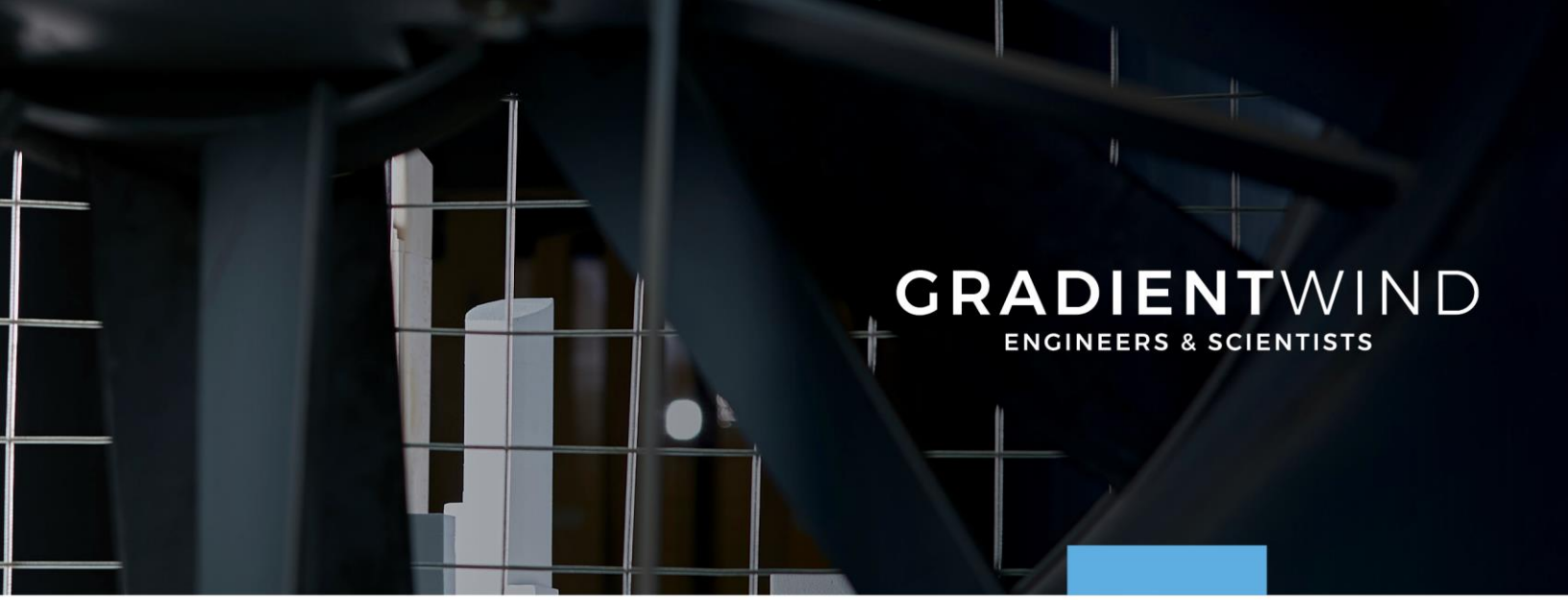

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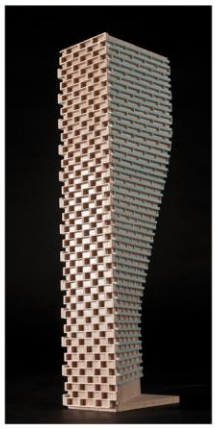
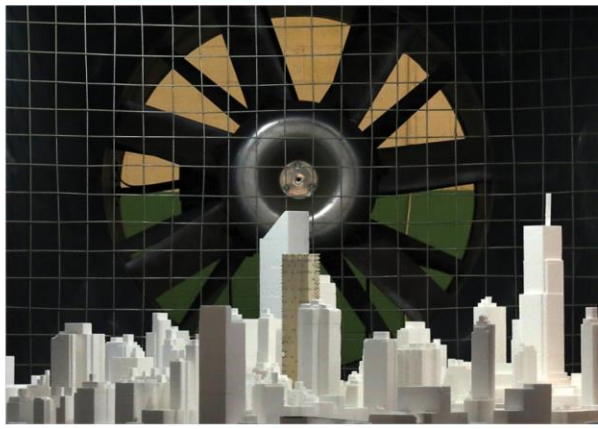
ENGINEERS & SCIENTISTS

ROADWAY TRAFFIC NOISE ASSESSMENT

471 Richmond Street West &
38 Camden Street
Toronto, Ontario

REPORT: GWE18-068 – Traffic Noise R1





May 30, 2019

PREPARED FOR

Manga Hotels (Richmond) Inc.
3279 Caroga Drive
Mississauga, ON
L4V 1A3

PREPARED BY

Michael Lafortune, C.E.T., Environmental Scientist
Joshua Foster, P.Eng., Principal

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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EXECUTIVE SUMMARY

This document describes a roadway traffic noise assessment performed for a proposed hotel development located at 471 Richmond Street West and 38 Camden Street in Toronto, Ontario. The development comprises two building sections connected by a two-storey podium: a 17-storey building section at 471 Richmond Street West and a 15-storey building section at 38 Camden Street, located north and south on the site, respectively. Outdoor amenity space is provided at the 2nd floor between the two towers but is not considered as an outdoor living area as this space is less than 4 metres in depth. The major source of transportation noise is roadway traffic along Richmond Street West. 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) requirements; (ii) noise level criteria as specified by the Ministry of the Environment, Conservation and Parks (MECP) NPC-300 guidelines; (iii) future vehicular traffic volumes based on theoretical maximum roadway capacities; and (iv) architectural drawings received from Sweeny & Co Architects.

The results of the current analysis indicate that noise levels will range between 49 and 69 dBA during the daytime period (07:00-23:00) and between 42 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the development's northern façade, which is nearest and most exposed to Richmond Street West. Noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will be required on the north façade of the building at 471 Richmond Road, where noise levels exceed 65 dBA (see Figure 3). On all other sides of the building materials meeting Ontario Building Code compliance will be sufficient.

Results of the calculations also indicate that 471 Richmond Street West will require air conditioning, which will allow occupants the option to keep windows closed and maintain a comfortable living environment. The proponent is planning to use Packaged Terminal Air Conditioning (PTAC) units. These should provide a minimum STC of 27, equal to that of the windows, and indoor noise emissions should not exceed a Noise Criteria (NC) of 30.

With regards to stationary noise impacts, a stationary noise study will be performed 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 NPC-300 limits.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Manga Hotels (Richmond) Inc. to undertake a roadway traffic noise assessment for a proposed hotel development located at 471 Richmond Street West and 38 Camden Street in Toronto, Ontario. This report summarizes the methodology, results, and recommendations related to a roadway traffic noise assessment. Gradient Wind's scope of work involved assessing exterior and interior noise levels generated by local roadway traffic. The assessment was performed on the basis of theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP) NPC-300[1] guidelines. Noise calculations were based on architectural drawings provided by Sweeny & Co Architects in March 2019, with future roadway traffic volumes based on theoretical maximum roadway capacities.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise assessment is a proposed hotel development located at 471 Richmond Street West and 38 Camden Street in Toronto, Ontario. The study site is situated between existing medium-rise buildings to the east and west, on a parcel of land bounded by Brant Street to the west, Camden Street to the south, Spadina Avenue to the east and Richmond Street West to the north.

The development comprises two building sections connected by a two-storey podium: a 17-storey building section at 471 Richmond Street West and a 15-storey building section at 38 Camden Street, located north and south on the site, respectively. The building sections feature rectangular planforms with the long axis oriented along Richmond Street West for 471 Richmond Street West and the short axis oriented along Camden Street for 38 Camden Street. Outdoor amenity space is provided at the 2nd floor between the two towers but is not considered as an outdoor living area as this space is less than 4 metres (m) in depth.

Following our analysis, changes have been made to the design of the building that are not reflected in the figures of this report. Notable changes include a minor variation in the building floorplate at the southeast corner of the ground floor mezzanine, which will not have an appreciable affect on noise levels. Changes

[1] Ministry of the Environment and Climate Change – Publication NPC-300

have also been made to the interior of the building that will not influence noise levels. The results and discussion of this report therefore remain applicable to the updated design.

The major source of transportation noise is roadway traffic along Richmond Street West. The site is surrounded by a Commercial Residential Zone (CR) on all sides. 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) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the MECP 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 transportation, 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 and railways, 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 impacts on buildings. Table 1 below describes the applicable indoor noise level limits for roadway sources, as specified in NPC-300.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [2]

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[3]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[4]. 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[5].

[2] Adapted from MECP, Environmental Noise Guidelines, NPC 300
[3] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[4] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.2 Theoretical Roadway Noise Predictions

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

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

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks.
- 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.
- Distance adjustment used for receivers where source-receiver distances is less than 15 m, as per ORNAMENT methodology.
- Surrounding and proposed buildings in some cases used as barrier when the line of sight between the source and receiver is broken by the building.

4.2.1 Roadway Traffic Volumes

NPC-300 dictates that noise calculations should consider future sound levels projected a minimum of 10 years into the future. Therefore, roadway traffic volumes are generally based on projected roadway traffic counts. Where roadway traffic counts were not available, theoretical maximum capacities for arterial roadways and highways were used. Additionally, where projected roadway traffic counts exceeded the theoretical maximum capacities, the latter was used. Table 2 (below) summarizes the AADT values used for each roadway in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Source	Roadway Class	Speed Limit (km/h)	AADT
Richmond Street West	2-UAU (Urban Arterial Undivided)	40	**15,000**
Spadina Avenue	4-UAD (Urban Arterial Divided)	50	**35,000**
Adelaide Street West	2-UAU (Urban Arterial Undivided)	40	**15,000**

4.3 Indoor Noise Calculations

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

As per Section 4.2, when daytime noise levels (from road and rail sources) at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[6] 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[7], 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).

[6] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[7] 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 Location	STAMSON 5.04 Noise Level (dBA)	
		Day	Night
1	471 Richmond Street West Level 1 – North Façade	69	61
2	471 Richmond Street West Level 1 – East Façade	62	54
3	471 Richmond Street West Level 1 – West Façade	63	55
4	471 Richmond Street West Level 16 – North Façade	68	60
5	471 Richmond Street West Level 16 – East Façade	64	56
6	471 Richmond Street West Level 16 – West Façade	60	53
7	38 Camden Street Level 15 – South Façade	49	42

The results of the current analysis indicate that noise levels will range between 49 and 69 dBA during the daytime period (07:00-23:00) and between 42 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the development's northern façade, which is nearest and most exposed to Richmond Street West.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 and NPC-300 for building components at the north façade of 471 Richmond Street West. 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. The STC requirements for the windows are summarized below (see Figure 3):

- **Hotel Suite Windows or Curtin Walls**

(i) Windows facing north will require a minimum STC of 27

(ii) All other windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Exterior Walls**

(i) If window wall systems are used, exterior wall components facing north will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[8]. Alternative construction may include 92 mm steel studs with 16 mm gypsum wall board on the inside and 16 mm gypsum exterior sheathing on the outside, with additional cladding materials.

The STC requirements would 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 window/wall system is 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 conditioning, which will allow occupants the option to keep windows closed and maintain a comfortable living environment. The proponent is planning to use Packaged Terminal Air Conditioning (PTAC) units. These should provide a minimum STC of 27, equal to that of the windows, and indoor noise emissions should not exceed a Noise Criteria (NC) of 30. 38 Camden Street will not require upgraded building components or specific ventilation requirements.

[8] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 49 and 69 dBA during the daytime period (07:00-23:00) and between 42 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the development's northern façade, which is nearest and most exposed to Richmond Street West. Noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will be required on the north façade of the building at 471 Richmond Road, where noise levels exceed 65 dBA (see Figure 3). On all other sides of the building materials meeting Ontario Building Code compliance will be sufficient.

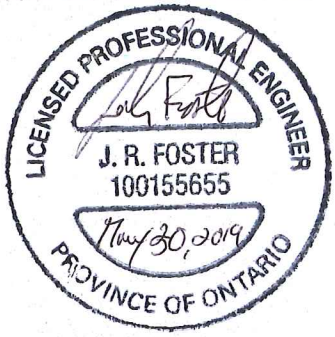
Results of the calculations also indicate that 471 Richmond Street West will require air conditioning, which will allow occupants the option to keep windows closed and maintain a comfortable living environment. The proponent is planning to use Packaged Terminal Air Conditioning (PTAC) units. These should provide a minimum STC of 27, equal to that of the windows, and indoor noise emissions should not exceed a Noise Criteria (NC) of 30. 38 Camden Street will not require upgraded building components or specific ventilation requirements.

With regards to stationary noise impacts, a stationary noise study will be performed 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 NPC-300 limits.

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,

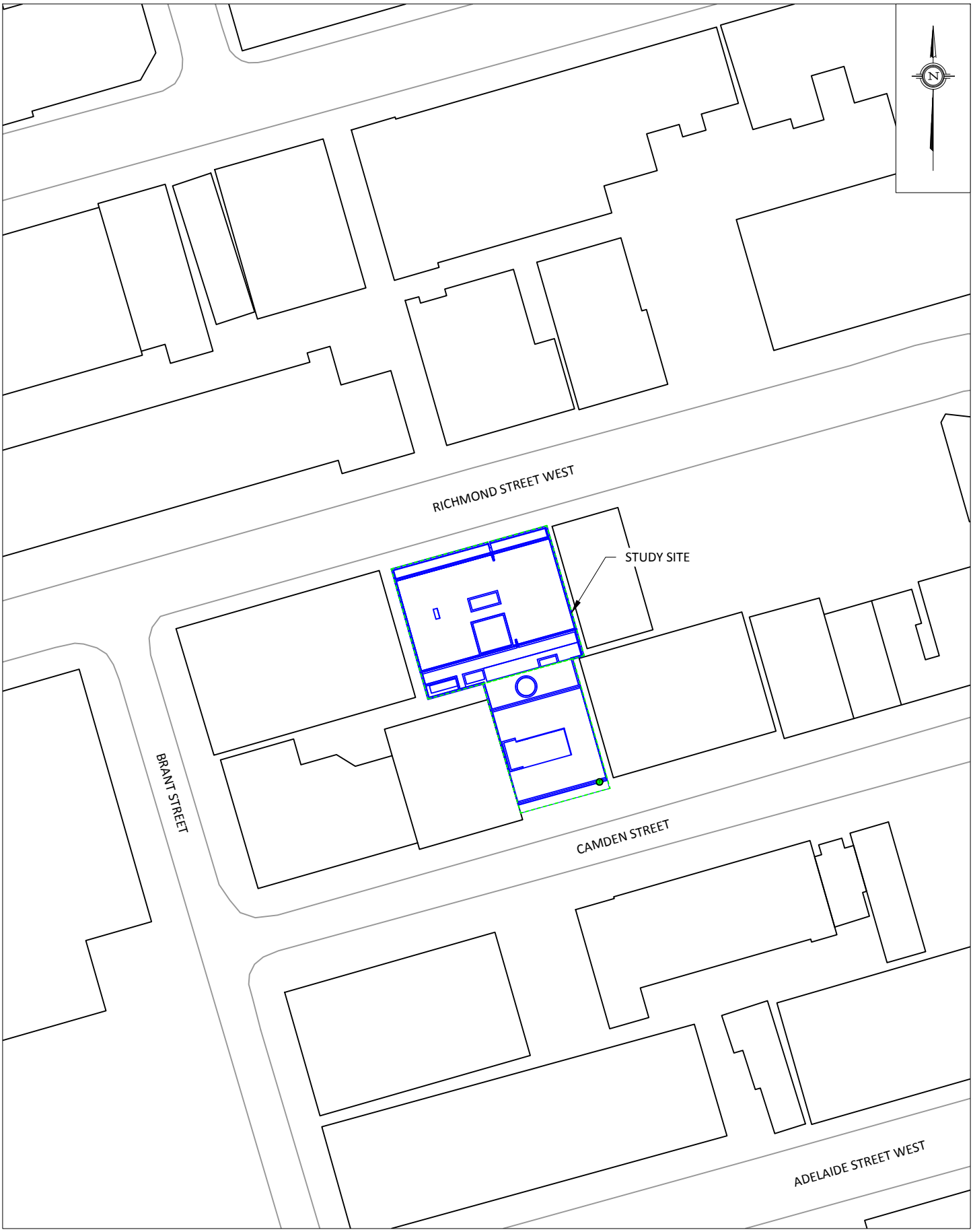
Gradient Wind Engineering Inc.



Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Principal

GWE18-068 – Traffic Noise R1



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PROJECT	471 RICHMOND ROAD WEST ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE18-068-1
DATE	APRIL 17, 2019
DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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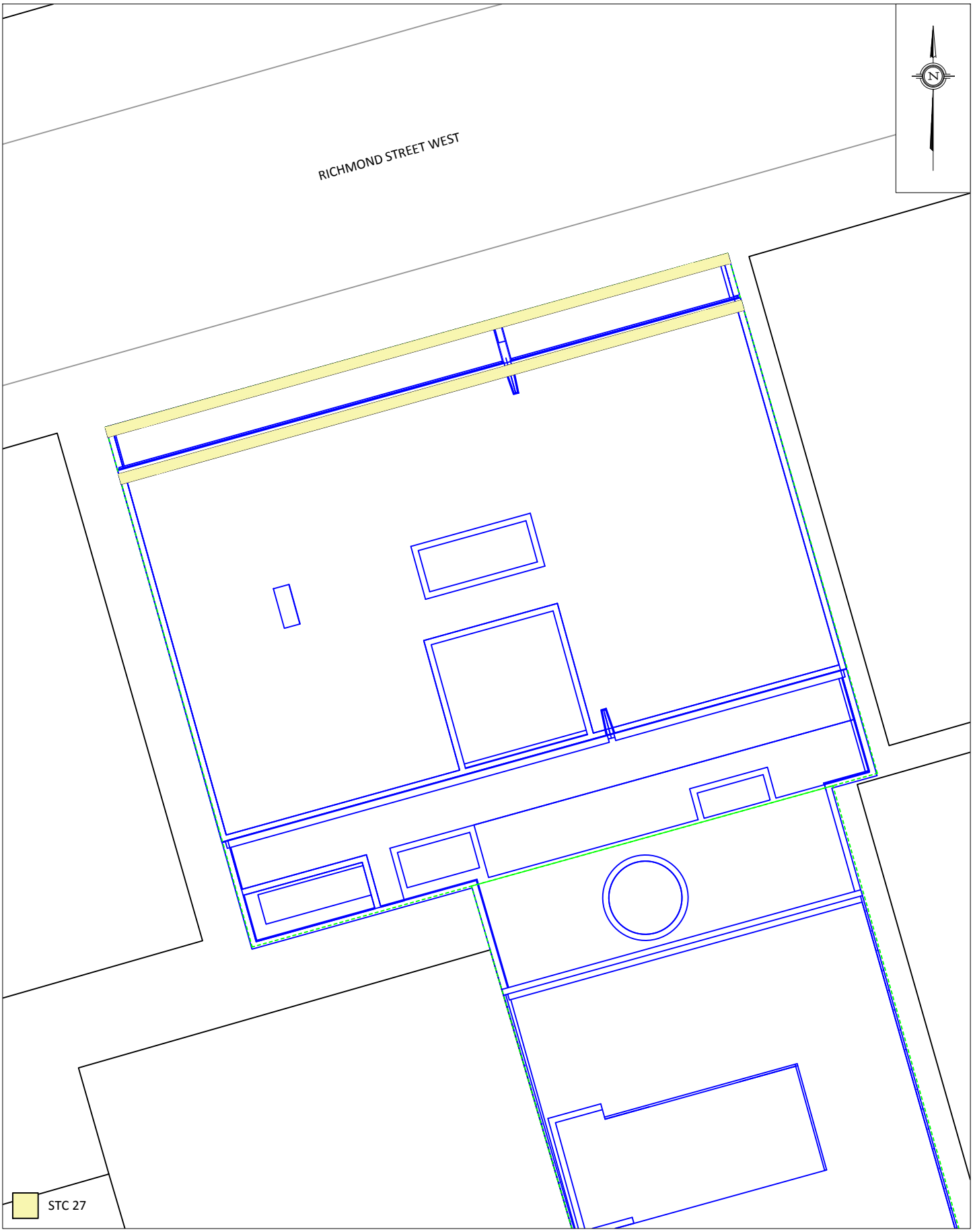
DATE	APRIL 17, 2019	DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS



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PROJECT	471 RICHMOND ROAD WEST ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:250 (APPROX.)	DRAWING NO.	GWE18-068-3
DATE	APRIL 17, 2019	DRAWN BY	M.L.

FIGURE 3:
HOTEL SUITE WINDOW STC REQUIREMENTS

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: 02-05-2018 16:10:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   86.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   8.80 / 8.80   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 66.59 + 0.00) = 66.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     86   0.00  66.69   0.00   0.00  -0.10   0.00   0.00   0.00
66.59
-------------------------------------------------------------------------
--

Segment Leq : 66.59 dBA

Total Leq All Segments: 66.59 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.99 + 0.00) = 58.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     86   0.00  59.09   0.00   0.00  -0.10   0.00   0.00   0.00
58.99
-------------------------------------------------------------------------
--

Segment Leq : 58.99 dBA

Total Leq All Segments: 58.99 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 66.59
                           (NIGHT): 58.99
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2018 16:10:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (day/night)
-------------------------------------------
Angle1   Angle2           :   0.00 deg   84.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   8.80 / 8.80   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  38.00 deg   Angle2 : 84.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :   1.00 / 1.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (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 !        8.80 !        8.31 !         8.31

ROAD (59.93 + 46.39 + 0.00) = 60.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     38   0.00  66.69   0.00   0.00  -6.75   0.00   0.00   0.00
59.93
-------------------------------------------------------------------------------
--
    38     84   0.00  66.69   0.00   0.00  -5.93   0.00   0.00 -14.37
46.39
-------------------------------------------------------------------------------
--

Segment Leq : 60.12 dBA

Total Leq All Segments: 60.12 dBA
```

```
Results segment # 1: Richmond (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 !        8.80 !        8.31 !         8.31

ROAD (52.33 + 38.80 + 0.00) = 52.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     38   0.00  59.09   0.00   0.00  -6.75   0.00   0.00   0.00
52.33
-------------------------------------------------------------------------------
--
    38     84   0.00  59.09   0.00   0.00  -5.93   0.00   0.00 -14.37
38.80
-------------------------------------------------------------------------------
--

Segment Leq : 52.52 dBA

Total Leq All Segments: 52.52 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 60.12
                           (NIGHT): 52.52
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2018 16:11:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (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  :  15.00 / 15.00  m
Receiver height           :   8.80 / 8.80   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -49.00 deg
Barrier height            :  40.00 m
Barrier receiver distance :   2.00 / 2.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (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 !        8.80 !        7.83 !         7.83

ROAD (0.00 + 40.77 + 61.03) = 61.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -49   0.00  66.69   0.00   0.00  -6.42   0.00   0.00 -19.49
40.77
-------------------------------------------------------------------------------
--
   -49      0   0.00  66.69   0.00   0.00  -5.65   0.00   0.00   0.00
61.03
-------------------------------------------------------------------------------
--

Segment Leq : 61.08 dBA

Total Leq All Segments: 61.08 dBA
```

```
Results segment # 1: Richmond (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 !        8.80 !        7.83 !         7.83

ROAD (0.00 + 33.18 + 53.44) = 53.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -49   0.00  59.09   0.00   0.00  -6.42   0.00   0.00 -19.49
33.18
-------------------------------------------------------------------------------
--
   -49      0   0.00  59.09   0.00   0.00  -5.65   0.00   0.00   0.00
53.44
-------------------------------------------------------------------------------
--

Segment Leq : 53.48 dBA

Total Leq All Segments: 53.48 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 61.08
                           (NIGHT): 53.48
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2018 16:11:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   86.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  45.90 / 45.90  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 66.59 + 0.00) = 66.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     86   0.00  66.69   0.00   0.00  -0.10   0.00   0.00   0.00
66.59
-------------------------------------------------------------------------
--

Segment Leq : 66.59 dBA

Total Leq All Segments: 66.59 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.99 + 0.00) = 58.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     86   0.00  59.09   0.00   0.00  -0.10   0.00   0.00   0.00
58.99
-------------------------------------------------------------------------
--

Segment Leq : 58.99 dBA

Total Leq All Segments: 58.99 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 66.59
                           (NIGHT): 58.99
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2018 16:11:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (day/night)
-------------------------------------------
Angle1   Angle2           :   0.00 deg   83.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  45.90 / 45.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :   0.00 deg   Angle2 : 83.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (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 !       45.90 !       34.06 !        34.06

ROAD (0.00 + 63.32 + 0.00) = 63.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     83   0.00  66.69   0.00   0.00  -3.36   0.00   0.00   0.00
63.32*
     0     83   0.00  66.69   0.00   0.00  -3.36   0.00   0.00   0.00
63.32
-------------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 63.32 dBA

Total Leq All Segments: 63.32 dBA
```

```
Results segment # 1: Richmond (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 !       45.90 !       34.06 !        34.06

ROAD (0.00 + 55.73 + 0.00) = 55.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     83   0.00  59.09   0.00   0.00  -3.36   0.00   0.00   0.00
55.73*
     0     83   0.00  59.09   0.00   0.00  -3.36   0.00   0.00   0.00
55.73
-------------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 55.73 dBA

Total Leq All Segments: 55.73 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 63.32
                           (NIGHT): 55.73
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-05-2018 16:11:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    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: Richmond (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  :  15.00 / 15.00  m
Receiver height           :  45.90 / 45.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -28.00 deg
Barrier height            :  40.00 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Richmond (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 !       45.90 !       34.06 !        34.06

ROAD (0.00 + 52.88 + 58.60) = 59.64 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -28   0.00  66.69   0.00   0.00  -4.63   0.00   0.00  -9.17
52.88
-------------------------------------------------------------------------------
--
   -28      0   0.00  66.69   0.00   0.00  -8.08   0.00   0.00   0.00
58.60
-------------------------------------------------------------------------------
--

Segment Leq : 59.64 dBA

Total Leq All Segments: 59.64 dBA
```


```
Results segment # 1: Richmond (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 !       45.90 !       34.06 !        34.06

ROAD (0.00 + 45.29 + 51.01) = 52.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -28   0.00  59.09   0.00   0.00  -4.63   0.00   0.00  -9.17
45.29
-------------------------------------------------------------------------------
--
   -28      0   0.00  59.09   0.00   0.00  -8.08   0.00   0.00   0.00
51.01
-------------------------------------------------------------------------------
--

Segment Leq : 52.04 dBA

Total Leq All Segments: 52.04 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 59.64
                           (NIGHT): 52.04
```

```
STAMSON 5.0        NORMAL REPORT        Date: 22-04-2019 11:35:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Adelaide (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod
Medium truck volume :   966/84    veh/TimePeriod
Heavy truck volume  :   690/60    veh/TimePeriod
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Adelaide (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  :  86.00 / 86.00  m
Receiver height           :  42.90 / 42.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  21.00 m
Barrier receiver distance :  74.00 / 74.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Spedina (day/night)
-------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  30000
    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: Spedina (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   12.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 137.00 / 137.00 m
Receiver height           :  42.90 / 42.90  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Adelaide (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 !       42.90 !        7.27 !         7.27

ROAD (0.00 + 41.37 + 0.00) = 41.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  66.69   0.00  -7.58   0.00   0.00   0.00 -17.74
41.37
-------------------------------------------------------------------------------
--

Segment Leq : 41.37 dBA


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

Source height = 1.50 m

ROAD (0.00 + 48.33 + 0.00) = 48.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     12   0.00  69.70   0.00  -9.61 -11.76   0.00   0.00   0.00
48.33
-------------------------------------------------------------------------------
--

Segment Leq : 48.33 dBA

Total Leq All Segments: 49.13 dBA
```

```
Results segment # 1: Adelaide (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 !       42.90 !        7.27 !         7.27

ROAD (0.00 + 33.77 + 0.00) = 33.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  59.09   0.00  -7.58   0.00   0.00   0.00 -17.74
33.77
-------------------------------------------------------------------------------
--

Segment Leq : 33.77 dBA


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

Source height = 1.50 m

ROAD (0.00 + 40.73 + 0.00) = 40.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     12   0.00  62.10   0.00  -9.61 -11.76   0.00   0.00   0.00
40.73
-------------------------------------------------------------------------------
--

Segment Leq : 40.73 dBA

Total Leq All Segments: 41.53 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 49.13
                           (NIGHT): 41.53
```