REPORT
PROJECT: 125581-6.2.1

NOISE CONTROL FEASIBILITY STUDY
RIVERSIDE SOUTH PHASE 17
4775 & 4875 SPRATT ROAD
RIVERSIDE SOUTH COMMUNITY

Prepared for Riverside South Development Corporation
by IBI GROUP

JULY 2020

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1 INTRODUCTION

This report has been prepared to determine the impact of roadway traffic on the residential lands of the Riverside South Phase 17 development area. The subject site is located at 4775 and 4875 Spratt Road in the Riverside South Community of Ottawa. The report analyses the expected noise levels in the development and any required noise control measures.

The current draft plan of subdivision for Riverside South Phase 17 is shown on **Figure 1**. The property, which is located east of Spratt Road and immediately south of 4725 Spratt Road (Claridge), occupies approximately 59 hectares and consists primarily of single-family lots, street townhomes and stacked townhomes. The site will be developed in three (3) separate phases, referred to herein as Phases 17-1, 17-2 and 17-3.

N

Future School
AREA=3.07 Ha.
7.59 Acres

COMMERCIAL
AREA=0.929 Ha 2.30
Acres

Medium Density
AREA=1.472 Ha
3.84 Acres

Park
AREA=2.124 Ha.
5.25 Acres

PARK
AREA=0.596 Ha.
1.47 Acres

Phase 1

Phase 2

Phase 3

Park

STREET No. 1
STREET No. 2
STREET No. 3
STREET No. 4
STREET No. 5
STREET No. 6
STREET No. 7
STREET No. 8
STREET No. 9
STREET No. 10
STREET No. 11
STREET No. 12
STREET No. 13
STREET No. 14
STREET No. 15
STREET No. 16
STREET No. 17
STREET No. 18
STREET No. 19
STREET No. 20
STREET No. 21
STREET No. 22

BLOCK 1
BLOCK 2
BLOCK 3
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BLOCK 8
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BLOCK 24

J:\125581_RSDCPhase17\7.0_Production\7.03_Design\04_Civil_LAND\Assessment Report\125581-FIG-1_-_PHASING.dwg Layout Name: PHASING PLAN Last Saved By: ddore Last Saved At: Jun. 30, 20

Scale	Project Title	Drawing Title	Sheet No.
NTS	Riverside South - Phase 17	PHASING PLAN	FIGURE 1

2 BACKGROUND

2.1 Noise Sources

The study area will be subject to roadway noise from existing Spratt Road to the west, as well as the proposed extensions of Borbridge Avenue, Solarium Avenue and Ralph Hennessy Avenue which will form part of the site's internal road network. Right-of-way is also currently being protected for the development of a future Bus Rapid Transit (BRT) to the north of the site.

The subject site is outside of the Airport Vicinity Development Zone (AVDZ), as shown on Annex 10 and Schedule K of the 2013 Official Plan, therefore aircraft noise from the Ottawa International Airport has not been considered in this study.

There are no rail lines within 500 metres of the site, therefore no consideration has been given to the noise impacts from rail traffic in accordance with the City of *Ottawa Environmental Noise Control Guidelines (January 2016)*, hereafter referred to as the ENC Guidelines.

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* and the *Ministry of Environment Publication NPC-300 (August 2013)*. 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 – ventilation and warning clause requirements

Similar to outdoor noise levels, the recommended indoor sound, the sound level criteria from Table 2.2b of the ENC Guidelines are as follows:

- 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 metres above the ground for daytime noise and at the plane of the bedroom window 4.5 metres above the ground for nighttime noise.

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 noise levels exceed 65 dBA at the living room and/or exceed 60 dBA at the bedroom then central air conditioning is mandatory and a warning clause is required.

2.2.2 Outdoor sound level criterion

As per Table 2.2a of NPC-300, the sound level criteria 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 metres from the building face at the centre of the unit or within the centre of the OLA at a height of 1.5 metres 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, with City approval, 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.

2.2.3 Indoor Sound Level Criterion – Building Components

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.

3 ROADWAY NOISE

3.1 Road Traffic Data

The major sources of road noise impacting the site are expected to originate from the traffic flows on Spratt Road, Borbridge Avenue, Solarium Avenue and Ralph Hennessy Avenue, as well as the future Bus Rapid Transit (BRT), as described below:

Spratt Road

Spratt Road is an existing two-lane rural road with a posted speed limit of 80km/h adjacent to the subject property. It is expected that the segment of Spratt Road along the frontage of the site will be reconstructed as an urban two-lane major collector road (2-UMCU) with a posted speed limit of 50km/h prior to full build-out/ occupancy of the proposed development.

Borbridge Avenue

Borbridge Avenue is a two-lane, undivided major collector (2-UMCU) road with a speed limit of 50km/h that presently exists west of Spratt Road. Borbridge Avenue will be extended further east through 4725 Spratt Road, as well as the northeast portion of Phase 17-1.

Solarium Avenue

Solarium Avenue is proposed two-lane, undivided major collector (2-UMCU) road with a speed limit of 50km/h that will be constructed through Phase 17-2 of the proposed development.

Ralph Hennessy Avenue

Ralph Hennessy Avenue is a two-lane, undivided collector road (2-UCU) road with a posted speed limit of 50km/h which exists through Phases 8 & 13 to the north of the site. As part of the proposed development, Ralph Hennessy Avenue will be extended further south near the eastern boundary the site through all three sub-phases.

Bus Rapid Transit (BRT) Line

Right-of-way is being protected for a future dedicated BRT corridor that will extend from Barrhaven Centre to the Riverside South Community Core. A portion of this protected corridor is located adjacent to the northeast property boundary of the site.

With the exception of the BRT line, traffic volume parameters were extracted from Appendix B: Table B1 of the ENC Guidelines for each of corresponding road classifications and are conservatively based on the capacity of each roadway. Appropriate traffic inputs for the BRT line were determined through correspondence with City of Ottawa technical staff (see **Appendix A**).

Table 3.1 below summarizes the traffic and road parameters are used to assess the noise levels.

TABLE 3.1: TRAFFIC AND ROAD DATA SUMMARY

	SPRATT, BORBRIDGE & SOLARIUM (2-UMCU)	RALPH HENNESSY (2-UCU)	BRT
Annual Average Daily Traffic (AADT)	12,000	8,000	600 buses
Posted Speed Limit (km/h)	50	50	80
% Medium Trucks	7%	7%	-
% Heavy Trucks	5%	5%	-
% Daytime Traffic	92%	92%	74%

3.2 Calculation Methods

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

In the BRT noise reports, the buses were modelled as heavy trucks to simulate the three axle articulated buses used in Ottawa. In the STAMSON program, the rapid transit function is used to calculate the BRT noise with a custom source used to simulate the “heavy truck” buses.

This study will identify the noise contours generated by the traffic for various scenarios. To determine the indoor noise level requirements for ventilation and noise clauses, the contours for the 55 dBA daytime and 50 dBA nighttime levels are used. For the indoor noise level requirement to evaluate building components, mandatory air conditioning and warning clauses, the 65 dBA daytime and 60 dBA night time contours are used. To determine the requirements for outdoor noise levels on the outdoor living area, the 55 dBA and 60 dBA daytime noise contours are used. The following table provides the offset from centreline of the roadway to the noise contours. The distances in **Table 3.2** below are measured from the right-of-way centreline for each roadway identified previously in **Table 3.1**.

TABLE 3.2: NOISE CONTOUR OFFSETS

NOISE CRITERIA		DISTANCE FROM CENTRELINE (M)		
		SPRATT, BORBRIDGE & SOLARIUM (2-UMCU)	RALPH HENNESSY (2-UCU)	BRT
Indoor Daytime	65 dBA	17.4	12.7	22.1
	55 dBA	69.5	54.4	90.5
Indoor Nighttime	60 dBA	10.9	7.3	38.9
	50 dBA	53.0	41.0	172.7
Outdoor Living Area (Daytime Only)	60 dBA	34.7	27.2	44.7
	55 dBA	69.5	54.4	90.5

Based on **Table 3.2** above for the indoor noise evaluation, the daytime contours for the collector and major collector roads are further from centreline than the nighttime levels for each criterion; therefore, only the daytime levels will be considered in the noise analysis for this study when considering noise impacts associated with these road types. For the BRT, the nighttime noise levels are further from centreline, therefore only the nighttime levels will be used for the indoor noise evaluation. Noise contours for both indoor (daytime only) and outdoor noise evaluation are shown on **Figure 2**. These contours have not been adjusted to reflect screening from proposed buildings. For clarity purposes, the noise contours have not been extended where they intersect with the noise contours from the larger roadway.

For the 65dBA contour line associated with Ralph Hennessy Avenue, the road centreline offset was determined to be less than 15m and thus the calculation could not be performed using the STAMSON noise software. Instead, a divergence calculation was completed, the results of which are attached in **Appendix B**. Given that Ralph Hennessy Avenue has a 26m ROW and that the results that the limit of the 65dBA noise level would occur approximately 12.7m from the road centreline, however, it can be concluded that no dwelling units along Ralph Hennessy would experience these noise levels.

4 RESULTS

4.1 Indoor Sound Levels

The daytime indoor 55 dBA contour shown on **Figure 2** represent the limit in which a Type 'C' Warning Clause and forced air heating with provision for central air conditioning are required for the residential units.

The daytime indoor 65 dBA contour is the limit in which a Type 'D' warning clause, central air conditioning and an acoustical review/ design of the building components are required. As noted in Section 3.2, the noise contours have not been adjusted to account for screening by the proposed buildings. A summary of the results of each roadway is as follows:

Major Collector Roads (2-UMCU) – The 65 dBA indoor contour, located 17.4 metres from the centreline of the existing and proposed major collector roadway including Spratt Road, Borbridge Avenue and Solarium Avenue, impacts only a select number of dwelling units within closest proximity to roadway. The 55 dBA noise contour, extending 69.5 metres from centreline, impacts a larger number of units, however the noise impacts will be reduced due to screening from the buildings closer to the road.

Ralph Hennessy Avenue (2-UCU) – As shown on **Figure 2**, the 65 dBA contour falls within the road ROW and therefore would not impact any dwelling units adjacent to the road. All units directly fronting, backing onto or flanking Ralph Hennessy Avenue will experience noise levels above 55 dBA, requiring alternative means of ventilation and a Type 'C' warning clause. The exact number of units that exceed 55 dBA will be determined during detailed design stage.

BRT – The 60 dBA indoor nighttime contour is located approximately 38.9 meters from the BRT centreline which impacts the townhomes flanking the BRT corridor, mandatory central air conditioning, a review of building components and a Type 'D' warning clause. It is expected that the noise from the BRT corridor will be screened by the dwelling units proposed within closest proximity to the corridor and thus will impact only a very small number of residences within this development.

Warning clauses for indoor noise are as follows:

Type 'C'

"This dwelling unit has been fitted with a forced air heating system and the ducting, etc. was sized to accommodate central air conditioning. Installation of central air conditioning by the occupant will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of the Environment's noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both on and in the immediate vicinity of the subject property."

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 City's and the Ministry of the Environment's noise criteria."

4.2 Outdoor Sound Levels

The outdoor 60 dBA contour on **Figure 2** represents the limit in which physical attenuation is required in the outdoor living areas of residential units. For units between the 60 dBA and 55 dBA contours, physical attenuation may not be required but should be considered as stated in Part 4, Section 3.4 of the ENC Guidelines. A summary of the results for each roadway is as follows:

Major Collector Roads (2-UMCU) – As the 60 dBA outdoor contour is located approximately 34.7 m from the centreline of the road, all outdoor living areas (OLA) in this range will require physical attenuation. Appropriate noise barrier locations for the existing Spratt Road alignment and the proposed extensions of Borbridge Avenue and Solarium Avenue are outlined in **Figure 2**. These noise barriers should be 2.2 metres high, consistent with previous phases of Riverside South. At locations where the unattenuated noise level is below 60 dBA but above 55 dBA a Type 'A' warning clause could be considered in lieu of a barrier.

Ralph Hennessy Avenue (2-UCU) – As the 60 dBA outdoor contour is located approximately 27.2 m from the centreline of the road, all outdoor living areas (OLAs) in this range will require physical attenuation. Appropriate noise barrier locations for the proposed extension of Ralph Hennessy Avenue through the proposed development lands are indicated in **Figure 2**. These noise barriers should be 2.2 metres high, consistent with previous phases of Riverside South. At locations where the unattenuated noise level is below 60 dBA but above 55 dBA, a Type 'A' warning clause could be considered in lieu of a barrier.

Due to overland flow routes drainage and access easements it may not be practical to construct a continuous barrier along either the above noted collector (2-UCU) or major collector (2-UMCU) roads located within the proposed development. In these situations, implementing a partial barrier will help reduce the noise levels below 60 dBA but may not reduce below 55 dBA, therefore a Type 'B' warning clause may still be required for select units.

BRT – As the 60 dBA outdoor contour is located approximately 44.7 metres from the centreline of the BRT, all outdoor living areas (OLA) for the units directly flanking the BRT will require physical attenuation. Noise barriers are required for these units and are shown on **Figure 2**. In order to reduce the noise below 55 dBA, the barriers may need to be up to four meters in height. If this is not practical, then a barrier height of 2.5 metres would likely reduce the noise level below 60 dBA and a Type 'B' warning clause would be required.

Warning clauses for outdoor noise are as follows:

Type 'A'

"Purchasers/tenants are advised that sound levels due to increasing Spratt Road, Borbridge Avenue, Solarium Avenue, Ralph Hennessy Avenue and BRT line traffic volumes may occasionally 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 '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 Spratt Road, Borbridge Avenue, Solarium Avenue, Ralph Hennessy Avenue and BRT line traffic volumes 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."

5 CONCLUSION

This report outlines the impact of roadway noise on the Riverside South Phase 17 development located at 4775 and 4875 Spratt Road in Ottawa. The exact location of residential units requiring noise warning clauses, ventilation, air conditioning requirements, acoustical review/design of building components, and the location and size of noise barriers will be determined during the detailed design phase when the Draft Plan and grading plan are finalized.

6 Professional Authorization

Prepared by:

Ben Pascolo-Neveu, P. Eng.

Reviewed by:

Lance Erion, P.Eng.
Associate

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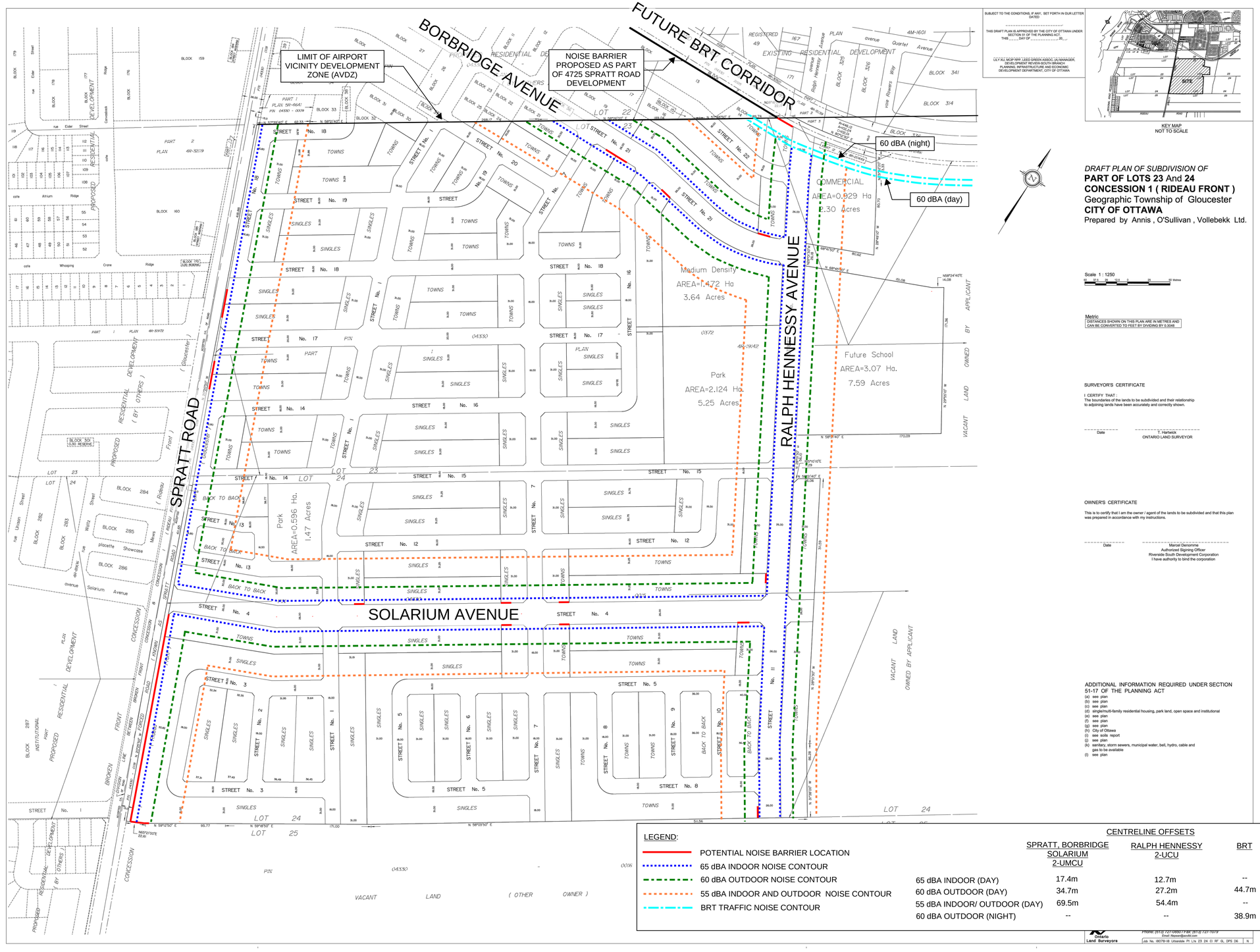
J:\125581_RSDCPhase17\7.0_Production\7.03_Design\04_Civil_LAND\Assessment Report\125581-FIG-1,2-Draft Plan.dwg Layout Name: DRAFT PLAN Last Saved By: Ben.Pascolo-Neveu Last Saved At: Jul. 9, 20



SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED

THIS DRAFT PLAN IS APPROVED BY THE CITY OF CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT. THIS _____ DAY OF _____, 20__.

LILY XU, MCIP, RPP, LEED GREEN ASSOC. (A) MANAGER, DEVELOPMENT REVIEW-SOUTH BRANCH PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

DRAFT PLAN OF SUBDIVISION OF
PART OF LOTS 23 And **24**
CONCESSION 1 (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1250
0 12.5 25 37.5 50 75 100 Metres

Metric
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :
The boundaries of the lands to be be subdivided and their relationship to adjoining lands have been accurately and correctly shown.

Date — T. Hertveldt, ONTARIO LAND SURVEYOR

OWNER'S CERTIFICATE

This is to certify that I am the owner / agent of the lands to be subdivided and that this plan was prepared in accordance with my instructions.

Date — Marcel Denomme, Authorized Signing Officer, Riverside South Development Corporation, I have authority to bind the corporation

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT

(a) see plan
(b) see plan
(c) see plan
(d) single/multi-family residential housing, park land, open space and institutional
(e) see plan
(f) see plan
(g) see plan
(h) City of Ottawa
(i) see soils report
(j) see plan
(k) sanitary, storm sewers, municipal water, bell, hydro, cable and gas to be available
(l) see plan

LEGEND:

- POTENTIAL NOISE BARRIER LOCATION
- 65 dBA INDOOR NOISE CONTOUR
- 60 dBA OUTDOOR NOISE CONTOUR
- 55 dBA INDOOR AND OUTDOOR NOISE CONTOUR
- BRT TRAFFIC NOISE CONTOUR

CENTRELINE OFFSETS

	SPRATT, BORBRIDGE SOLARIUM 2-UMCU	RALPH HENNESSY 2-UCU	BRT
65 dBA INDOOR (DAY)	17.4m	12.7m	--
60 dBA OUTDOOR (DAY)	34.7m	27.2m	44.7m
55 dBA INDOOR/ OUTDOOR (DAY)	69.5m	54.4m	--
60 dBA OUTDOOR (NIGHT)	--	--	38.9m

Ontario Land Surveyors
Phone: (613) 727-0993 FAX: (613) 727-1079
Email: Nelson@annis.com
Job No. 18079-18 Urbandale Pt Lts 23 24 C RF G, DPS D6 N

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	NOISE CONTROL FEASIBILITY STUDY RIVERSIDE SOUTH PHASE 17 4775 & 4875 SPRATT ROAD RSDC LANDS RIVERSIDE SOUTH COMMUNITY	NOISE PLAN	FIGURE 2

APPENDIX

APPENDIX A

Email Correspondence – BRT Parameters

Lance Erion

From: Yousfani, Asad <Asad.Yousfani@ottawa.ca>
Sent: Monday, April 04, 2016 10:08 AM
To: Lance Erion
Cc: Kaufman, Cathlyn; Jim Burghout; Terry Brule
Subject: FW: BRRT

Hi Lance,

I've received the following information from Frank for you to update the noise study.

Thanks,

Asad

From: McKinney, Frank
Sent: Monday, April 04, 2016 9:39 AM
To: Yousfani, Asad
Subject: FW: BRRT

Hi Asad, as requested by IBI at Friday's meeting:

As per p. 5 of Appendix F, the vehicle type, volume and speed assumptions were as follows:

"The ENCG accepts noise models based on the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), including the computerized version, STAMSON (MOE 1996). These models have built-in sound power data for road vehicles; however, they do not specify values specifically for buses. Based on ENCG section 2.4.1, transitway buses should be classified as "medium trucks" for modeling purposes using STAMSON. However, the buses operating on the BRT are 60 foot articulating buses, with three axles and a weight over 18,000 kg. Based on the MOE "STAMSON Version 4.1 User's Guide", a vehicle with three or more axles and a weight greater than 12,000 kg should be considered as a "heavy truck" for modelling. Therefore, the proposed BRT buses were modelled as "heavy trucks". A summary of the model inputs is presented below in Table 3.

Table 3: Traffic Inputs for Surface Transportation Corridor Modelling

	Dedicated BRT Sections of Project	Transit Street without Proposed BRT	Transit Street with Median BRT
AADT	600	14000	14600
Speed Limit	80 km/h	60 km/h	60 km/h
Day / Night Split	74% / 26%	92% / 8%	91% / 9%
% Medium / % Heavy of Total Traffic	0% / 100%	7% / 5%	7% / 8%

Frank

APPENDIX B
Noise Calculations

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:11:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2ucu.te Time Period: Day/Night 16/8 hours
Description: 2-UCU 60 dBA Daytime

Road data, segment # 1: 2-UCU (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: 2-UCU (day/night)

Angle1 Angle2	:	-90.00 deg 90.00 deg	
Wood depth	:	0	(No woods.)
No of house rows	:	0 / 0	
Surface	:	1	(Absorptive ground surface)
Receiver source distance	:	27.20 / 53.01 m	
Receiver height	:	1.50 / 4.50 m	
Topography	:	1	(Flat/gentle slope; no barrier)
Reference angle	:	0.00	

Results segment # 1: 2-UCU (day)

Source height = 1.50 m

ROAD (0.00 + 60.00 + 0.00) = 60.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.75	0.00	-4.29	-1.46	0.00	0.00	0.00	60.00

Segment Leq : 60.00 dBA

Total Leq All Segments: 60.00 dBA

Results segment # 1: 2-UCU (night)

Source height = 1.50 m

ROAD (0.00 + 48.25 + 0.00) = 48.25 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	58.16	0.00	-8.61	-1.30	0.00	0.00	0.00	48.25

Segment Leq : 48.25 dBA

Total Leq All Segments: 48.25 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.00
(NIGHT): 48.25

2-UCU5550 day night
STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:13:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2ucu.te Time Period: Day/Night 16/8 hours
Description: 2-UCU 55 dBA Daytime, 50 dBA Nighttime

Road data, segment # 1: 2-UCU (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: 2-UCU (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 : 54.43 / 40.99 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: 2-UCU (day)

Source height = 1.50 m

ROAD (0.00 + 55.00 + 0.00) = 55.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.75	0.00	-9.29	-1.46	0.00	0.00	0.00	55.00

2-UCU5550 day night

Segment Leq : 55.00 dBA

Total Leq All Segments: 55.00 dBA

↟

Results segment # 1: 2-UCU (night)

Source height = 1.50 m

ROAD (0.00 + 50.00 + 0.00) = 50.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	58.16	0.00	-6.86	-1.30	0.00	0.00	0.00	50.00

Segment Leq : 50.00 dBA

Total Leq All Segments: 50.00 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 55.00
(NIGHT): 50.00

↟

↟

2-UCU6560 day night (divergence req'd)
STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:32:05
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2ucu.te Time Period: Day/Night 16/8 hours
Description: 2-UMCU 65 dBA Daytime, 60 dBA Nighttime

Road data, segment # 1: 2-UCU (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: 2-UCU (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	:	15.00 / 15.00	m
Receiver height	:	1.50 / 4.50	m
Topography	:	1	(Flat/gentle slope; no barrier)
Reference angle	:	0.00	

Results segment # 1: 2-UCU (day)

Source height = 1.50 m

ROAD (0.00 + 64.29 + 0.00) = 64.29 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.75	0.00	0.00	-1.46	0.00	0.00	0.00	64.29

2-UCU6560 day night (divergence req'd)

Segment Leq : 64.29 dBA

Total Leq All Segments: 64.29 dBA

Results segment # 1: 2-UCU (night)

Source height = 1.50 m

ROAD (0.00 + 56.85 + 0.00) = 56.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	58.16	0.00	0.00	-1.30	0.00	0.00	0.00	56.85

Segment Leq : 56.85 dBA

Total Leq All Segments: 56.85 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.29

(NIGHT): 56.85

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:09:04
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2umcu.te Time Period: Day/Night 16/8 hours
Description: 2-UMCU 60 dBA Daytime

Road data, segment # 1: 2-UMCU (day/night)

Car traffic volume	9715/845	veh/TimePeriod *
Medium truck volume	773/67	veh/TimePeriod *
Heavy truck volume	552/48	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)	12000
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: 2-UMCU (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	34.74 / 53.01	m
Receiver height	1.50 / 4.50	m
Topography	1	(Flat/gentle slope; no barrier)
Reference angle	0.00	

Results segment # 1: 2-UMCU (day)

Source height = 1.50 m

ROAD (0.00 + 60.00 + 0.00) = 60.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.51	0.00	-6.05	-1.46	0.00	0.00	0.00	60.00

2-UMCU60 day

Segment Leq : 60.00 dBA

Total Leq All Segments: 60.00 dBA

Results segment # 1: 2-UMCU (night)

Source height = 1.50 m

ROAD (0.00 + 50.00 + 0.00) = 50.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	59.91	0.00	-8.61	-1.30	0.00	0.00	0.00	50.00

Segment Leq : 50.00 dBA

Total Leq All Segments: 50.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.00
(NIGHT): 50.00

2-UMCU5550 day night

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:06:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2umcu.te Time Period: Day/Night 16/8 hours
Description: 2-UMCU 55 dBA Daytime, 50 dBA Nighttime

Road data, segment # 1: 2-UMCU (day/night)

Car traffic volume	:	9715/845 veh/TimePeriod	*
Medium truck volume	:	773/67 veh/TimePeriod	*
Heavy truck volume	:	552/48 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)	:	12000
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: 2-UMCU (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	:	69.47 / 53.01	m
Receiver height	:	1.50 / 4.50	m
Topography	:	1	(Flat/gentle slope; no barrier)
Reference angle	:	0.00	

Results segment # 1: 2-UMCU (day)

Source height = 1.50 m

ROAD (0.00 + 55.00 + 0.00) = 55.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.51	0.00	-11.05	-1.46	0.00	0.00	0.00	55.00

2-UMCU5550 day night

Segment Leq : 55.00 dBA

Total Leq All Segments: 55.00 dBA

Results segment # 1: 2-UMCU (night)

Source height = 1.50 m

ROAD (0.00 + 50.00 + 0.00) = 50.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	59.91	0.00	-8.61	-1.30	0.00	0.00	0.00	50.00

Segment Leq : 50.00 dBA

Total Leq All Segments: 50.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.00
(NIGHT): 50.00

2-UMCU6560 day night (night divergence req'd)
STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 11:41:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 2umcu.te Time Period: Day/Night 16/8 hours
Description: 2-UMCU 65 dBA Daytime, 60 dBA Nighttime

Road data, segment # 1: 2-UMCU (day/night)

Car traffic volume	:	9715/845	veh/TimePeriod *
Medium truck volume	:	773/67	veh/TimePeriod *
Heavy truck volume	:	552/48	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)	:	12000
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: 2-UMCU (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	:	17.37 / 15.00	m
Receiver height	:	1.50 / 4.50	m
Topography	:	1	(Flat/gentle slope; no barrier)
Reference angle	:	0.00	

Results segment # 1: 2-UMCU (day)

Source height = 1.50 m

ROAD (0.00 + 65.00 + 0.00) = 65.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.51	0.00	-1.06	-1.46	0.00	0.00	0.00	65.00

2-UMCU6560 day night (night divergence req'd)
Segment Leq : 65.00 dBA

Total Leq All Segments: 65.00 dBA

Results segment # 1: 2-UMCU (night)

Source height = 1.50 m

ROAD (0.00 + 58.61 + 0.00) = 58.61 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	59.91	0.00	0.00	-1.30	0.00	0.00	0.00	58.61

Segment Leq : 58.61 dBA

Total Leq All Segments: 58.61 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.00
(NIGHT): 58.61

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 13:26:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: brt.te Time Period: Day/Night 16/8 hours
Description: BRT - 60 dBA Daytime

RT/Custom data, segment # 1: BRT (day/night)
---
1 - Custom (87.0 dBA):
Traffic volume : 444/156 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (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 : 44.72 / 172.72 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 2.40 m

RT/Custom (0.00 + 60.00 + 0.00) = 60.00 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.63	69.16	-7.75	-1.41	0.00	0.00	0.00	60.00

Segment Leq : 60.00 dBA

Total Leq All Segments: 60.00 dBA

Results segment # 1: BRT (night)

Source height = 2.40 m

RT/Custom (0.00 + 50.00 + 0.00) = 50.00 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

BRT60 day

-90	90	0.54	67.63	-16.38	-1.25	0.00	0.00	0.00	50.00

Segment Leq : 50.00 dBA

Total Leq All Segments: 50.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.00
(NIGHT): 50.00

BRT5550 day night

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 13:23:47
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: brt.te Time Period: Day/Night 16/8 hours
Description: BRT - 55 dBA Daytime, 50 dBA Nighttime

RT/Custom data, segment # 1: BRT (day/night)
---

1 - Custom (87.0 dBA):
Traffic volume : 444/156 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (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 : 90.54 / 172.72 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 2.40 m

RT/Custom (0.00 + 55.00 + 0.00) = 55.00 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.63	69.16	-12.75	-1.41	0.00	0.00	0.00	55.00

Segment Leq : 55.00 dBA

Total Leq All Segments: 55.00 dBA

Results segment # 1: BRT (night)

Source height = 2.40 m

RT/Custom (0.00 + 50.00 + 0.00) = 50.00 dBA

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

BRT5550 day night

-90	90	0.54	67.63	-16.38	-1.25	0.00	0.00	0.00	50.00

Segment Leq : 50.00 dBA

Total Leq All Segments: 50.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.00
(NIGHT): 50.00

BRT6560 day night

STAMSON 5.0 NORMAL REPORT Date: 09-07-2020 13:21:13
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: brt.te Time Period: Day/Night 16/8 hours
Description: BRT - 65 dBA Daytime, 60 dBA Nighttime

RT/Custom data, segment # 1: BRT (day/night)
---

1 - Custom (87.0 dBA):
Traffic volume : 444/156 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (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 : 22.10 / 38.86 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 2.40 m

RT/Custom (0.00 + 65.00 + 0.00) = 65.00 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.63	69.16	-2.75	-1.41	0.00	0.00	0.00	65.00

Segment Leq : 65.00 dBA

Total Leq All Segments: 65.00 dBA

Results segment # 1: BRT (night)

Source height = 2.40 m

RT/Custom (0.00 + 60.00 + 0.00) = 60.00 dBA

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

BRT6560 day night

-90	90	0.54	67.63	-6.38	-1.25	0.00	0.00	0.00	60.00

Segment Leq : 60.00 dBA

Total Leq All Segments: 60.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.00
(NIGHT): 60.00

Divergence Calculations - For Source-Receiver Distances < 15m Apart

Divergence - Line Source - 60 dBA (Nighttime) - 2-UMCU

Origin	Distance	d1	15	m
	Noise	n1	58.61	dBA
Receiver	Noise	n2	60	dBA
Distance (est)		d2	10.891589	

Note: Distance (est) = d1 / (10^((n2-n1)/10))
*When n2>n1

Divergence - Line Source - 65 dBA (Daytime) - 2-UCU

Origin	Distance	d1	15	m
	Noise	n1	64.29	dBA
Receiver	Noise	n2	65	dBA
Distance (est)		d2	12.737707	

Note: Distance (est) = d1 / (10^((n2-n1)/10))
*When n2>n1

Divergence - Line Source - 60 dBA (Nighttime) - 2-UCU

Origin	Distance	d1	15	m
	Noise	n1	56.85	dBA
Receiver	Noise	n2	60	dBA
Distance (est)		d2	7.2625855	

Note: Distance (est) = d1 / (10^((n2-n1)/10))
*When n2>n1