

REPORT
Project: 34206-5.2.2

ENVIRONMENTAL NOISE IMPACT ASSESSMENT 192 BRONSON AVENUE



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Updated April 2018

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1 INTRODUCTION

On behalf of our client, a study has been prepared to determine the impact of roadway traffic on the proposed 21 storey mixed use building located in the City of Ottawa. This report deals with the expected noise levels in the development and any required noise control measures.

As shown on Figure 1, the proposed building will front Bronson Avenue on the east and Cambridge Street on the west. The site is bounded by existing buildings on the north and south sides.

2 BACKGROUND

2.1 Noise Sources

The study area is primarily subject to road noise from Bronson Avenue and Cambridge Street. Aircraft noise from the Ottawa International Airport is not a factor as the airport is not in close proximity to the study area. There are no rail lines within 500 meters of the site.

2.2 Sound Level Limits for Road Traffic

Sound level criteria for road traffic is taken from the City of Ottawa Environmental Noise Control Guidelines hereafter referred to as the guidelines. Noise levels are expressed in the form Leq (T) which refers to a weighted level of a steady sound carrying the same total energy in the time period T (in hours) as the observed fluctuation sound.

2.2.1 Indoor Sound Level Criterion

Similar to outdoor noise levels, the recommended indoor sound level criteria from Table 2.2b of the guidelines are:

- Bedrooms – 23:00 to 07:00 – 40 dBA Leq (8)
- Other areas – 07:00 to 23:00 – 45 dBA Leq (16)

The sound levels are based on the windows and doors to an indoor space being closed.

For the purpose of assessing indoor sound levels, the outdoor sound levels are observed at the plane of the living room window at 1.5 meters above the ground for daytime noise and at the plane of the bedroom window 4.5 meters above the ground for nighttime noise as per the guidelines.

As per NPC-300 C7.1.3 when the outdoor sound levels are less than or equal to 65 dBA at the living room window and/or less than or equal to 60 dBA at the bedroom level then the building must be compliant with the Ontario Building Code. Should the outdoor sound levels exceed this criteria then the building component (walls, windows etc.) must be designed to achieve indoor sound level criteria.

As per NPC-300 C7.1.2.1 and C7.1.2.2 when the outdoor noise levels at the living room are greater than 55 dBA and less than or equal to 65 dBA and/or greater than 50 dBA and less than or equal to 60 dBA at the bedroom window then a warning clause is required and forced air heating with provision for central air conditioning is required. Should the outdoor sound levels exceed the criteria central air conditioning is mandatory and a warning clause is required.

2.2.2 Outdoor Sound Level Criterion

As per Table 2.2a of the guidelines the sound level criterion for the outdoor living area (OLA) for the daytime period between 07:00 and 23:00 hours is 55 dBA Leq (16). Sound levels for the OLA are calculated 3 meters from the building face at the center of the unit or within the center of the OLA at a height of 1.5 meters above the ground.

If the Leq sound level is less than or equal to the above criteria then no further action is required by the developer. If the sound level exceeds the criteria by less than 5 dBA then the developer may either provide a warning clause to prospective purchasers or install physical attenuation. For sound levels greater than 5 dBA above the criteria, control measures are required to reduce the noise levels as close to 55 dBA as technically, economically and administratively possible. Should the sound levels with the barrier in place exceed 55 dBA a warning clause is also required.

3 ROADWAY NOISE

3.1 Road Traffic Data

The major source of road noise impacting this development is the traffic moving along Bronson Avenue and Cambridge Street.

Traffic parameters are taken from Table 1.7 of the Noise Control Guidelines; Bronson Avenue is a four lane urban arterial undivided (4-UAU) while Cambridge Street is a two lane urban collector (2-UCU). Table 3.1 summarizes the traffic and road parameters that were used in this report.

**TABLE 3.1
TRAFFIC AND ROAD DATA SUMMARY**

	BRONSON AVENUE	CAMBRIDGE STREET
Annual Average Daily Traffic (AADT)	30,000	8,000
Posted Speed Limit (km/hr)	50	50
% Medium Trucks	7%	7%
% Heavy Trucks	5%	5%
% Daytime Traffic	92%	92%
Road Gradient	0.5% - 2.0%	0.5% - 2.0%

3.2 Calculation Methods

Roadway noise was calculated using the STAMSON 5.04 computer program from the Ontario Ministry of the Environment.

Four receiver locations representing each side of the building are used to calculate the roadway noise levels as shown on Figure 1. Receiver A is subject to noise from only Bronson Avenue, and Receiver C receives noise from only Cambridge Street, while Receivers B and D are subject to noise from both streets. At each receiver location, the noise is calculated at the building face at several stories to determine indoor noise levels.

There are roof top terraces on Levels 2, 5, 10 and 19 that meet the requirements for outdoor living areas as defined in the guidelines and are evaluated for outdoor noise. Terraces on Levels 4 and on the north face of level 5 and the east face of level 19 are less than 4 meters deep and do not qualify as an OLA. Similarly, the units fronting Cambridge Street at Level 1 have outdoor areas less than 37 square meters and also do not qualify as OLA's.

Unattenuated daytime noise levels at the outdoor recreational area (terraces) and unattenuated daytime and nighttime noise levels at the building face (for determining indoor sound levels) for each receiver location are shown on Tables 3.2 and 3.3. Parameters used for calculating the noise levels, the perpendicular distance from source to receiver, and the roadway segment angles are also included in the tables. STAMSON is limited in that it cannot calculate noise levels at a source to receiver distance less than 15 meters. Where the source to receiver distance is less, the noise is calculated at 15 meters and a divergence calculation is made to account for the difference. The divergence adjustment is shown on Table 3.2. Noise calculations are included in the appendix including the divergence calculations.

Outdoor noise levels for the terraces are normally calculated at 1.5 meters above floor level at the center of the terrace in accordance with the guidelines. For terraces on Level 10 and 19 which are exposed to noise from Bronson Avenue and Cambridge Street, a “worst case” calculation is made 3 meters from the edge of the terrace on the Bronson side which has the higher noise levels.

TABLE 3.2
UNATTENUATED NOISE LEVELS AT BUILDING FACE

RECEIVER	FLOOR	ROADWAY	DISTANCE SOURCE TO RECEIVER	LEFT ANGLE	RIGHT ANGLE	DAYTIME NOISE (DBA)	NIGHTTIME NOISE (DBA)
C	1	Cambridge	14.0*	-90	90	66.05	58.46
A	3	Bronson	13.6*	-90	90	71.92	64.32
B	3	Bronson Cambridge	22.5 57.8	-90 0	0 90	67.15	59.55
C	5	Cambridge	26.0	-90	90	63.36	55.77
D	8	Cambridge Bronson	38.3 42.0	-90 0	0 90	65.12	57.53
A	20	Bronson	15.0	-90	90	71.49	63.89
*Adjusted Noise Levels							
RECEIVER	FLOOR	ROADWAY	NOISE AT 15 M	DIVERGENCE ADJUSTMENT		DAYTIME NOISE (DBA)	NIGHTTIME NOISE (DBA)
C	1	Cambridge	65.75 58.16	0.30 0.30		66.05	58.46
A	3	Bronson	71.49 63.89	0.43 0.43		71.92	64.32

TABLE 3.3
UNATTENUATED NOISE LEVELS AT OLA

LOCATION	ROADWAY	DISTANCE SOURCE TO RECEIVER	LEFT ANGLE	RIGHT ANGLE	DAYTIME NOISE (DBA)
Level 2 Terrace	Cambridge	40.0	-40	-15	52.92
Level 5 Terrace	Cambridge	23.0	-90	90	63.89
Level 10 Terrace	Bronson Cambridge	18.8 61.2	-45 -40	90 5	69.38
Level 19 Terrace	Bronson Cambridge	16.5 63.5	-45 -5	90 90	70.04

4 ABATEMENT MEASURES

4.1 Indoor Sound Levels

As per Table 3.2, all units (except for units on the west face above level 5 which are only exposed to noise from Cambridge) have daytime noise levels above 65 dBA. Central air conditioning is required along with a warning clause and a review of building components. Calculations are required to determine the STC rating required for each building component in order to comply with the noise control guidelines.

4.2 Outdoor Sound Levels

As shown on Table 3.3, the daytime noise exceeds 60 dBA requiring physical attenuation. An elevated terrace in a multi-storey residential building is not the same as a backyard in a subdivision so that the 2.2 meter minimum height in the guidelines is not practical for the application. A handrail 1.1 meters in height is proposed for this development at all terraces. The railing has tempered glass panels with no gaps and a minimum surface density of 10 kg/m² that will act as a noise barrier. The tempered glass barrier is 0.95 meters high and due to the geometry of the elevated terrace the noise levels are reduced below 55 dBA at a distance of 3 meters from the barrier. Directly adjacent to the barrier the noise levels would not be reduced, however, a 2.2 meter high barrier would defeat the purpose of providing an outdoor terrace, therefore, a warning clause is proposed. Attenuated noise levels have been calculated for all the locations in Table 3.3 and are summarized in Table 4.1.

TABLE 4.1
ATTENUATED NOISE LEVELS AT OLA

LOCATION	ROADWAY	DISTANCE BARRIER TO RECEIVER	LEFT ANGLE	RIGHT ANGLE	DAYTIME NOISE (DBA)
Level 5 Terrace	Cambridge	9.0	-90	90	48.69
Level 10 Terrace	Bronson Cambridge	3.0 13.0	-45 -40	90 5	54.59
Level 19 Terrace	Bronson Cambridge	3.0 38.0	-45 -5	90 90	53.51

5 SUMMARY OF ATTENUATION MEASURES

5.1 Warning Clauses

As almost all units are exposed to daytime noise levels above 65 dBA, a Type 'D' warning clause is required on title for all units. As explained in Section 4.2, a Type 'B' warning is required for all units with access to the Level 5, 10 and 19 terraces. The following warning clause is taken from Section C8.1 of NPC-300 of the guidelines.

Type B	"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 Bronson Avenue/Cambridge Street road traffic may on occasion interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the Environment's noise criteria."
Type D	"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."

5.2 Air Conditioning and Building Components

Mandatory central air conditioning and an acoustical review of building components (windows, walls, doors) is required for the units.

5.3 Noise Barrier

Noise barriers as described in Section 4.2 is required at the level 5, 10 and 19 terraces.

Prepared by:

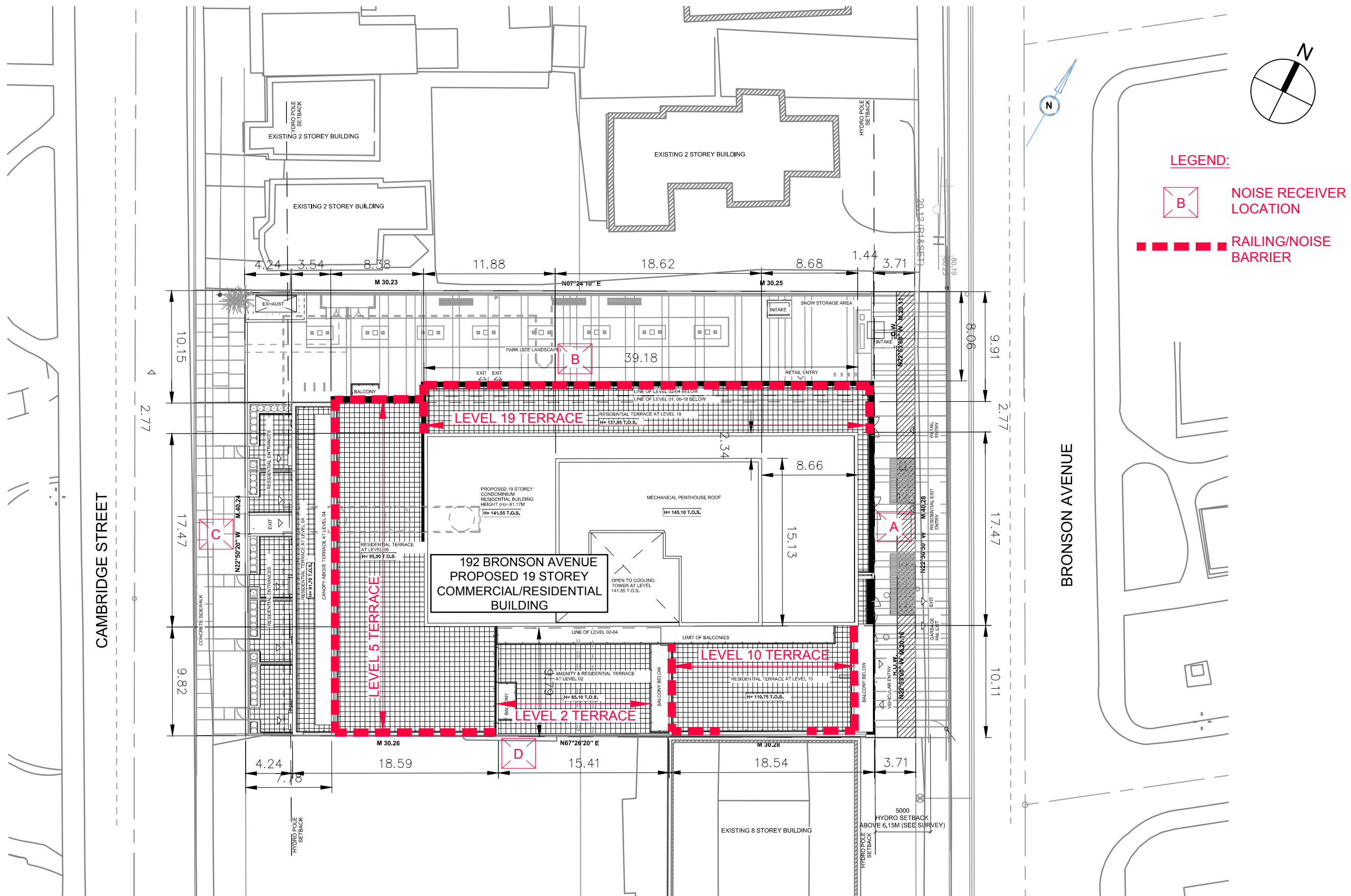


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APPENDIX

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:22:44
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: clin.te Time Period: Day/Night 16/8 hours
Description: Receiver C Level 1 indoor

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

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (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 : 15.00 / 15.00 m
Receiver height : 2.50 / 2.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 65.75 + 0.00) = 65.75 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.75	0.00	0.00	0.00	0.00	0.00	0.00	65.75

Segment Leq : 65.75 dBA

Total Leq All Segments: 65.75 dBA

Results segment # 1: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 58.16 + 0.00) = 58.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.16	0.00	0.00	0.00	0.00	0.00	0.00	58.16

Segment Leq : 58.16 dBA

Total Leq All Segments: 58.16 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.75
(NIGHT): 58.16

DIVERGENCE - Line Source

Noise (est.) = $N_1 - 10\log(D_2/D_1)$

Receiver Location			N ₁ (dBA)	D ₁ (m)	D ₂ (m)	Adjustment (dBA)	Noise (est.) (dBA)
C	1st Floor	Day	65.75	15.0	14.0	0.30	66.05
		Night	58.16	15.0	14.0	0.30	58.46

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:37:50
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a3in.te Time Period: Day/Night 16/8 hours
Description: Receiver A Level 3 indoor

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (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 : 15.00 / 15.00 m
Receiver height : 2.50 / 2.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 8.20 m
Reference angle : 0.00

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 71.49 + 0.00) = 71.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	71.49	0.00	0.00	0.00	0.00	0.00	0.00	71.49

Segment Leq : 71.49 dBA

Total Leq All Segments: 71.49 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 63.89 + 0.00) = 63.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.89	0.00	0.00	0.00	0.00	0.00	0.00	63.89

Segment Leq : 63.89 dBA

Total Leq All Segments: 63.89 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.49
(NIGHT): 63.89

DIVERGENCE - Line Source

$$\text{Noise (est.)} = N_1 - 10\log(D_2/D_1)$$

Receiver Location			N ₁ (dBA)	D ₁ (m)	D ₂ (m)	Adjustment (dBA)	Noise (est.) (dBA)
A	3rd Floor	Day	71.49	15.0	13.6	0.43	71.92
		Night	63.89	15.0	13.6	0.43	64.32

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:41:26
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: b3in.te Time Period: Day/Night 16/8 hours
Description: Receiver B Level 3 indoor

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 22.50 / 22.50 m
Receiver height : 2.50 / 2.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 8.20 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

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Angle1  Angle2      :   0.00 deg   90.00 deg
Wood depth      :           0      (No woods.)
No of house rows :           0 / 0
Surface         :           2      (Reflective ground surface)
Receiver source distance : 57.80 / 57.80 m
Receiver height  :   2.50 / 2.50 m
Topography      :           3      (Elevated; no barrier)
Elevation       :   8.20 m
Reference angle  :   0.00
  
```

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 66.72 + 0.00) = 66.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	71.49	0.00	-1.76	-3.01	0.00	0.00	0.00	66.72

Segment Leq : 66.72 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 56.88 + 0.00) = 56.88 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	65.75	0.00	-5.86	-3.01	0.00	0.00	0.00	56.88

Segment Leq : 56.88 dBA

Total Leq All Segments: 67.15 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 59.12 + 0.00) = 59.12 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	63.89	0.00	-1.76	-3.01	0.00	0.00	0.00	59.12

Segment Leq : 59.12 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 49.29 + 0.00) = 49.29 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	58.16	0.00	-5.86	-3.01	0.00	0.00	0.00	49.29

Segment Leq : 49.29 dBA

Total Leq All Segments: 59.55 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.15
(NIGHT): 59.55

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:48:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: c5in.te Time Period: Day/Night 16/8 hours
Description: Receiver C Level 5 indoor

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

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (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 : 26.00 / 26.00 m
Receiver height : 2.50 / 2.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 15.10 m
Reference angle : 0.00

Results segment # 1: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 63.36 + 0.00) = 63.36 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.75	0.00	-2.39	0.00	0.00	0.00	0.00	63.36

Segment Leq : 63.36 dBA

Total Leq All Segments: 63.36 dBA

Results segment # 1: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 55.77 + 0.00) = 55.77 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.16	0.00	-2.39	0.00	0.00	0.00	0.00	55.77

Segment Leq : 55.77 dBA

Total Leq All Segments: 55.77 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.36
(NIGHT): 55.77

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:52:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: D8in.te Time Period: Day/Night 16/8 hours
Description: Receiver D Level 8 indoor

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 42.00 / 42.00 m
Receiver height : 2.50 / 2.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 24.70 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

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Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth      :           0       (No woods.)
No of house rows :           0 / 0
Surface         :           2       (Reflective ground surface)
Receiver source distance : 38.30 / 38.30 m
Receiver height  :           2.50 / 2.50 m
Topography      :           3       (Elevated; no barrier)
Elevation       :           24.70 m
Reference angle  :           0.00
  
```

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 64.01 + 0.00) = 64.01 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	71.49	0.00	-4.47	-3.01	0.00	0.00	0.00	64.01

Segment Leq : 64.01 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 58.67 + 0.00) = 58.67 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	65.75	0.00	-4.07	-3.01	0.00	0.00	0.00	58.67

Segment Leq : 58.67 dBA

Total Leq All Segments: 65.12 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 56.41 + 0.00) = 56.41 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	63.89	0.00	-4.47	-3.01	0.00	0.00	0.00	56.41

Segment Leq : 56.41 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 51.08 + 0.00) = 51.08 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	58.16	0.00	-4.07	-3.01	0.00	0.00	0.00	51.08

Segment Leq : 51.08 dBA

Total Leq All Segments: 57.53 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.12
(NIGHT): 57.53

STAMSON 5.0 NORMAL REPORT Date: 02-09-2014 16:55:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a20in.te Time Period: Day/Night 16/8 hours
Description: Receiver A Level 20 indoor

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (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 : 15.00 / 15.00 m
Receiver height : 2.50 / 2.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 61.60 m
Reference angle : 0.00

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 71.49 + 0.00) = 71.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	71.49	0.00	0.00	0.00	0.00	0.00	0.00	71.49

Segment Leq : 71.49 dBA

Total Leq All Segments: 71.49 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 63.89 + 0.00) = 63.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.89	0.00	0.00	0.00	0.00	0.00	0.00	63.89

Segment Leq : 63.89 dBA

Total Leq All Segments: 63.89 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.49
(NIGHT): 63.89

STAMSON 5.0 NORMAL REPORT Date: 18-04-2018 16:44:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 192t2ola.te Time Period: Day/Night 16/8 hours
Description: Level 2 Terrace OLA

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

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT) : 8000
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: Cambridge (day/night)

Angle1 Angle2 : -40.00 deg -15.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 1.50 / 16.60 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.60 m
Reference angle : 0.00

Results segment # 1: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 52.92 + 0.00) = 52.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-40	-15	0.00	65.75	0.00	-4.26	-8.57	0.00	0.00	0.00	52.92

Segment Leq : 52.92 dBA

Total Leq All Segments: 52.92 dBA

Results segment # 1: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 45.32 + 0.00) = 45.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-40	-15	0.00	58.16	0.00	-4.26	-8.57	0.00	0.00	0.00	45.32

Segment Leq : 45.32 dBA

Total Leq All Segments: 45.32 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 52.92
(NIGHT) : 45.32

Filename: 192b5br.te Time Period: Day/Night 16/8 hours
 Description: Level 5 Terrace OLA

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

```
-----
Car traffic volume   :   6477/563   veh/TimePeriod  *
Medium truck volume :    515/45    veh/TimePeriod  *
Heavy truck volume  :    368/32    veh/TimePeriod  *
Posted speed limit  :     50 km/h
Road gradient       :      1 %
Road pavement       :      1 (Typical asphalt or concrete)
```

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

```
24 hr Traffic Volume (AADT or SADT):   8000
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: Cambridge (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  :   23.00 / 23.00 m
Receiver height           :    1.50 / 4.50 m
Topography                :      3      (Elevated; no barrier)
Elevation                 :   14.50 m
Reference angle           :    0.00
```

Results segment # 1: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 63.89 + 0.00) = 63.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.75	0.00	-1.86	0.00	0.00	0.00	0.00	63.89

Segment Leq : 63.89 dBA

Total Leq All Segments: 63.89 dBA

Results segment # 1: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 56.30 + 0.00) = 56.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------

-90	90	0.00	58.16	0.00	-1.86	0.00	0.00	0.00	0.00	56.30
-----	----	------	-------	------	-------	------	------	------	------	-------

Segment Leq : 56.30 dBA

Total Leq All Segments: 56.30 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 63.89

(NIGHT) : 56.30

Filename: 192b10br.te Time Period: Day/Night 16/8 hours
Description: Level 10 Terrace OLA

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : -45.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 18.80 / 18.80 m
Receiver height : 1.50 / 4.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 30.25 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

```

-----
Angle1   Angle2           : -40.00 deg    5.00 deg
Wood depth           :      0          (No woods.)
No of house rows     :      0 / 0
Surface              :      2          (Reflective ground surface)
Receiver source distance : 61.20 / 61.20 m
Receiver height       :  1.50 / 4.50 m
Topography           :      3          (Elevated; no barrier)
Elevation            :  30.25 m
Reference angle       :   0.00
  
```

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 69.26 + 0.00) = 69.26 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	71.49	0.00	-0.98	-1.25	0.00	0.00	0.00	69.26

Segment Leq : 69.26 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 53.62 + 0.00) = 53.62 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-40	5	0.00	65.75	0.00	-6.11	-6.02	0.00	0.00	0.00	53.62

Segment Leq : 53.62 dBA

Total Leq All Segments: 69.38 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 61.66 + 0.00) = 61.66 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	63.89	0.00	-0.98	-1.25	0.00	0.00	0.00	61.66

Segment Leq : 61.66 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 46.03 + 0.00) = 46.03 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------

-40	5	0.00	58.16	0.00	-6.11	-6.02	0.00	0.00	0.00	46.03
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Segment Leq : 46.03 dBA

Total Leq All Segments: 61.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 69.38

(NIGHT) : 61.78

Filename: 192b19br.te Time Period: Day/Night 16/8 hours
Description: Level 19 Terrace OLA

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : -45.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.50 / 16.50 m
Receiver height : 1.50 / 4.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 57.45 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

```

-----
Angle1   Angle2       :   -5.00 deg   90.00 deg
Wood depth      :           0       (No woods.)
No of house rows :           0 /  0
Surface         :           2       (Reflective ground surface)
Receiver source distance : 63.50 / 63.50 m
Receiver height  :           1.50 / 4.50 m
Topography       :           3       (Elevated; no barrier)
Elevation        :          57.45 m
Reference angle   :           0.00
  
```

Results segment # 1: Bronson (day)

Source height = 1.50 m

ROAD (0.00 + 69.83 + 0.00) = 69.83 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	71.49	0.00	-0.41	-1.25	0.00	0.00	0.00	69.83

Segment Leq : 69.83 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

ROAD (0.00 + 56.71 + 0.00) = 56.71 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.00	65.75	0.00	-6.27	-2.78	0.00	0.00	0.00	56.71

Segment Leq : 56.71 dBA

Total Leq All Segments: 70.04 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

ROAD (0.00 + 62.23 + 0.00) = 62.23 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	63.89	0.00	-0.41	-1.25	0.00	0.00	0.00	62.23

Segment Leq : 62.23 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

ROAD (0.00 + 49.11 + 0.00) = 49.11 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------

-5	90	0.00	58.16	0.00	-6.27	-2.78	0.00	0.00	0.00	49.11
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Segment Leq : 49.11 dBA

Total Leq All Segments: 62.44 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 70.04

(NIGHT): 62.44

STAMSON 5.0 NORMAL REPORT Date: 18-04-2018 17:00:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 192b5br.te Time Period: Day/Night 16/8 hours
Description: Level 5 Terrace OLA with barrier

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

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (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 : 23.00 / 23.00 m
Receiver height : 1.50 / 4.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 0.95 m
Elevation : 14.50 m
Barrier receiver distance : 9.00 / 3.00 m
Source elevation : 80.50 m
Receiver elevation : 95.00 m
Barrier elevation : 95.00 m
Reference angle : 0.00

Results segment # 1: Cambridge (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-4.18	90.82

ROAD (0.00 + 48.69 + 0.00) = 48.69 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.75	0.00	-1.86	0.00	0.00	0.00	-15.20	48.69

Segment Leq : 48.69 dBA

Total Leq All Segments: 48.69 dBA

Results segment # 1: Cambridge (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	4.50	2.22	97.22

ROAD (0.00 + 56.30 + 0.00) = 56.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.16	0.00	-1.86	0.00	0.00	0.00	-0.69	55.61*
-90	90	0.00	58.16	0.00	-1.86	0.00	0.00	0.00	0.00	56.30

* Bright Zone !

Segment Leq : 56.30 dBA

Total Leq All Segments: 56.30 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.69
(NIGHT): 56.30

STAMSON 5.0 NORMAL REPORT Date: 18-04-2018 17:00:13
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 192b10br.te Time Period: Day/Night 16/8 hours
Description: Level 10 Terrace OLA with barrier

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : -45.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 18.80 / 18.80 m
Receiver height : 1.50 / 4.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -45.00 deg Angle2 : 90.00 deg
Barrier height : 0.95 m
Elevation : 30.25 m
Barrier receiver distance : 3.00 / 3.00 m
Source elevation : 80.50 m
Receiver elevation : 110.75 m
Barrier elevation : 110.75 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

```
-----
Car traffic volume   : 6477/563   veh/TimePeriod *
Medium truck volume  : 515/45    veh/TimePeriod *
Heavy truck volume   : 368/32    veh/TimePeriod *
Posted speed limit   : 50 km/h
Road gradient        : 1 %
Road pavement        : 1 (Typical asphalt or concrete)
```

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

```
24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

```
-----
Angle1   Angle2           : -40.00 deg   5.00 deg
Wood depth           : 0             (No woods.)
No of house rows     : 0 / 0
Surface              : 2             (Reflective ground surface)
Receiver source distance : 61.20 / 61.20 m
Receiver height       : 1.50 / 4.50 m
Topography           : 4             (Elevated; with barrier)
Barrier angle1        : -40.00 deg   Angle2 : 5.00 deg
Barrier height        : 0.95 m
Elevation             : 30.25 m
Barrier receiver distance : 13.00 / 13.00 m
Source elevation      : 80.50 m
Receiver elevation     : 110.75 m
Barrier elevation     : 110.75 m
Reference angle       : 0.00
```

Results segment # 1: Bronson (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 ! -3.33 ! 107.42
```

ROAD (0.00 + 54.54 + 0.00) = 54.54 dBA

```
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
-----
-45     90    0.00  71.49   0.00 -0.98 -1.25  0.00  0.00 -14.72  54.54
-----
```

Segment Leq : 54.54 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-4.93	105.82

ROAD (0.00 + 35.00 + 0.00) = 35.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-40	5	0.00	65.75	0.00	-6.11	-6.02	0.00	0.00	-18.62	35.00

Segment Leq : 35.00 dBA

Total Leq All Segments: 54.59 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	4.50	-0.81	109.94

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
-45	90	0.00	63.89	0.00	-0.98	-1.25	0.00	0.00	-7.59	54.07

Segment Leq : 54.07 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	4.50	-2.56	108.19

ROAD (0.00 + 32.21 + 0.00) = 32.21 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-40	5	0.00	58.16	0.00	-6.11	-6.02	0.00	0.00	-13.82	32.21

Segment Leq : 32.21 dBA

Total Leq All Segments: 54.10 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.59
(NIGHT): 54.10

STAMSON 5.0 NORMAL REPORT Date: 18-04-2018 17:13:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 192b19br.te Time Period: Day/Night 16/8 hours
Description: Level 19 Terrace OLA with barrier

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Bronson (day/night)

Angle1 Angle2 : -45.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.50 / 16.50 m
Receiver height : 1.50 / 4.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -45.00 deg Angle2 : 90.00 deg
Barrier height : 0.95 m
Elevation : 57.45 m
Barrier receiver distance : 3.00 / 3.00 m
Source elevation : 80.50 m
Receiver elevation : 137.95 m
Barrier elevation : 137.95 m
Reference angle : 0.00

Road data, segment # 2: Cambridge (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
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: Cambridge (day/night)

Angle1 Angle2 : -5.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 63.50 / 63.50 m
Receiver height : 1.50 / 4.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -5.00 deg Angle2 : 90.00 deg
Barrier height : 0.95 m
Elevation : 57.45 m
Barrier receiver distance : 38.00 / 38.00 m
Source elevation : 80.50 m
Receiver elevation : 137.95 m
Barrier elevation : 137.95 m
Reference angle : 0.00

Results segment # 1: Bronson (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver Height (m)	! Barrier Height (m)	! Elevation of Barrier Top (m)
1.50	!	1.50	!
		-8.95	!
			129.00

ROAD (0.00 + 53.40 + 0.00) = 53.40 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	71.49	0.00	-0.41	-1.25	0.00	0.00	-16.43	53.40

Segment Leq : 53.40 dBA

Results segment # 2: Cambridge (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver Height (m)	! Barrier Height (m)	! Elevation of Barrier Top (m)
1.50	!	1.50	!
		-32.88	!
			105.07

ROAD (0.00 + 37.51 + 0.00) = 37.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.00	65.75	0.00	-6.27	-2.78	0.00	0.00	-19.20	37.51

Segment Leq : 37.51 dBA

Total Leq All Segments: 53.51 dBA

Results segment # 1: Bronson (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	4.50	-6.49	131.46

ROAD (0.00 + 50.33 + 0.00) = 50.33 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	90	0.00	63.89	0.00	-0.41	-1.25	0.00	0.00	-11.90	50.33

Segment Leq : 50.33 dBA

Results segment # 2: Cambridge (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	4.50	-31.68	106.27

ROAD (0.00 + 30.02 + 0.00) = 30.02 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.00	58.16	0.00	-6.27	-2.78	0.00	0.00	-19.09	30.02

Segment Leq : 30.02 dBA

Total Leq All Segments: 50.37 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.51
(NIGHT): 50.37