Traffic Noise Assessment

70 Beech Street
Ottawa, Ontario

REPORT: GWE18-018 – Traffic Noise

Prepared For:

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EXECUTIVE SUMMARY

This document describes a traffic noise assessment in support of site plan application for a proposed mixed-use development at 70 Beech Street in Ottawa, Ontario. The development comprises a six-storey building with commercial units at grade, office units at Level 2, and residential units in the remaining floors above. An outdoor amenity area is provided on the building rooftop. The major sources of traffic noise are Preston Street to the west of the site, and Highway 417 to the north. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment and Climate Change (MOECC) 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) site plan drawings prepared by RLA Architecture dated May 2018.

The results of the current analysis indicate that noise levels will range between 61 and 71 dBA during the daytime period (07:00-23:00) and between 53 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs at the north façade, which is nearest and most exposed to Highway 417. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 7.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. A Warning Clause[1] will also be required be placed on all Lease, Purchase and Sale Agreements.

Noise levels at the rooftop receptor (Receptor 5) are expected to approach 67 dBA during the daytime period. If this area is to be used as an outdoor living area, noise control measures are required to reduce the L_{eq} to 55 dBA. Further analysis investigated the noise mitigating impact of raising the north and west perimeter guards from a standard height of 1.1 m (base case) to 3.0 m above the walking surface. Results of the investigation proved that noise levels can only be reduced to 63 dBA. This marginal improvement would not justify the cost of installing such a high wall, and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible. A warning clause will be required.

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

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by RLA Architecture on behalf of The Properties Group to undertake a traffic noise assessment in support of site plan application for a proposed mixed-use development 70 Beech Street 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. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[2] and Ministry of the Environment and Climate Change (MOECC)[3] guidelines. Noise calculations were based on architectural drawings prepared by RLA Architecture dated May 2018, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed mixed-use development at 70 Beech Street in Ottawa, Ontario. The development comprises a six-storey building of nearly square planform. Commercial units occupy grade level, followed by office units in Level 2, and residential units for remaining floors above. Floorplates set back from the south side at Level 2 and the north side at Level 3 to create roof decks; however, as the roof decks extend less than 4 metres from the façade, they do not require consideration as outdoor living areas (OLA) in this study. An outdoor amenity area is provided on the building rooftop, setback from the east and west edges.

The site is surrounded by low-rise residential buildings from the south clockwise to the northwest, a paved lot followed by medium and high-rise buildings to the north (situated between the study building and Highway 417), medium-rise industrial and institutional buildings to the east, and low-rise followed by medium and high-rise residential buildings to the southeast.

The major sources of traffic noise are Preston Street to the west of the site, and Highway 417 to the north. Although Rochester Street and Booth Street, located east of the site, are nearby major collector roadways, they are located just beyond 100 metres of the study site and therefore are not included as sources

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

influencing the study site as per ENCG Section 2.1. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The main goals of this work 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 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 for roadway as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD)[4]

Type of Space	Time Period	L_{eq} (dBA)
		Road
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[5]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[6]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, building components will require higher levels of sound attenuation[7].

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

[4] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[5] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[6] MOECC, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[7] MOECC, 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 MOECC 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 was taken to be 92% / 8% respectively for all streets.
- Reflective ground surface used for receivers due to presence of hard (paved) ground.
- Topography assumed to be a flat/gentle slope surrounding the study building. Highway 417 is elevated approximately 8 m above local grade.
- Receptor height taken to be 18.9 metres at the 6th floor for the centre of the window (height to 6th floor slab + 1.5 metres) for Receptors 1-4, and at 23.5 m for rooftop Receptor 5.
- The mid-rise building at 17 Aberdeen Street to the north was considered as a noise barrier with a height of 24-metres.
- For select sources where appropriate, Receptors 1-5 considered the proposed building as a barrier with a height of 22 metres, partially or fully obstructing exposure to the source as illustrated by exposure angles in Figures 2-6. A standard 1.1 m tall parapet was assumed to enclose the terrace.
- Noise receptors were strategically placed at 5 locations around the study area (see Figure 1).
- Receptor distances and exposure angles are illustrated in Figures 2-6.

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[8] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway / Transit Class	Speed Limit (km/h)	Traffic Volumes
Eastbound Queensway (Highway 417)	4 Lane Freeway	100	**73,332**
Westbound Queensway (Highway 417)	4 Lane Freeway	100	**73,332**
Preston Street	2-Lane Urban Arterial-(2-UAU)	50	**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 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 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[9] 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

[9] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

Based on published research[10], 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).

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	18.9	POW – 6th Floor – North Façade	71	63
2	18.9	POW – 6th Floor – East Façade	67	59
3	18.9	POW – 6th Floor – South Façade	61	53
4	18.9	POW – 6th Floor – West Façade	69	62
5	23.5	OLA – Rooftop Outdoor Amenity Area	67	59

The results of the current analysis indicate that noise levels will range between 61 and 71 dBA during the daytime period (07:00-23:00) and between 53 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs at the north façade, which is nearest and most exposed to Highway 417.

[10] CMHC, Road & Rail Noise: Effects on Housing

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 7):

- **Bedroom Windows**

(i) Bedroom windows facing north will require a minimum STC of 34

(ii) Bedroom windows facing east and west will require a minimum STC of 32

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

- **Living Room Windows**

(i) Living room windows facing north will require a minimum STC of 29

(ii) Living room windows facing east and west will require a minimum STC of 27

(iii) All other living room windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Exterior Walls**

(i) Exterior wall components on the north, east, south and west façades will require a minimum STC of 45 which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[11]

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

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

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 central air conditioning, 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 be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

5.1 Noise Barrier Calculation

Noise levels at the rooftop receptor (Receptor 5) are expected to approach 67 dBA during the daytime period. If this area is to be used as an outdoor living area, noise control measures are required to reduce the L_{eq} to 55 dBA. Further analysis investigated the noise mitigating impact of raising the north and west perimeter guards from a standard height of 1.1 m (base case) to 3.0 m above the walking surface. Results of the investigation proved that noise levels can only be reduced to 63 dBA. This marginal improvement would not justify the cost of installing such a high wall, and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible. Table 4 summarizes the results of the barrier investigation.

TABLE 4: RESULTS OF NOISE BARRIER INVESTIGATION

Location	Reference Receptor	Barrier Height (m)	Daytime L_{eq} Noise Levels (dBA)	
			With Barrier	Without Barrier
OLA – Rooftop Amenity Area (north and west perimeter)	5	3.0 m	63	67

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 61 and 71 dBA during the daytime period (07:00-23:00) and between 53 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs at the north façade, which is nearest and most exposed to Highway 417. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated on Figure 7.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause[12] will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing roadway traffic may, on occasion, interfere with some activities of the dwelling occupants and will interfere with outdoor activities, as the sound levels exceed the sound level limits of the City and the Ministry of the Environment and Climate Change. To help address the need for sound attenuation, this development includes:*
>
> - *STC rated multi-pane glazing elements and spandrel panels*
> - *East and west façade bedroom/living room: STC 34/29*
> - *North and west façade bedroom/living room: STC 32/27*
> - *STC rated exterior walls*
> - *North, east, south and west façade: STC 45*
>
> *This dwelling unit has also been designed with air conditioning. Air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment and Climate Change.*
>
> *To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features."*

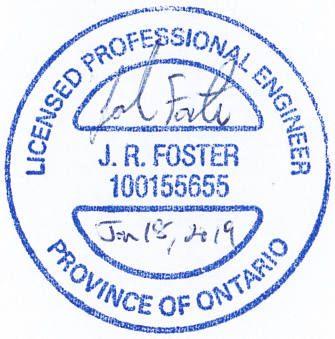
[12] City of Ottawa Environmental Noise Control Guidelines, January 2016

Noise levels at the rooftop receptor (Receptor 5) are expected to approach 67 dBA during the daytime period. If this area is to be used as an outdoor living area, noise control measures are required to reduce the L_{eq} to 55 dBA. Further analysis investigated the noise mitigating impact of raising the north and west perimeter guards from a standard height of 1.1 m (base case) to 3.0 m above the walking surface. Results of the investigation proved that noise levels can only be reduced to 63 dBA. This marginal improvement would not justify the cost of installing such a high wall, and reducing noise levels to 55 dBA would require excessive barrier heights that would not be feasible.

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

Yours truly,

Gradient Wind Engineering Inc.



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GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-1
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

FIGURE 1:
SITE PLAN AND RECEPTOR LOCATIONS

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934
GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-2
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

FIGURE 2:
RECEPTOR 1 DISTANCES AND EXPOSURE ANGLES

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-3
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

FIGURE 3:
RECEPTOR 2 DISTANCES AND EXPOSURE ANGLES

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-4
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

FIGURE 4:
RECEPTOR 3 DISTANCES AND EXPOSURE ANGLES

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934
GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-5
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

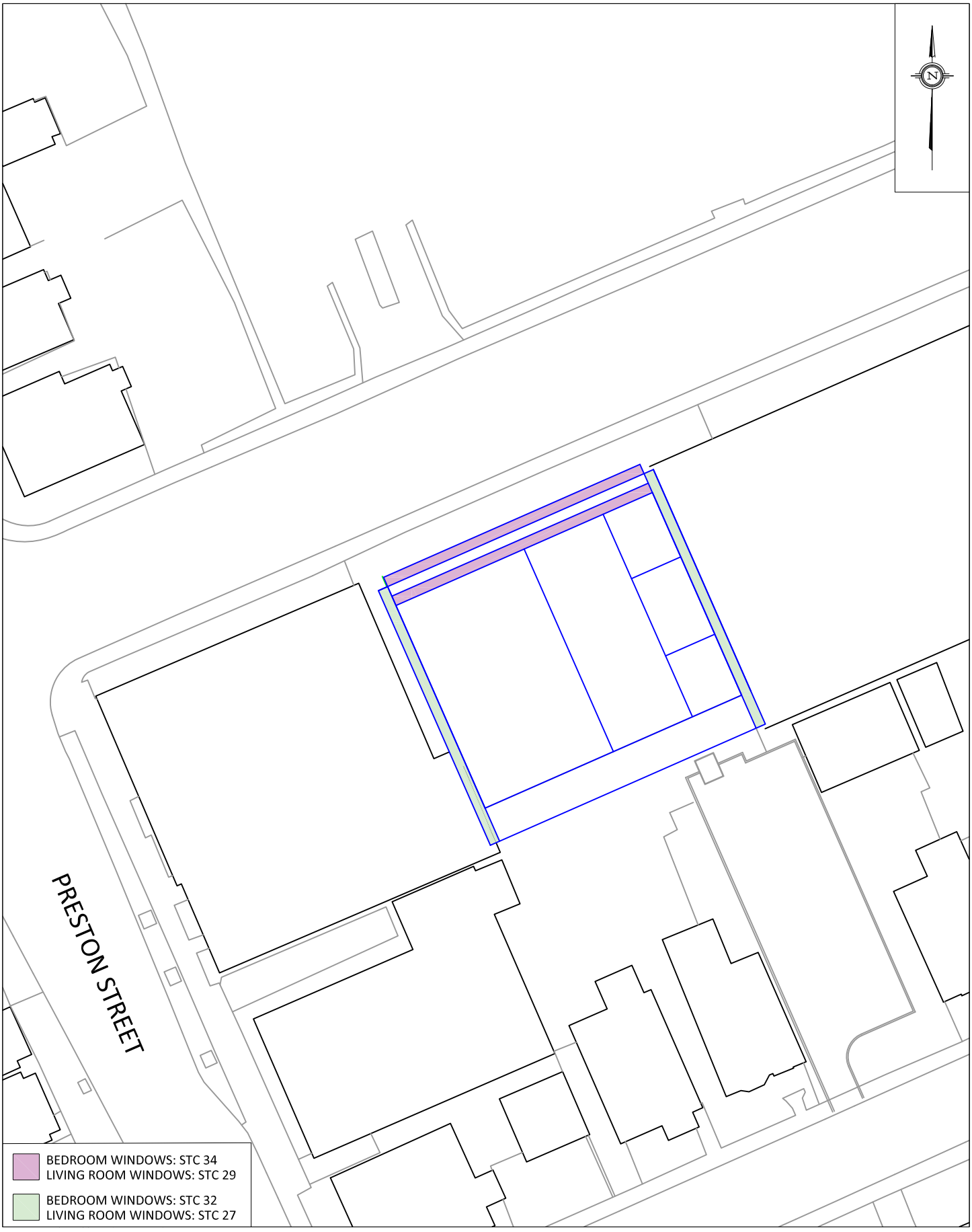
FIGURE 5:
RECEPTOR 4 DISTANCES AND EXPOSURE ANGLES

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934
GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-018-6
DATE	JUNE 18, 2018
DRAWN BY	M.P.

DESCRIPTION

FIGURE 6:
RECEPTOR 5 DISTANCES AND EXPOSURE ANGLES



127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	70 BEECH STREET - TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE18-018-7
DATE	JUNE 18, 2018	DRAWN BY	M.P.

FIGURE 7:
BARRIER LOCATIONS

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 15-06-2018 09:32:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: 417 East (day/night)
----------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 East (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  : 276.00 / 276.00 m
Receiver height           :  18.90 / 18.90  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  -2.00 deg   Angle2 : 44.00 deg
Barrier height            :  24.00 m
Elevation                 :   8.50 m
Barrier receiver distance : 136.00 / 136.00 m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  60.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: 417 West (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 West (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  : 293.00 / 293.00 m
Receiver height           :  18.90 / 18.90  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  -2.00 deg   Angle2 : 44.00 deg
Barrier height            :  24.00 m
Elevation                 :   8.50 m
Barrier receiver distance : 136.00 / 136.00 m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  60.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Preston St (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  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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 # 3: Preston St (day/night)
--------------------------------------------
Angle1   Angle2           :   4.00 deg   72.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  43.00 / 43.00  m
Receiver height           :  18.90 / 18.90  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: 417 East (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 !       18.90 !       16.51 !        76.51

ROAD (65.64 + 49.47 + 62.82) = 67.54 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     -2   0.00  81.40   0.00 -12.65  -3.11   0.00   0.00   0.00
65.64
-------------------------------------------------------------------------------
--
    -2     44   0.00  81.40   0.00 -12.65  -5.93   0.00   0.00 -13.35
49.47
-------------------------------------------------------------------------------
--
    44     90   0.00  81.40   0.00 -12.65  -5.93   0.00   0.00   0.00
62.82
-------------------------------------------------------------------------------
--

Segment Leq : 67.54 dBA
```

```
Results segment # 2: 417 West (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 !       18.90 !       16.77 !        76.77

ROAD (65.38 + 49.71 + 62.56) = 67.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     -2   0.00  81.40   0.00 -12.91  -3.11   0.00   0.00   0.00
65.38
-------------------------------------------------------------------------------
--
    -2     44   0.00  81.40   0.00 -12.91  -5.93   0.00   0.00 -12.85
49.71
-------------------------------------------------------------------------------
--
    44     90   0.00  81.40   0.00 -12.91  -5.93   0.00   0.00   0.00
62.56
-------------------------------------------------------------------------------
--

Segment Leq : 67.28 dBA
```

```
Results segment # 3: Preston St (day)
-------------------------------------

Source height = 1.50 m

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
-------------------------------------------------------------------------
--
     4     72   0.00  68.48   0.00  -4.57  -4.23   0.00   0.00   0.00
59.68
-------------------------------------------------------------------------
--

Segment Leq : 59.68 dBA

Total Leq All Segments: 70.77 dBA

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

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       18.90 !       16.51 !        76.51

ROAD (58.04 + 41.87 + 55.23) = 59.94 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     -2   0.00  73.80   0.00 -12.65  -3.11   0.00   0.00   0.00
58.04
-------------------------------------------------------------------------
--
    -2     44   0.00  73.80   0.00 -12.65  -5.93   0.00   0.00 -13.35
41.87
-------------------------------------------------------------------------
--
    44     90   0.00  73.80   0.00 -12.65  -5.93   0.00   0.00   0.00
55.23
-------------------------------------------------------------------------
--

Segment Leq : 59.94 dBA
```

```
Results segment # 2: 417 West (night)
-----------------------------------

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       18.90 !       16.77 !        76.77

ROAD (57.78 + 42.11 + 54.97) = 59.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     -2   0.00  73.80   0.00 -12.91  -3.11   0.00   0.00   0.00
57.78
-------------------------------------------------------------------------------
--
    -2     44   0.00  73.80   0.00 -12.91  -5.93   0.00   0.00 -12.85
42.11
-------------------------------------------------------------------------------
--
    44     90   0.00  73.80   0.00 -12.91  -5.93   0.00   0.00   0.00
54.97
-------------------------------------------------------------------------------
--

Segment Leq : 59.69 dBA
```

```
Results segment # 3: Preston St (night)
---------------------------------------

Source height = 1.50 m

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
-------------------------------------------------------------------------
--
     4     72   0.00  60.88   0.00  -4.57  -4.23   0.00   0.00   0.00
52.08
-------------------------------------------------------------------------
--

Segment Leq : 52.08 dBA

Total Leq All Segments: 63.18 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 70.77
                           (NIGHT): 63.18
```

```
STAMSON 5.0         NORMAL REPORT         Date: 15-06-2018 09:31:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: 417 East (day/night)
----------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 East (day/night)
-------------------------------------------
Angle1   Angle2           :  -8.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 274.00 / 274.00 m
Receiver height           :  18.90 / 18.90  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  -8.00 deg   Angle2 : 37.00 deg
Barrier height            :  24.00 m
Elevation                 :   8.50 m
Barrier receiver distance : 105.00 / 105.00 m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  60.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: 417 West (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 West (day/night)
------------------------------------------
Angle1   Angle2           :  -8.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 291.00 / 291.00 m
Receiver height           :  18.90 / 18.90  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  -8.00 deg   Angle2 : 37.00 deg
Barrier height            :  24.00 m
Elevation                 :   8.50 m
Barrier receiver distance : 105.00 / 105.00 m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  60.00 m
Reference angle           :   0.00
```

```
Results segment # 1: 417 East (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 !       18.90 !       17.49 !        77.49

ROAD (0.00 + 50.10 + 63.47) = 63.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    -8     37   0.00  81.40   0.00 -12.62  -6.02   0.00   0.00 -12.65
50.10
-------------------------------------------------------------------------------
--
    37     90   0.00  81.40   0.00 -12.62  -5.31   0.00   0.00   0.00
63.47
-------------------------------------------------------------------------------
--

Segment Leq : 63.67 dBA
```

```
Results segment # 2: 417 West (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 !       18.90 !       17.69 !        77.69

ROAD (0.00 + 50.23 + 63.21) = 63.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    -8     37   0.00  81.40   0.00 -12.88  -6.02   0.00   0.00 -12.27
50.23
-------------------------------------------------------------------------------
--
    37     90   0.00  81.40   0.00 -12.88  -5.31   0.00   0.00   0.00
63.21
-------------------------------------------------------------------------------
--

Segment Leq : 63.42 dBA

Total Leq All Segments: 66.56 dBA
```

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

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       18.90 !       17.49 !        77.49

ROAD (0.00 + 42.51 + 55.87) = 56.07 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    -8     37   0.00  73.80   0.00 -12.62  -6.02   0.00   0.00 -12.65
42.51
-------------------------------------------------------------------------------
--
    37     90   0.00  73.80   0.00 -12.62  -5.31   0.00   0.00   0.00
55.87
-------------------------------------------------------------------------------
--

Segment Leq : 56.07 dBA
```

```
Results segment # 2: 417 West (night)
-----------------------------------

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       18.90 !       17.69 !        77.69

ROAD (0.00 + 42.63 + 55.61) = 55.82 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    -8     37   0.00  73.80   0.00 -12.88  -6.02   0.00   0.00 -12.27
42.63
-------------------------------------------------------------------------------
--
    37     90   0.00  73.80   0.00 -12.88  -5.31   0.00   0.00   0.00
55.61
-------------------------------------------------------------------------------
--

Segment Leq : 55.82 dBA

Total Leq All Segments: 58.96 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 66.56
                           (NIGHT): 58.96
```

STAMSON 5.0 NORMAL REPORT Date: 14-06-2018 16:35:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Preston St (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	: 50	km/h
Road gradient	: 0	%
Road pavement	: 1	(Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT)	: 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: Preston St (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	: 43.00 / 43.00	m
Receiver height	: 18.90 / 18.90	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

```
Results segment # 1: Preston St (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.90 + 0.00) = 60.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  68.48   0.00  -4.57  -3.01   0.00   0.00   0.00
60.90
-------------------------------------------------------------------------
--

Segment Leq : 60.90 dBA

Total Leq All Segments: 60.90 dBA


Results segment # 1: Preston St (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.30 + 0.00) = 53.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  60.88   0.00  -4.57  -3.01   0.00   0.00   0.00
53.30
-------------------------------------------------------------------------
--

Segment Leq : 53.30 dBA

Total Leq All Segments: 53.30 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 60.90
                           (NIGHT): 53.30
```

STAMSON 5.0 NORMAL REPORT Date: 14-06-2018 16:43:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R4.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: 417 East (day/night)

Car traffic volume	: 59370/5163	veh/TimePeriod *
Medium truck volume	: 4723/411	veh/TimePeriod *
Heavy truck volume	: 3373/293	veh/TimePeriod *
Posted speed limit	: 100	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)	: 73332
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: 417 East (day/night)

Angle1 Angle2	: -90.00 deg	-8.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 0 / 0	
Surface	: 2	(Reflective ground surface)
Receiver source distance	: 277.00 / 277.00	m
Receiver height	: 18.90 / 18.90	m
Topography	: 3	(Elevated; no barrier)
Elevation	: 8.50	m
Reference angle	: 0.00	

```
Road data, segment # 2: 417 West (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 West (day/night)
------------------------------------------
Angle1   Angle2           : -90.00 deg   -8.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 294.00 / 294.00 m
Receiver height           :  18.90 / 18.90  m
Topography                :      3       (Elevated; no barrier)
Elevation                 :   8.50 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Preston St (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  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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 # 3: Preston St (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   69.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  41.00 / 41.00  m
Receiver height           :  18.90 / 18.90  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 65.32 + 0.00) = 65.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     -8    0.00  81.40   0.00 -12.66  -3.41   0.00   0.00   0.00
65.32
-------------------------------------------------------------------------
--

Segment Leq : 65.32 dBA



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

Source height = 1.50 m

ROAD (0.00 + 65.06 + 0.00) = 65.06 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     -8    0.00  81.40   0.00 -12.92  -3.41   0.00   0.00   0.00
65.06
-------------------------------------------------------------------------
--

Segment Leq : 65.06 dBA
```

```
Results segment # 3: Preston St (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.57 + 0.00) = 63.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     69   0.00  68.48   0.00  -4.37  -0.54   0.00   0.00   0.00
63.57
-------------------------------------------------------------------------
--

Segment Leq : 63.57 dBA

Total Leq All Segments: 69.49 dBA




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

Source height = 1.49 m

ROAD (0.00 + 57.72 + 0.00) = 57.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     -8   0.00  73.80   0.00 -12.66  -3.41   0.00   0.00   0.00
57.72
-------------------------------------------------------------------------
--

Segment Leq : 57.72 dBA
```

```
Results segment # 2: 417 West (night)
-------------------------------------

Source height = 1.49 m

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     -8   0.00  73.80   0.00 -12.92  -3.41   0.00   0.00   0.00
57.46
-------------------------------------------------------------------------
--

Segment Leq : 57.46 dBA




Results segment # 3: Preston St (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.98 + 0.00) = 55.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     69   0.00  60.88   0.00  -4.37  -0.54   0.00   0.00   0.00
55.98
-------------------------------------------------------------------------
--

Segment Leq : 55.98 dBA

Total Leq All Segments: 61.89 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 69.49
                           (NIGHT): 61.89
```

```
STAMSON 5.0        NORMAL REPORT        Date: 18-06-2018 14:55:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: 417 East (day/night)
-------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 East (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  : 285.00 / 285.00 m
Receiver height           :  23.50 / 23.50  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  23.10 m
Elevation                 :   8.50 m
Barrier receiver distance :  10.80 / 10.80  m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: 417 West (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 West (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  : 302.00 / 302.00 m
Receiver height           :  23.50 / 23.50  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  23.10 m
Elevation                 :   8.50 m
Barrier receiver distance :  10.80 / 10.80  m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Preston St (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  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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 # 3: Preston St (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   62.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  59.00 / 59.00  m
Receiver height           :  23.50 / 23.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 62.00 deg
Barrier height            :  23.10 m
Barrier receiver distance :  18.00 / 18.00  m
Source elevation          :  62.00 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Results segment # 1: 417 East (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 !       23.50 !       22.99 !        84.99

ROAD (0.00 + 63.59 + 0.00) = 63.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  81.40   0.00 -12.79   0.00   0.00   0.00  -5.02
63.59
-------------------------------------------------------------------------------
--

Segment Leq : 63.59 dBA



Results segment # 2: 417 West (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 !       23.50 !       23.02 !        85.02

ROAD (0.00 + 63.35 + 0.00) = 63.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  81.40   0.00 -13.04   0.00   0.00   0.00  -5.01
63.35
-------------------------------------------------------------------------------
--

Segment Leq : 63.35 dBA
```

```
Results segment # 3: Preston St (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 !       23.50 !       16.79 !        78.79

ROAD (0.00 + 46.08 + 0.00) = 46.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     62   0.00  68.48   0.00  -5.95  -0.73   0.00   0.00 -15.72
46.08
-------------------------------------------------------------------------------
--

Segment Leq : 46.08 dBA

Total Leq All Segments: 66.52 dBA




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

Source height = 1.49 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       23.50 !       22.99 !        84.99

ROAD (0.00 + 55.99 + 0.00) = 55.99 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  73.80   0.00 -12.79   0.00   0.00   0.00  -5.02
55.99
-------------------------------------------------------------------------------
--

Segment Leq : 55.99 dBA
```

```
Results segment # 2: 417 West (night)
-----------------------------------

Source height = 1.49 m

Barrier height for grazing incidence
-----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       23.50 !       23.02 !        85.02

ROAD (0.00 + 55.75 + 0.00) = 55.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  73.80   0.00 -13.04   0.00   0.00   0.00  -5.01
55.75
-------------------------------------------------------------------------------
--

Segment Leq : 55.75 dBA



Results segment # 3: Preston St (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 !       23.50 !       16.79 !        78.79

ROAD (0.00 + 38.48 + 0.00) = 38.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     62   0.00  60.88   0.00  -5.95  -0.73   0.00   0.00 -15.72
38.48
-------------------------------------------------------------------------------
--

Segment Leq : 38.48 dBA

Total Leq All Segments: 58.92 dBA
```

```
TOTAL Leq FROM ALL SOURCES (DAY): 66.52
                           (NIGHT): 58.92



STAMSON 5.0        NORMAL REPORT        Date: 18-06-2018 14:55:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5b_3.te             Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: 417 East (day/night)
-------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 East (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  : 285.00 / 285.00 m
Receiver height           :  23.50 / 23.50  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  25.00 m
Elevation                 :   8.50 m
Barrier receiver distance :  10.80 / 10.80  m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: 417 West (day/night)
------------------------------------------
Car traffic volume  : 59370/5163  veh/TimePeriod  *
Medium truck volume :  4723/411   veh/TimePeriod  *
Heavy truck volume  :  3373/293   veh/TimePeriod  *
Posted speed limit  :   100 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):  73332
    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: 417 West (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  : 302.00 / 302.00 m
Receiver height           :  23.50 / 23.50  m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  25.00 m
Elevation                 :   8.50 m
Barrier receiver distance :  10.80 / 10.80  m
Source elevation          :  70.50 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Preston St (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  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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 # 3: Preston St (day/night)
------------------------------------------------
Angle1   Angle2           : -90.00 deg   62.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  59.00 / 59.00  m
Receiver height           :  23.50 / 23.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 62.00 deg
Barrier height            :  25.00 m
Barrier receiver distance :  18.00 / 18.00  m
Source elevation          :  62.00 m
Receiver elevation        :  62.00 m
Barrier elevation         :  62.00 m
Reference angle           :   0.00
```

```
Results segment # 1: 417 East (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 !       23.50 !       22.99 !        84.99

ROAD (0.00 + 59.80 + 0.00) = 59.80 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  81.40   0.00 -12.79   0.00   0.00   0.00  -8.81
59.80
-------------------------------------------------------------------------------
--

Segment Leq : 59.80 dBA



Results segment # 2: 417 West (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 !       23.50 !       23.02 !        85.02

ROAD (0.00 + 59.62 + 0.00) = 59.62 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  81.40   0.00 -13.04   0.00   0.00   0.00  -8.74
59.62
-------------------------------------------------------------------------------
--

Segment Leq : 59.62 dBA
```

```
Results segment # 3: Preston St (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 !       23.50 !       16.79 !        78.79

ROAD (0.00 + 44.44 + 0.00) = 44.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     62   0.00  68.48   0.00  -5.95  -0.73   0.00   0.00 -17.36
44.44
-------------------------------------------------------------------------------
--

Segment Leq : 44.44 dBA

Total Leq All Segments: 62.79 dBA




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

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       23.50 !       22.99 !        84.99

ROAD (0.00 + 52.20 + 0.00) = 52.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  73.80   0.00 -12.79   0.00   0.00   0.00  -8.81
52.20
-------------------------------------------------------------------------------
--

Segment Leq : 52.20 dBA
```

```
Results segment # 2: 417 West (night)
-------------------------------------

Source height = 1.49 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.49 !       23.50 !       23.02 !        85.02

ROAD (0.00 + 52.02 + 0.00) = 52.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  73.80   0.00 -13.04   0.00   0.00   0.00  -8.74
52.02
-------------------------------------------------------------------------------
--

Segment Leq : 52.02 dBA
```

```
Results segment # 3: Preston St (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 !       23.50 !       16.79 !        78.79

ROAD (0.00 + 36.84 + 0.00) = 36.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     62   0.00  60.88   0.00  -5.95  -0.73   0.00   0.00 -17.36
36.84
-------------------------------------------------------------------------------
--

Segment Leq : 36.84 dBA

Total Leq All Segments: 55.19 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 62.79
                           (NIGHT): 55.19
```