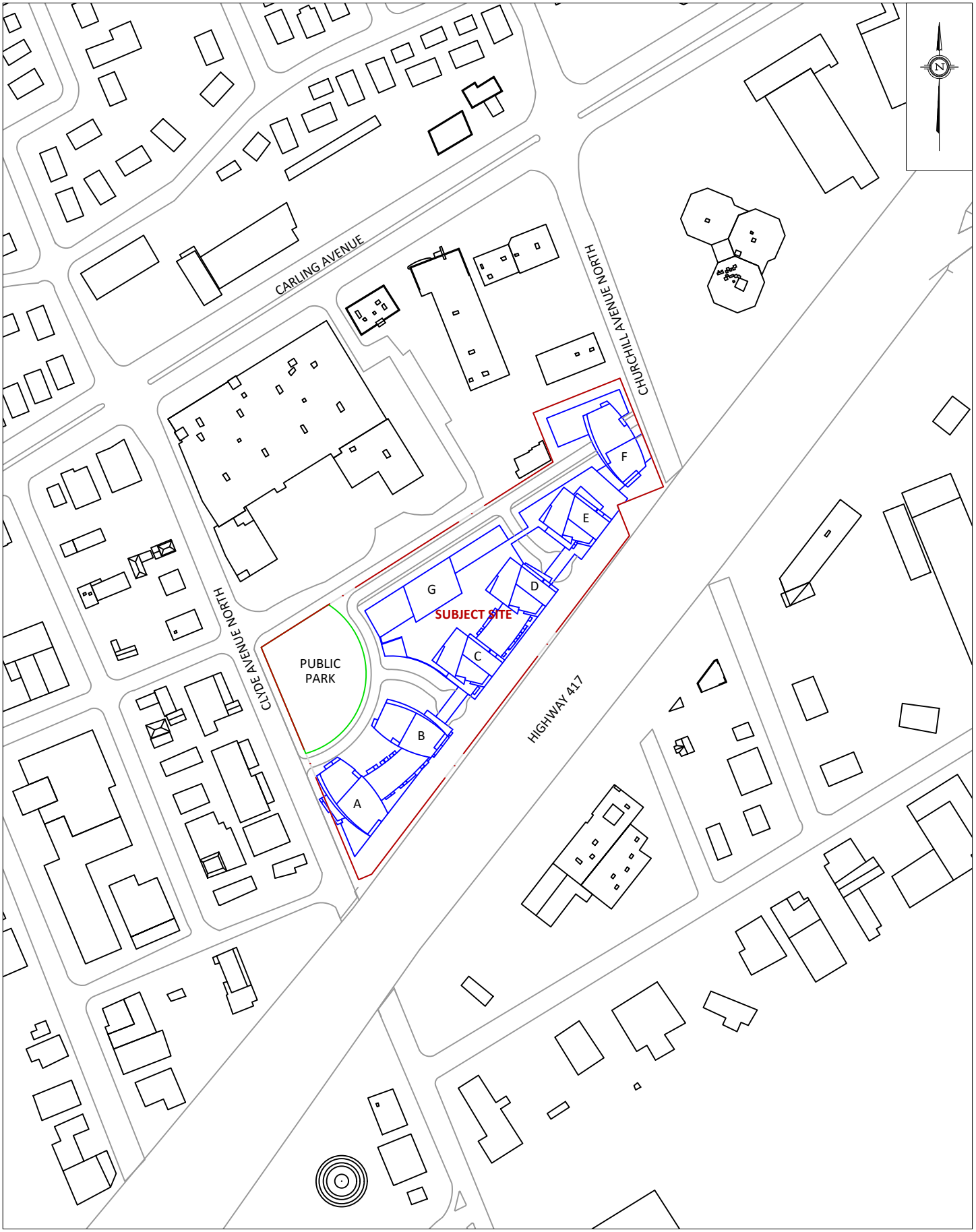
Sincerely,

Gradient Wind Engineering Inc.

Samantha Phillips. B.Eng.
Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File 20-213-T.Noise Feasibility



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PROJECT	861 CLYDE AVENUE NORTH, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GW20-213-1
DATE	OCTOBER 23, 2020
DRAWN BY	S.P.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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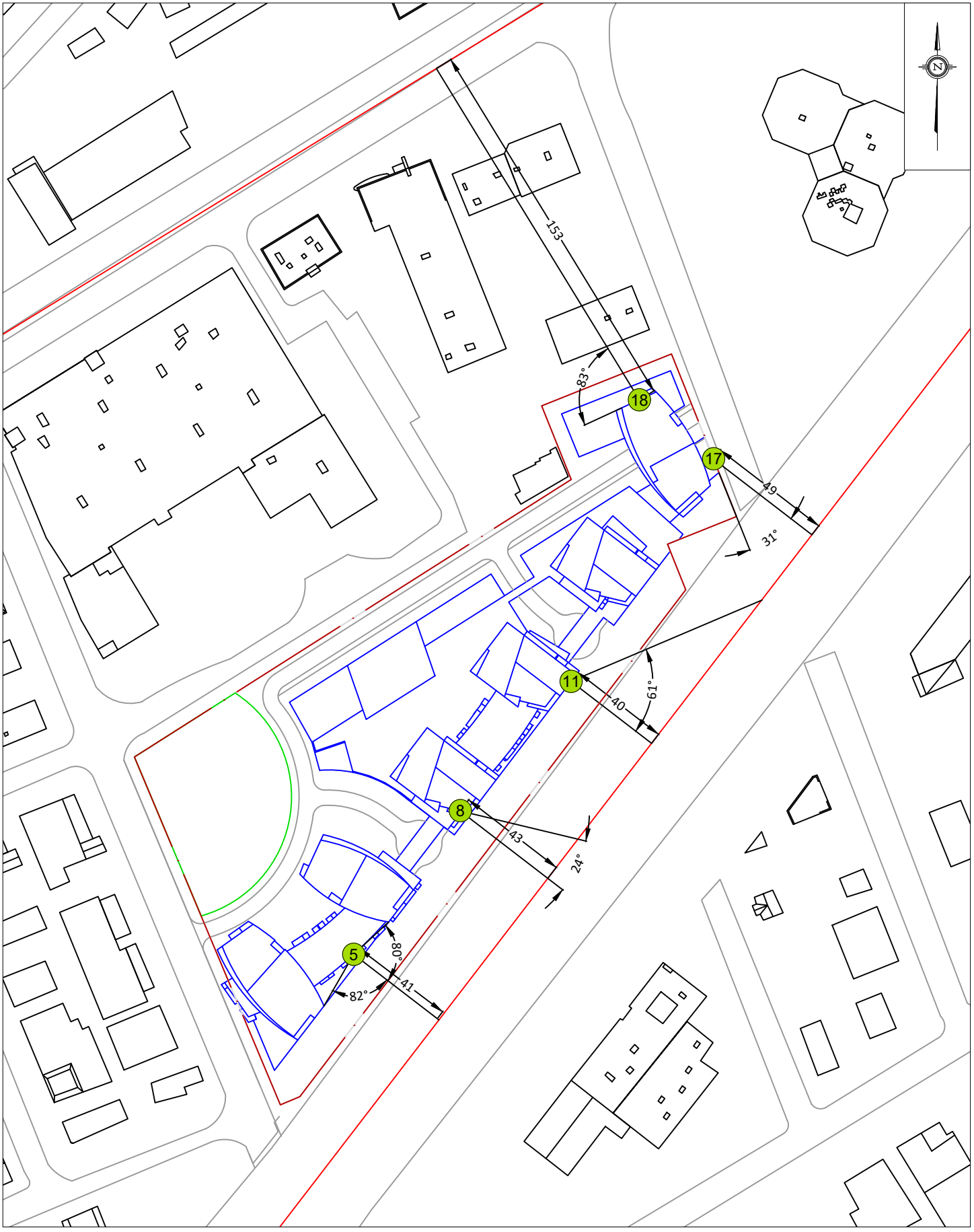
PROJECT	861 CLYDE AVENUE NORTH, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
SCALE	1:1500 (APPROX.)	DRAWING NO.	GW20-213-2
DATE	OCTOBER 23, 2020	DRAWN BY	S.P.

FIGURE 2:
RECEPTOR LOCATIONS



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PROJECT	861 CLYDE AVENUE NORTH, OTTAWA ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW20-213-3
DATE	OCTOBER 23, 2020	DRAWN BY	S.P.

FIGURE 3:
STAMSON INPUT PARAMETERS

FIGURE 4: DAYTIME TRAFFIC NOISE CONTOURS (1.5 M ABOVE GRADE)

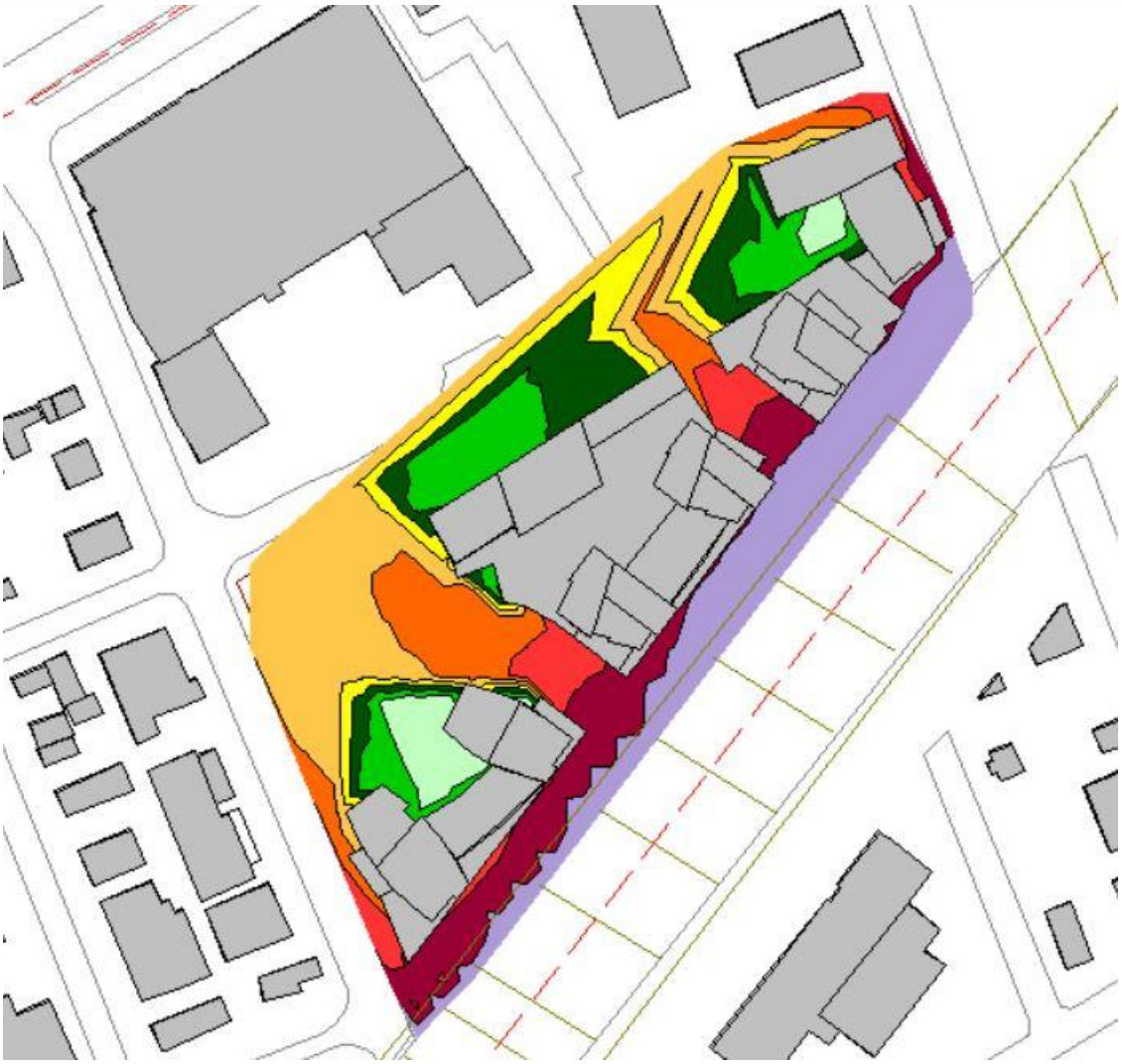

FIGURE 5: NIGHTTIME TRAFFIC NOISE CONTOURS (1.5 M ABOVE GRADE)

FIGURE 6: DAYTIME TRAFFIC NOISE CONTOURS (70 M ABOVE GRADE)

- *80 – 85 dB*
- *75 – 80 dB*
- *70 – 75 dB*
- *65 – 70 dB*
- *60 – 65 dB*
- *55 – 60 dB*
- *50 – 55 dB*
- *45 – 50 dB*
- *40 – 45 dB*
- *35 – 40 dB*
- *0 – 35 dB*

FIGURE 7: NIGHTTIME TRAFFIC NOISE CONTOURS (70 M 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: 21-10-2020 10:49:50
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: hwy 417 (day/night)
-------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     2 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: hwy 417 (day/night)
-----------------------------------------
Angle1   Angle2           : -80.00 deg   82.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  41.00 / 41.00  m
Receiver height           :  16.50 / 16.50  m
Topography                :      3       (Elevated; no barrier)
Elevation                 :   3.80 m
Reference angle           :   0.00
```

```
Results segment # 1: hwy 417 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 80.02 + 0.00) = 80.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -80     82   0.00  84.85   0.00  -4.37  -0.46   0.00   0.00   0.00
80.02
-------------------------------------------------------------------------
--

Segment Leq : 80.02 dBA

Total Leq All Segments: 80.02 dBA


Results segment # 1: hwy 417 (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 72.43 + 0.00) = 72.43 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -80     82   0.00  77.25   0.00  -4.37  -0.46   0.00   0.00   0.00
72.43
-------------------------------------------------------------------------
--

Segment Leq : 72.43 dBA

Total Leq All Segments: 72.43 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 80.02
                           (NIGHT): 72.43
```

```
STAMSON 5.0         NORMAL REPORT         Date: 23-10-2020 10:38:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r8.te                 Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: hwy 417 (day/night)
-------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     2 %
Road pavement       :     1 (Typical asphalt or concrete)

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

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    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: hwy 417 (day/night)
-----------------------------------------
Angle1   Angle2           : -24.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  43.00 / 43.00  m
Receiver height           :  25.30 / 25.30  m
Topography                :      3       (Elevated; no barrier)
Elevation                 :   2.50 m
Reference angle           :   0.00
```

```
Results segment # 1: hwy 417 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 78.29 + 0.00) = 78.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -24     90   0.00  84.85   0.00  -4.57  -1.98   0.00   0.00   0.00
78.29
-------------------------------------------------------------------------
--

Segment Leq : 78.29 dBA

Total Leq All Segments: 78.29 dBA


Results segment # 1: hwy 417 (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 70.69 + 0.00) = 70.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -24     90   0.00  77.25   0.00  -4.57  -1.98   0.00   0.00   0.00
70.69
-------------------------------------------------------------------------
--

Segment Leq : 70.69 dBA

Total Leq All Segments: 70.69 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 78.29
                           (NIGHT): 70.69
```

```
STAMSON 5.0        NORMAL REPORT        Date: 23-10-2020 10:40:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r11.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: hwy 417 1 (day/night)
----------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     2 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: hwy 417 1 (day/night)
-------------------------------------------
Angle1   Angle2           : -61.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  40.00 / 40.00  m
Receiver height           :  25.30 / 25.30  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: hwy 417 2 (day/night)
---------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     2 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: hwy 417 2 (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   -61.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  40.00 / 40.00  m
Receiver height           :  25.30 / 25.30  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: hwy 417 1 (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 79.82 + 0.00) = 79.82 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -61     90   0.00  84.85   0.00  -4.26  -0.76   0.00   0.00   0.00
79.82
-------------------------------------------------------------------------
--

Segment Leq : 79.82 dBA


Results segment # 2: hwy 417 2 (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 72.66 + 0.00) = 72.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -61   0.00  84.85   0.00  -4.26  -7.93   0.00   0.00   0.00
72.66
-------------------------------------------------------------------------
--

Segment Leq : 72.66 dBA

Total Leq All Segments: 80.58 dBA
```

```
Results segment # 1: hwy 417 1 (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 72.23 + 0.00) = 72.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -61     90   0.00  77.25   0.00  -4.26  -0.76   0.00   0.00   0.00
72.23
-------------------------------------------------------------------------
--

Segment Leq : 72.23 dBA


Results segment # 2: hwy 417 2 (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.06 + 0.00) = 65.06 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -61   0.00  77.25   0.00  -4.26  -7.93   0.00   0.00   0.00
65.06
-------------------------------------------------------------------------
--

Segment Leq : 65.06 dBA

Total Leq All Segments: 72.99 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 80.58
                           (NIGHT): 72.99
```

```
STAMSON 5.0        NORMAL REPORT        Date: 23-10-2020 10:41:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r17.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: hwy 417 (day/night)
-------------------------------------------
Car traffic volume  : 118739/10325 veh/TimePeriod  *
Medium truck volume :  9445/821   veh/TimePeriod  *
Heavy truck volume  :  6747/587   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     2 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT): 146664
    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: hwy 417 (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   31.00 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           :  16.50 / 16.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: hwy 417 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 77.98 + 0.00) = 77.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     31   0.00  84.85   0.00  -5.14  -1.72   0.00   0.00   0.00
77.98
-------------------------------------------------------------------------
--

Segment Leq : 77.98 dBA

Total Leq All Segments: 77.98 dBA


Results segment # 1: hwy 417 (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 70.39 + 0.00) = 70.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     31   0.00  77.25   0.00  -5.14  -1.72   0.00   0.00   0.00
70.39
-------------------------------------------------------------------------
--

Segment Leq : 70.39 dBA

Total Leq All Segments: 70.39 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 77.98
                           (NIGHT): 70.39
```

```
STAMSON 5.0        NORMAL REPORT        Date: 23-10-2020 10:41:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r18.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: carling (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  :    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):  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: carling (day/night)
-----------------------------------------
Angle1   Angle2           : -83.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 153.00 / 153.00 m
Receiver height           :  91.50 / 91.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 64.97 + 0.00) = 64.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83     90   0.00  75.22   0.00 -10.09  -0.17   0.00   0.00   0.00
64.97
-------------------------------------------------------------------------
--

Segment Leq : 64.97 dBA

Total Leq All Segments: 64.97 dBA


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

Source height = 1.50 m

ROAD (0.00 + 57.37 + 0.00) = 57.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83     90   0.00  67.63   0.00 -10.09  -0.17   0.00   0.00   0.00
57.37
-------------------------------------------------------------------------
--

Segment Leq : 57.37 dBA

Total Leq All Segments: 57.37 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 64.97
                           (NIGHT): 57.37
```