Traffic Noise Assessment

100 New Orchard Avenue
Ottawa, Ontario

REPORT: GWE18-087 – 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 residential development at 100 New Orchard Drive in Ottawa, Ontario. The proposed development is a 14-storey apartment building, with a penthouse on the roof. Amenity space is provided in the form of outdoor terraces on the 14th floor. Private balconies are shown in the site plan drawings, but along with some terraces on the 14th floor, they are not considered Outdoor Living Areas (OLA) since they are less than 4-metres in depth. The major sources of traffic noise are due to Richmond Road to the south, and Sir John A. MacDonald Parkway 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 received from David Blakely Architect Inc.

The results of the current analysis indicate that noise levels will range between 58 and 65 dBA during the daytime period (07:00-23:00) and between 51 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs on the north and west façades of the development, most exposed to Sir John A. Macdonald Parkway. Predicted noise levels due to roadway traffic do not exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will not be required. However, the building will require forced air heating with provisions for central air conditioning. If provided or installed by the tenant, central air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Noise levels at the rooftop terrace are expected to exceed 55 dBA but are less than 60 dBA during the daytime period. According to the ENCG, if these areas are to be used as outdoor living areas, noise control measures (barriers) are required to reduce the L_{eq} to 55 dBA where technically and administratively feasible. Investigation into the application of a noise barrier found that noise levels can be reduced to below 55 dBA with the application of a 1.1-metre acoustic guard rail (noise screen). The barrier is required

to be a noise screen and must be constructed from materials having a minimum surface density of 20 kg/m^2 or having an STC rating of 30 and must be continuous with no gaps. This can be achieved using 6 mm thick monolithic glass panels. As found in Part 5 of the ENCG with regards to noise barrier design, the following information will be required by the City for review prior to installation of the barrier:

1. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
2. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
3. Layout plan, and wall elevations, showing proposed colours and patterns.

CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by New Orchard Investment Inc. to undertake a traffic noise assessment in support of site plan application for a proposed residential development at 100 New Orchard Drive in Ottawa, Ontario. The proposed development is a 14-storey apartment building, with a penthouse on the roof. This report summarizes the methodology, results, and recommendations related to a traffic noise assessment. GWE's scope of work involved assessing exterior and interior noise levels generated by local roadway traffic. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment and Climate Change (MOECC)[2] guidelines. Noise calculations were based on architectural drawings received from David Blakely Architect 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 traffic noise assessment a proposed residential development at 100 New Orchard Drive in Ottawa, Ontario. The proposed development is a 14-storey apartment building, with a penthouse on the roof. The first two floors are mainly dedicated to parking and mechanical spaces, while residential use occupies the 3rd – 13th floor. The 14th floor contains a penthouse for indoor amenity uses and rooftop terraces. Amenity space is provided in the form of outdoor terraces on the 14th floor. Private balconies are shown in the site plan drawings, but along with some terraces on the 14th floor, they are not considered Outdoor Living Areas (OLA) since they are less than 4-metres in depth. Therefore, the only terrace considered as an OLA is on the north façade of the building facing Sir John A. McDonald Parkway. The site is surrounded by residential and industrial buildings in the immediate vicinity to the east, south and west, while the north of the site is within 150 metres of the Ottawa River. Richmond Road is located south of the development, with a dense residential area beyond that to the south. Sir John A. MacDonald Parkway is located north of the site. The major sources of traffic noise are Sir John A. MacDonald Parkway and Richmond Road. Figure 1 illustrates a complete site plan with surrounding context.

[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

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)[3]

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[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which 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[6].

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

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECC, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MOECC, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.3 Roadway Noise Assessment

4.3.1 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 exposed to Richmond Road due to presence of hard (paved) ground, but absorptive ground surface used to receptors exposed to Sir John A. MacDonald Parkway due to presence of soft grassland.
- Topography assumed to be a flat/gentle slope.
- Receptor height taken to be 19.5 metres at the 7th floor, and 34.5 metres at the 12th floor for the centre of the window in the absence of elevation drawings as stated in the Ontario Road Noise Analysis Method for Environmental and Transportation (ORNAMENT) technical document[7].
- Receptor heights considered worst-case conditions with full exposure to sources of noise, therefore, no surrounding buildings were considered as potential noise barriers.
- Receptor 9 considered the proposed building as a barrier with a height of 36-metres, and a receiver 1.5 metre above the 12th floor roof (original site plan contained 13-story building).
- Noise receptors were strategically placed at 9 locations around the study area (see Figure 2).
- Receptor distances and exposure angles illustrated in Figures 3-4.

[7] ORNAMENT Technical Document, October 1989, Section 5.5.4

4.4 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.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway / Transit Class	Speed Limit (km/h)	Traffic Volumes
Richmond Road	2-UAD	50	**15,000**
Sir John A. Macdonald Parkway	4-Lane Urban Arterial-Divided (4-UAD)	60	**35,000**

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.

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

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	19.5	POW – 7th Floor – South Façade	58	51
2	19.5	POW – 7th Floor – East Façade	62	54
3	19.5	POW – 7th Floor – North Façade	64	56
4	19.5	POW – 7th Floor – West Façade	63	56
5	34.5	POW – 12th Floor – South Façade	58	51
6	34.5	POW – 12th Floor – East Façade	62	55
7	34.5	POW – 12th Floor – North Façade	65	58
8	34.5	POW – 12th Floor – West Façade	65	57
9	37.5	OLA – 14th Floor – Outdoor Terrace	59	52

The results of the current analysis indicate that noise levels will range between 58 and 65 dBA during the daytime period (07:00-23:00) and between 51 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs on the north and west façades of the development, most exposed to Sir John A. Macdonald Parkway. Predicted noise levels due to roadway traffic do not exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will not be required.

Results of the calculations also indicate that the development will require forced air heating with provisions for 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 to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

5.1 Noise Barrier Calculation

Noise levels at the rooftop terrace are expected to slightly exceed 55 dBA during the daytime period. According to the ENCG, if these areas are to be used as outdoor living areas, noise control measures (barriers) are required to reduce the Leq to 55 dBA where technically and administratively feasible. Investigation into the application of a noise barrier found that noise levels can be reduced to below 55 dBA with the application of a 1.1-metre acoustic guard rail (noise screen). The barrier is required to be a

noise screen and must be constructed from materials having a minimum surface density of 20 kg/m^2 or having an STC rating of 30 and must be continuous with no gaps. This can be achieved using 6 mm thick monolithic glass panels. Table 4 summarizes the results of the barrier investigations, while the barrier is illustrated in Figure 2. Design of the barriers will conform to the requirements outlined in Part 5 of the ENCG.

TABLE 4: RESULTS OF NOSIE BARRIER INVESTIGATION

Location	Reference Receptor	Barrier Height (m)	Daytime L_{eq} Noise Levels (dBA)	
			With Barrier	Without Barrier
OLA – 14th Floor – Rooftop Terrace	9	1.1	51	59

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 58 and 65 dBA during the daytime period (07:00-23:00) and between 51 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (65 dBA) occurs on the north and west façades of the development, most exposed to Sir John A. Macdonald Parkway. Predicted noise levels due to roadway traffic do not exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will not be required.

Noise levels at the rooftop terrace are expected to slightly exceed 55 dBA but are less than 60 dBA during the daytime period. According to the ENCG, if these areas are to be used as outdoor living areas, noise control measures (barriers) are required to reduce the L_{eq} to 55 dBA where technically and administratively feasible. Investigation into the application of a noise barrier found that noise levels can be reduced to below 55 dBA with the application of a 1.1-metre acoustic guard rail (noise screen). The barrier is required to be a noise screen and must be constructed from materials having a minimum surface density of 20 kg/m^2 or having an STC rating of 30 and must be continuous with no gaps. This can be achieved using 6 mm thick monolithic glass panels. As found in Part 5 of the ENCG with regards to noise barrier design, the following information will be required by the City for review prior to installation of the barrier:

1. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
2. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
3. Layout plan, and wall elevations, showing proposed colours and patterns.

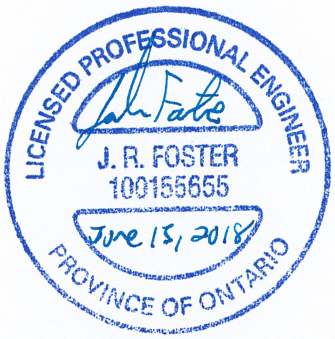
Results of the calculations also indicate that the development will require forced air heating with provisions for central air conditioning. If provided or installed by the tenant, central air conditioning will allow occupants to keep windows closed and maintain a comfortable living environment. Additionally, sound attenuation has been addressed for the rooftop terrace in the form of a noise screen as detailed in Section 5.1 and illustrated in Figure 2. In addition to ventilation requirements, Warning Clauses in all Lease, Purchase and Sale Agreements will be required 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 will interfere with some 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 has been designed so as to provide an outdoor amenity area and indoor environment that is within provincial guidelines. Measures for sound attenuation include:*
>
> - *An acoustic barrier for the rooftop terrace as detailed in Section 5.1.*
>
> *To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features.*
>
> *To ensure that provincial sound level limits are not exceeded, this dwelling unit has been designed with forced air heating and the provision for central air conditioning. The installation of central 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."*

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.



P.P.

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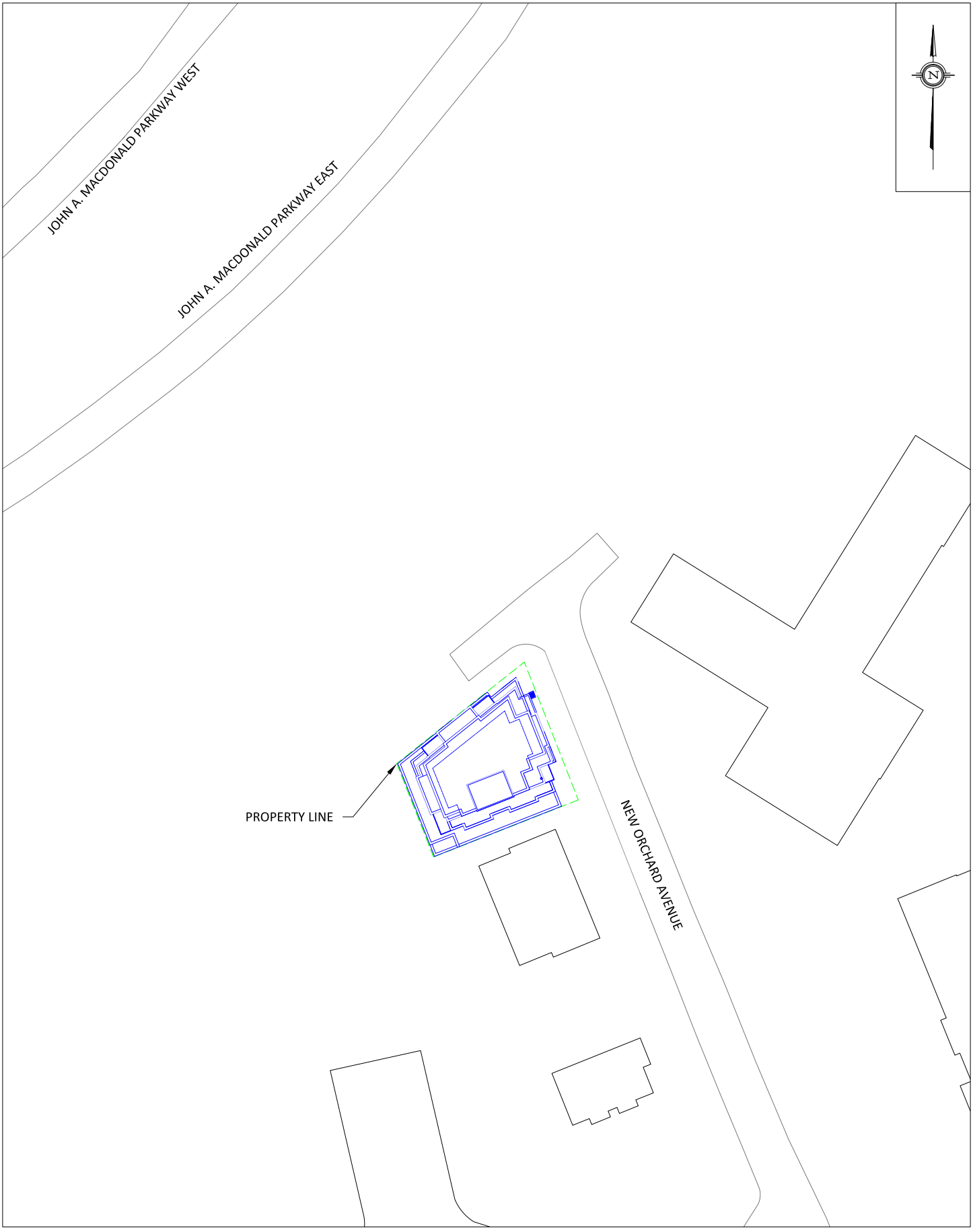


127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

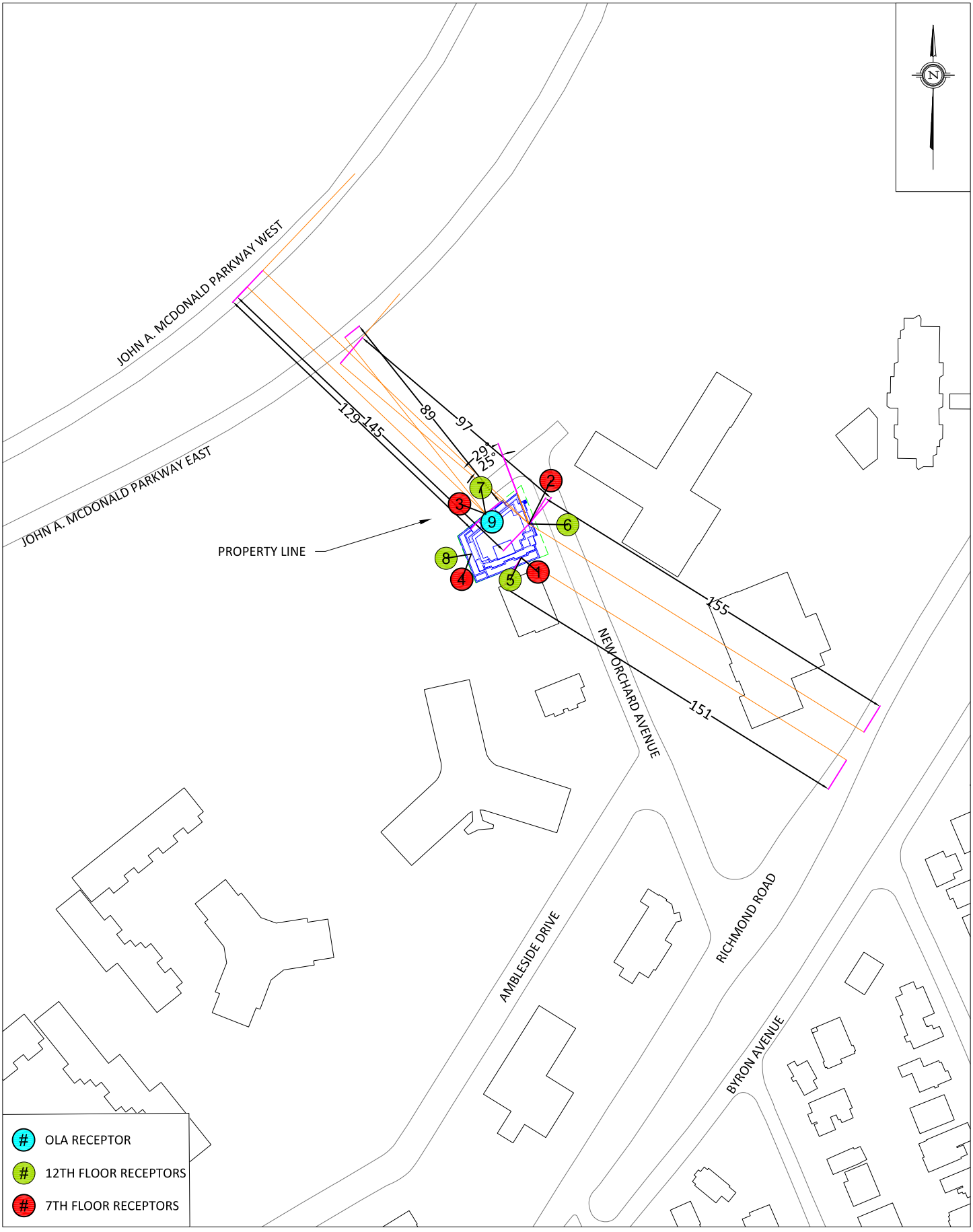
PROJECT	100 NEW ORCHARD AVENUE - TRAFFIC NOISE ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE18-087-1
DATE	JUNE 5, 2018	DRAWN BY	O.D.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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

PROJECT	100 NEW ORCHARD AVENUE - TRAFFIC NOISE ASSESSMENT
SCALE	1:750 (APPROX.)
DRAWING NO.	GWE18-087-2
DATE	JUNE 5, 2018
DRAWN BY	O.D.
DESCRIPTION	FIGURE 2: RECEPTOR LOCATIONS



127 Walgreen Road
Ottawa, Ontario
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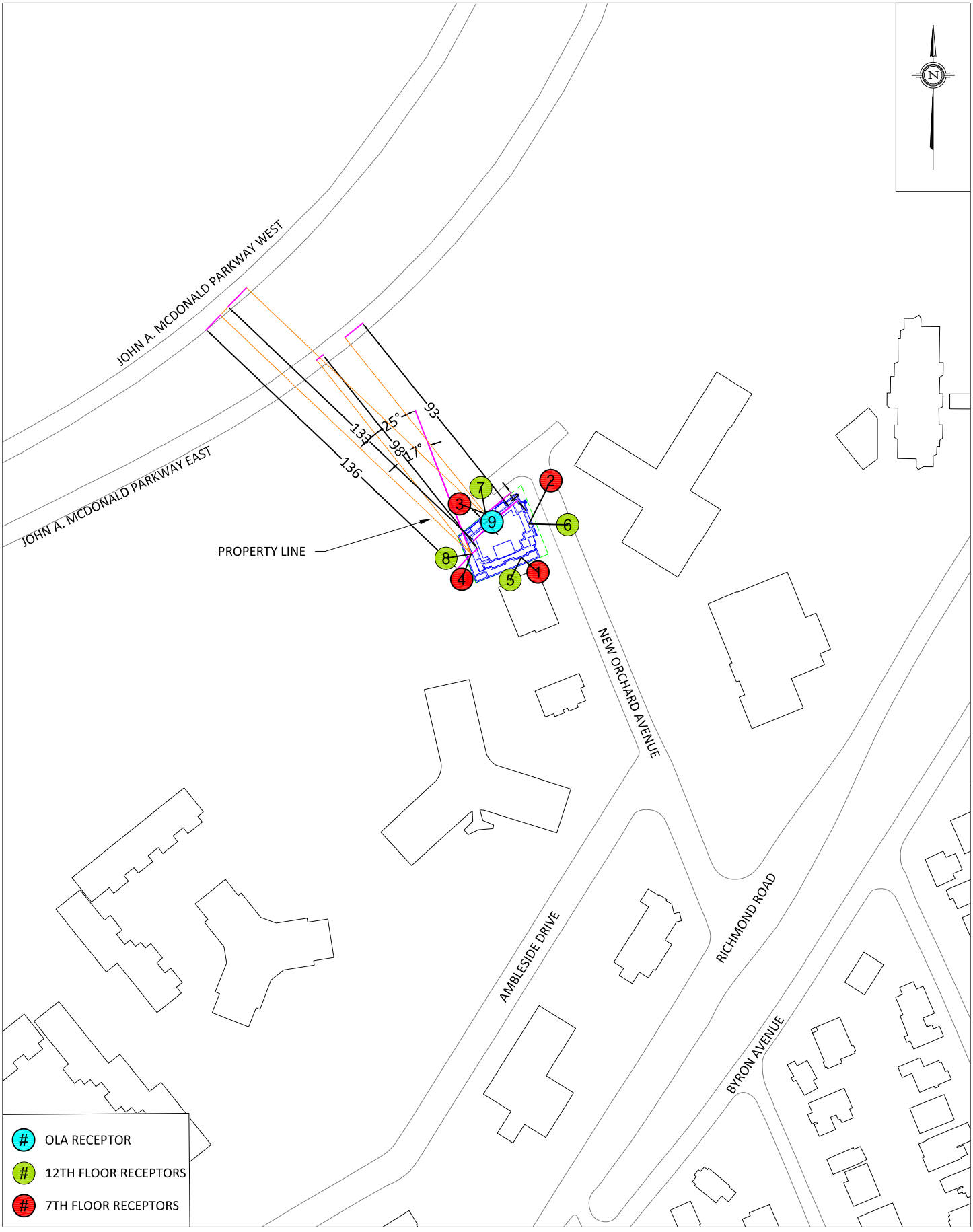
GRADIENT WIND ENGINEERING INC

PROJECT	100 NEW ORCHARD AVENUE - TRAFFIC NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE18-087-3
DATE	JUNE 5, 2018
DRAWN BY	O.D.

DESCRIPTION

FIGURE 3:
RECEPTOR DISTANCES AND EXPOSURE ANGLES



127 Walgreen Road
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GRADIENT WIND ENGINEERING INC

PROJECT	100 NEW ORCHARD AVENUE - TRAFFIC NOISE ASSESSMENT		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GWE18-087-4
DATE	JUNE 5, 2018	DRAWN BY	O.D.

DESCRIPTION

FIGURE 4:
RECEPTOR DISTANCES AND EXPOSURE ANGLES

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 34:54:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    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: Richmond (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  : 151.00 / 151.00 m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

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

Source height = 1.50 m

ROAD (0.00 + 58.45 + 0.00) = 58.45 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00 -10.03   0.00   0.00   0.00   0.00  58.45
-------------------------------------------------------------------------------

Segment Leq : 58.45 dBA

Total Leq All Segments: 58.45 dBA

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

Source height = 1.50 m

ROAD (0.00 + 50.85 + 0.00) = 50.85 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00 -10.03   0.00   0.00   0.00   0.00  50.85
-------------------------------------------------------------------------------

Segment Leq : 50.85 dBA

Total Leq All Segments: 50.85 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.45
                           (NIGHT): 50.85
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 34:57:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    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: Richmond (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  : 155.00 / 155.00 m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           :  29.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  97.00 / 97.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 3: John Mcd. W (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           :  25.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 145.00 / 145.00 m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

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

Source height = 1.50 m

ROAD (0.00 + 58.34 + 0.00) = 58.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00 -10.14   0.00   0.00   0.00   0.00  58.34
-------------------------------------------------------------------------------

Segment Leq : 58.34 dBA


Results segment # 2: John Mcd. E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.39 + 0.00) = 56.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    29     90   0.12  70.67   0.00  -9.08  -5.19   0.00   0.00   0.00  56.39
-------------------------------------------------------------------------------

Segment Leq : 56.39 dBA


Results segment # 3: John Mcd. W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.74 + 0.00) = 54.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    25     90   0.12  70.67   0.00 -11.04  -4.89   0.00   0.00   0.00  54.74
-------------------------------------------------------------------------------

Segment Leq : 54.74 dBA

Total Leq All Segments: 61.51 dBA

#
```

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

Source height = 1.50 m

ROAD (0.00 + 50.74 + 0.00) = 50.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00 -10.14   0.00   0.00   0.00   0.00  50.74
-------------------------------------------------------------------------------

Segment Leq : 50.74 dBA


Results segment # 2: John Mcd. E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 48.79 + 0.00) = 48.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    29     90   0.12  63.07   0.00  -9.08  -5.19   0.00   0.00   0.00  48.79
-------------------------------------------------------------------------------

Segment Leq : 48.79 dBA

Results segment # 3: John Mcd. W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.14 + 0.00) = 47.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    25     90   0.12  63.07   0.00 -11.04  -4.89   0.00   0.00   0.00  47.14
-------------------------------------------------------------------------------

Segment Leq : 47.14 dBA

Total Leq All Segments: 53.91 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.51
                           (NIGHT): 53.91
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 34:57:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  89.00 / 89.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
------------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 129.00 / 129.00 m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: John Mcd. E (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.67 + 0.00) = 61.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  70.67   0.00  -8.66  -0.34   0.00   0.00   0.00  61.67
-------------------------------------------------------------------------------

Segment Leq : 61.67 dBA

#
```

```
Results segment # 2: John Mcd. W (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.86 + 0.00) = 59.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  70.67   0.00 -10.47  -0.34   0.00   0.00   0.00  59.86
-------------------------------------------------------------------------------

Segment Leq : 59.86 dBA

Total Leq All Segments: 63.87 dBA


Results segment # 1: John Mcd. E (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.07 + 0.00) = 54.07 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  63.07   0.00  -8.66  -0.34   0.00   0.00   0.00  54.07
-------------------------------------------------------------------------------

Segment Leq : 54.07 dBA


Results segment # 2: John Mcd. W (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.27 + 0.00) = 52.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  63.07   0.00 -10.47  -0.34   0.00   0.00   0.00  52.27
-------------------------------------------------------------------------------

Segment Leq : 52.27 dBA

Total Leq All Segments: 56.27 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.87
                           (NIGHT): 56.27
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 34:59:30
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  98.00 / 98.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
------------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 136.00 / 136.00 m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: John Mcd. E (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.20 + 0.00) = 61.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  70.67   0.00  -9.13  -0.34   0.00   0.00   0.00  61.20
-------------------------------------------------------------------------------

Segment Leq : 61.20 dBA

#
```

```
Results segment # 2: John Mcd. W (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.61 + 0.00) = 59.61 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  70.67   0.00 -10.72  -0.34   0.00   0.00   0.00  59.61
-------------------------------------------------------------------------------

Segment Leq : 59.61 dBA

Total Leq All Segments: 63.49 dBA


Results segment # 1: John Mcd. E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.60 + 0.00) = 53.60 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  63.07   0.00  -9.13  -0.34   0.00   0.00   0.00  53.60
-------------------------------------------------------------------------------

Segment Leq : 53.60 dBA


Results segment # 2: John Mcd. W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.01 + 0.00) = 52.01 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.12  63.07   0.00 -10.72  -0.34   0.00   0.00   0.00  52.01
-------------------------------------------------------------------------------

Segment Leq : 52.01 dBA

Total Leq All Segments: 55.89 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.49
                           (NIGHT): 55.89
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 34:59:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    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: Richmond (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  : 151.00 / 151.00 m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

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

Source height = 1.50 m

ROAD (0.00 + 58.45 + 0.00) = 58.45 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00 -10.03   0.00   0.00   0.00   0.00  58.45
-------------------------------------------------------------------------------

Segment Leq : 58.45 dBA

Total Leq All Segments: 58.45 dBA


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

Source height = 1.50 m

ROAD (0.00 + 50.85 + 0.00) = 50.85 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00 -10.03   0.00   0.00   0.00   0.00  50.85
-------------------------------------------------------------------------------

Segment Leq : 50.85 dBA

Total Leq All Segments: 50.85 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.45
                           (NIGHT): 50.85
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 35:00:25
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Richmond (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    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: Richmond (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  : 155.00 / 155.00 m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           :  29.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  97.00 / 97.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 3: John Mcd. W (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           :  25.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 145.00 / 145.00 m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

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

Source height = 1.50 m

ROAD (0.00 + 58.34 + 0.00) = 58.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00 -10.14   0.00   0.00   0.00   0.00  58.34
-------------------------------------------------------------------------------

Segment Leq : 58.34 dBA


Results segment # 2: John Mcd. E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.86 + 0.00) = 57.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    29     90   0.00  70.67   0.00  -8.11  -4.70   0.00   0.00   0.00  57.86
-------------------------------------------------------------------------------

Segment Leq : 57.86 dBA


Results segment # 3: John Mcd. W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.39 + 0.00) = 56.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    25     90   0.00  70.67   0.00  -9.85  -4.42   0.00   0.00   0.00  56.39
-------------------------------------------------------------------------------

Segment Leq : 56.39 dBA

Total Leq All Segments: 62.38 dBA

#
```

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

Source height = 1.50 m

ROAD (0.00 + 50.74 + 0.00) = 50.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00 -10.14   0.00   0.00   0.00   0.00  50.74
-------------------------------------------------------------------------------

Segment Leq : 50.74 dBA


Results segment # 2: John Mcd. E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.26 + 0.00) = 50.26 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    29     90   0.00  63.07   0.00  -8.11  -4.70   0.00   0.00   0.00  50.26
-------------------------------------------------------------------------------

Segment Leq : 50.26 dBA


Results segment # 3: John Mcd. W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 48.79 + 0.00) = 48.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    25     90   0.00  63.07   0.00  -9.85  -4.42   0.00   0.00   0.00  48.79
-------------------------------------------------------------------------------

Segment Leq : 48.79 dBA

Total Leq All Segments: 54.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 62.38
                           (NIGHT): 54.78
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 35:00:44
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  89.00 / 89.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
------------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 129.00 / 129.00 m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: John Mcd. E (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.93 + 0.00) = 62.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -7.73   0.00   0.00   0.00   0.00  62.93
-------------------------------------------------------------------------------

Segment Leq : 62.93 dBA

#
```

```
Results segment # 2: John Mcd. W (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.32 + 0.00) = 61.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -9.34   0.00   0.00   0.00   0.00  61.32
-------------------------------------------------------------------------------

Segment Leq : 61.32 dBA

Total Leq All Segments: 65.21 dBA


Results segment # 1: John Mcd. E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.34 + 0.00) = 55.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -7.73   0.00   0.00   0.00   0.00  55.34
-------------------------------------------------------------------------------

Segment Leq : 55.34 dBA

Results segment # 2: John Mcd. W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.72 + 0.00) = 53.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -9.34   0.00   0.00   0.00   0.00  53.72
-------------------------------------------------------------------------------

Segment Leq : 53.72 dBA

Total Leq All Segments: 57.62 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.21
                           (NIGHT): 57.62
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-05-2018 35:01:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  98.00 / 98.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
------------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 136.00 / 136.00 m
Receiver height           :  34.50 / 34.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: John Mcd. E (day)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.51 + 0.00) = 62.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -8.15   0.00   0.00   0.00   0.00  62.51
-------------------------------------------------------------------------------

Segment Leq : 62.51 dBA

#
```

```
Results segment # 2: John Mcd. W (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.09 + 0.00) = 61.09 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -9.57   0.00   0.00   0.00   0.00  61.09
-------------------------------------------------------------------------------

Segment Leq : 61.09 dBA

Total Leq All Segments: 64.87 dBA


Results segment # 1: John Mcd. E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.92 + 0.00) = 54.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -8.15   0.00   0.00   0.00   0.00  54.92
-------------------------------------------------------------------------------

Segment Leq : 54.92 dBA


Results segment # 2: John Mcd. W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.49 + 0.00) = 53.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -9.57   0.00   0.00   0.00   0.00  53.49
-------------------------------------------------------------------------------

Segment Leq : 53.49 dBA

Total Leq All Segments: 57.27 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.87
                           (NIGHT): 57.27
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 29-05-2018 11:17:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r9.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  92.00 / 92.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  36.00 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :  36.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 132.00 / 132.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  36.00 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :  36.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

#
```

```
Results segment # 1: John Mcd. E (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 !        1.50 !       35.93 !        35.93

ROAD (0.00 + 57.77 + 0.00) = 57.77 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -7.88   0.00   0.00   0.00  -5.02  57.77
-------------------------------------------------------------------------------

Segment Leq : 57.77 dBA


Results segment # 2: John Mcd. W (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 !        1.50 !       36.41 !        36.41

ROAD (0.00 + 53.53 + 0.00) = 53.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.67   0.00  -9.44   0.00   0.00   0.00  -4.31  56.91*
   -90     90   0.66  70.67   0.00 -15.68  -1.46   0.00   0.00   0.00  53.53
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 53.53 dBA

Total Leq All Segments: 59.16 dBA

#
```

```
Results segment # 1: John Mcd. E (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 !        1.50 !       35.93 !        35.93

ROAD (0.00 + 50.18 + 0.00) = 50.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -7.88   0.00   0.00   0.00  -5.02  50.18
-------------------------------------------------------------------------------

Segment Leq : 50.18 dBA


Results segment # 2: John Mcd. W (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 !        1.50 !       36.41 !        36.41

ROAD (0.00 + 45.93 + 0.00) = 45.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.07   0.00  -9.44   0.00   0.00   0.00  -4.31  49.32*
   -90     90   0.66  63.07   0.00 -15.68  -1.46   0.00   0.00   0.00  45.93
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 45.93 dBA

Total Leq All Segments: 51.57 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.16
                           (NIGHT): 51.57
#
```

```
STAMSON 5.0        NORMAL REPORT        Date: 29-05-2018 11:17:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r9b.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: John Mcd. E (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. E (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  92.00 / 92.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.10 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :  36.00 m
Barrier elevation         :  36.00 m
Reference angle           :   0.00

#
```

```
Road data, segment # 2: John Mcd. W (day/night)
-----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  17500
    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: John Mcd. W (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 132.00 / 132.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.10 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :  36.00 m
Barrier elevation         :  36.00 m
Reference angle           :   0.00

#
```

```
Results segment # 1: John Mcd. E (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 !        1.50 !       -0.07 !        35.93

ROAD (0.00 + 48.46 + 0.00) = 48.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.59  70.67   0.00 -12.56  -1.34   0.00   0.00  -8.31  48.46
-------------------------------------------------------------------------------

Segment Leq : 48.46 dBA


Results segment # 2: John Mcd. W (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 !        1.50 !        0.41 !        36.41

ROAD (0.00 + 47.69 + 0.00) = 47.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.59  70.67   0.00 -15.06  -1.34   0.00   0.00  -6.57  47.69
-------------------------------------------------------------------------------

Segment Leq : 47.69 dBA

Total Leq All Segments: 51.10 dBA

#
```

```
Results segment # 1: John Mcd. E (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 !        1.50 !       -0.07 !        35.93

ROAD (0.00 + 40.86 + 0.00) = 40.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.59  63.07   0.00 -12.56  -1.34   0.00   0.00  -8.31  40.86
-------------------------------------------------------------------------------

Segment Leq : 40.86 dBA


Results segment # 2: John Mcd. W (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 !        1.50 !        0.41 !        36.41

ROAD (0.00 + 40.10 + 0.00) = 40.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.59  63.07   0.00 -15.06  -1.34   0.00   0.00  -6.57  40.10
-------------------------------------------------------------------------------

Segment Leq : 40.10 dBA

Total Leq All Segments: 43.51 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 51.10
                           (NIGHT): 43.51
```