Roadway Traffic Noise Feasibility Assessment

Stonebridge Development, Phase 16
2701 Longfields Drive
Ottawa, Ontario

REPORT: GWE18-086 - Traffic Noise R2

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EXECUTIVE SUMMARY

This document describes a roadway traffic noise feasibility assessment performed for Phase 16 of the proposed Stonebridge residential subdivision at 2701 Longfields Drive in Ottawa, Ontario. The study site is situated southwest of Longfields Drive in proximity to where the roadway intersects with Prince of Wales Drive. Although the road network and arrangement of land uses may be subject to change through the development approval process, the initial draft plan comprises sixteen residential blocks, as well as park space at the northernmost extent of the site. The major source of roadway noise affecting the development is Longfields Drive, an arterial roadway along the east perimeter of the study site.

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) a concept plan prepared by NAK Design Strategies dated May 3, 2018, in addition to a draft plan of the subdivision dated September 27, 2019.

As the site plan may be subject to change, the approach undertaken in this feasibility study was to establish noise contours around the site without the consideration of site massing. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control would be required for various areas on site. The results of the current study indicate that noise levels over the site due to roadway traffic will range between approximately 69 and 55 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Longfields Drive.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 100 metres of Longfields Drive may require noise control measures depending on final site orientation. The layout of the site generally limits OLA exposure with only Blocks 98, 104, 105, and Lot 91 siding onto the corridor. These measures are described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

Once the final site plan configuration has been established, future detailed noise studies would be performed at the time of site plan approval to determine site specific noise mitigation and appropriate warning clauses.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by Mattamy Homes to undertake a roadway traffic noise feasibility assessment of the proposed Stonebridge residential subdivision located at 2701 Longfields Drive in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment, and was prepared in support of the client's draft plan of subdivision applications. GWE's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic. The report also quantitatively addresses any potential noise impacts. 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[2] guidelines. Noise calculations were based on an initial concept plan prepared by NAK Design Strategies, 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 subdivision located at 2701 Longfields Drive, in proximity to where the roadway intersects with Prince of Wales Drive in Ottawa, Ontario. The study site will occupy land currently forming part of the Stonebridge Golf Club. The current concept plan comprises 184 lots for townhomes and single-family dwellings. Land at the northernmost extent of the study site is also designated as park space. This assessment anticipates the potential for each unit to contain outdoor living areas in the form of rear yards.

Longfields Drive (an arterial roadway) is located along the east perimeter of the site and is the major source of roadway noise, as per the Land Use Concept Plan. The nearest other arterial or collector roadways to the site, Prince of Wales Drive (an arterial roadway) and Kilbirnie Drive (a collector roadway), are more than 100 m from the site and are therefore considered insignificant sources of traffic noise. The site is surrounded by green space and agricultural land directly to the north and south, respectively, as well as by residential subdivisions to the east and west. Figure 1 illustrates the site location with surrounding context.

Due to the current state of the development, the final site configuration is uncertain and may be subject to change. Therefore, the approach undertaken in this feasibility assessment was to establish noise contours around the site as per the current plans, however site massing was ignored. The contours, based

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Publication NPC-300

on the City of Ottawa noise criteria, were used to determine what level of noise control for various areas on site would be required.

3. OBJECTIVES

The principal objective of this work is to calculate the future noise levels on the study site produced by local roadway traffic and explore potential for noise mitigation where required.

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 vehicle traffic, 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 Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. OLA do not need to be considered during the nighttime period.

Predicted noise levels at the outdoor living area dictate the action required to achieve the recommended sound levels. According to the ENCG, if an area is to be used as an outdoor living area (OLA), noise control measures are required to reduce the L_{eq} to 55 dBA. This is typically done with noise control measures

outlined in Section 5.2. When noise levels at these areas exceed the criteria, specific Warning Clause requirements may apply. As this is a preliminary assessment, noise control recommendations are of a general nature. Specific mitigation requirements would be the work of a future study.

4.3 Roadway Noise Assessment

4.3.1 Theoretical Roadway Traffic Noise Predictions

Noise predictions were determined by computer modelling using two programs. To provide a general sense of noise across the site, the employed software program was *Predictor-Lima (TMN calculation)*, which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid with 5 × 5 m spacing was placed across the study site, along with a number of discrete receptors at key sensitive areas. Although this program outputs noise contours, it is not the approved model for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the Ministry of the Environment and Climate Change's (MOECC) computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as shown in Figure 2. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 1 below, 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 ground surface between source and receivers
- The study site was treated as having flat or gently sloping topography
- No massing considered as potential noise screening elements
- For Receptor 4, two segments were considered due to the curvature of the roadway.
- Receptor distances and exposure angles illustrated in Figure 2.
- Eight (8) receptor locations were chosen throughout the study site.

4.3.2 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[3] (TMP) which provides 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 1 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 1: ROADWAY TRAFFIC DATA

Roadway	Roadway Class	Speed Limit (km/h)	Official Plan AADT
Longfields Drive	4-Lane Urban Arterial -Divided (4-UAD)	70	**35,000**

*Daytime and Nighttime volumes based on correspondence with the City of Ottawa

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations for the daytime period, covering the entire study site, are shown in Figure 3. Discrete receptors were also placed at ground level at key locations throughout the site. The noise contours were generated using *TMN* and verified with discrete receptors using STAMSON 5.04, as shown in Figure 2 and summarized in Table 2 below. Receptor 1 is located on the southeastern most block of the site, Receptors 2 to 4 in the central west section of the site, Receptors 5 on the northwestern most block, and Receptors 6 to 8 further setback from Longfields Drive. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

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

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	STAMSON 5.04 Noise Level (dBA)	Predictor-Lima Noise Level (dBA)
		Day	Day
1	1.5	66	67
2	1.5	63	64
3	1.5	69	69
4	1.5	68	68
5	1.5	67	68
6	1.5	57	60
7	1.5	57	60
8	1.5	55	55

As shown above, the results calculated from *TMN* generally have good correlation with calculations performed in STAMSON 5.04. A tolerance of 3 dBA between models is generally considered acceptable given human hearing cannot detect a change in sound level of less than 3 dBA. As stated in Section 4.3.1, no massing of proposed buildings was considered as potential screening elements. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 100 metres of Longfields Drive may require noise control measures. These measures are described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

5.2 Summary of Noise Control Measures

The OLA noise levels predicted due to roadway traffic, at a number of receptors, exceed the criteria listed in the ENCG for outdoor living areas, as discussed in Section 4.2. Therefore, noise control measures as described below, subscribing to Table 2.3a in the ENCG and listed in order of preference, will be required to reduce the L_{eq} to 55 dBA:

- Distance setback with soft ground
- Insertion of noise insensitive land uses between the source and sensitive points of reception
- Orientation of buildings to provide sheltered zones in rear yards
- Shared outdoor amenity areas
- Earth berms (sound barriers)
- Acoustic barriers

Examining the noise control measures listed above, these conclusions consider the possibility that not all of the proposed buildings will be oriented to provide screening elements for their OLA against traffic sources. Distance setback, insertion of non-noise sensitive land uses, and building orientation to provide sheltered zones in rear yards may not be feasible due to the requirements of the Community Development Plan. It is also not feasible to have shared outdoor amenity areas for this development with respect to rear yards, as this would have a significant impact on salability. Therefore, the most feasible measures are insertion of earth berms or acoustic wall barriers between the sensitive rear yards and sources of noise. By siding lots along the arterial roadway, the extent of barriers is minimized. The use of earth berms or acoustic barriers will depend on the grading plan when it becomes available. Both options can reduce OLA noise levels to below 55 dBA.

Regarding Figure 3, the area(s) with noise levels under 55 dBA (yellow and light orange) have no ventilation or mitigation requirements. The area(s) with noise levels between 55 and 65 dBA (orange and red) require forced air heating with provision for central air conditioning with an applicable generic Warning Clause. Finally, the area(s) that represent noise levels above 65 dBA (maroon) require central air conditioning with an applicable extensive mitigation Warning Clause. Additionally, if the daytime/nighttime noise levels in the plane of window for a bedroom or living room is greater than 65 dBA or 60 dBA, respectively, building components including windows, walls and doors, where applicable, will be designed so that the indoor noise levels comply with the noise levels specified in the ENCG. A detailed review of proposed assemblies will be conducted at the time of site plan approval to determine site specific noise mitigation and appropriate warning clauses.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 69 and 55 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Longfields Drive.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 100 metres of Longfields Drive may require noise control measures. The layout of the site generally limits OLA exposure, with only Blocks 98, 104, 105, and Lot 91 siding onto the corridor. Mitigation measures are described in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

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
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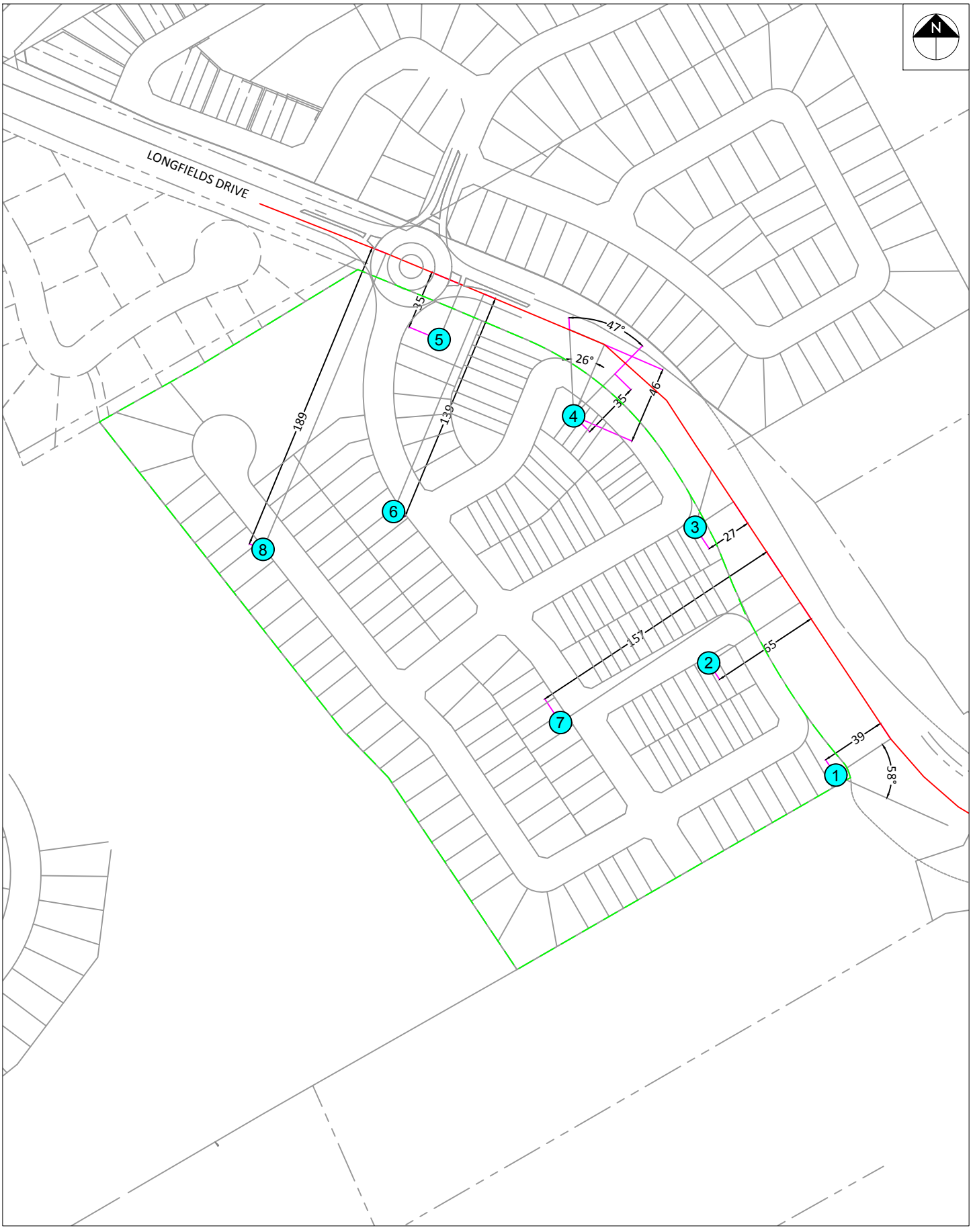
GRADIENT WIND ENGINEERING INC

PROJECT	STONEBRIDGE PHASE 16 - TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:3000 (APPROX.)	DRAWING NO. GWE18-086-1	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
DATE	OCTOBER 9, 2019	DRAWN BY J.F.	



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PROJECT	STONEBRIDGE PHASE 16 - TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:3000 (APPROX.)	DRAWING NO. GWE18-086-2	FIGURE 2: RECEPTOR LOCATIONS AND EXPOSURE ANGLES
DATE	OCTOBER 9, 2019	DRAWN BY J.F.	

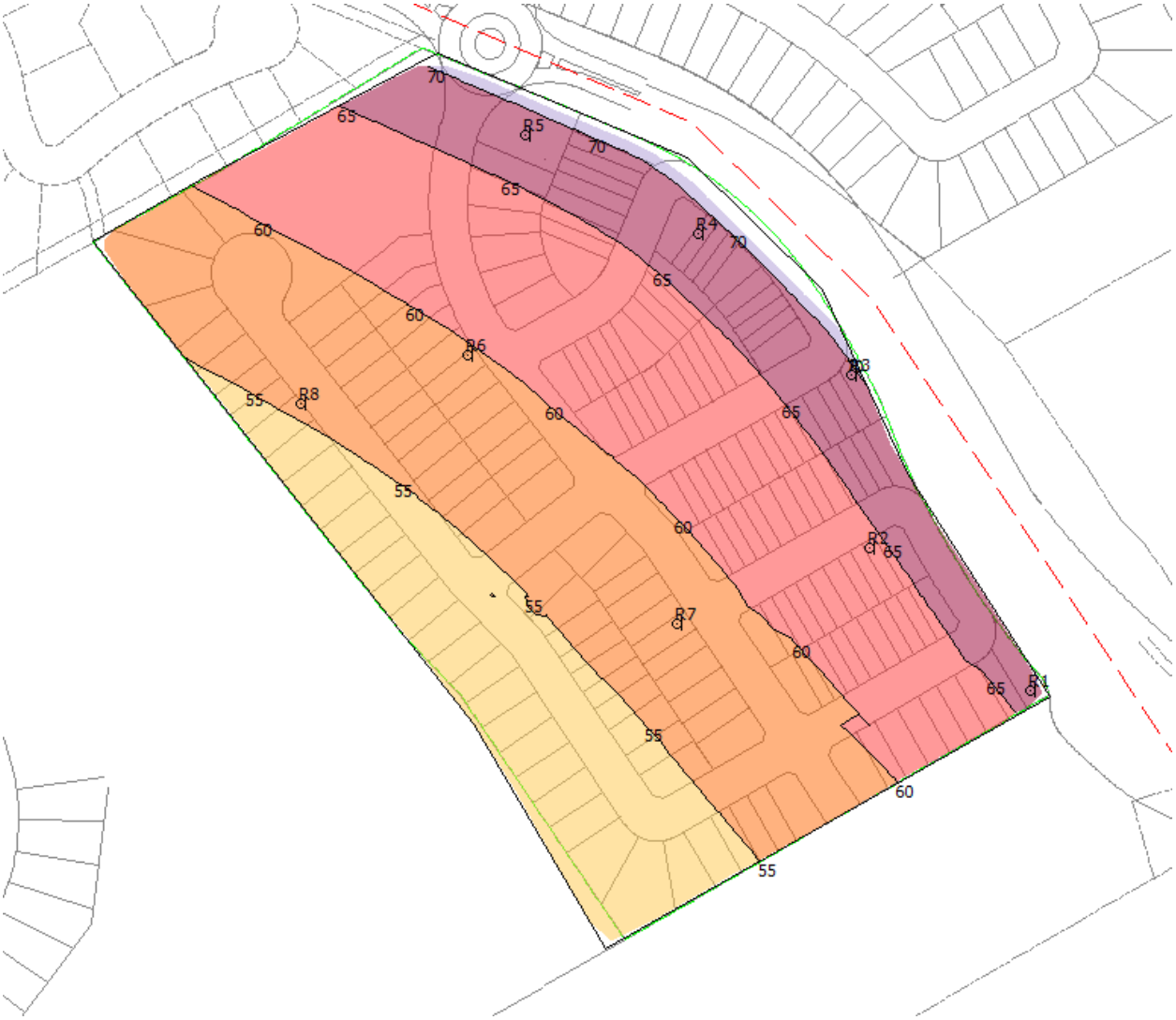

FIGURE 3: GROUND LEVEL NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD)

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA AND SUPPORTING INFORMATION

```
STAMSON 5.0        NORMAL REPORT        Date: 16-05-2018 16:42:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: POR1.te              Time Period: Day/Night 16/8 hours
Description: Receptor 1


Road data, segment # 1: Longfields (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  :    70 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: Longfields (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   58.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  39.00 / 39.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 66.19 + 0.00) = 66.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     58    0.66  75.00   0.00  -6.89  -1.92   0.00   0.00   0.00
66.19
-------------------------------------------------------------------------
--

Segment Leq : 66.19 dBA

Total Leq All Segments: 66.19 dBA


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

Source height = 1.50 m

ROAD (0.00 + 58.59 + 0.00) = 58.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     58    0.66  67.40   0.00  -6.89  -1.92   0.00   0.00   0.00
58.59
-------------------------------------------------------------------------
--

Segment Leq : 58.59 dBA

Total Leq All Segments: 58.59 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 66.19
                           (NIGHT): 58.59
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:48:24
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por2.te              Time Period: Day/Night 16/8 hours
Description: Receptor 2


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  :  65.00 / 65.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 62.97 + 0.00) = 62.97 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00 -10.57  -1.46   0.00   0.00   0.00
62.97
-------------------------------------------------------------------------
--

Segment Leq : 62.97 dBA

Total Leq All Segments: 62.97 dBA


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

Source height = 1.50 m

ROAD (0.00 + 55.37 + 0.00) = 55.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00 -10.57  -1.46   0.00   0.00   0.00
55.37
-------------------------------------------------------------------------
--

Segment Leq : 55.37 dBA

Total Leq All Segments: 55.37 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 62.97
                           (NIGHT): 55.37
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:52:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por3.te              Time Period: Day/Night 16/8 hours
Description: Receptor 3


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  :  27.00 / 27.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 69.30 + 0.00) = 69.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00  -4.24  -1.46   0.00   0.00   0.00
69.30
-------------------------------------------------------------------------
--

Segment Leq : 69.30 dBA

Total Leq All Segments: 69.30 dBA


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

Source height = 1.50 m

ROAD (0.00 + 61.70 + 0.00) = 61.70 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00  -4.24  -1.46   0.00   0.00   0.00
61.70
-------------------------------------------------------------------------
--

Segment Leq : 61.70 dBA

Total Leq All Segments: 61.70 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 69.30
                           (NIGHT): 61.70
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:05:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por4.te              Time Period: Day/Night 16/8 hours
Description: Receptor 4


Road data, segment # 1: Long east (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  :    70 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: Long east (day/night)
--------------------------------------------
Angle1   Angle2           : -47.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  35.00 / 35.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Long west (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  :    70 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: Long west (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   -26.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Long east (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 66.66 + 0.00) = 66.66 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -47     90   0.66  75.00   0.00  -6.11  -2.22   0.00   0.00   0.00
66.66
-------------------------------------------------------------------------
--

Segment Leq : 66.66 dBA


Results segment # 2: Long west (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.27 + 0.00) = 60.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -26   0.66  75.00   0.00  -8.08  -6.65   0.00   0.00   0.00
60.27
-------------------------------------------------------------------------
--

Segment Leq : 60.27 dBA

Total Leq All Segments: 67.56 dBA
```

```
Results segment # 1: Long east (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.07 + 0.00) = 59.07 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -47     90   0.66  67.40   0.00  -6.11  -2.22   0.00   0.00   0.00
59.07
-------------------------------------------------------------------------
--

Segment Leq : 59.07 dBA


Results segment # 2: Long west (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.35 + 0.00) = 53.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -26   0.57  67.40   0.00  -7.64  -6.41   0.00   0.00   0.00
53.35
-------------------------------------------------------------------------
--

Segment Leq : 53.35 dBA

Total Leq All Segments: 60.10 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 67.56
                           (NIGHT): 60.10
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:55:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por5.te              Time Period: Day/Night 16/8 hours
Description: Receptor 4


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  :  35.00 / 35.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 67.43 + 0.00) = 67.43 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00  -6.11  -1.46   0.00   0.00   0.00
67.43
-------------------------------------------------------------------------
--

Segment Leq : 67.43 dBA

Total Leq All Segments: 67.43 dBA


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

Source height = 1.50 m

ROAD (0.00 + 59.83 + 0.00) = 59.83 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00  -6.11  -1.46   0.00   0.00   0.00
59.83
-------------------------------------------------------------------------
--

Segment Leq : 59.83 dBA

Total Leq All Segments: 59.83 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 67.43
                           (NIGHT): 59.83
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:41:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por6.te              Time Period: Day/Night 16/8 hours
Description: Receptor 6


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  : 139.00 / 139.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 57.49 + 0.00) = 57.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00 -16.05  -1.46   0.00   0.00   0.00
57.49
-------------------------------------------------------------------------
--

Segment Leq : 57.49 dBA

Total Leq All Segments: 57.49 dBA


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

Source height = 1.50 m

ROAD (0.00 + 49.89 + 0.00) = 49.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00 -16.05  -1.46   0.00   0.00   0.00
49.89
-------------------------------------------------------------------------
--

Segment Leq : 49.89 dBA

Total Leq All Segments: 49.89 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 57.49
                           (NIGHT): 49.89
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:43:05
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por7.te              Time Period: Day/Night 16/8 hours
Description: Receptor 7


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  : 157.00 / 157.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 56.61 + 0.00) = 56.61 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00 -16.93  -1.46   0.00   0.00   0.00
56.61
-------------------------------------------------------------------------
--

Segment Leq : 56.61 dBA

Total Leq All Segments: 56.61 dBA


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

Source height = 1.50 m

ROAD (0.00 + 49.01 + 0.00) = 49.01 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00 -16.93  -1.46   0.00   0.00   0.00
49.01
-------------------------------------------------------------------------
--

Segment Leq : 49.01 dBA

Total Leq All Segments: 49.01 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 56.61
                           (NIGHT): 49.01
```

```
STAMSON 5.0        NORMAL REPORT        Date: 17-05-2018 13:45:05
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por7.te              Time Period: Day/Night 16/8 hours
Description: Receptor 8


Road data, segment # 1: Longfields (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  :    70 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: Longfields (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  : 189.00 / 189.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 55.27 + 0.00) = 55.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  75.00   0.00 -18.27  -1.46   0.00   0.00   0.00
55.27
-------------------------------------------------------------------------
--

Segment Leq : 55.27 dBA

Total Leq All Segments: 55.27 dBA


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

Source height = 1.50 m

ROAD (0.00 + 47.68 + 0.00) = 47.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.66  67.40   0.00 -18.27  -1.46   0.00   0.00   0.00
47.68
-------------------------------------------------------------------------
--

Segment Leq : 47.68 dBA

Total Leq All Segments: 47.68 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 55.27
                           (NIGHT): 47.68
```