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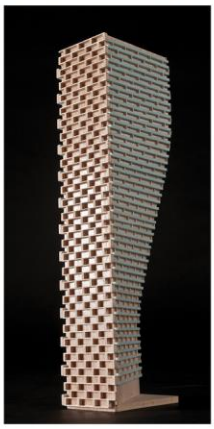
ROADWAY TRAFFIC NOISE ASSESSMENT

3430 Carling Avenue
Ottawa, Ontario

REPORT: 22-311 – Traffic Noise



December 15, 2022

PREPARED FOR

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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken to satisfy the requirements for a Site Plan Control (SPC) application submission for a proposed development located at 3430 Carling Avenue in Ottawa, Ontario. The proposed development comprises two 6-storey residential buildings, plus mechanical level, situated on a trapezoidal parcel of land fronting onto Carling Avenue. The primary source of roadway traffic noise includes Carling Avenue. 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 Project1 Studio in November 2022.

The results of the current analysis indicate that noise levels will range between 60 and 73 dBA during the daytime period (07:00-23:00) and between 59 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (73 dBA) occurs at the north façade of both east and west buildings, which are nearest and most exposed to Carling Avenue. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 3.

Results of the calculations also indicate that the development will require air-conditioned dwelling units, 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, as summarized in Section 6 of this report.

Noise levels at the rooftop terraces are expected to exceed the 55 dBA OLA noise criterion during the daytime period. Further analysis investigated the noise mitigating impact of a 1.1 m high noise barrier on the rooftop terraces of both buildings. With this mitigation measure, noise levels reduce to 57 and 56 dBA at the west and east terrace, respectively. A Type A Warning Clause will be required for rooftop terraces associated with the east and west buildings, as summarized in Section 6.

The development is surrounded by low-rise residential buildings in all compass directions; as a result, no existing stationary noise sources are expected to be a concern. With regard to stationary noise impacts, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed building become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits. As the mechanical equipment will primarily reside in the mechanical level located on the high roof, noise levels on the surrounding noise sensitive properties are expected to be negligible. In the event that noise levels exceed ENCG criteria, noise impacts can generally be minimized by judicious selection and placement of the equipment.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Rohit Communities Ontario Inc. to undertake a roadway traffic noise assessment to satisfy the requirements for a Site Plan Control (SPC) application submission for a proposed residential development located at 3430 Carling Avenue in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings provided by Project1 Studio in November 2022, 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 assessment is a proposed residential development located at 3430 Carling Avenue in Ottawa, Ontario. The proposed development comprises two 6-storey buildings on a trapezoidal parcel of land fronting Carling Avenue to the north. The east building comprises a nominally rectangular planform with two levels of shared underground parking and residential units from Levels 1 to 6. The west building comprises an "L"-shaped planform residential units from Levels 1 to 6. Both buildings are topped with a Mechanical Penthouse with an adjacent outdoor terrace.

The development is surrounded by low-rise residential buildings in all compass directions; as a result, no existing stationary noise sources are expected to be a concern. A stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed building become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise sensitive areas, which are the residential dwellings surrounding the site. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits. As the mechanical equipment will primarily reside in the mechanical

[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

level located on the high roof, noise levels on the surrounding noise sensitive properties are expected to be negligible. In the event that noise levels exceed ENCG criteria, noise impacts can generally be minimized by judicious selection and placement of the equipment.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study building produced by local roadway traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

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

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

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

(that is relevant to this study) is 45 and 40 dBA for living rooms and sleeping quarters, respectively, 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 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 (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 technically and administratively feasible to acceptable levels at or below the criterion. Furthermore, noise levels at the OLA must not exceed 60 dBA if mitigation can be technically and administratively achieved.

[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

4.2.2 Theoretical Roadway Noise Predictions

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

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

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split for all streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Noise receptors were strategically placed at 6 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figure 3.

4.2.3 Roadway Traffic Volumes

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Carling Avenue	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**

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

4.3 Indoor Noise Calculations

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

As per Section 4.2, when daytime noise levels from road sources at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[8] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[9], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, which was prepared for site plan approval, detailed floor layouts and building elevations have not been finalized; therefore, detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

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

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

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

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
1	16.5	POW – 6th Floor, East Building – North Façade	73	66
2	16.5	POW – 6th Floor, East Building – East Façade	69	61
3	16.5	POW – 6th Floor, West Building – East Façade	66	59
4	16.5	POW – 6th Floor, West Building – West Façade	69	61
5	19.5	OLA – West Building, Rooftop Amenity Area	60	N/A
6	19.5	OLA – East Building, Rooftop Amenity Area	60	N/A

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

The results of the current analysis indicate that noise levels will range between 60 and 73 dBA during the daytime period (07:00-23:00) and between 59 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (73 dBA) occurs at the north façade of both buildings, which is nearest and most exposed to Carling Avenue. As noise levels at rooftop terraces exceed 55 dBA, noise control measures are required to reduce the noise levels as close as possible to 55 dBA.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3, 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). As per city of Ottawa requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC

requirements for the windows are summarized below for various units within the development (see Figure 4):

TABLE 4: NOISE CONTROL REQUIREMENTS

Building	Façade	Min. Window STC (Bedroom/Living Room)	Exterior Wall STC
East Building	North Façade	36/31	45
West Building			
East Building	East Façade	32/27	45
West Building	West Façade		
West Building	East Façade	29/25	45
East Building	West Façade		

The STC requirements apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a punch window and wall system may be used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however several manufacturers and various combinations of window components, such as those proposed, will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors.

Results of the calculations also indicate that the development will require air-conditioned dwelling units, 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 in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

5.2.1 Noise Control Measures - Noise Barriers

Noise levels at the rooftop terraces are expected to exceed the 55 dBA OLA noise criterion during the daytime period. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA but not exceeding 60 dBA. Further analysis investigated the noise mitigating impact of a 1.1 m high noise barrier on the rooftop terraces of both buildings. With this mitigation measure, noise levels reduce to 57 and 56 dBA at the west and east rooftop terrace, respectively. A Type A Warning Clause will be required for rooftop terraces on both buildings. Table 5 (below) summarizes the results of the barrier investigation. The location of the barrier can be seen in Figure 5. As noise levels are under 60 dBA a solid noise screen around the terraces is only a recommendation, not a requirement.

TABLE 5: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Height Above Roof (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)	
			No Barrier	With 1.1m Barrier
5	1.5	West Building, Rooftop Terrace	60	57
6	1.5	East Building, Rooftop Terrace	60	56

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 60 and 73 dBA during the daytime period (07:00-23:00) and between 59 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (73 dBA) occurs at the north façade of both buildings, which are nearest and most exposed to Carling Avenue. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 3.

Results of the calculations also indicate that both buildings in the development will require air-conditioned dwelling units, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause[10] will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

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

Noise levels at the rooftop terraces are expected to exceed the 55 dBA OLA noise criterion during the daytime period. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA but not exceeding 60 dBA. Further analysis investigated the noise mitigating impact of a 1.1 m high noise barrier on the rooftop terraces of both buildings. With this mitigation measure, noise levels reduce to 57 and 56 dBA at the west and east rooftop terrace, respectively. A Type A Warning Clause will be required for rooftop terraces associated with the east and west buildings:

Type A:

> *"Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally 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."*

[10] City of Ottawa Environmental Noise Control Guidelines, January 2016

The development is surrounded by low-rise residential buildings in all compass directions; as a result, no existing stationary noise sources are expected to be a concern. With regard to stationary noise impacts, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed building become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise sensitive areas. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels fall below ENCG limits. As the mechanical equipment will primarily reside in the mechanical level located on the high roof, noise levels on the surrounding noise sensitive properties are expected to be negligible. In the event that noise levels exceed the ENCG criteria, noise impacts can generally be minimized by judicious selection and placement of the equipment.

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

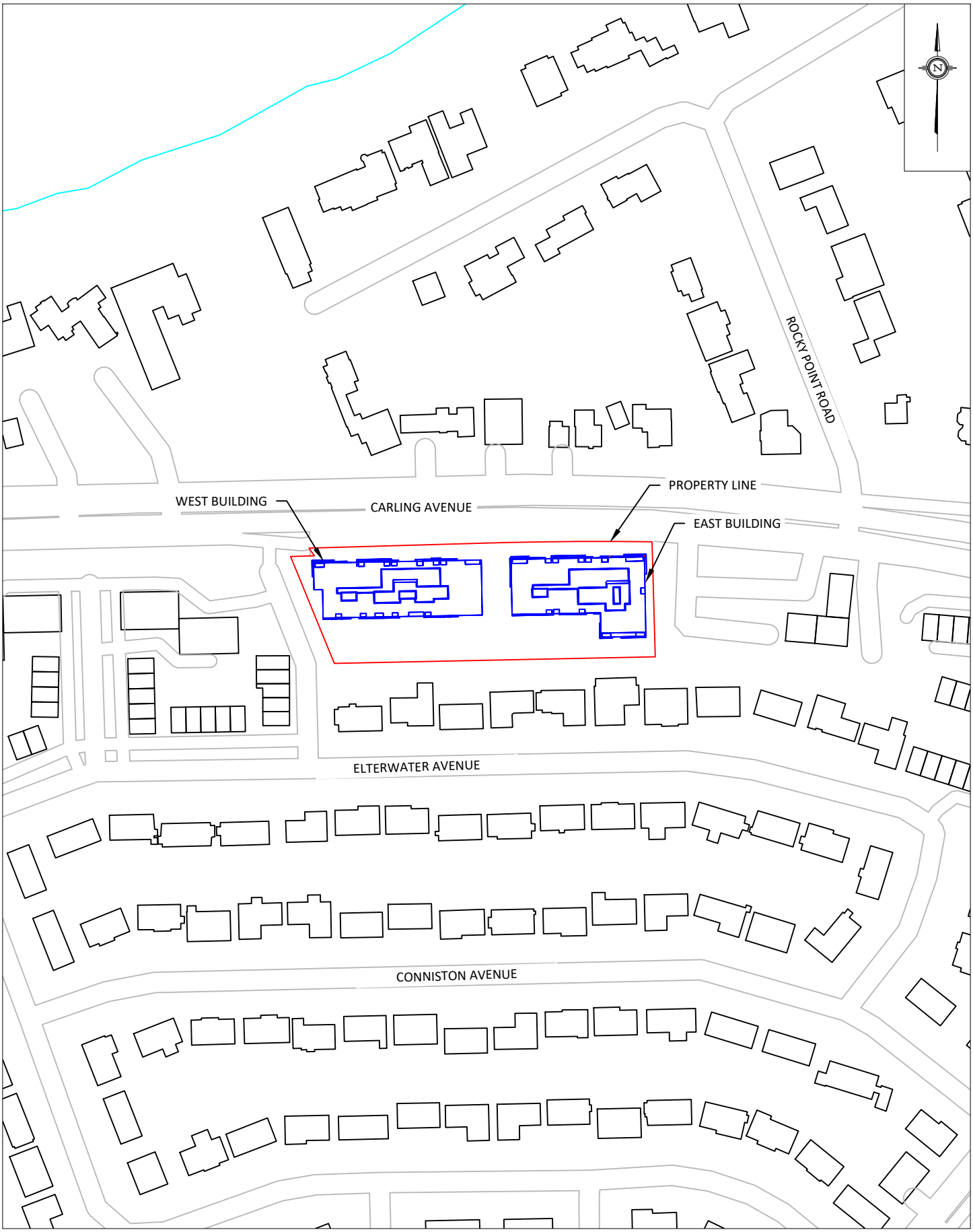
Sincerely,

Gradient Wind Engineering Inc.

Essraa Alqassab, BASc
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #22-311-Traffic Noise



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PROJECT	3430 CARLING AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW22-311-1
DATE	DECEMBER 12, 2022	DRAWN BY	E.A.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS

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DRAWING NO.	GW22-311-3
DATE	DECEMBER 12, 2022
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DESCRIPTION

FIGURE 3:
STAMSON PARAMETERS

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DATE	DECEMBER 12, 2022	DRAWN BY	E.A.

FIGURE 4:
STC RECOMMENDATIONS

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SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-311-5
DATE	DECEMBER 12, 2022	DRAWN BY	E.A.

FIGURE 5:
NOISE BARRIER RECOMMENDATIONS

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: 12-12-2022 13:59:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (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           :  16.50 / 16.50  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 + 73.13 + 0.00) = 73.13 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.00  73.68   0.00  -0.54   0.00   0.00   0.00   0.00
73.13
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 73.13 dBA

Total Leq All Segments: 73.13 dBA


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

Source height = 1.50 m

ROAD (0.00 + 65.54 + 0.00) = 65.54 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -0.54   0.00   0.00   0.00   0.00
65.54
-------------------------------------------------------------------------------
--

Segment Leq : 65.54 dBA

Total Leq All Segments: 65.54 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 73.13
                           (NIGHT): 65.54
```

```
STAMSON 5.0        NORMAL REPORT        Date: 12-12-2022 14:00:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (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  :  24.00 / 24.00  m
Receiver height           :  16.50 / 16.50  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 + 68.62 + 0.00) = 68.62 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90    0.00  73.68   0.00  -2.04  -3.01   0.00   0.00   0.00
68.62
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 68.62 dBA

Total Leq All Segments: 68.62 dBA


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

Source height = 1.50 m

ROAD (0.00 + 61.03 + 0.00) = 61.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90   0.00  66.08   0.00  -2.04  -3.01   0.00   0.00   0.00
61.03
-------------------------------------------------------------------------------
--

Segment Leq : 61.03 dBA

Total Leq All Segments: 61.03 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 68.62
                           (NIGHT): 61.03
```

```
STAMSON 5.0        NORMAL REPORT        Date: 12-12-2022 13:59:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   56.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  25.00 / 25.00  m
Receiver height           :  16.50 / 16.50  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 + 66.39 + 0.00) = 66.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     56   0.00  73.68   0.00  -2.22  -5.07   0.00   0.00   0.00
66.39
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 66.39 dBA

Total Leq All Segments: 66.39 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.79 + 0.00) = 58.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     56   0.00  66.08   0.00  -2.22  -5.07   0.00   0.00   0.00
58.79
-------------------------------------------------------------------------------
--

Segment Leq : 58.79 dBA

Total Leq All Segments: 58.79 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 66.39
                           (NIGHT): 58.79
```

```
STAMSON 5.0        NORMAL REPORT        Date: 12-12-2022 14:00:27
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (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  :  23.00 / 23.00  m
Receiver height           :  16.50 / 16.50  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 + 68.81 + 0.00) = 68.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  73.68   0.00  -1.86  -3.01   0.00   0.00   0.00
68.81
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 68.81 dBA

Total Leq All Segments: 68.81 dBA


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

Source height = 1.50 m

ROAD (0.00 + 61.21 + 0.00) = 61.21 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  66.08   0.00  -1.86  -3.01   0.00   0.00   0.00
61.21
-------------------------------------------------------------------------------
--

Segment Leq : 61.21 dBA

Total Leq All Segments: 61.21 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 68.81
                           (NIGHT): 61.21
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-12-2022 09:52:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  24.00 / 24.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  18.00 m
Barrier receiver distance :   6.00 / 6.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Carling (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 !       19.50 !       15.00 !        15.00

ROAD (0.00 + 59.68 + 0.00) = 59.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  73.68   0.00  -2.04   0.00   0.00   0.00 -11.96
59.68
-------------------------------------------------------------------------------
--

Segment Leq : 59.68 dBA

Total Leq All Segments: 59.68 dBA


Results segment # 1: Carling (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 !       19.50 !       15.00 !        15.00

ROAD (0.00 + 52.08 + 0.00) = 52.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -2.04   0.00   0.00   0.00 -11.96
52.08
-------------------------------------------------------------------------------
--

Segment Leq : 52.08 dBA

Total Leq All Segments: 52.08 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 59.68
                           (NIGHT): 52.08
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-12-2022 09:53:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5b.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Carling (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: Carling (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  24.00 / 24.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  19.10 m
Barrier receiver distance :   6.00 / 6.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Carling (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 !       19.50 !       15.00 !        15.00

ROAD (0.00 + 57.46 + 0.00) = 57.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  73.68   0.00  -2.04   0.00   0.00   0.00 -14.18
57.46
-------------------------------------------------------------------------
--

Segment Leq : 57.46 dBA

Total Leq All Segments: 57.46 dBA


Results segment # 1: Carling (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 !       19.50 !       15.00 !        15.00

ROAD (0.00 + 49.86 + 0.00) = 49.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -2.04   0.00   0.00   0.00 -14.18
49.86
-------------------------------------------------------------------------
--

Segment Leq : 49.86 dBA

Total Leq All Segments: 49.86 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 57.46
                           (NIGHT): 49.86
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-12-2022 09:54:05
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Carling (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: Carling (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           :  19.50 / 19.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  18.00 m
Barrier receiver distance :   6.00 / 6.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Carling (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 !       19.50 !       15.35 !        15.35

ROAD (0.00 + 59.96 + 0.00) = 59.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  73.68   0.00  -2.39   0.00   0.00   0.00 -11.32
59.96
-------------------------------------------------------------------------
--

Segment Leq : 59.96 dBA

Total Leq All Segments: 59.96 dBA


Results segment # 1: Carling (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 !       19.50 !       15.35 !        15.35

ROAD (0.00 + 52.37 + 0.00) = 52.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -2.39   0.00   0.00   0.00 -11.32
52.37
-------------------------------------------------------------------------
--

Segment Leq : 52.37 dBA

Total Leq All Segments: 52.37 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 59.96
                           (NIGHT): 52.37
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-12-2022 09:54:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6b.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Carling (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: Carling (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           :  19.50 / 19.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  19.10 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Carling (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 !       19.50 !       13.96 !        13.96

ROAD (0.00 + 56.15 + 0.00) = 56.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  73.68   0.00  -2.39   0.00   0.00   0.00 -15.14
56.15
-------------------------------------------------------------------------
--

Segment Leq : 56.15 dBA

Total Leq All Segments: 56.15 dBA


Results segment # 1: Carling (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 !       19.50 !       13.96 !        13.96

ROAD (0.00 + 48.55 + 0.00) = 48.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  66.08   0.00  -2.39   0.00   0.00   0.00 -15.14
48.55
-------------------------------------------------------------------------
--

Segment Leq : 48.55 dBA

Total Leq All Segments: 48.55 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 56.15
                           (NIGHT): 48.55
```