

Environmental Noise Analysis

Densmore Village

Proposed Residential Development

Densmore Road and Parkview Hills Drive

Town of Cobourg

June 08, 2021
Project: 111-078-100

Prepared for

Marshall Homes (Cobourg)



Guangsheng (Sam) Du, M.Sc., P.Eng.



VALCOUSTICS
Canada Ltd.

Version History

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Environmental Noise Analysis

Densmore Village

Proposed Residential Development Densmore Road and Parkview Hills Drive Town of Cobourg

EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) previously prepared an Environmental Noise Assessment dated January 5, 2012 for a proposed residential development at Densmore Road and Parkview Hills Drive. This report addresses revisions to the site plan. The proposed development will consist of seven (7) 2-storey townhouse buildings, five (5) 3-storey stacked townhouse buildings, and a stormwater management pond.

The main noise sources with potential for impact on the proposed development are road traffic on Densmore Road and Highway 401. There are no stationary sources that are expected to have a significant noise impact on the subject site.

The sound levels on this site have been determined and compared with applicable Ministry of the Environment, Conservation and Parks (MECP) noise guideline limits to determine the need for noise mitigation.

To meet the applicable transportation noise source guideline limits at the proposed development, the noise mitigation requirements are summarized below:

- Buildings 8 to 12 require mandatory air conditioning;
- Buildings 1 to 7 require provision for air conditioning to be added at a later date;
- Buildings 8 to 12 require exterior walls meeting a minimum STC of 54 (e.g. brick veneer) and windows meeting STC 31 are required; and
- Buildings 1 to 7 require exterior walls meeting a minimum STC of 54 (e.g. brick veneer) and windows meeting STC 26 are required.

Final requirements should be checked when detailed building plans are available. This could be done as a condition for obtaining a building permit.

1.0 INTRODUCTION

1.1 SCOPE

Valcoustics Canada Ltd. (VCL) was retained to prepare an Environmental Noise Assessment in support of the Site Plan application for the proposed residential development at Densmore Road and Parkview Hills Drive. This report addresses updates to the site plan. The potential sound levels and noise mitigation measures needed for the proposed development to comply with the MECP noise guideline requirements are outlined herein.

1.2 THE SITE AND SURROUNDING AREA

The site is located at the intersection of Densmore Road and Parkview Hills Drive in the Town of Cobourg. The site is bounded by:

- Highway 401 to the north;
- Densmore Road with residential development beyond, to the east;
- Densmore Road with residential development and a school beyond, to the south; and
- A nursing home and hotel with Division Street beyond, to the west.

A Key Plan for the site is included as Figure 1.

This study is based on the Site Plan prepared by 4 Architecture Inc., dated March 26, 2021. The Site Plan is included as Figure 2.

1.3 THE PROPOSED DEVELOPMENT

The proposed development consists of seven (7) 2-storey townhouse buildings and five (5) 3-storey townhouse buildings and a stormwater management pond. Common outdoor amenity area is provided at grade level. The townhouse units will be provided with balconies but as they are below 4 m in depth, they will not be considered as Outdoor Living Areas (OLAs) under the MECP noise guidelines.

2.0 ENVIRONMENTAL NOISE GUIDELINES

The applicable noise guidelines for new residential development are those in MECP Publication NPC-300, "Environmental Noise Guideline, Stationary, and Transportation Sources – Approval and Planning".

The environmental noise guidelines of the MECP, as provided in Publication NPC-300, are discussed briefly below, and summarized in Appendix A.

2.1 TRANSPORTATION SOURCE NOISE GUIDELINES

2.1.1 Architectural Elements

In the daytime (0700 to 2300), the indoor criterion for road noise is $L_{eq\ Day}^{(1)}$ of 45 dBA for sensitive spaces such as living/dining rooms, dens and bedrooms. At night, the indoor criterion for road noise is $L_{eq\ Night}^{(2)}$ of 45 dBA for sensitive spaces such as living/dining rooms and dens and 40 dBA for bedrooms. The architectural design of the building envelope (walls, windows, etc.) must provide adequate sound isolation to achieve these indoor sound level limits, based on the applicable outdoor sound level on the facades.

2.1.2 Ventilation

In accordance with the MECP noise guideline for road traffic sources, if the daytime sound level, $L_{eq\ Day}$, at the exterior face of a noise sensitive window is greater than 65 dBA, means must be provided so that windows can be kept closed for noise control purposes and central air conditioning is required. For daytime sound levels between 56 dBA and 65 dBA inclusive, there need only be the provision for adding air conditioning at a later date. A warning clause advising the occupant of the potential interference with some activities is also required. At nighttime, air conditioning would be required when the sound level exceeds 60 dBA ($L_{eq\ Night}$) at a noise sensitive window (provision for adding air conditioning is required when greater than 50 dBA).

2.1.3 Outdoors

For outdoor amenity areas (“Outdoor Living Areas” – OLAs), the guideline is $L_{eq\ Day}$ of 55 dBA, with an excess not exceeding 5 dBA considered acceptable if it is technically not practicable to achieve the 55 dBA objective, providing warning clauses are registered on title. Note that for road traffic sources, a balcony is not considered an OLA, unless it is the only OLA for the occupant, and it is:

- at least 4 m in depth; and
- unenclosed.

3.0 NOISE SOURCES

3.1 TRANSPORTATION SOURCES

The noise sources with potential to impact the proposed development are road traffic on Highway 401 and Densmore Road. Road traffic on other nearby roadways is minor and is not expected to have a significant noise impact on the subject site.

Road traffic volume on Highway 401 was obtained from the Ministry of Transportation Ontario (MTO). Summer Average Daily Traffic (SADT) counts are higher than the AADT and were used in this assessment over Annual Average Daily Traffic (AADT), making the analysis conservative. A day/night split of 67% / 33% was used as is typical for controlled access highways. Overall truck

(1) 16-hour energy equivalent sound level (0700-2300 hours).
(2) 8-hour energy equivalent sound level (2300-0700 hours).

percentage was 30% according to data from MTO. Heavy/medium truck split was assumed to be 80%/ 20% of the truck volumes.

The traffic data for Densmore Road was verbally obtained from the Town of Cobourg Engineering Department in 2008. The existing volumes were escalated to the year 2031 design conditions using an annual growth rate of 5%, compounded annually. A day/night split of 90%/10% was used. Trucks were assumed to 1% heavy trucks and 1% medium trucks.

The road traffic data is summarized in Table 1. Correspondence is included as Appendix B.

3.2 STATIONARY SOURCES

The main stationary sources in this location are expected to be rooftop HVAC units at neighbouring nursing home and school. Due to relatively high background noise from Highway 401, these sources are expected to comply with MECP noise guidelines and therefore are not considered further in this assessment.

4.0 NOISE IMPACT ASSESSMENT

4.1 ANALYSIS METHOD

Using the road traffic data in Table 1, the sound levels, in terms of $L_{eq\ Day}$ and $L_{eq\ Night}$, were determined using STAMSON V5.04 – ORNAMENT, the computerized road traffic noise prediction models of the MOE.

The daytime and nighttime sound levels at the building facades were assessed at the top floor windows, the worst-case location. The assessment was made at 4.5 m above grade for 2-storey townhouse units and at 7.5 m above grade for 3-storey townhouse units.

The daytime sound levels at the OLA were assessed 1.5 m above grade at the center of the designated outdoor area. All balconies and patios are lesser than 4 m in depth and hence not considered OLAs under the definition of the MECP noise guidelines.

4.2 SOUND LEVEL PREDICTION

The highest daytime/nighttime sound levels of 69 dBA/69 dBA are predicted to occur at the north-east corner of the north facade of Building 12 adjacent to Densmore Road. The unmitigated daytime sound level of 56 dBA is predicted to occur in the outdoor amenity area.

Inherent screening of each building face due to its orientation to the noise source as well as that provided by proposed buildings on the subject site were taken into account.

Table 2 summarises the predicted sound levels outdoors at specific locations.

A sample sound level calculation is included in Appendix C.

4.3 NOISE ABATEMENT REQUIREMENTS

The noise control measures can generally be classified into two categories which are interrelated, but which can be treated separately for the most part:

- a) Architectural elements to achieve acceptable indoor noise guidelines for transportation sources; and
- b) Design features to protect the OLAs.

Noise abatement requirements are summarised in Table 3 and notes to Table 3.

4.3.1 Indoors

4.3.1.1 Architectural requirements

The indoor sound level guidelines can be achieved by using appropriate construction for exterior walls, windows, and doors. In determining the worst-case architectural requirements for the townhouse units, exterior wall and window areas were assumed to be 80% and 30% respectively, of the associated floor area at a corner room with facades exposed directly or at an angle to the traffic noise source, for both living/dining areas and sleeping quarters.

- Buildings 8 to 12 require exterior walls meeting a minimum STC of 54 (e.g. brick veneer) and windows meeting STC 31 are required.
- Buildings 1 to 7 require exterior walls meeting a minimum STC of 54 (e.g. brick veneer) and windows meeting STC 26 are required.

4.3.1.2 Ventilation requirements

Based on the predicted sound levels, the ventilation requirements are:

- Mandatory air conditioning for Buildings 8 to 12.
- Provision to adding air conditioning for Buildings 1 to 7.

4.3.2 Outdoors

The unmitigated daytime OLA sound level is predicted to be below the 60 dBA maximum permitted by MECP noise guidelines. Sound barriers are therefore not mandatory for noise control purposes provided appropriate warning clauses are registered on the title.

4.3.3 Warning clauses

Warning clauses are a tool to inform prospective owners/occupants of potential annoyance due to existing noise sources. Where the guideline sound level limits are exceeded, appropriate warning clauses should be registered on title or included in the development agreement that is registered on title. The warning clauses should also be included in agreements of Offers of Purchase and Sale and lease/rental agreements to make future occupants aware of the potential noise situation.

Table 3 and the notes to Table 3 summarize the warning clauses for the site.

5.0 CONCLUSIONS

With the incorporation of the recommended noise mitigation measures, the indoor and outdoor transportation noise guidelines can be met. Future occupants will be made aware of potential noise situation through warning clauses, as per MECP guidelines.

The approvals and administrative procedures are available to ensure that the noise requirements are implemented.

6.0 REFERENCES

- 1) PC STAMSON 5.04, "Computer Program for Road Traffic Noise Assessment", Ontario Ministry of the Environment.
- 2) Building Practice Note No. 56: "Controlling Sound Transmission into Buildings", by J. D. Quirt, Division of Building Research, National Council of Canada, September 1985.
- 3) "Sound Level Limits for Stationary Sources in Class 1 and 2 Areas (URBAN)", Ontario Ministry of the Environment, Publication NPC-205, October 1995.
- 4) "Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning", Ontario Ministry of the Environment, Publication NPC-300, August 2013.
- 5) "Environmental Noise Analysis, Densmore Village – Proposed Residential Development", Project No. 111-078, Valcoustics Canada Ltd., January 5, 2012.

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TABLE 1 ROAD TRAFFIC DATA

Roadway	Year	24-hour Volume	% Trucks		Day/Night (%)	Speed Limit (kph)
			Medium	Heavy		
Highway 401 – EB ⁽¹⁾	Ultimate-SADT ⁽²⁾	49850	6	24	67/33	100
Highway 401 – WB ⁽¹⁾	Ultimate-SADT ⁽²⁾	49850	6	24	67/33	100
Densmore Road	2008 ⁽³⁾	2840 (8549)	1	1	90/10	50

Notes:

- (1) Obtained from MTO.
- (2) SADT - Summer Average Daily Traffic.
- (3) Obtained verbally from the Town of Cobourg in 2008. Value in brackets is project to the year 2031 using a growth rate of 5% compounded annually. Truck percentages are assumed.

TABLE 2 PREDICTED UNMITIGATED SOUND LEVELS⁽¹⁾

Location	Source	Distance (m) ⁽²⁾	Leq Day (dBA)	Leq Night (dBA)
R1	Highway 401 EB	208	66	66
	Highway 401 WB	226	65	65
	Densmore Road	15	57	51
	Total	-	69	69
R2	Highway 401 EB	208	63	63
	Highway 401 WB	226	62	62
	Densmore Road	15	60	54
	Total	-	67	66
R3	Highway 401 EB	274	53	53
	Highway 401 WB	292	53	53
	Densmore Road	17	56	50
	Total	-	59	57
R4	Densmore Road	17	59	53
	Total	0	59	53
R5	Densmore Road	15	60	54
	Total	-	60	54
R6	Highway 401 EB	229	61	61
	Highway 401 WB	247	60	60
	Densmore Road	57	42	35
	Total	-	63	63
R7	Highway 401 EB	229	65	65
	Highway 401 WB	247	65	65
	Total	-	68	68
R8	Highway 401 EB	251	63	63
	Highway 401 WB	268	64	64
	Total	-	67	67
R9	Highway 401 EB	298	60	60
	Highway 401 WB	280	61	61
	Total	-	64	64
OLA1	Highway 401 EB	282	53	-
	Highway 401 WB	300	53	-
	Densmore Road	56	42	-
	Total	-	56	-

Notes:

- (1) Daytime/nighttime receptors were taken at the top floor windows. OLA receptors were taken at 1.5 m above grade. Figure 2 shows the assessment receptor locations.
- (2) Distance indicated is from the centreline of the noise sources to facade or OLA.

TABLE 3 MINIMUM NOISE ABATEMENT MEASURES

Location	Air Conditioning ⁽¹⁾	Exterior Wall ⁽²⁾	Window STC Rating ⁽³⁾	Sound Barrier ⁽⁴⁾	Warning Clauses ⁽⁵⁾
Buildings 8 to 12	Mandatory	STC 54	STC 31	None	A + C + D
Buildings 1 to 7	Provision for adding	STC 54	STC 26	None	A + B + D

Notes:

- (1) Where methods must be provided to allow windows to remain closed for noise control purposes, a commonly used technique for is the use of air conditioning.
- (2) STC - Sound Transmission Class Rating (Reference ASTM-E413). Analyses were based upon the assumption that wall and window areas are as indicated in Section 4.2.1.1 of this report. Requirements should be checked once floor plans have been finalized and exterior wall construction details are defined.
- (3) STC values are based upon the assumption that all wall and window areas are as indicated in Section 4.2.1.1 of this report. Requirements should be checked once floor plans have been finalized and exterior wall construction details are defined.
- (4) Sound barriers must be of solid construction with no gaps, cracks, or holes, and must meet a minimum surface density of 20 kg/m². Suitable material can include wood, concrete metal sandwich panel, glazing or a combination of these.
- (5) The warning clauses to be registered on title and be included in Offers of Purchase and Sale for designated lots:
 - A. "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 road traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment, Conservation and Parks."
 - B. 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."
 - C. "This dwelling unit has been supplied with an 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 the Municipality and the Ministry of the Environment, Conservation and Parks."
 - D. "Purchasers/tenants are advised that due to the proximity of the existing commercial/business establishments, noise from these facilities may at times be audible."
- (6) All exterior doors shall be fully weather-stripped.

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Pierre Gernain, Valcoustics Canada Ltd.



General Notes

No.	Revision/Issue	Date

VALCOUSTICS

Canada Ltd.

30 Wertheim Court, Unit 25
Richmond Hill, Ontario
Canada L4B 1B9
solutions@valcoustics.com
Phone: (905) 764-5223
Fax: (905) 764-6813

Project Name

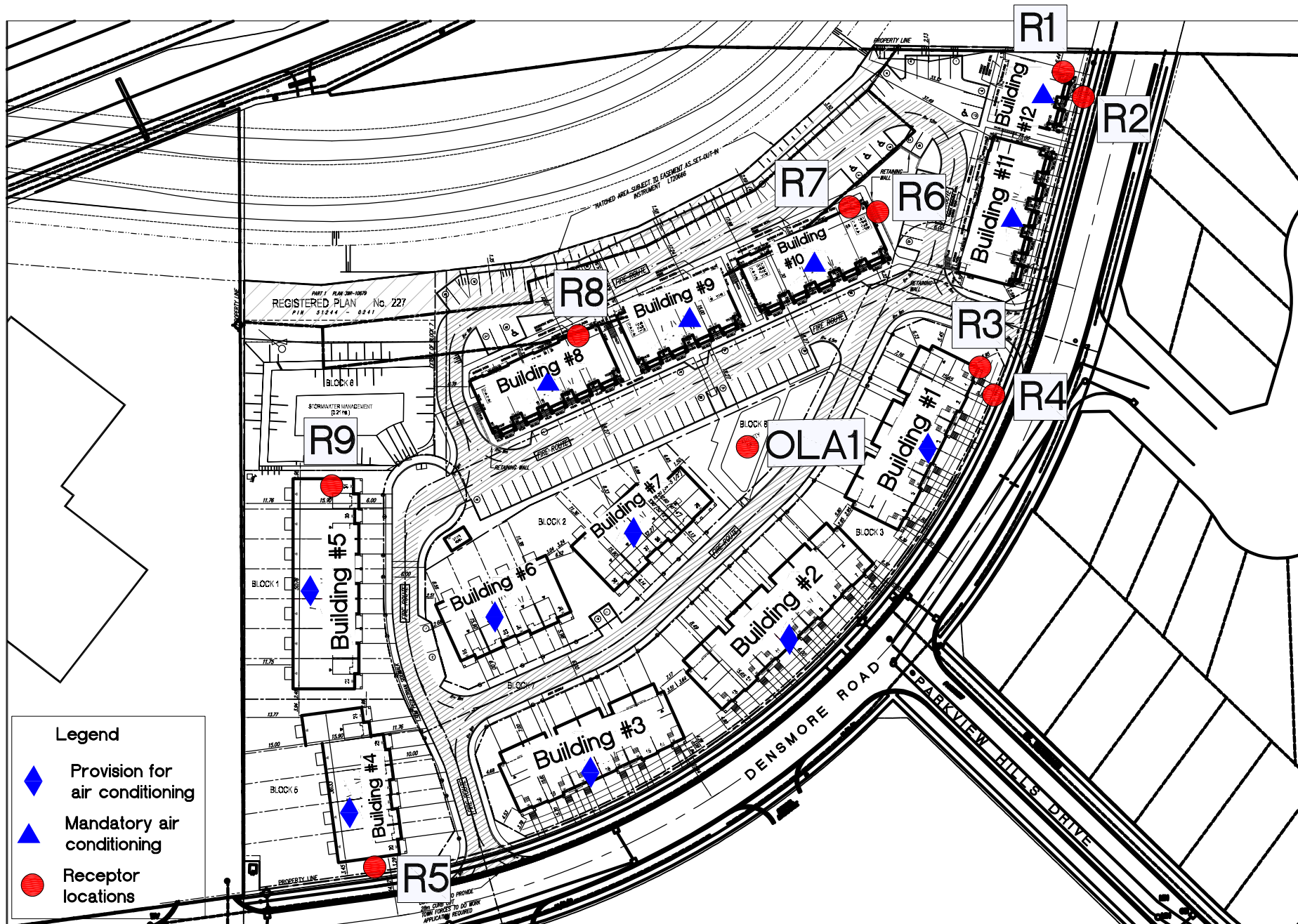
Densmore Village

Title

Key Plan

Project	111-078.100	Figure	1
Date	2021-05-14		
Scale	N.T.S.		

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Pierre Gernain, Valcoustics Canada Ltd.



Legend

- ◆ Provision for air conditioning
- ▲ Mandatory air conditioning
- Receptor locations

General Notes

No.	Revision/Issue	Date

VALCOUSTICS
Canada Ltd.
30 Wertheim Court, Unit 25
Richmond Hill, Ontario
Canada L4B 1B9
solutions@valcoustics.com
Phone: (905) 764-5223
Fax: (905) 764-6813

Project Name
Densmore Village

Title
Site Plan

Project 111-078.100	Figure 2
Date 2021 - 05 - 25	
Scale N.T.S.	

APPENDIX A

ROAD TRAFFIC DATA

Sam Du

From: Caimano, Riccardo (MTO) <Riccardo.Caimano@ontario.ca>
Sent: April 22, 2021 1:33 PM
To: Sam Du
Cc: Abhishek Thyagarajan
Subject: RE: 1110078.100 - Densmore Road Subdivision/Cobourg-DD

Hi Sam,

In response to your request please find below the information available from this office for Highway 401 east of Division Street.

2016 AADT = 42,500
2016 SADT = 51,800
Number of through lanes (2016) = 4
Ultimate AADT = 81,800
Ultimate SADT = 99,700
Ultimate number of through lanes = 6
Posted Speed = 100 km/hr
Percentage of Trucks = 30%

Please note that the above information is estimated based upon our current knowledge of the area, which may be subject to change in the future. Other information related to ROW and gradient will be available from Eastern Region Traffic Office. Unfortunately, we do not have any data related to the on- or off-ramps.

If you require further information, please don't hesitate to contact me.

Regards,

Riccardo Caimano, EIT (he/him) | Planner
Systems Analysis and Forecasting Office
Ministry of Transportation Ontario
Mobile: 416.587.9098 | E: Riccardo.Caimano@ontario.ca

From: Sam Du <sam@valcoustics.com>
Sent: April 21, 2021 4:22 PM
To: Caimano, Riccardo (MTO) <Riccardo.Caimano@ontario.ca>
Cc: Abhishek Thyagarajan <abhishek@valcoustics.com>
Subject: 1110078.100 - Densmore Road Subdivision/Cobourg-DD

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Riccardo,

APPENDIX B

ENVIRONMENTAL NOISE GUIDELINES

APPENDIX B
ENVIRONMENTAL NOISE GUIDELINES
MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE (MOE)

Reference: MOE Publication NPC-300, October 2013: “*Environmental Noise Guideline, Stationary and Transportation Source – Approval and Planning*”.

SPACE	SOURCE	TIME PERIOD	CRITERION
Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	Road	07:00 to 23:00	45 dBA
	Rail	07:00 to 23:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 5
Living/dining, den areas of residences, hospitals, nursing homes, etc. (except schools or daycare centres)	Road	23:00 to 07:00	45 dBA
	Rail	23:00 to 07:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 5
Sleeping quarters	Road	07:00 to 23:00	45 dBA
	Rail	07:00 to 23:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 0
Sleeping quarters	Road	23:00 to 07:00	40 dBA
	Rail	23:00 to 07:00	35 dBA
	Aircraft	24-hour period	NEF/NEP 0
Outdoor Living Areas	Road and Rail	07:00 to 23:00	55 dBA
Outdoor Point of Reception	Aircraft	24-hour period	NEF/NEP 30 [#]
	Stationary Source Class 1 Area	07:00 to 19:00 ⁽¹⁾	50 ⁺ dBA
		19:00 to 23:00 ⁽¹⁾	50 ⁺ dBA
	Class 2 Area	07:00 to 19:00 ⁽²⁾	50 ⁺ dBA
		19:00 to 23:00 ⁽²⁾	45 ⁺ dBA
	Class 3 Area	07:00 to 19:00 ⁽³⁾	45 ⁺ dBA
		19:00 to 23:00 ⁽³⁾	40 ⁺ dBA
	Class 4 Area	07:00 to 19:00 ⁽⁴⁾	55 ⁺ dBA
		19:00 to 23:00 ⁽⁴⁾	55 ⁺ dBA

..../cont'd

SPACE	SOURCE	TIME PERIOD	CRITERION
Plane of a Window of Noise Sensitive Spaces	Stationary Source Class 1 Area	07:00 to 19:00 ⁽¹⁾	50* dBA
		19:00 to 23:00 ⁽¹⁾	50* dBA
		23:00 to 07:00 ⁽¹⁾	45* dBA
	Class 2 Area	07:00 to 19:00 ⁽²⁾	50* dBA
		19:00 to 23:00 ⁽²⁾	50* dBA
		23:00 to 07:00 ⁽²⁾	45* dBA
	Class 3 Area	07:00 to 19:00 ⁽³⁾	45* dBA
		19:00 to 23:00 ⁽³⁾	45* dBA
		23:00 to 07:00 ⁽³⁾	40* dBA
	Class 4 Area	07:00 to 19:00 ⁽⁴⁾	60* dBA
		19:00 to 23:00 ⁽⁴⁾	60* dBA
		23:00 to 07:00 ⁽⁴⁾	55* dBA

- # may not apply to in-fill or re-development.
 * or the minimum hourly background sound exposure $L_{eq(1)}$, due to road traffic, if higher.
 (1) Class 1 Area: Urban.
 (2) Class 2 Area: Urban during day; rural-like evening and night.
 (3) Class 3 Area: Rural.
 (4) Class 4 Area: Subject to land use planning authority's approval.

Reference: MOE Publication ISBN 0-7729-2804-5, 1987: *"Environmental Noise Assessment in Land-Use Planning"*.

EXCESS ABOVE RECOMMENDED SOUND LEVEL LIMITS (dBA)	CHANGE IN SUBJECTIVE LOUDNESS ABOVE	MAGNITUDE OF THE NOISE PROBLEM	NOISE CONTROL MEASURES (OR ACTION TO BE TAKEN)
No excess (<55 dBA)	—	No expected noise problem	None
1 to 5 inclusive (56 to 60 dBA)	Noticeably louder	Slight noise impact	If no physical measures are taken, then prospective purchasers or tenants should be made aware by suitable warning clauses.
6 to 10 inclusive (61 - 65 dBA)	Almost twice as loud	Definite noise impact	Recommended.
11 to 15 inclusive (66 - 70 dBA)	Almost three times as loud	Serious noise impact	Strongly Recommended.
16 and over (>70 dBA)	Almost four times as loud	Very serious noise impact	Strongly Recommended (may be mandatory).

APPENDIX C

SAMPLE SOUND LEVEL CALCULATIONS

STAMSON 5.0 NORMAL REPORT Date: 08-06-2021 15:46:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: 401 EB (day/night)

Car traffic volume : 23264/11631 veh/TimePeriod *
Medium truck volume : 1994/997 veh/TimePeriod *
Heavy truck volume : 7976/3988 veh/TimePeriod *
Posted speed limit : 100 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): 49850
Percentage of Annual Growth : 2.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 6.00
Heavy Truck % of Total Volume : 24.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 1: 401 EB (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 : 208.00 / 208.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: 401 WB (day/night)

Car traffic volume : 23264/11631 veh/TimePeriod *
Medium truck volume : 1994/997 veh/TimePeriod *
Heavy truck volume : 7976/3988 veh/TimePeriod *
Posted speed limit : 100 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): 49850
Percentage of Annual Growth : 2.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 6.00
Heavy Truck % of Total Volume : 24.00
Day (16 hrs) % of Total Volume : 66.67

Data for Segment # 2: 401 WB (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 : 226.00 / 226.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 3: Densmore (day/night)

Car traffic volume : 7694/855 veh/TimePeriod *
Medium truck volume : 79/9 veh/TimePeriod *
Heavy truck volume : 79/9 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): 2840
Percentage of Annual Growth : 5.00
Number of Years of Growth : 23.00
Medium Truck % of Total Volume : 1.00
Heavy Truck % of Total Volume : 1.00
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 3: Densmore (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 15.00 / 15.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: 401 EB (day)

Source height = 2.21 m

ROAD (0.00 + 65.79 + 0.00) = 65.79 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.37 82.34 0.00 -15.63 -0.92 0.00 0.00 0.00 65.79

Segment Leq : 65.79 dBA

Results segment # 2: 401 WB (day)

Source height = 2.21 m

ROAD (0.00 + 65.30 + 0.00) = 65.30 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.37 82.34 0.00 -16.12 -0.92 0.00 0.00 0.00 65.30

Segment Leq : 65.30 dBA

Results segment # 3: Densmore (day)

Source height = 1.00 m

ROAD (0.00 + 57.46 + 0.00) = 57.46 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.40	61.46	0.00	0.00	-4.00	0.00	0.00	0.00	57.46

Segment Leq : 57.46 dBA

Total Leq All Segments: 68.89 dBA

Results segment # 1: 401 EB (night)

Source height = 2.21 m

ROAD (0.00 + 65.79 + 0.00) = 65.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.37	82.34	0.00	-15.63	-0.92	0.00	0.00	0.00	65.79

Segment Leq : 65.79 dBA

Results segment # 2: 401 WB (night)

Source height = 2.21 m

ROAD (0.00 + 65.30 + 0.00) = 65.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.37	82.34	0.00	-16.12	-0.92	0.00	0.00	0.00	65.30

Segment Leq : 65.30 dBA

Results segment # 3: Densmore (night)

Source height = 1.01 m

ROAD (0.00 + 50.97 + 0.00) = 50.97 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.40	54.97	0.00	0.00	-4.00	0.00	0.00	0.00	50.97

Segment Leq : 50.97 dBA

Total Leq All Segments: 68.64 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 68.89
(NIGHT) : 68.64