REPORT

185 Dunlop Street East

Barrie, Ontario

Noise Impact Study

SACL #SW18349.A0

July 2, 2019

Submitted to:

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Reviewed by:

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1. Introduction

Swallow Acoustic Consultants Ltd. (SACL) was retained by Aalto Development Inc. to complete a Noise Impact Study for the proposed development (Project) at 185 Dunlop Street East in Barrie, Ontario. This study is based on the latest ISM Architects Inc. architectural drawing set, issued for client review, dated December 13, 2018. It is our understanding that the proposed development consists of a 10-storey mixed-use building. We understand that this study is required by the City of Barrie for Site Plan Approval.

This report assesses the noise impact on the proposed development from surrounding environmental noise sources and provides noise control recommendations to meet the requirements of the City of Barrie, using the noise criteria developed by the Ontario Ministry of the Environment, Conservation and Parks (MECP), as outlined in the MECP publication NPC-300 "Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning," dated August 2013 [1].

2. Project Site

The Project is located on the south side of Dunlop Street East, Barrie, between Poyntz Street and Sampson Street. The proposed building consists of 10 above-grade levels and one partially below-grade parking level, accessible from the west side of the building. Level 1 consists of residential and commercial units, parking, and amenity space. Levels 2 and 3 consist of residential units and parking, and Levels 3 to 9 consist of residential units. Level 10 is the penthouse level, and consists of residential units, mechanical rooms, and outdoor terraces.

Directly south of the Project is the Barrie North Shore Trail and Kempenfelt Bay, which is connected to Lake Simcoe. To the west of the Project is Sam Cancilla Park. To the east is a 7-storey rental apartment building. To the north, opposite Dunlop Street East, are various 2 to 3 storey commercial buildings. Approximately 70m to the northwest, at 150 Dunlop Street East, is a 15-storey condominium building.

An aerial photo of the Project area is provided in Appendix A, Figure 1. A site plan for the proposed Project is in Figure 2, and a zoning map of the surrounding area is in Figure 3.

3. Noise Sources

A site visit was conducted on June 19, 2019, to identify significant noise sources that may impact the Project and to review the surrounding area. The major transportation noise sources that impact the Project are road traffic along Dunlop Street East and Collier Street.

Road traffic along Poyntz Street, Sampson Street, and Berczy Street is insignificant relative to the other road sources. Road traffic along Simcoe Street and Mulcaster Street is a sufficient distance away that it is not audible over the other noise sources from the Project location.

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There are no significant existing stationary noise sources in the area. Potential future stationary noise sources are discussed in Section 5.

4. Transportation Noise Sources

4.1. Critical Noise Receptors

The critical noise receptors are the noise-sensitive areas of the proposed development most likely to be affected by the road traffic noise. Points of Reception (PORs) at the plane-of-window on the 9th level of the building are set as the critical noise receptors, as these locations are most exposed to the traffic noise. A POR is also set at the plane-of-window of a Level 1 commercial unit.

Outdoor terraces at the northwest and northeast corners of Level 10 are considered Outdoor Living Areas (OLAs). All other residential terraces and unit balconies are less than 4m in depth and are therefore not defined as OLAs, according to MECP NPC-300.

The locations of all critical noise receptors are summarized in Table 1 and shown in Figure 4 to Figure 6.

Table 1: Critical Noise Receptors

Receptor ID	Level	Receptor Location
POR1	9	N façade residential, exposed to Dunlop St E and Collier St
POR2	9	W façade residential, exposed to Dunlop St E and Collier St
POR3	1	N façade commercial, exposed to Dunlop St E and Collier St
OLA1	10	NW corner terrace, exposed to Dunlop St E and Collier St
OLA2	10	NE corner terrace, exposed to Dunlop St E and Collier St

4.2. Sound Levels

4.2.1. Road Traffic

Traffic data for Dunlop Street East and Collier Street was obtained from the City of Barrie and is attached in Appendix B. As specified by the City of Barrie, annual growth rates of 2% and 3% were applied to Dunlop Street East and Collier Street, respectively, for a period of 12 years to estimate the annual average daily traffic (AADT) in 2031.

A typical city daytime/nighttime traffic split of 90%/10% was used for both streets to convert the 24-hour total to daytime (07:00 – 23:00) and night-time (23:00 – 07:00) totals.

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The “Commercial and Heavy” traffic percentage provided by the City of Barrie is 2% for Dunlop Street East and 4% for Collier Street. These percentages are assumed to be comprised of 55% “medium trucks” and 45% “heavy trucks,” which is a typical distribution for cities. The road traffic data is summarized in Table 2.

Table 2: Road Traffic Data

Road	Speed Limit (km/h)	Present AADT	Annual Growth Rate (%)	Growth Period (years)	Ultimate AADT (in 2031)	Medium Trucks (%)	Heavy Trucks (%)	Day / Night (%)
Dunlop Street East	50	12,500	2	12	15,853	1.1	0.9	90 / 10
Collier Street	50	4,000	3	12	5,703	2.2	1.8	90 / 10

4.2.2. Sound Level Calculations

Calculations of traffic sound levels were performed using STAMSON 5.04, the software implementation of the MECP ORNAMENT model for road traffic, which was developed and published by the MECP for transportation noise prediction. The STAMSON reports for road traffic noise predictions are attached in Appendix C, and the predicted sound levels are shown in Table 3.

Due to the minimum allowable source-to-receiver distance limit in the STAMSON software, the sound level calculations for some of the PORs were corrected to arrive at the final sound levels presented in Table 3. This STAMSON calculation adjustment is explained in further detail in Appendix C.

Table 3: Predicted Sound Levels at Critical Noise Receptors

Receptor ID	Predicted Sound Pressure Level, L_{eq} (dBA)	
	Day (07:00 – 23:00)	Night (23:00 – 07:00)
POR1	67	61
POR2	63	56
POR3	67	-
OLA1	49	-
OLA2	49	-

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4.3. Sound Level Limits

Guidelines for acceptable sound levels of road and rail traffic on residential developments are given in Part C of the MECP publication NPC-300 "Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning," dated August 2013 [1].

4.3.1. Outdoor Sound Level Limits

The MECP outdoor sound level limit for traffic noise is as follows:

Table 4: MECP Outdoor Living Area Sound Level Limit

Time Period	*Sound Level ($L_{eq\ [16\text{-}hour]}$) (dBA)*
Day-time (07:00 - 23:00)	55

In addition to the above outdoor levels, the MECP has a sliding scale to determine the need for outdoor noise reduction measures depending on outdoor sound levels:

Table 5: MECP Noise Control Requirements for Outdoor Receptors

Outdoor Sound Level (Day-time L_{eq}) (dBA)	*Need for Noise Reduction Measures*
$55 < L_{eq} \leq 60$	Noise control measures may be implemented. If no noise control measures are planned, a Type A warning clause must be included in the unit title or lease agreement.
$L_{eq} > 60$	Noise control measures required to reduce the L_{eq} to below 60 dBA and as close to 55 dBA as technically, economically, and administratively feasible. A Type B warning clause is required if resultant L_{eq} exceeds 55 dBA.

4.3.2. Indoor Sound Level Limits

The indoor sound levels limits developed by MECP for road sources are as follows:

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Table 6: MECP Indoor Sound Level Limits

Room	*Time Period*	*Road Sound Level Limit (L_{eq}) (dBA)*
Living/dining, den areas of residences, etc.	Day-time (07:00 - 23:00)	45
	Night-time (23:00 - 07:00)	45
Bedrooms	Day-time (07:00 - 23:00)	45
	Night-time (23:00 - 07:00)	40
General offices, reception areas, retail stores, etc.	Day-time (07:00 - 23:00)	50

In addition to the above indoor levels, the MECP has a sliding scale to determine the need for noise reduction measures depending on the sound level at the plane of window:

Table 7: MECP Road Noise Ventilation and Warning Clause Requirements

ASSESSMENT LOCATION	*SOUND LEVEL, L_{eq} (dBA)*	*VENTILATION REQUIREMENTS*	*WARNING CLAUSE*
PLANE OF LIVING ROOM WINDOW (07:00-23:00)	$55 < L_{eq} \leq 65$	Forced air heating with provision for central air conditioning.	Type C Required
	$L_{eq} > 65$	Central air conditioning	Type D Required
PLANE OF BEDROOM WINDOW (23:00-07:00)	$50 < L_{eq} \leq 60$	Forced air heating with provision for central air conditioning.	Type C Required
	$L_{eq} > 60$	Central air conditioning	Type D Required

Table 8: MECP Road Noise Building Component Requirements

ASSESSMENT LOCATION	*SOUND LEVEL, L_{eq} (dBA)*	*BUILDING COMPONENT REQUIREMENTS*
PLANE OF LIVING ROOM WINDOW (07:00-23:00)	$L_{eq} \leq 65$	Building components must be compliant with the Ontario Building Code (OBC).
	$L_{eq} > 65$	Building components must be designed to achieve indoor sound level criteria in Table 6.
PLANE OF BEDROOM WINDOW (23:00-07:00)	$L_{eq} \leq 60$	Building components must be compliant with the Ontario Building Code (OBC).
	$L_{eq} > 60$	Building components must be designed to achieve indoor sound level criteria in Table 6.

4.4. Noise Control Measures for Traffic Noise

Noise control recommendations for the critical receptors and the corresponding areas that they represent in the proposed development are summarized in Table 9 and discussed in the subsequent sections.

Table 9: Noise Control Requirements

Receptor and Representative Areas	*Noise Barrier*	*Ventilation*	*Building Components*	*Warning Clause*
POR1 – North-facing residential units	N/A	Central air conditioning	Building components must be designed to achieve indoor sound level criteria.	Type D
POR2 – West and east-facing residential units	N/A	Forced-air heating	Building components must be compliant with the Ontario Building Code.	Type C
POR3 – North-facing commercial units	N/A	Forced-air heating	Building components must be compliant with the Ontario Building Code.	Type C
OLA1 – Level 10 terrace, NW corner	No	N/A	N/A	None
OLA2 – Level 10 terrace, NE corner	No	N/A	N/A	None

4.4.1. Outdoor Living Area

The predicted noise levels at OLA1 and OLA2 are below 55 dBA, which is below the sound level limit for OLAs specified in MECP NPC-300 (Table 4). No noise mitigation or warning clause is required for the OLAs.

4.4.2. Ventilation

The predicted noise level at POR1 exceeds the upper limit of Table 7. Therefore, central air conditioning is required for all north-facing residential units, including the northwest and northeast corner units. A minimum of forced-air heating with the provision for central air conditioning is required for all residential units facing west or east, except for the northwest and northeast corner units; and for all north-facing commercial units.

4.4.3. Building Components

Building components for the north-facing residential units must be designed to meet the indoor sound level limits. The sound transmission losses of the building façade components required to meet MECP interior sound levels with the predicted outdoor sound level were determined based on conservatively estimated maximum building component percentages. The maximum building component percentages were estimated using the latest floor plans and elevation drawings. It was assumed that the fixed glazing area is double the operable glazing area. The minimum transmission losses, in terms of Sound Transmission Class (STC), are provided in Table 10.

Table 10: Building Envelope Requirements

Component	Maximum Component Area Percentage Versus Floor Area of Room	Minimum STC Required
POR1 – North-facing Residential Units		
Solid Exterior	55%	33
Fixed Glazing	80%	34
Operable Glazing	40%	31

The façade of the north-facing residential units is required to be a minimum STC-33 to meet indoor sound level limits. The following example construction is sufficient to meet this requirement:

- 12.7 mm gypsum board
- Vapour barrier
- 38 x 89 mm studs
- 50 mm (or thicker) mineral wool or glass fibre batts

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- Sheathing
- Wood siding or metal siding and fibre backer board

The glazing for the north-facing residential units is required to be a minimum of STC-34 for fixed glazing and STC-31 for operable glazing. The following glazing recommendation is expected to meet these STC requirements:

- 6mm glass (6mm airspace) 6mm glass

The above constructions are provided for reference only. STC requirements should be verified with the glazing manufacturer. Any constructions with equivalent or greater STC values will be acceptable.

For all other units except for the north-facing residential units, façade components and glazing meeting minimum OBC requirements will be suitable to meet the required indoor sound level limits.

4.4.4. Warning Clauses for Traffic Noise

Since central air conditioning is required for the north-facing residential units, including the northwest and northeast corner units, the following Type D warning clause should be inserted in all development agreements for each of these dwellings:

> "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, Conservation and Parks."

For all residential units facing west or east, except for the northwest and northeast corner units; and for all north-facing commercial units, only the provision for adding central air conditioning is required. Therefore, the following Type C warning clause should be inserted in all development agreements for each of these units. Note that if any of these units is provided with central air conditioning, the Type C warning clause below should be replaced with the Type D warning clause above.

> "This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments 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, Conservation and Parks."

5. Stationary Noise Sources

The following sections describe the noise impact assessment for stationary noise sources.

5.1 Noise Criteria for Stationary Noise Sources

The guidelines for assessing the noise impact of noise-generating facilities on proposed noise-sensitive areas in Ontario are given in Part C of the MECP publication NPC-300 "Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning," dated 2013[1]. Table 11 outlines the minimum noise criteria for stationary noise sources. The site-specific noise criteria for each time of day are either the value in Table 11 or the minimum hourly background noise level ($L_{eq\ [1hr]}$), whichever is higher.

Table 11: MECP Exclusionary Noise Level Criteria – Stationary Noise Sources

Time Period	Class 1 Area (Urban) $L_{eq\ [1hr]}$ (dBA)
Day-time (07:00 – 19:00)	50
Evening (19:00 – 23:00)	50
Night-time (23:00 – 07:00)	45

5.2 Existing Potential Stationary Noise Sources

SACL conducted a site visit on June 19, 2019. No significant stationary noise sources from the surrounding residential and commercial areas were identified during the site visit.

5.3 Future Potential Stationary Noise Sources

There are no known future potential stationary noise sources in the Project area. Potential stationary noise sources associated with this project such as cooling towers, make-up air units, etc. should be selected to ensure that indoor noise level limits are met at the Project and at neighbouring buildings.

6. Concluding Comments

With the incorporation of the noise control measures presented in Section 4.4 of this report, the noise impact of the transportation noise sources on the Project is expected to meet MECP criteria. There are currently no existing significant stationary noise sources that impact the Project or known future stationary sources. The proposed 10-storey mixed-use building located at 185 Dunlop Street East, Barrie, should therefore be approved from a noise perspective.

------ End ------

References

1. Ontario Ministry of the Environment and Climate Change. *Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning, Publication NPC-300*, August 2013.

2. City of Barrie. *Zoning By-Law 2009-141 North Section*, 2018. [Online]. Available: https://www.barrie.ca/City%20Hall/Planning-and-Development/Documents/Zoning-Bylaw/Zoning%20By-law%202009-141%20City%20North.pdf [Accessed: 24- June- 2019].

Appendices

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Appendix A: FIGURES

Figure 1. Site Aerial with the Approximate Project Boundary Outlined in Red

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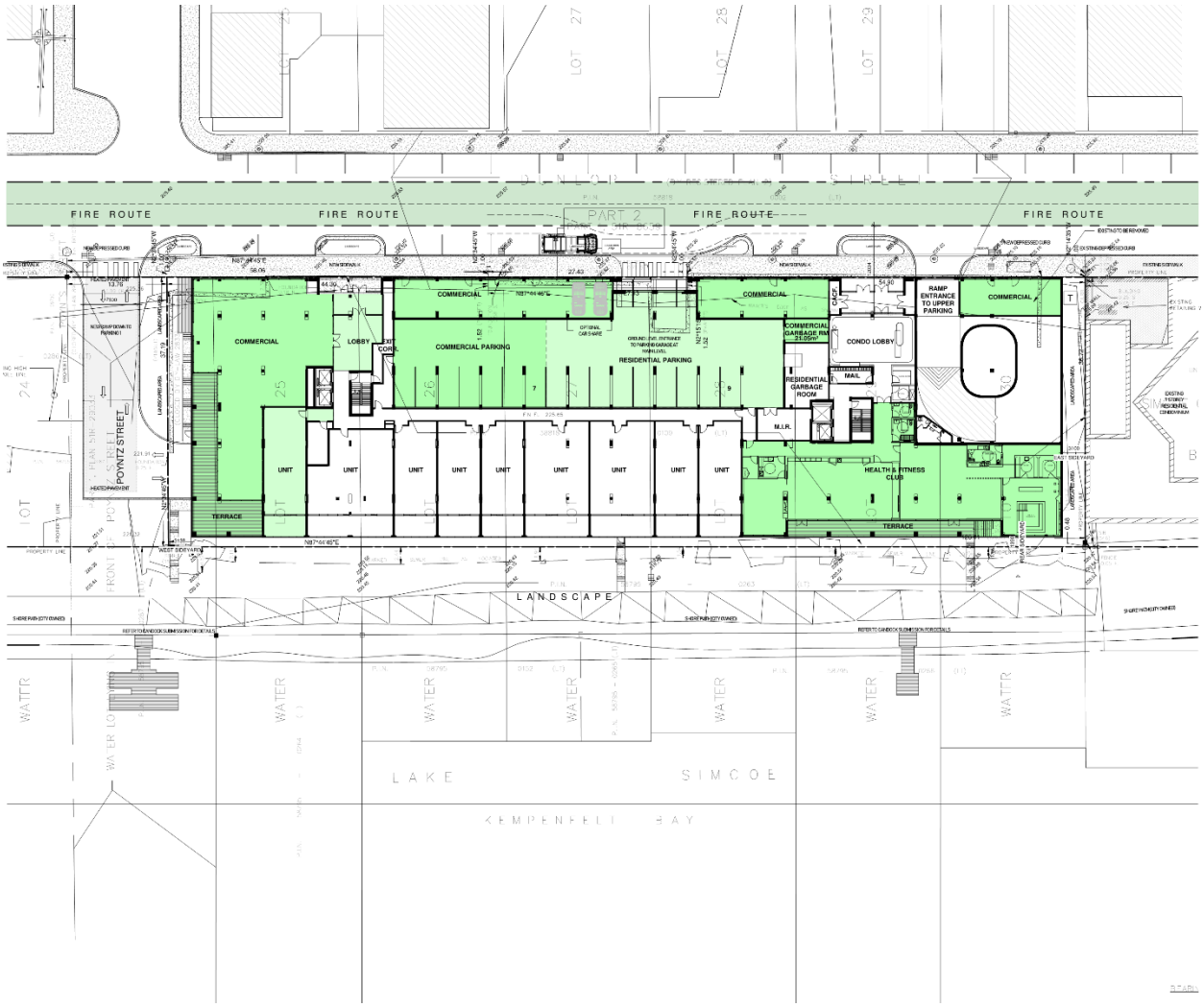

Figure 2. Site Plan

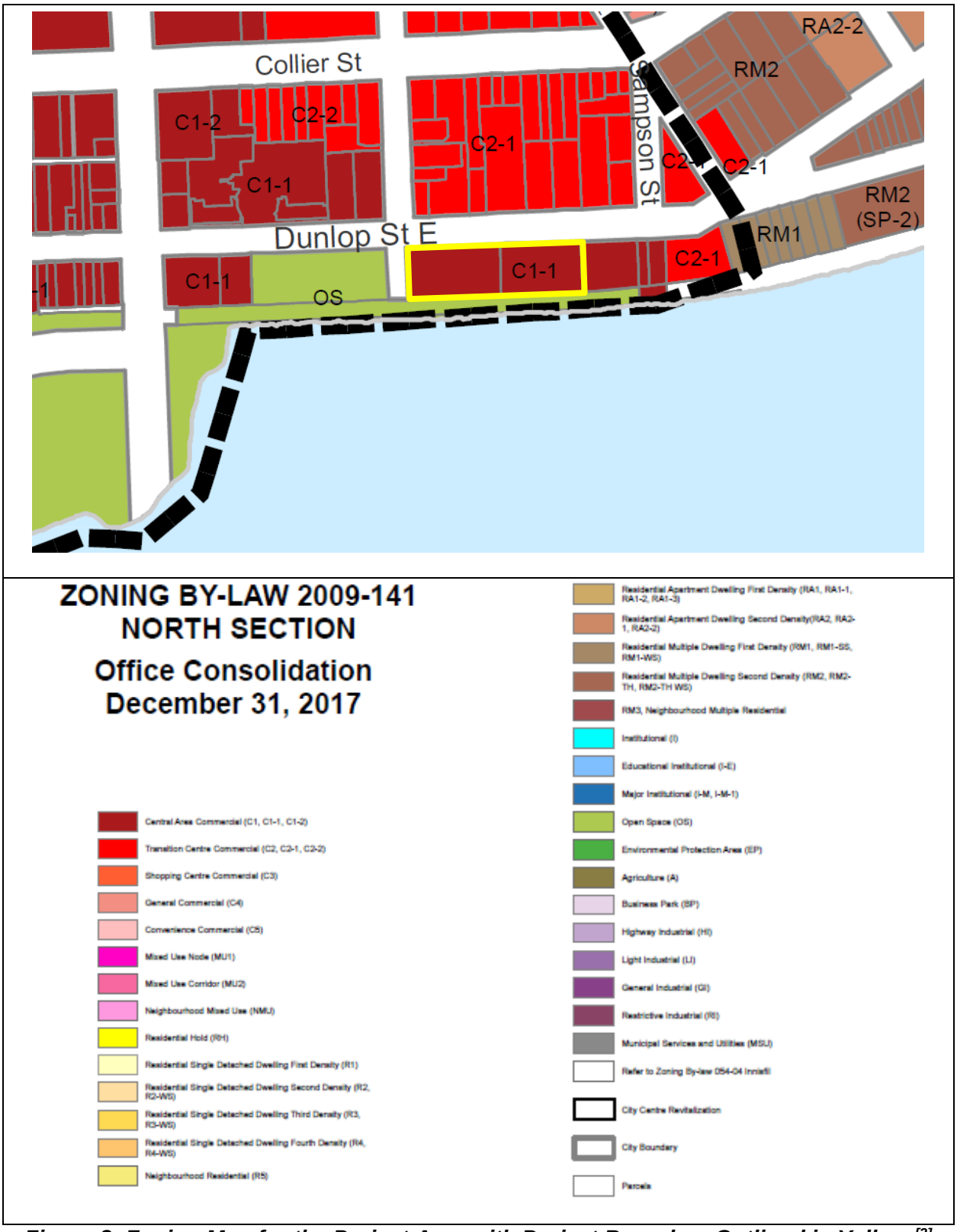

Figure 3: Zoning Map for the Project Area with Project Boundary Outlined in Yellow [2]

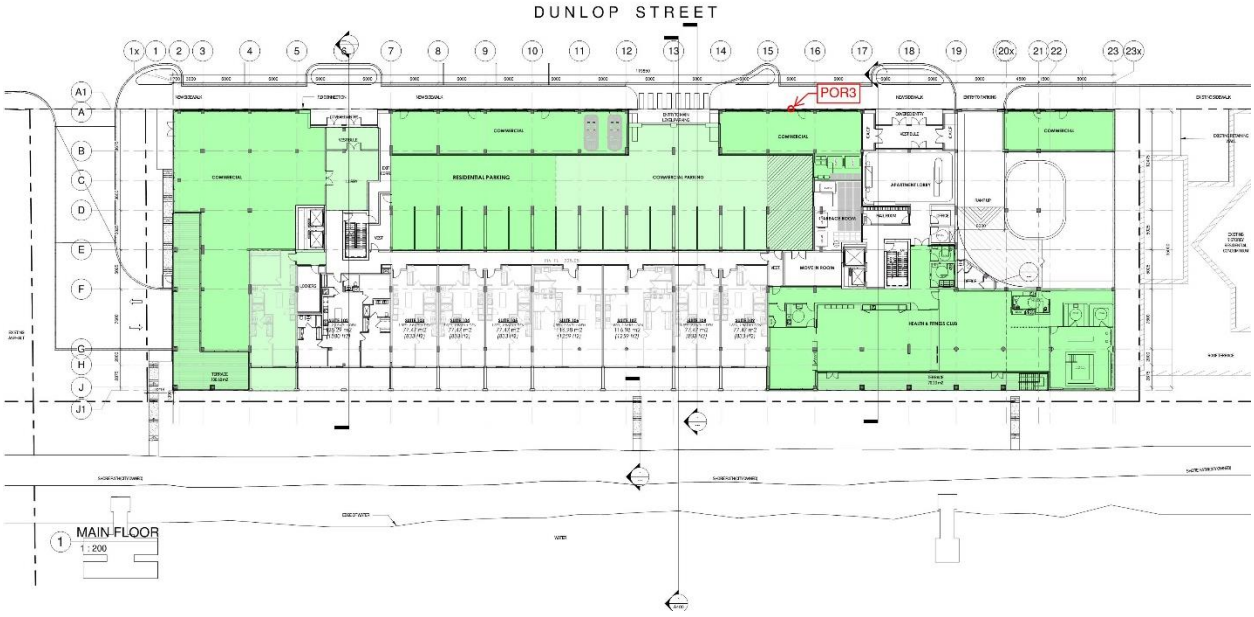

Figure 4: POR3 Location, 1st Floor

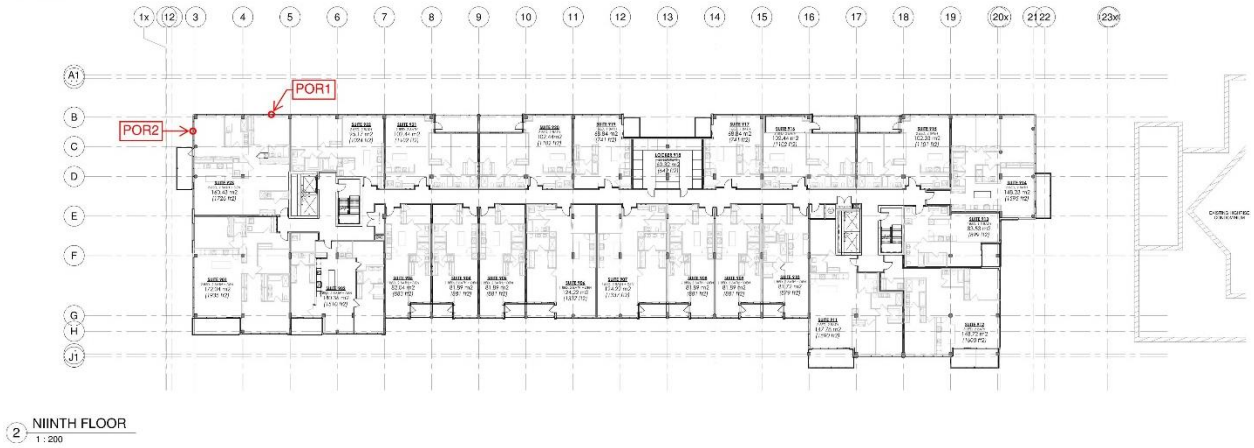

Figure 5: POR1 and POR2 Locations, 9th Floor

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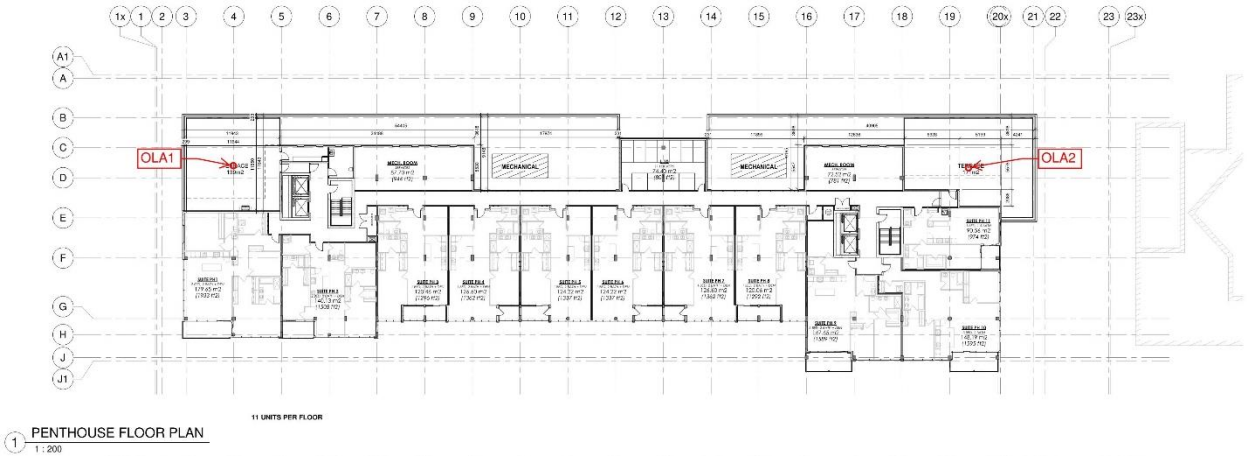

Figure 6: OLA1 and OLA2 Locations, 10th Floor (Penthouse)

Appendix B: TRAFFIC DATA

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Vanoostveen, Paul

From: Justin MacDonald <Justin.MacDonald@barrie.ca>
Sent: Wednesday, June 19, 2019 11:22 AM
To: Vanoostveen, Paul
Subject: RE: Road Traffic Data Request - 185 Dunlop St E

Good morning Paul,

- Dunlop St. E. between Poyntz St. and Sampson St. – 12,500 vehicles per day with 2% commercial and heavy vehicles, with 2% growth to a horizon year of 2031
- Collier St. between Poyntz St. and Berczy St. – 4,000 vehicles per day with 4% commercial and heavy, with 3% growth to a horizon year of 2031

We do not have a day/night split.

Should you require any other information please let me know.

Thanks,

Justin MacDonald, C.E.T.,
Senior Transportation Operations Technologist
Roads, Parks & Fleet

Barrie

City of Barrie: Barrie Operations Centre, 165 Ferndale Drive North, Barrie ON, L4N 9V9
Office: 705-739-4220 5178

From: Vanoostveen, Paul [mailto:PVanoostveen@ThorntonTomasetti.com]
Sent: Tuesday, June 18, 2019 5:19 PM
To: Justin MacDonald <Justin.MacDonald@barrie.ca>
Subject: Road Traffic Data Request - 185 Dunlop St E

Hello Justin,

We are conducting a noise impact study for a proposed development at 185 Dunlop Street East, Barrie.

Could you please provide traffic data (including vehicles/day (AADT), annual growth rate, heavy/medium truck %, and day/night %) for:

- Dunlop St. E. between Poyntz St. and Sampson St.
- Collier St. between Poyntz St. and Berczy St.

Thanks,

SWALLOW
ACOUSTICS, NOISE & VIBRATION CONTROL
Thornton Tomasetti

Paul Vanoostveen, M.A.Sc.

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Appendix C: STAMSON CALCULATIONS

The following correction was made to the STAMSON calculations shown below to account for the limitations of the program. These corrections are reflected in the final sound levels shown in Table 3 of this report.

- Because the minimum allowable source-to-receiver distance in STAMSON is 15m, the sound levels from Dunlop Street East at POR1, POR2, and POR3 were calculated using a source-to-receiver distance of 15m, then corrected for the actual distance using the formula below. L_1 is the sound pressure level at a distance d_1, of 15m, and L_2 is the sound pressure level at the actual distance, d_2.

$$L_2 = L_1 + 20\log\left(\frac{d_1}{d_2}\right)$$

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STAMSON 5.0 NORMAL REPORT Date: 20-06-2019 15:50:59
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por1.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Dunlop St E (day/night)

Car traffic volume	: 13982/1554	veh/TimePeriod *
Medium truck volume	: 157/17	veh/TimePeriod *
Heavy truck volume	: 128/14	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)	12500
Percentage of Annual Growth	2.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	1.10
Heavy Truck % of Total Volume	0.90
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 1: Dunlop St E (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	: 26.35 / 26.35	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

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

Car traffic volume	: 4927/547	veh/TimePeriod *
Medium truck volume	: 113/13	veh/TimePeriod *
Heavy truck volume	: 92/10	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:

POR1

24 hr Traffic Volume (AADT or SADT)	4000
Percentage of Annual Growth	3.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	2.20
Heavy Truck % of Total Volume	1.80
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 2: Collier St (day/night)

Angle1 Angle2	-90.00 deg	90.00 deg
Wood depth	0	(No woods.)
No of house rows	2 / 0	
Surface	1	(Absorptive ground surface)
Receiver source distance	135.17 / 135.17 m	
Receiver height	26.35 / 26.35 m	
Topography	1	(Flat/gentle slope; no barrier)
Reference angle	0.00	

Results segment # 1: Dunlop St E (day)

Source height = 0.97 m

ROAD (0.00 + 63.92 + 0.00) = 63.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.92	0.00	0.00	0.00	0.00	0.00	0.00	63.92

Segment Leq : 63.92 dBA

Results segment # 2: Collier St (day)

Source height = 1.16 m

ROAD (0.00 + 47.94 + 0.00) = 47.94 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	60.97	0.00	-9.55	0.00	0.00	-3.49	0.00	47.94

Segment Leq : 47.94 dBA

Total Leq All Segments: 64.03 dBA

Results segment # 1: Dunlop St E (night)

Source height = 0.97 m

ROAD (0.00 + 57.35 + 0.00) = 57.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	57.35	0.00	0.00	0.00	0.00	0.00	0.00	57.35

Segment Leq : 57.35 dBA

Results segment # 2: Collier St (night)

Source height = 1.15 m

ROAD (0.00 + 44.87 + 0.00) = 44.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	54.42	0.00	-9.55	0.00	0.00	0.00	0.00	44.87

Segment Leq : 44.87 dBA

Total Leq All Segments: 57.59 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.03
(NIGHT): 57.59

STAMSON 5.0 NORMAL REPORT Date: 20-06-2019 15:52:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Dunlop St E (day/night)

Car traffic volume	: 13982/1554	veh/TimePeriod *
Medium truck volume	: 157/17	veh/TimePeriod *
Heavy truck volume	: 128/14	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)	12500
Percentage of Annual Growth	2.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	1.10
Heavy Truck % of Total Volume	0.90
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 1: Dunlop St E (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	: 15.00 / 15.00	m
Receiver height	: 26.35 / 26.35	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

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

Car traffic volume	: 4927/547	veh/TimePeriod *
Medium truck volume	: 113/13	veh/TimePeriod *
Heavy truck volume	: 92/10	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:

POR2

24 hr Traffic Volume (AADT or SADT): 4000
Percentage of Annual Growth : 3.00
Number of Years of Growth : 12.00
Medium Truck % of Total Volume : 2.20
Heavy Truck % of Total Volume : 1.80
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 2: Collier St (day/night)

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 2 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 137.17 / 137.17 m
Receiver height : 26.35 / 26.35 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Dunlop St E (day)

Source height = 0.97 m

ROAD (0.00 + 60.91 + 0.00) = 60.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	63.92	0.00	0.00	-3.01	0.00	0.00	0.00	60.91

Segment Leq : 60.91 dBA

Results segment # 2: Collier St (day)

Source height = 1.16 m

ROAD (0.00 + 44.87 + 0.00) = 44.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	60.97	0.00	-9.61	-3.01	0.00	-3.49	0.00	44.87

Segment Leq : 44.87 dBA

Total Leq All Segments: 61.02 dBA

Results segment # 1: Dunlop St E (night)

Source height = 0.97 m

ROAD (0.00 + 54.34 + 0.00) = 54.34 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	57.35	0.00	0.00	-3.01	0.00	0.00	0.00	54.34

Segment Leq : 54.34 dBA

Results segment # 2: Collier St (night)

Source height = 1.15 m

ROAD (0.00 + 41.80 + 0.00) = 41.80 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.00	54.42	0.00	-9.61	-3.01	0.00	0.00	0.00	41.80

Segment Leq : 41.80 dBA

Total Leq All Segments: 54.58 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.02
(NIGHT): 54.58

STAMSON 5.0 NORMAL REPORT Date: 20-06-2019 15:58:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Dunlop St E (day/night)

Car traffic volume	: 13982/1554	veh/TimePeriod *
Medium truck volume	: 157/17	veh/TimePeriod *
Heavy truck volume	: 128/14	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)	12500
Percentage of Annual Growth	2.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	1.10
Heavy Truck % of Total Volume	0.90
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 1: Dunlop St E (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	: 1.50 / 1.50	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

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

Car traffic volume	: 4927/547	veh/TimePeriod *
Medium truck volume	: 113/13	veh/TimePeriod *
Heavy truck volume	: 92/10	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:

POR3

24 hr Traffic Volume (AADT or SADT)	4000
Percentage of Annual Growth	3.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	2.20
Heavy Truck % of Total Volume	1.80
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 2: Collier St (day/night)

Angle1 Angle2	-90.00 deg	90.00 deg
Wood depth	0	(No woods.)
No of house rows	2 / 0	
Surface	1	(Absorptive ground surface)
Receiver source distance	135.17 / 135.17 m	
Receiver height	1.50 / 1.50	m
Topography	1	(Flat/gentle slope; no barrier)
Reference angle	0.00	

Results segment # 1: Dunlop St E (day)

Source height = 0.97 m

ROAD (0.00 + 63.92 + 0.00) = 63.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.92	0.00	0.00	0.00	0.00	0.00	0.00	63.92

Segment Leq : 63.92 dBA

Results segment # 2: Collier St (day)

Source height = 1.16 m

ROAD (0.00 + 40.18 + 0.00) = 40.18 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	60.97	0.00	-15.85	-1.46	0.00	-3.49	0.00	40.18

Segment Leq : 40.18 dBA

Total Leq All Segments: 63.94 dBA

Results segment # 1: Dunlop St E (night)

Source height = 0.97 m

ROAD (0.00 + 57.35 + 0.00) = 57.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	57.35	0.00	0.00	0.00	0.00	0.00	0.00	57.35

Segment Leq : 57.35 dBA

Results segment # 2: Collier St (night)

Source height = 1.15 m

ROAD (0.00 + 37.11 + 0.00) = 37.11 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	54.42	0.00	-15.85	-1.46	0.00	0.00	0.00	37.11

Segment Leq : 37.11 dBA

Total Leq All Segments: 57.39 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.94
(NIGHT): 57.39

STAMSON 5.0 NORMAL REPORT Date: 20-06-2019 16:16:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: OLA1.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Dunlop St E (day/night)

Car traffic volume	: 13982/1554	veh/TimePeriod *
Medium truck volume	: 157/17	veh/TimePeriod *
Heavy truck volume	: 128/14	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)	12500
Percentage of Annual Growth	2.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	1.10
Heavy Truck % of Total Volume	0.90
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 1: Dunlop St E (day/night)

Angle1 Angle2	: -90.00 deg	68.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 0 / 0	
Surface	: 2	(Reflective ground surface)
Receiver source distance	: 16.51 / 16.51	m
Receiver height	: 29.70 / 29.70	m
Topography	: 2	(Flat/gentle slope; with barrier)
Barrier angle1	: -90.00 deg	Angle2 : 68.00 deg
Barrier height	: 28.20 m	
Barrier receiver distance	: 6.34 / 6.34	m
Source elevation	: 0.00 m	
Receiver elevation	: 0.00 m	
Barrier elevation	: 0.00 m	
Reference angle	: 0.00	

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

Car traffic volume	: 4927/547	veh/TimePeriod *
Medium truck volume	: 113/13	veh/TimePeriod *
Heavy truck volume	: 92/10	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):   4000
    Percentage of Annual Growth        :   3.00
    Number of Years of Growth          :  12.00
    Medium Truck % of Total Volume     :   2.20
    Heavy Truck  % of Total Volume     :   1.80
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 2: Collier St (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   68.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      2 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 141.51 / 141.51 m
Receiver height           :  29.70 / 29.70  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 68.00 deg
Barrier height            :  28.20 m
Barrier receiver distance :   6.34 / 6.34   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

↟
Results segment # 1: Dunlop St E (day)
--------------------------------------

Source height = 0.97 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.97 !       29.70 !       18.67 !        18.67

ROAD (0.00 + 45.47 + 0.00) = 45.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     68   0.00  63.92   0.00  -0.42  -0.57   0.00   0.00 -17.46  45.47
-------------------------------------------------------------------------------
```

Segment Leq : 45.47 dBA

↟
Results segment # 2: Collier St (day)

Source height = 1.16 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.16	29.70	28.42	28.42

ROAD (0.00 + 47.18 + 0.00) = 47.18 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	68	0.00	60.97	0.00	-9.75	-0.57	0.00	-3.48	0.00	47.18
-90	68	0.00	60.97	0.00	-9.75	-0.57	0.00	0.00	-4.86	45.80*
-90	68	0.00	60.97	0.00	-9.75	-0.57	0.00	0.00	0.00	50.66

* Bright Zone !

Segment Leq : 47.18 dBA

Total Leq All Segments: 49.42 dBA

↟
Results segment # 1: Dunlop St E (night)

Source height = 0.97 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.97	29.70	18.67	18.67

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	68	0.00	57.35	0.00	-0.42	-0.57	0.00	0.00	-17.46	38.91

Segment Leq : 38.91 dBA

↟
Results segment # 2: Collier St (night)

Source height = 1.15 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.15	29.70	28.42	28.42

ROAD (0.00 + 44.10 + 0.00) = 44.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	68	0.00	54.42	0.00	-9.75	-0.57	0.00	0.00	-4.86	39.25*
-90	68	0.00	54.42	0.00	-9.75	-0.57	0.00	0.00	0.00	44.10

* Bright Zone !

Segment Leq : 44.10 dBA

Total Leq All Segments: 45.25 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 49.42
(NIGHT): 45.25
↟
↟

STAMSON 5.0 NORMAL REPORT Date: 20-06-2019 16:18:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: OLA2.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Dunlop St E (day/night)

Car traffic volume	: 13982/1554	veh/TimePeriod *
Medium truck volume	: 157/17	veh/TimePeriod *
Heavy truck volume	: 128/14	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)	12500
Percentage of Annual Growth	2.00
Number of Years of Growth	12.00
Medium Truck % of Total Volume	1.10
Heavy Truck % of Total Volume	0.90
Day (16 hrs) % of Total Volume	90.00

Data for Segment # 1: Dunlop St E (day/night)

Angle1 Angle2	: -70.00 deg	90.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 0 / 0	
Surface	: 2	(Reflective ground surface)
Receiver source distance	: 16.51 / 16.51	m
Receiver height	: 29.70 / 29.70	m
Topography	: 2	(Flat/gentle slope; with barrier)
Barrier angle1	: -70.00 deg	Angle2 : 90.00 deg
Barrier height	: 28.20 m	
Barrier receiver distance	: 6.73 / 6.73	m
Source elevation	: 0.00 m	
Receiver elevation	: 0.00 m	
Barrier elevation	: 0.00 m	
Reference angle	: 0.00	

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

Car traffic volume	: 4927/547	veh/TimePeriod *
Medium truck volume	: 113/13	veh/TimePeriod *
Heavy truck volume	: 92/10	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):   4000
    Percentage of Annual Growth        :   3.00
    Number of Years of Growth          :  12.00
    Medium Truck % of Total Volume     :   2.20
    Heavy Truck  % of Total Volume     :   1.80
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 2: Collier St (day/night)
--------------------------------------------
Angle1   Angle2           : -70.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      2 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 141.51 / 141.51 m
Receiver height           :  29.70 / 29.70  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -70.00 deg   Angle2 : 90.00 deg
Barrier height            :  28.20 m
Barrier receiver distance :   6.73 / 6.73   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Dunlop St E (day)
--------------------------------------

Source height = 0.97 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.97 !       29.70 !       17.99 !        17.99

ROAD (0.00 + 45.31 + 0.00) = 45.31 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -70     90   0.00  63.92   0.00  -0.42  -0.51   0.00   0.00 -17.67  45.31
-------------------------------------------------------------------------------
```

Segment Leq : 45.31 dBA

↟
Results segment # 2: Collier St (day)

Source height = 1.16 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.16	29.70	28.34	28.34

ROAD (0.00 + 47.23 + 0.00) = 47.23 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	90	0.00	60.97	0.00	-9.75	-0.51	0.00	-3.48	0.00	47.23
-70	90	0.00	60.97	0.00	-9.75	-0.51	0.00	0.00	-4.94	45.77*
-70	90	0.00	60.97	0.00	-9.75	-0.51	0.00	0.00	0.00	50.72

* Bright Zone !

Segment Leq : 47.23 dBA

Total Leq All Segments: 49.39 dBA

↟
Results segment # 1: Dunlop St E (night)

Source height = 0.97 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.97	29.70	17.99	17.99

ROAD (0.00 + 38.75 + 0.00) = 38.75 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	90	0.00	57.35	0.00	-0.42	-0.51	0.00	0.00	-17.67	38.75

Segment Leq : 38.75 dBA

↟
Results segment # 2: Collier St (night)

Source height = 1.15 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.15	29.70	28.34	28.34

ROAD (0.00 + 44.16 + 0.00) = 44.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	90	0.00	54.42	0.00	-9.75	-0.51	0.00	0.00	-4.94	39.21*
-70	90	0.00	54.42	0.00	-9.75	-0.51	0.00	0.00	0.00	44.16

* Bright Zone !

Segment Leq : 44.16 dBA

Total Leq All Segments: 45.26 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 49.39
(NIGHT): 45.26

↟
↟