Roadway Traffic Noise Feasibility Assessment

112 Nelson Street

Ottawa, Ontario

REPORT: GWE17-156 – Traffic Noise

Prepared For:

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October 19, 2017

EXECUTIVE SUMMARY

This document describes a roadway traffic noise feasibility assessment performed for a proposed residential development located at 112 Nelson Street, in Ottawa, Ontario. The development comprises a new nine-storey building with an 'L' shaped footprint. Outdoor amenity space has been assumed as common rooftop terrace. Balconies less than 4 m in depth are not considered as outdoor living areas, as per the ENCG. The major source of transportation noise is King Edward Avenue and Rideau Street. 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) architectural drawings received from Domicile Developments Inc..

The results of the current analysis indicate that noise levels will range between 50 and 58 dBA during the daytime period (07:00-23:00) and between 42 and 50 dBA during the nighttime period (23:00-07:00). The highest noise levels (i.e. 58 dBA) occur along the development's west façade, which is nearest and most exposed to King Edward Avenue.

The noise levels predicted due to roadway traffic fall below the criteria listed in Section 4.2 for upgraded building components. However, results of the calculations also indicate that the development will likely require forced air heating and provisions for central air conditioning. The installation of central air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. With ventilation requirements, Warning Clauses are also required be placed on all Lease, Purchase and Sale Agreements.

Noise levels at the rooftop floor terrace were found to approach 53 dBA during the daytime period, which is below the ENCG criteria; therefore, no mitigation would be required. However, it is recommended outdoor living areas (OLA) should be positioned away from arterial roadways to reduce noise levels. If the need arises for OLA noise mitigation, this can be addressed during site plan control.

TABLE OF CONTENTS

		PAGE
1.	INTRODUCTION	1
2.	TERMS OF REFERENCE	1
3.	OBJECTIVES	1
4.	METHODOLOGY	2
4.1	Background	2
4.2	Roadway Traffic Noise	2
4.2.1	Criteria for Roadway Traffic Noise	2
4.2.1	Roadway Traffic Volumes	3
4.2.2	Theoretical Transportation Noise Predictions	3
5.	RESULTS AND DISCUSSION	4
5.1	Roadway Traffic Noise Levels	4
6.	CONCLUSIONS AND RECOMMENDATIONS	4
FIGURES		
APPENDICES:		
	Appendix A – STAMSON 5.04 Input and Output Data	

1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by Domicile Developments Inc. to undertake a roadway traffic noise feasibility assessment of a proposed residential development located at 112 Nelson Street in Ottawa, Ontario, as part of a rezoning application. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment. GWE's scope of work involved assessing exterior 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[1] and Ministry of the Environment and Climate Change (MOECC)[2] guidelines. Noise calculations were based on architectural drawings received from Domicile Developments Inc., with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is a proposed residential development, comprising a new nine-storey building with an 'L' shaped footprint. The development will contain parking below grade, common and amenity space at grade, while the remaining floors contain residential space only. The site is located along Nelson Street between York Street and Rideau Street where an industrial building currently sits. The site sits on industrial land and is surrounded by mixed-use zones, including commercial, industrial and residential. Outdoor amenity space has been assumed as common rooftop terrace. Balconies less than 4 m in depth are not considered as outdoor living areas, as per the ENCG. The major source of transportation noise is King Edward Avenue and Rideau Street. 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 building produced by local roadway traffic, and (ii) provide commentary with regards to the City of Ottawa's Environmental Noise Control Guidelines criteria, as outlined in Section 4 of this report.

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

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

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended indoor 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]. 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[4].

Likewise, Outdoor Living Area's are required to achieve the recommended sound levels with the use of noise control measures, such as noise barriers. Noise levels at the OLA must should not exceed 55 dBA unless it is technically or administratively unfeasible to do so.

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

4.2.1 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[5] 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 summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway / Transit Class	Speed Limit (km/h)	Traffic Volumes
King Edward Avenue	4-UAD	40	**35,000**
Rideau Street	2-UAU	50	**15,000**

4.2.2 Theoretical Transportation Noise Predictions

Noise predictions were performed with the aid of the MOECC computerized noise assessment program, STAMSON 5.04, for road and rail analysis. Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise, and by using existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions
- The day/night split was taken to be 92% / 8% respectively for all streets
- Absorptive and reflective intermediate ground surfaces based on specific source-receiver path ground characteristics
- Topography considered to be flat or gently sloping
- Surrounding existing buildings used as noise barriers
- Noise receptors were strategically identified at four (4) locations around the study area (see Figure 2).

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

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. A sample of STAMSON 5.04 input parameters for Receptor 3 is shown in Figure 3.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Plane of Window Receptor Location	Noise Level (dBA)	
		Day	Night
1	9th Floor – North Façade	50	42
2	9th Floor – South Façade	56	48
3	9th Floor – West Façade	58	50
4	Rooftop Terrace	53	45

The results of the current analysis indicate that noise levels will range between 50 and 58 dBA during the daytime period (07:00-23:00) and between 42 and 50 dBA during the nighttime period (23:00-07:00). The highest noise levels (i.e. 58 dBA) occur along the development's west façade, which is nearest and most exposed to King Edward Avenue.

6. CONCLUSIONS AND RECOMMENDATIONS

The noise levels predicted due to roadway traffic fall below the criteria listed in Section 4.2 for upgraded building components. However, results of the calculations also indicate that the development will likely require forced air heating and provisions for central air conditioning. The installation of central air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. With ventilation requirements, Warning Clauses are also required be placed on all Lease, Purchase and Sale Agreements.

Noise levels at the rooftop floor terrace were found to approach 53 dBA during the daytime period, which is below the ENCG criteria; therefore, no mitigation would be required. However, it is recommended outdoor living areas (OLA) should be positioned away from the roadway to reduce noise levels. If the need arises for OLA noise mitigation, this can be addressed during site plan control.

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.

LICENSED PROFESSIONAL ENGINEER
J. R. FOSTER
100155655
Oct 19, 2017
PROVINCE OF ONTARIO

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GWE17-156 – Traffic Noise

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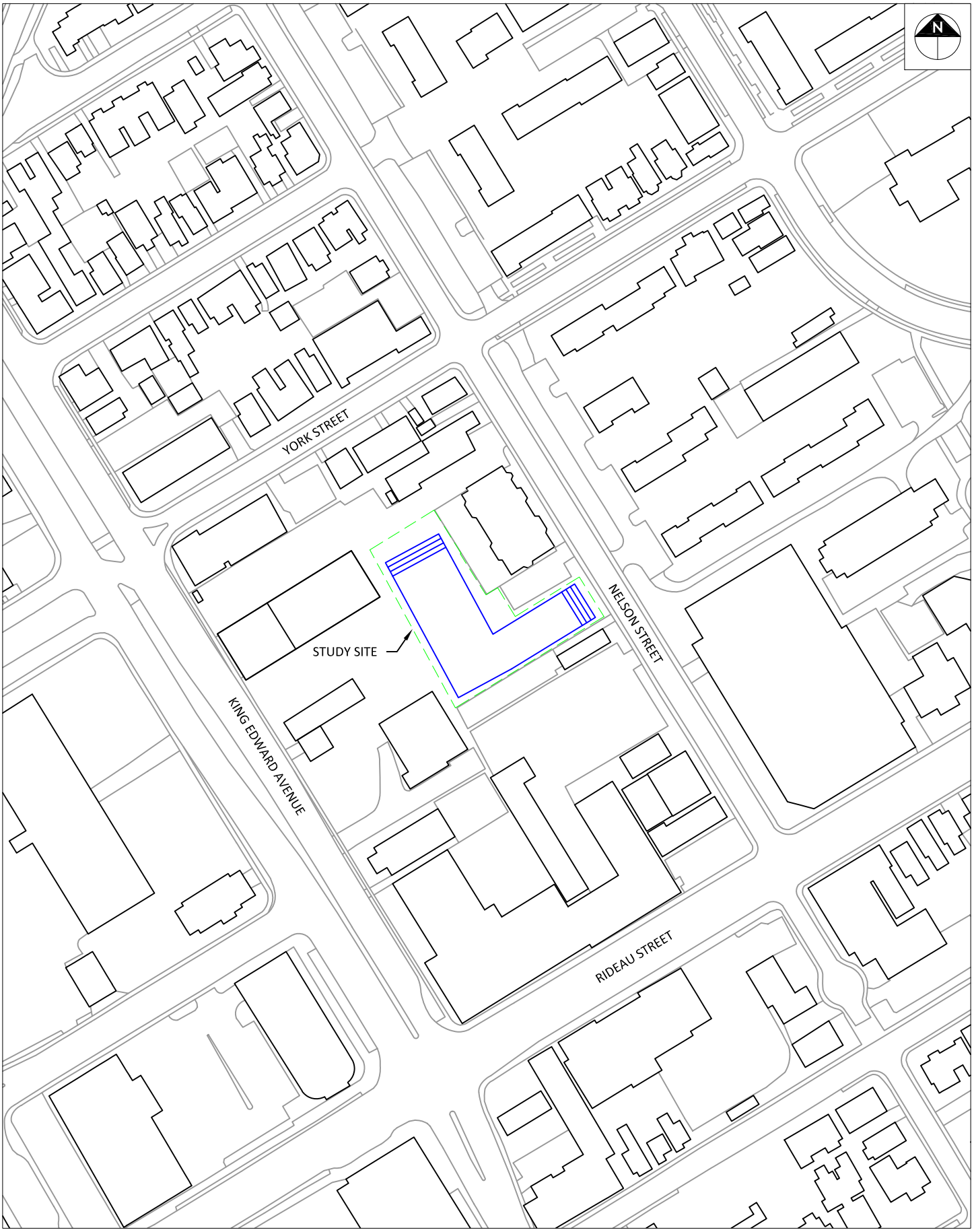
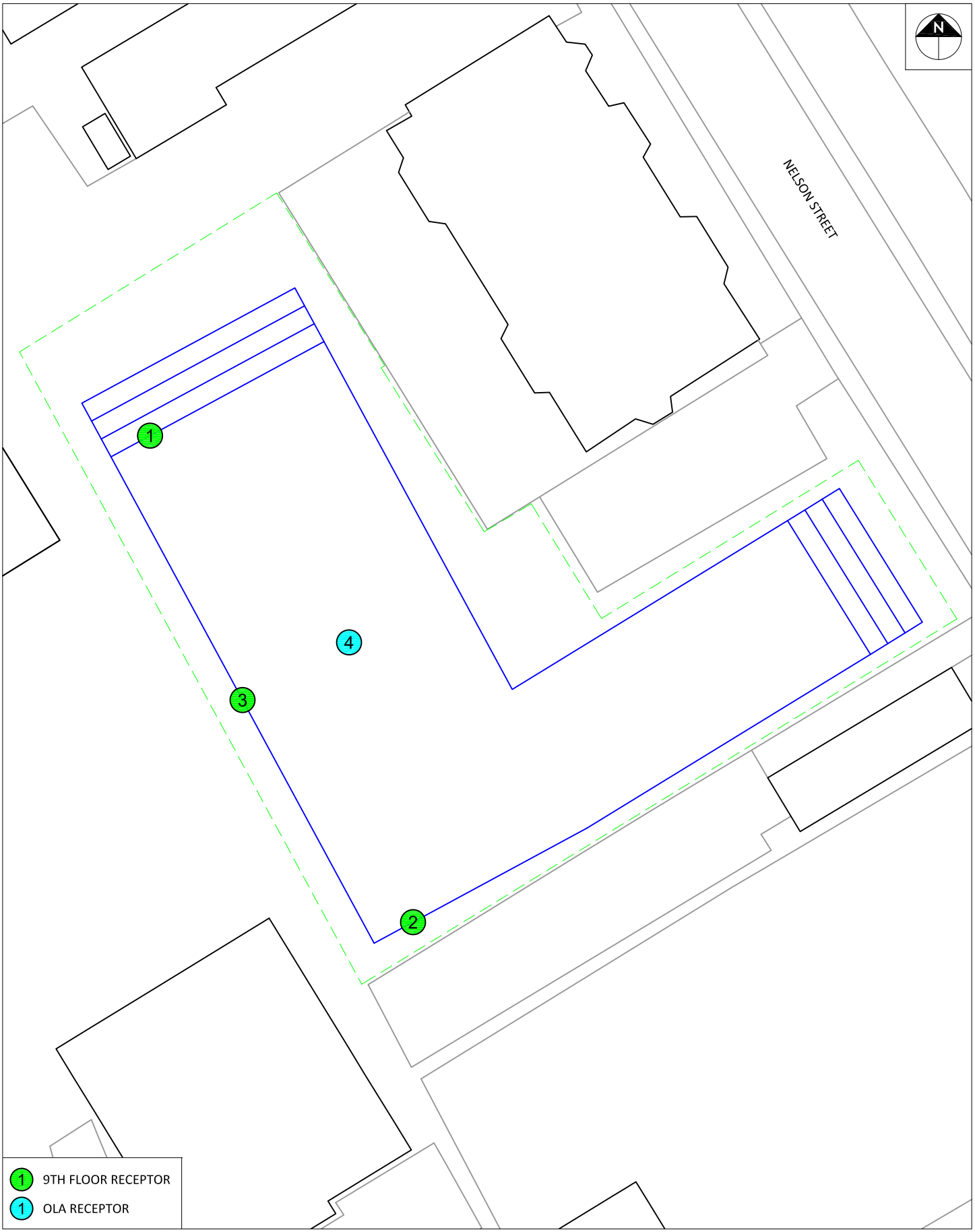
Partner



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

PROJECT	112 NELSON STREET ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE17-156-1
DATE	OCTOBER 19, 2017
DRAWN BY	M.L.
DESCRIPTION	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT



127 Walgreen Road
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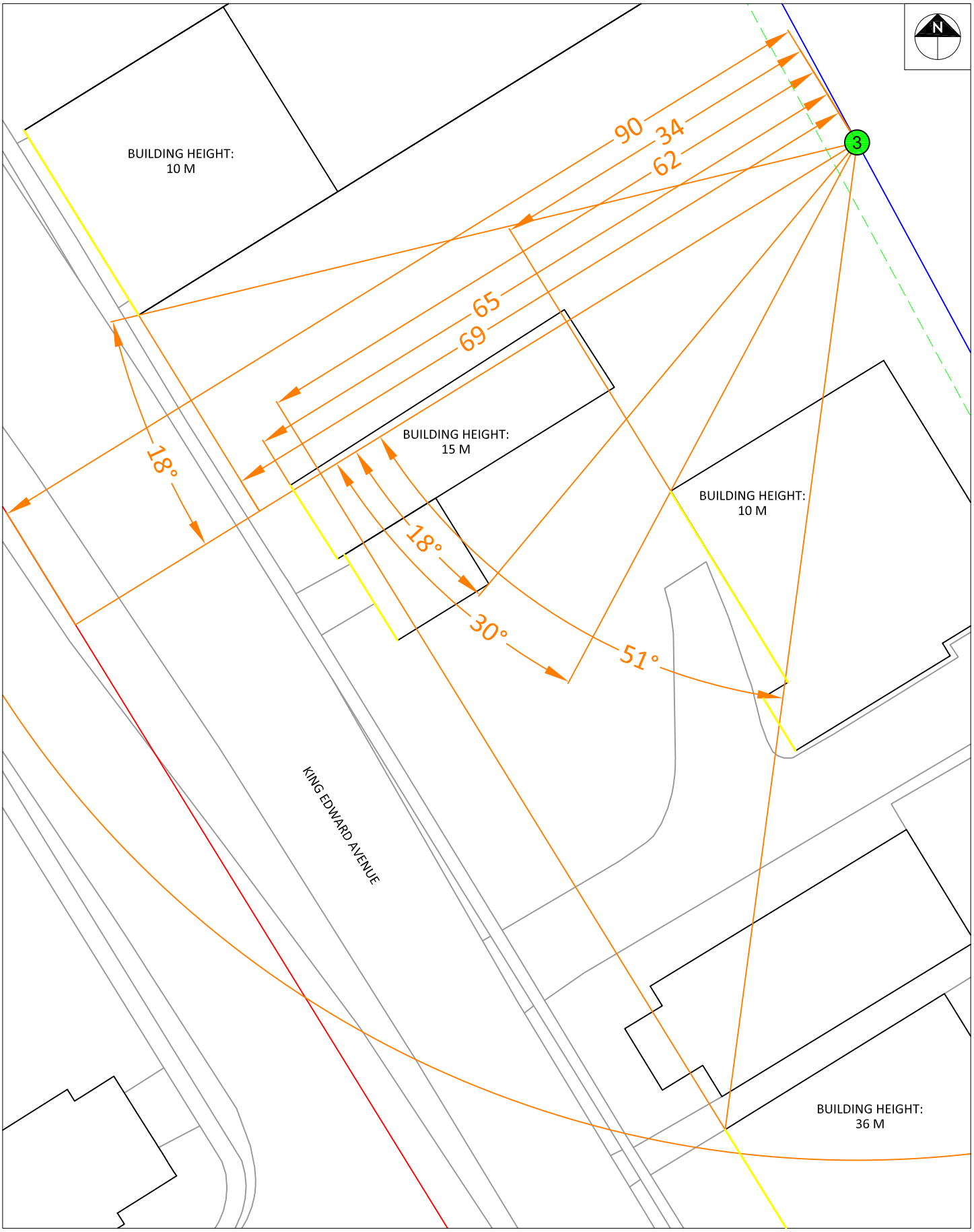
PROJECT	112 NELSON STREET ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:500 (APPROX.)
DRAWING NO.	GWE17-156-2
DATE	OCTOBER 19, 2017
DRAWN BY	M.L.
DESCRIPTION	FIGURE 2: RECEPTOR LOCATIONS



127 Walgreen Road
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GRADIENT WIND ENGINEERING INC

PROJECT	112 NELSON STREET ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT
SCALE	1:500 (APPROX.)
DRAWING NO.	GWE17-156-3
DATE	OCTOBER 19, 2017
DRAWN BY	M.L.
DESCRIPTION	FIGURE 3: STAMSON INPUT RECEPTOR 3

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 11-10-2017 33:56:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Edward (day/night)
-----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: King Edward (day/night)
---------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  96.00 / 96.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :   0.00 deg   Angle2 : 90.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :  75.00 / 75.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Edward (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 !       25.50 !        6.75 !         6.75

ROAD (0.00 + 49.50 + 0.00) = 49.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
     0     90   0.00  70.37   0.00  -8.06  -3.01   0.00   0.00  -9.79
49.50
--------------------------------------------------------------------------
--

Segment Leq : 49.50 dBA

Total Leq All Segments: 49.50 dBA
```

```
Results segment # 1: King Edward (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 !       25.50 !        6.75 !         6.75

ROAD (0.00 + 41.90 + 0.00) = 41.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
     0     90   0.00  62.77   0.00  -8.06  -3.01   0.00   0.00  -9.79
41.90
--------------------------------------------------------------------------
--

Segment Leq : 41.90 dBA

Total Leq All Segments: 41.90 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 49.50
                         (NIGHT): 41.90
```

```
STAMSON 5.0        NORMAL REPORT        Date: 11-10-2017 33:56:12
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King EdwardL (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: King EdwardL (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   -37.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  93.00 / 93.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -37.00 deg
Barrier height            :  36.00 m
Barrier receiver distance :  65.00 / 65.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: King EdwardR (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: King EdwardR (day/night)
----------------------------------------------
Angle1   Angle2           : -37.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  93.00 / 93.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -37.00 deg   Angle2 : 0.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :  36.00 / 36.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Rideau (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: Rideau (day/night)
----------------------------------------
Angle1   Angle2           : -28.00 deg   7.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 125.00 / 125.00 m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -28.00 deg   Angle2 : 7.00 deg
Barrier height            :  10.00 m
Barrier receiver distance : 111.00 / 111.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King EdwardL (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 !       25.50 !        8.72 !         8.72

ROAD (0.00 + 38.52 + 0.00) = 38.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90    -37   0.00  70.37   0.00  -7.92  -5.31   0.00   0.00 -18.61
38.52
--------------------------------------------------------------------------
--

Segment Leq : 38.52 dBA
```

```
Results segment # 2: King EdwardR (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 !       25.50 !       16.21 !        16.21

ROAD (0.00 + 55.57 + 0.00) = 55.57 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -37      0   0.00  70.37   0.00  -7.92  -6.87   0.00   0.00   0.00
55.57*
   -37      0   0.00  70.37   0.00  -7.92  -6.87   0.00   0.00   0.00
55.57
--------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 55.57 dBA
```

```
Results segment # 3: Rideau (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 !       25.50 !        4.18 !         4.18

ROAD (0.00 + 33.98 + 0.00) = 33.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -28      7   0.00  68.48   0.00  -9.21  -7.11   0.00   0.00 -18.18
33.98
--------------------------------------------------------------------------
--

Segment Leq : 33.98 dBA

Total Leq All Segments: 55.68 dBA
```

```
Results segment # 1: King EdwardL (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 !       25.50 !        8.72 !         8.72

ROAD (0.00 + 30.92 + 0.00) = 30.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90    -37   0.00  62.77   0.00  -7.92  -5.31   0.00   0.00 -18.61
30.92
--------------------------------------------------------------------------
--

Segment Leq : 30.92 dBA
```

```
Results segment # 2: King EdwardR (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 !       25.50 !       16.21 !        16.21

ROAD (0.00 + 47.97 + 0.00) = 47.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -37      0   0.00  62.77   0.00  -7.92  -6.87   0.00   0.00   0.00
47.97*
   -37      0   0.00  62.77   0.00  -7.92  -6.87   0.00   0.00   0.00
47.97
--------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 47.97 dBA
```

```
Results segment # 3: Rideau (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 !       25.50 !        4.18 !         4.18

ROAD (0.00 + 26.38 + 0.00) = 26.38 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
---------------------------------------------------------------------------
--
   -28      7   0.00  60.88   0.00  -9.21  -7.11   0.00   0.00 -18.18
26.38
---------------------------------------------------------------------------
--

Segment Leq : 26.38 dBA

Total Leq All Segments: 48.08 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 55.68
                         (NIGHT): 48.08
```

```
STAMSON 5.0        NORMAL REPORT        Date: 11-10-2017 33:56:17
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Edward1 (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: King Edward1 (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   -51.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  90.00 / 90.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -51.00 deg
Barrier height            :  36.00 m
Barrier receiver distance :  62.00 / 62.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: King Edward2 (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: King Edward2 (day/night)
----------------------------------------------
Angle1   Angle2           : -51.00 deg   -30.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  90.00 / 90.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -51.00 deg   Angle2 : -30.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :  34.00 / 34.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: King Edward3 (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 3: King Edward3 (day/night)
----------------------------------------------
Angle1   Angle2           : -30.00 deg   18.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  90.00 / 90.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -18.00 deg   Angle2 : 0.00 deg
Barrier height            :  15.00 m
Barrier receiver distance :  65.00 / 65.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 4: King Edward4 (day/night)
------------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 4: King Edward4 (day/night)
----------------------------------------------
Angle1   Angle2           :  18.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  90.00 / 90.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  18.00 deg   Angle2 : 90.00 deg
Barrier height            :  10.00 m
Barrier receiver distance :  69.00 / 69.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Edward1 (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 !       25.50 !        8.96 !         8.96

ROAD (0.00 + 37.74 + 0.00) = 37.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90    -51   0.00  70.37   0.00  -7.78  -6.64   0.00   0.00 -18.20
37.74
--------------------------------------------------------------------------
--

Segment Leq : 37.74 dBA
```

```
Results segment # 2: King Edward2 (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 !       25.50 !       16.43 !        16.43

ROAD (0.00 + 53.25 + 0.00) = 53.25 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -51    -30   0.00  70.37   0.00  -7.78  -9.33   0.00   0.00   0.00
53.25*
   -51    -30   0.00  70.37   0.00  -7.78  -9.33   0.00   0.00   0.00
53.25
--------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 53.25 dBA
```

```
Results segment # 3: King Edward3 (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 !       25.50 !        8.16 !         8.16

ROAD (50.82 + 34.57 + 52.58) = 54.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-----------------------------------------------------------------------------
--
   -30    -18   0.00  70.37   0.00  -7.78 -11.76   0.00   0.00   0.00
50.82
-----------------------------------------------------------------------------
--
   -18      0   0.00  70.37   0.00  -7.78 -10.00   0.00   0.00 -18.01
34.57
-----------------------------------------------------------------------------
--
     0     18   0.00  70.37   0.00  -7.78 -10.00   0.00   0.00   0.00
52.58
-----------------------------------------------------------------------------
--

Segment Leq : 54.84 dBA
```

```
Results segment # 4: King Edward4 (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 !       25.50 !        7.10 !         7.10

ROAD (0.00 + 49.79 + 0.00) = 49.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
    18     90   0.00  70.37   0.00  -7.78  -3.98   0.00   0.00  -8.81
49.79
--------------------------------------------------------------------------
--

Segment Leq : 49.79 dBA

Total Leq All Segments: 57.91 dBA
```

```
Results segment # 1: King Edward1 (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 !       25.50 !        8.96 !         8.96

ROAD (0.00 + 30.15 + 0.00) = 30.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90    -51   0.00  62.77   0.00  -7.78  -6.64   0.00   0.00 -18.20
30.15
--------------------------------------------------------------------------
--

Segment Leq : 30.15 dBA
```

```
Results segment # 2: King Edward2 (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 !       25.50 !       16.43 !        16.43

ROAD (0.00 + 45.66 + 0.00) = 45.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
---------------------------------------------------------------------------
--
   -51    -30   0.00  62.77   0.00  -7.78  -9.33   0.00   0.00   0.00
45.66*
   -51    -30   0.00  62.77   0.00  -7.78  -9.33   0.00   0.00   0.00
45.66
---------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 45.66 dBA
```

```
Results segment # 3: King Edward3 (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 !       25.50 !        8.16 !         8.16

ROAD (43.23 + 26.97 + 44.99) = 47.25 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-----------------------------------------------------------------------------
--
   -30    -18   0.00  62.77   0.00  -7.78 -11.76   0.00   0.00   0.00
43.23
-----------------------------------------------------------------------------
--
   -18      0   0.00  62.77   0.00  -7.78 -10.00   0.00   0.00 -18.01
26.97
-----------------------------------------------------------------------------
--
     0     18   0.00  62.77   0.00  -7.78 -10.00   0.00   0.00   0.00
44.99
-----------------------------------------------------------------------------
--

Segment Leq : 47.25 dBA
```

```
Results segment # 4: King Edward4 (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 !       25.50 !        7.10 !         7.10

ROAD (0.00 + 42.20 + 0.00) = 42.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
    18     90   0.00  62.77   0.00  -7.78  -3.98   0.00   0.00  -8.81
42.20
--------------------------------------------------------------------------
--

Segment Leq : 42.20 dBA

Total Leq All Segments: 50.32 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 57.91
                         (NIGHT): 50.32
```

```
STAMSON 5.0        NORMAL REPORT        Date: 11-10-2017 33:56:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: King Edward (day/night)
-----------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    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):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: King Edward (day/night)
---------------------------------------------
Angle1   Angle2           : -45.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  : 102.00 / 102.00 m
Receiver height           :  28.50 / 28.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -45.00 deg   Angle2 : 90.00 deg
Barrier height            :  27.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: King Edward (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 !       28.50 !       25.32 !        25.32

ROAD (0.00 + 52.59 + 0.00) = 52.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -45     90   0.00  70.37   0.00  -8.33  -1.25   0.00   0.00  -8.20
52.59
--------------------------------------------------------------------------
--

Segment Leq : 52.59 dBA

Total Leq All Segments: 52.59 dBA
```

```
Results segment # 1: King Edward (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 !       28.50 !       25.32 !        25.32

ROAD (0.00 + 45.00 + 0.00) = 45.00 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -45     90   0.00  62.77   0.00  -8.33  -1.25   0.00   0.00  -8.20
45.00
--------------------------------------------------------------------------
--

Segment Leq : 45.00 dBA

Total Leq All Segments: 45.00 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 52.59
                         (NIGHT): 45.00
```