Noise Impact Assessment
994 Bronson Avenue
Ottawa, Ontario

Type of Document:
Site Plan Submission

Client:
Takyan Developments
300-100 Argyle Avenue
Ottawa, ON K2P 1B6

Project Number:
OTT-00238170-A0

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Date Submitted:
April 2017

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Legal Notification

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1 Introduction

Takyan Developments retained exp Services Inc. (**exp**) to undertake a noise impact assessment in support of a site plan application for a proposed three storey student residence building located at 994 Bronson Avenue in the City of Ottawa. The site is situated on the west side of Bronson Avenue between Holmwood and Findlay Avenues. The proposed building fronts Bronson Avenue which is classified as a 4-lane urban arterial (4-UAD) roadway. The building is also just under 100m north of a section of Queen Elizabeth Drive, which is classified as a two-lane urban arterial (2-UAU) roadway and is noted as a Federal Roadway (NCC) in the City of Ottawa's Transportation Master Plan. The site is subject to noise generated from vehicles travelling along Bronson Avenue as well as noise generated from the Queen Elizabeth Drive.

Noise levels were calculated on all four sides of the building façade. Outdoor Living Areas (OLAs) were assessed on the roof top and in the rear yard of the property. This report assesses noise impact from surface transportation sources only. No stationary noise sources were noted at the site which would exceed the sound level criteria, and therefore an assessment of stationary noise sources was outside the scope of this project.

This study was carried out in accordance with the Ministry of the Environment and Climate Change's (MOECC) Environmental Noise Control Guideline NPC-300 and the City of Ottawa's Environmental Noise Control Guidelines (COENCG). The findings of the study will address noise levels, and recommend if noise abatement measures are necessary to bring noise levels to acceptable levels. This noise impact study is prepared to address the following requirements as identified in Section 2.1 of the COENCG and Section 4.8.7 of the City's Official Plan (COOP):

Development proposals for new noise sensitive land uses are required to include a noise feasibility study and/or detailed noise study in the following locations:

- *Mixed Use Centre, Town Centre and Mainstreets as identified on Schedule B;*

or within

- *100 metres from the right-of-way of:*
  - *an existing or proposed arterial, collector or major collector road identified on Schedules E and F; or*
  - *a light rail transit corridor; bus rapid transit, or transit priority corridor identified on Schedule D;*
- *250 metres from the right-of-way of:*
  - *an existing or proposed highway;*
- *300 metres from the right of way of*
  - *a proposed or existing rail corridor or;*
  - *secondary main railway line;*
- *500 metres from the right-of-way of:*
  - *a 400-series provincial highway, freeway or*
  - *a principle main railway line.*

2 References

A summary of the documents that were referenced during the preparation of this report include the following:

- Ministry of the Environment Technical Document, ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, Sept 1999.
- Ministry of the Environment & Climate Change Publication NPC-300, Stationary and Transportation Sources Approvals and Planning, August 2013.
- City of Ottawa Official Plan (COOP), 2013.
- City of Ottawa Transportation Master Plan (COTMP), November 2013.
- City of Ottawa Environmental Noise Control Guidelines (COENCG), January 2016.

3 Sound Level Criteria

Ministry of the Environment & Climate Change requirements and the City of Ottawa Guidelines place limitations on indoor and outdoor sound levels from road traffic which are summarized in Table 3-1 below. Noise criteria is taken from Tables 2.2a and 2.2b from the COENCG.

Table 3-1: MOECC and City of Ottawa Indoor and Outdoor Criteria for Noise from Road Traffic

Location	Space	Time Period	Equivalent Level Leq (dBA)
Indoors	**Sleeping quarters of residences, hospitals, schools, nursing / retirement homes, etc.**	**Nighttime 23:00 to 07:00**	**40**
	Sleeping quarters of hotels/motels	Nighttime 23:00 to 07:00	45
	Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	**Daytime 07:00 to 23:00**	**45**
	Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	Nighttime 23:00 to 07:00	40
	General offices, reception areas, retail stores, etc.	Daytime 07:00 to 23:00	50
Outdoors	**Outdoor Living Areas**	**Daytime 07:00 to 23:00**	**55**

As the proposed project consists of a 3-storey residential building and includes outdoor amenity spaces, the noise criteria that applies for the indoor and outdoor areas are the rows shown **bold** in Table 3-1.

The basic physical measurement of noise used in this report is the A-weighted sound level measured in dBA, which is an overall measurement of sound over a full range of frequencies. Because noise from roadway traffic fluctuates over the audible range of hearing, it is convenient to describe noise in terms of an equivalent 24-hour sound level (denoted as Leq). MOECC Guidelines require that traffic noise be evaluated in relation to specific locations during certain time periods.

In general, noise levels are predicted for outdoor living areas (generally the backyard of a residential home) during the day and for indoor areas (living areas during the day and bedrooms during the nighttime. A summary of these requirements is shown in Tables 3-2 through 3-5.

Table 3-2: Outdoor, Ventilation & Warning Clause Requirements Road Noise, Daytime (0700-2300)

ASSESSMENT LOCATION	Leq (16 hr) (dBA)	VENTILATION REQUIREMENTS	OUTDOOR CONTROL MEASURES	WARNING CLAUSE
Outdoor Living Area (OLA)	Less than or equal to 55 dBA	N/A	None required	Not required
	Greater than 55 dBA to less than or equal to 60 dBA	N/A	Control measures (barriers) may not required but should be considered	Required if resultant Leq exceeds 55 dBA, Type A
	Greater than 60 dBA	N/A	Control measures (barriers) required to reduce the Leq to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible	Required if resultant Leq exceeds 55 dBA, Type B
Plane of Living Room Window	Greater than 50 dBA to less than or equal to 55 dBA	None required	N/A	Not required
	Greater than 55 dBA to less than or equal to 65 dBA	Forced air heating with provision for central air conditioning	N/A	Required Type C
	Greater than 65 dBA	Central air conditioning	N/A	Required Type D

Table 3-3: Ventilation and Warning Clause Requirements Road Noise, Nighttime (2300-0700)

ASSESSMENT LOCATION	L_{eq} (8 hr) (dBA)	VENTILATION REQUIREMENTS	WARNING CLAUSE
Plane of Bedroom Window	Greater than 50 dBA to less or equal to 60 dBA	Forced air heating with provision for central air conditioning	Required Type C
	Greater than 60 dBA	Central air conditioning	Required Type D

Table 3-4: Building Component Requirements Road Noise, Daytime (0700-2300)

ASSESSMENT LOCATION	NOISE SOURCE	L_{eq} (16 hr) (dBA)	WARNING CLAUSE
Plane of Living Room Window	Road	Less than or equal to 65 dBA	Building compliant with Ontario Building Code
		Greater than 65 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

Table 3-5: Building Component Requirements Road Noise, Nighttime (2300-0700)

ASSESSMENT LOCATION	NOISE SOURCE	L_{eq} (8 hr) (dBA)	WARNING CLAUSE
Plane of Bedroom Window	Road	Less than or equal to 60 dBA	Building compliant with Ontario Building Code
		Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

The warning clauses referred to above are contained in Table 3-6 below. Ministry of the Environment & Climate Change warning clauses and City of Ottawa specific warning clauses (*red italics*) are shown. Where applicable, these clauses are to be inserted on all Offers/Agreements of Purchase and Sale or Leases to notify potential purchasers and tenants of these environmental concerns. The City of Ottawa warning clauses were taken from Table A1 of the COENCG.

Table 3-6: MOECC Warning Clauses

Type A	"Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally 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." *"Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment."*
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 road traffic (rail traffic) (air 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." *"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/rail/Light Rail/transitway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment."*
Type C	"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." *"This dwelling unit has also been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment."*
Type D	"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment." *"This dwelling unit has been supplied with a central air conditioning system and other measures 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 City and the Ministry of the Environment."*
Type E	"Purchasers/tenants are advised that due to the proximity of the adjacent industry (facility) (utility), noise from the industry (facility) (utility) may at times be audible." *"Purchasers/tenants are advised that due to the proximity of the adjacent industry (facility) (utility), noise from the industry (facility) (utility) may at times interfere with outdoor activities."*

3.1 Vehicular Traffic Noise

The site is located within 100 meters from the right-of-way of an existing urban arterial roadway (Bronson Avenue) and a portion of the site is 100 meters from the Queen Elizabeth Drive therefore per the City's guidelines a noise assessment is required. Highway 417, which is a 4-lane freeway is greater than 1,000 meters north of the site and therefore is not accessed as a noise source. Figure 1 in Appendix A illustrates the overall site location.

Figure 2 in Appendix A illustrates the noise source and receiver locations used. In general, noise levels are predicted for: 1) building façade or plane of window (POW) during the daytime and nighttime, and 2) for Outdoor Living Areas (OLA) during the daytime.

Noise levels were calculated (or predicted) for the building façade at the Plane of the Window (POW) for either daytime or nighttime, and were used to dictate the action required to achieve the recommended sound level requirements. The mitigation of the indoor sound levels is achieved by selection of building architectural components (walls, windows, doors), based on the noise reduction required. The 16-hour daytime and 8-hour nighttime sound levels were calculated at six (6) locations around the site. Four (4) locations on the building façade and two (2) OLA spaces. The results of the predicted noise levels at the six locations stipulate the ventilation, building code and associated warning clause requirements.

Daytime and nighttime sound levels were assessed at the following locations, and are illustrated on Figure 2 (façade) and Figure 3 (OLAs)

- N (North façade of the building)
- S (South façade of the building)
- E (East façade of the building)
- W (West façade of the building)
- OLA 1 (Outdoor amenity space in backyard)
- OLA 2 (Outdoor amenity space on rooftop)

STAMSON file names used were denoted based on the location around the building, or at the outdoor living areas based on noise emanating from Bronson and Queen Elizabeth Drive (QED).

3.2 Aircraft/Airport Noise

The site is located outside the Airport Vicinity Development Zone and outside the Airport Operating Influence Zone as per Schedule K of the Ottawa Official Plan. The site is also outside both the 25 NEF and NEP contours therefore noise from air traffic does not impact this site.

3.3 Stationary Noise

A review of the surrounding building uses and the zoning of adjacent properties were completed to determine if there was a potential impact or influence from stationary noise sources. Typically, industrial and commercial land uses can be a potential stationary noise source. Stationary sources of noise include all sources of sound and vibration that will exist or operate within the site, excluding construction noise. The noise level criteria for stationary noise sources is the higher value between the exclusion limit values prescribed by the MOECC (and City of Ottawa) or the corresponding minimum hourly background /ambient sound level due to traffic. For OLA during the daytime and POW during the daytime or nighttime the exclusion limit values are 50 dBa and 45 dBa, respectively.

Just north of the property on the east side of Bronson Avenue there is an eleven (11) storey apartment building. A review of this building shows that there is no rooftop air conditioning unit, as individual window a/c units are visible. The closest corner of the 11-storey building to the site is more than 60 metres. From our observations, and considering the existing high levels of sound from Bronson Avenue road traffic, no significant stationary noise sources have been identified that are likely to cause noise levels exceeding the MOECC and City of Ottawa requirements.

4 Road Noise Prediction Procedures

All noise levels have been predicted using MOECC's software and methodology. STAMSON Version 5.03 (1999), which is based on the Ontario Road Noise Analysis Method for Environment and Transportation ("ORNAMENT") Model, was used for all calculations in this report. Detailed output files are attached in Appendix D for reference. In addition to the traffic data that was used in the analysis, theoretical noise predictions were based on the following information:

- Truck traffic on Bronson consists of 5% heavy trucks, 7% medium trucks. For the QED, no truck traffic is permitted and therefore was not included for this road segment.
- The Day/Night split used for roadways and freeways was 92% and 8%.
- Intermediate surfaces between the source and receiver locations were assessed as a reflective ground surface (facing Bronson Ave), or absorptive surface.
- Topography was assessed as flat/gentle slope facing east façade Bronson and elevated for other road segments.
- Road pavement and road gradient was assessed as typical asphalt or concrete and flat grade.

For all modelling with STAMSON, source and receivers were assumed to be elevated with a reflective separating surface. This ensures that no ground absorption is applied to the prediction results. Therefore, when no ground absorption is applied, the predicted sound levels do not increase with the height of the receiver, and the results are the same for all floors. This is a conservative assumption which simplifies the prediction of sound levels on all floors. Noise levels were assessed at the building facade.

Traffic information used for this study was obtained from the review of existing roadway conditions and reference to the City of Ottawa's Noise Control Guidelines. In proximity to the site, two roadways are within the required distance for potential noise impact evaluation. Road and traffic parameters used in our analysis are summarized in Table 4-1 below.

Table 4-1: Traffic and Road Parameters

Traffic Parameters	Bronson Avenue	*Queen Elizabeth Drive
R.O.W. WIDTH (m)	Approx. 23.5 m	N/A (NCC owned)
Roadway Type	2 Lane Urban Arterial Divided (4-UAD)	2 Lane Urban Arterial (2-UAU)
A.A.D.T. (veh/day)	35,000 or 17,500 / direction	15,000
Day/night split (%)	92 / 8	92 / 8
Medium trucks (%)	7	0
Heavy trucks (%)	5	0
Posted Speed Limit (km/hr)	50 km/hr	60 km/hr

**Queen Elizabeth Drive is designated truck free.*

5 Summary of Results

The predicted noise levels ranged from approximately

- The anticipated noise level on the east façade of the proposed building facing Bronson Avenue is approximately 71.9 dBA during the daytime and 64.3 dBa during the nighttime.
- The anticipated noise level on the north and south façade of the proposed building which are perpendicular to Bronson Avenue, range between 66.7 dBA & 68.3 dBA during the daytime and between 59.1 dBA & 60.7 dBA during the nighttime.
- The anticipated noise level on the west façade of the proposed building (facing backyard) is approximately 46.3 dBA during the daytime and 38.7 dBA during the nighttime.
- The anticipated noise levels in the rear yard OLA is approximately 45.3 dBA during the daytime and 41.1 dBA during the nighttime.
- The anticipated daytime noise levels on rooftop amenity space is approximately 69.2 dBA during the daytime. With the addition of a 1.7m noise attenuation barrier, the noise level would drop to 55.0 dBa.

A summary of predicted noise levels for various assessment locations is summarized below in Table 5-1 and 5-2 below. Detailed results and output from STAMSON Version 5.03 are contained in Appendix C.

Table 5-1: Summary of Anticipated Noise Levels

Receiver Location	Receptor Type	Combined Equivalent Noise Level Leq (dBa)	
		Daytime (07:00 – 23:00)	Nighttime (23:00 – 7:00)
N	Façade	66.72	59.12
S	Façade	68.28	60.68
E	Façade	71.87	64.27
W	Façade	46.34	38.74
OLA-1	Outdoor Amenity	45.32	41.08
OLA-2 (free-field) OLA-2 (with barrier in place)	Outdoor Amenity	69.38 55.02	61.78 47.43

6 Mitigation Measures

Table 6-1 below summarizes the requirements for ventilation, outdoor control measures and building components for all assessment locations.

Table 6-1: Summary of Requirements based on Receiver Location

Receiver Location	Outdoor Control Measures Warning Clause	Ventilation Requirement		*Building Component Requirement	
		Plane of Living Room Windows (Daytime)	Plane of Bedroom Windows (Nighttime)	Plane of Living Room Windows (Daytime)	Plane of Bedroom Windows (Nighttime)
N	n/a	Type D	Type C	Required	Compliant
S	n/a	Type D	Type D	Required	Required
E	n/a	Type D	Type D	Required	Required
W	n/a	None	None	Compliant	Compliant
OLA-1	Not Required	n/a	n/a	n/a	n/a
OLA-2	Noise Barrier, Type B	n/a	n/a	n/a	n/a

**Building Code Requirements.*
Required = Building components must be designed to achieve indoor sound levels criteria, or
Compliant = Building compliant with Ontario Building Code.

Table 6-2 below summarizes the noise attenuation barrier required to reduce noise levels in the outdoor living areas to acceptable levels. A minimum attenuation barrier of 1.7m is required around the perimeter of the rooftop terrace.

Table 6-2: Summary of Attenuation Barrier Requirements

Assessment Location	Height of Barrier Required (m)
OLA-1 (Rear yard Area at Ground Level)	Not required
OLA-2 (Rooftop Patio)	1.7

7 Indoor Noise Control Measures

When noise levels exceed 65 dBA during the daytime or 60 dBA during the nighttime as noted Tables 3-4 and 3-5 at the Plane of Window (POW) locations, then the building envelope (or building components) must be acoustically designed to ensure the indoor noise criteria is achieved. The indoor noise level required is 45 dBA during the daytime or 40 dBA during the nighttime as noted in Table 3-1. The appropriate building components are selected based on the Acoustic Insulation Factor (AIF), which is related to the difference in indoor and outdoor levels. The Acoustic Insulation Factor (AIF) needed to control the road traffic noise is calculated as follows:

AIF = L_{eq} outdoor façade – L_{eq} indoor + 10 log C + *2*

where:

Leq outdoor façade =	Outdoor façade sound level
Leq indoor =	Indoor objective sound level
C =	Number of building components forming envelope of room (typically equals 3 for a corner room and 2 for other rooms)

Table 7-1 below outlines the AIF required for various road traffic sound levels as well as the glazing requirements to meet MOECC guidelines. Based on the values below the nighttime sound levels require that both window and wall treatment comply with the Ontario Building Code.

Table 7-1 – AIF Values and Typical Building Treatments For Road Traffic Sound Levels

Daytime Façade Sound Level (dBa)	Nighttime Facade Sound Level (dBa)	Air Conditioning Requirement	AIF Required	Window Treatments	Wall Treatments
55 or less	50 or less	None	17 or less	None (OBC)	EW1
56 to 65	51 to 60	Provisions	18 to 27	None (OBC)	EW1
66 to 68	61 to 63	Required	28 to 30	None (OBC)	EW2
69 to 70	64 to 65	Required	31 to 32	STC 31 to 32	EW3
71 to 72	66 to 67	Required	33 to 34	STC 33 to 34	EW4
73 to 78	68 to 73	Required	35 to 40	STC 35 to 40	EW5
79	74	Required	41	STC 41	EW5

Source: " Road and Rail Noise: Effects on Housing", NHA 5156, 08/86 CMHC, 1986
Building treatments are based upon an assumed window/floor ratio of 25% and wall/floor ratio of 80%.
AIF is based on 3 components (i.e. corner room location. For 2 components (ie only one exterior wall) AIF would be 2 points lower.
OBC window: Requires Ontario Building Code compliant construction.
EW1 denotes a typical metal or vinyl clad siding exterior wall. EW1R denotes an EW1 exterior wall with interior drywall mounted on resilient channels.EW2 denotes an EW1 exterior wall with an additional

25mm of rigid insulation. EW4 denotes a typical 20mm stucco clad exterior wall. EW5 denotes a typical brick veneer clad exterior wall.

Floor plans and building elevations are still preliminary and therefore preparation of detailed acoustical specifications for the building envelope are not provided. Based on an assumed window/floor and window/floor ratios, the wall and window component requirements were estimated. Preliminary architectural plans are illustrated in Appendix C.

Once detailed building architectural plans are finalized, it is recommended that an acoustical consultant review and/or design the building components to ensure that indoor noise levels will meet the requirements.

Based on the results of Table 5-1 and the formula above for the required AIF, the minimum acoustical performance for the exterior façade was based on the daytime L_{EQ} = 71 for receiver E (Facing Bronson Avenue), an assumed wall/floor ratio of 80%, resulting in a required **AIF = 33 or an STC = 39**.

For the window requirements, based on the daytime L_{EQ} = 71 for receiver E (Facing Bronson Avenue), an assumed window/floor ratio of 25%, resulting in a required **AIF = 33 or an STC = 33.** Based on the preliminary estimate of 25% window/floor area, a 3-25-3 window would be required. This represents a double glazed windows with 3mm glass, and 25mm air space.

8 Recommendations

We recommend that the site plan application for the proposed development at 994 Bronson Avenue be approved from a “Noise Study” assessment perspective, based on the following:

A noise attenuation barrier be located around the rooftop terrace to reduce noise levels to acceptable levels for this amenity space. The noise attenuation barrier to meet specifications as identified in Part 5 of the City of Ottawa Environmental Noise Control Guidelines. A 1.7m high attenuation barrier is required to reduce anticipated noise levels to 55 dBa.

Preliminary floor plans and building elevations were used to estimate preliminary acoustical specifications for the exterior windows and wall facing Bronson Avenue. Once detailed building architectural plans are finalized, it is recommended that an acoustical consultant review and/or design the building components to ensure that anticipated indoor noise levels meet the requirements. In the meantime, the preliminary window/wall requirements are:

- The exterior façade (based on wall/floor ratio of 80%) results in a required **AIF = 33 or an STC = 39**.
- The exterior windows (based on window/floor ratio of 25%), results in a **AIF = 33 or an STC = 33.**

<u>For any unit within the proposed building that has an exterior wall facing east (Bronson Avenue), north or south (perpendicular to Bronson Avenue) shall require the following warning clauses to meet indoor noise criteria:</u>

Type D Warning Clause: “This dwelling unit has been supplied with a central air conditioning system and other measures 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 City and the Ministry of the Environment.”

Type B Warning Clause: "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 occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment."

For any unit within the proposed building that has an exterior wall facing west (away from Bronson Avenue), shall not require any warning clauses to meet indoor noise criteria, however a Type B Warning Clause is required.

Type B Warning Clause: "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 occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment."

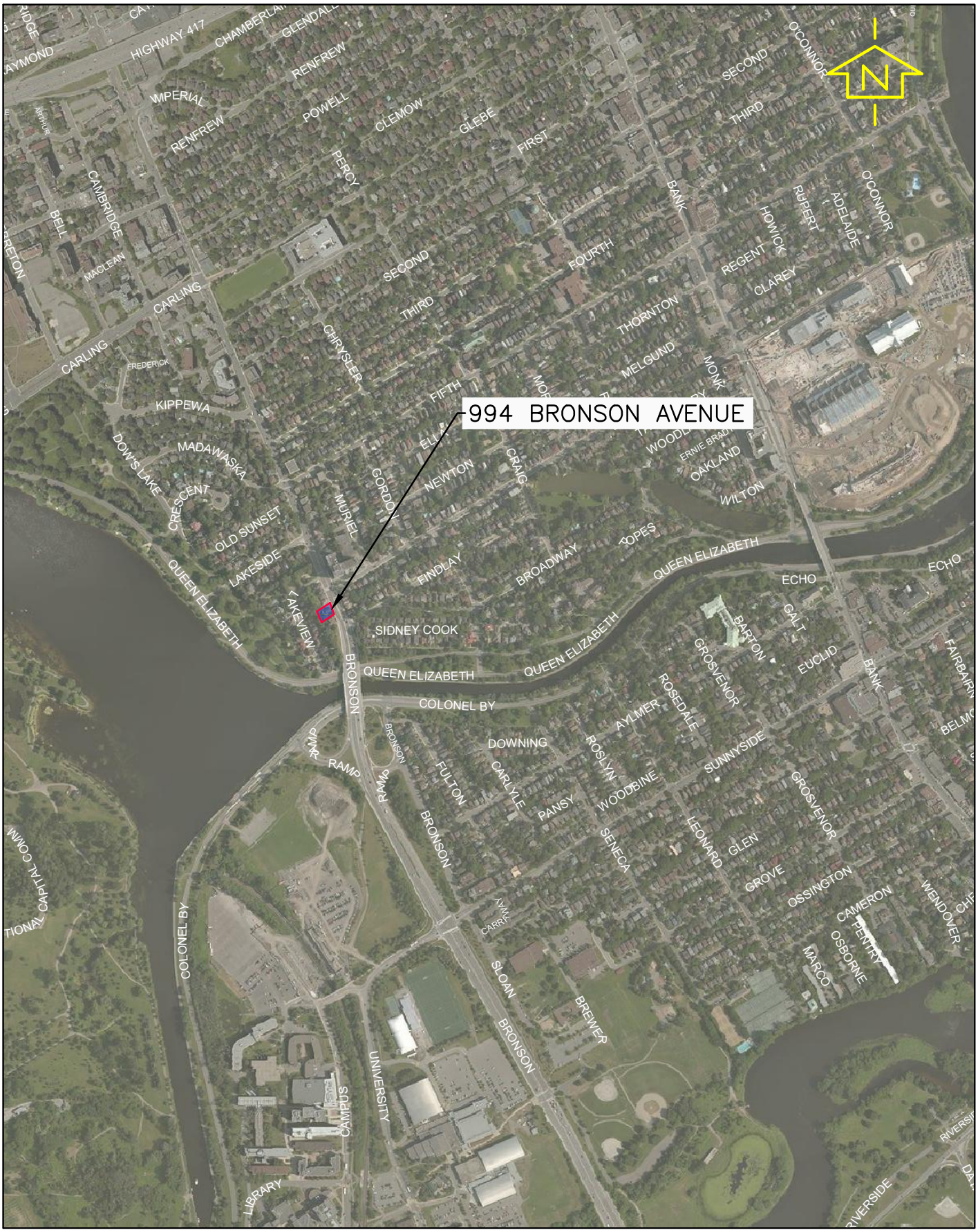
Warning clause shall be included in all Agreements of Purchase and Sale in accordance with the terms specified by the Development Agreement.

Appendix A – Figures

Figure 1 - Site Location Plan

Figure 2 – Source/Receiver Locations for Building Facade

Figure 3 - Source/Receiver Locations for Outdoor Amenity Areas



exp Services Inc. 100-2650 Queensview Drive Ottawa, ON K2B 8H6 www.exp.com	DESIGN JLF DRAWN SAB DATE APR 2017 FILE NO 237170	994 BRONSON AVENUE TAKYAN DEVELOPMENTS SITE LOCATION PLAN	SCALE 1:10,000 SKETCH NO FIG 1

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994 BRONSON AVE
TAKYAN DEVELOPMENTS

SOURCE/RECEIVER LOCATIONS
FOR BUILDING FACADE

SCALE	1:1000
FIGURE NO	FIG 2

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994 BRONSON AVENUE
TAKYAN DEVELOPMENTS

SOURCE/RECEIVER LOCATIONS
OUTDOOR AMENITY AREAS

SCALE 1:500

SKETCH NO FIG 3

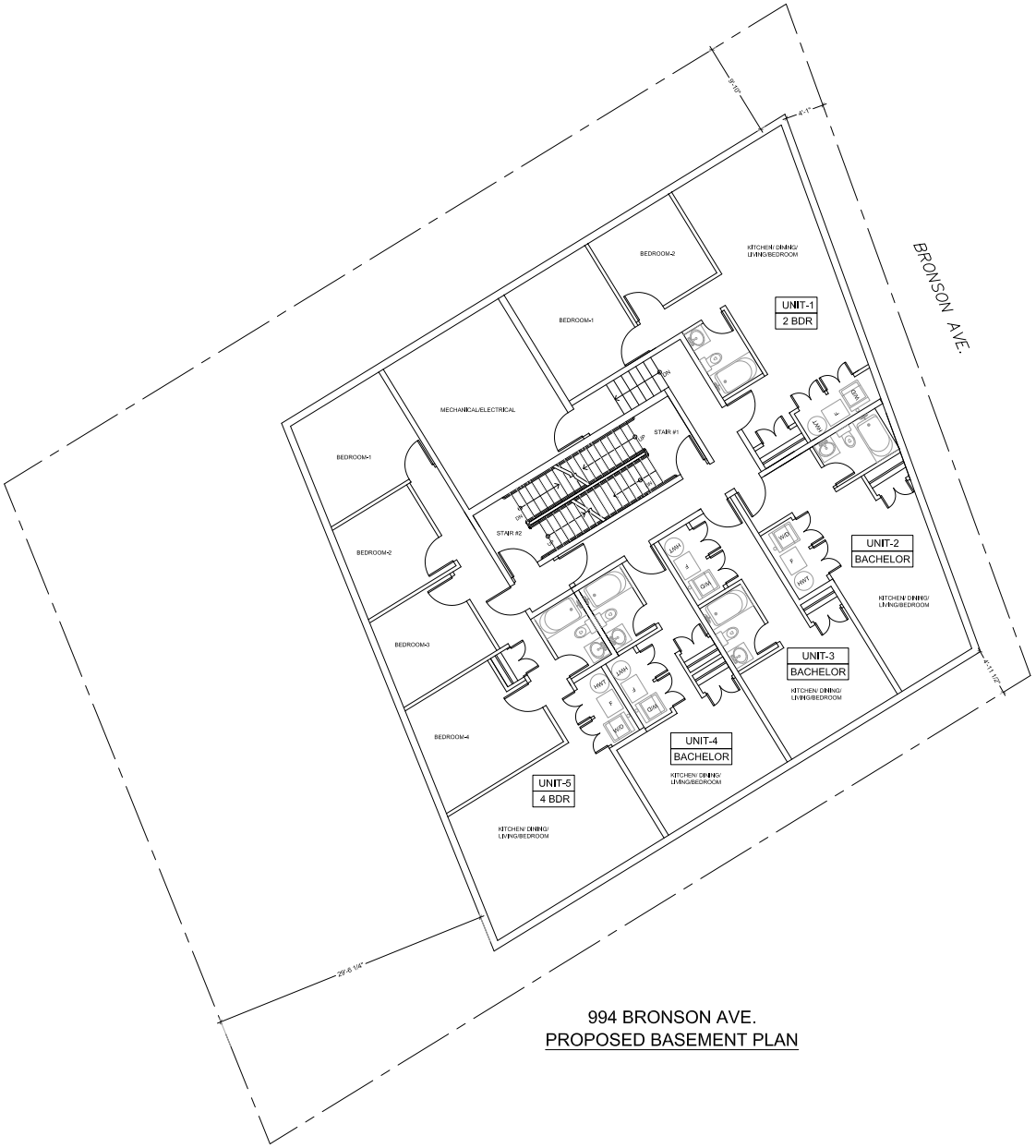
Appendix B – Tables

Table B1- Noise Source/Receiver Data

TABLE B1 - SOURCE/RECEIVER DATA

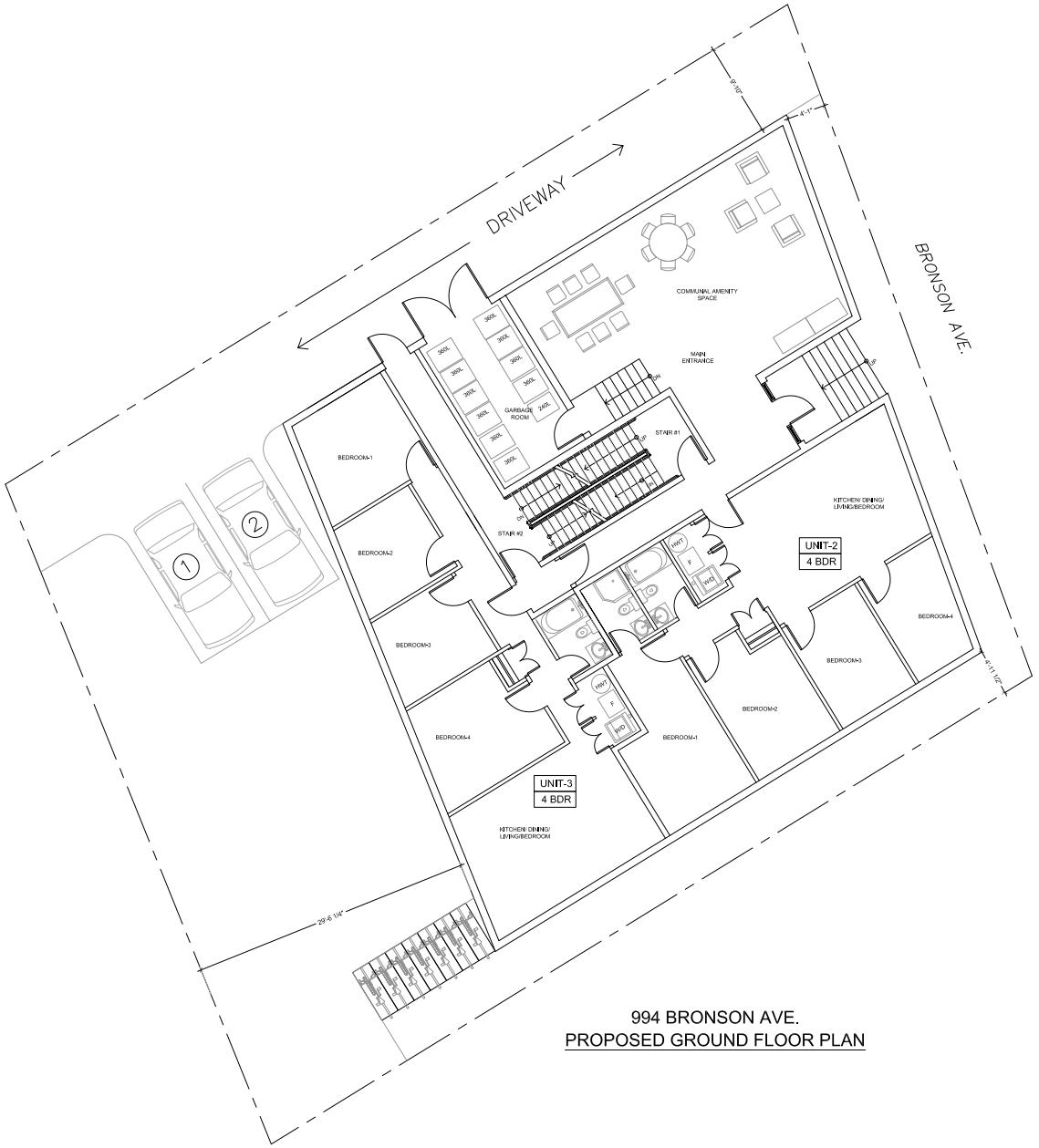
Location	Assessment Location	Stamson File Name		Noise Source	Angles		Source to Receiver Dist (m)	Source Ground Elev (m)	Receiver Ground Elev (m)	Receiver Height (m)	Elev Diff (Source-Receiver) (m)	Barrier to Receiver Dist (m)	Barrier Base Elev (m)	**Elevation Change (m)
		Unattenuated (Without/No Barrier)	Attenuated (With Barrier)		From	To								
N	Façade	N		Bronson - NB	-78	-9	25.80	70.8	71.05	1.5	0.25			
				Bronson - SB	-78	-9	16.50	70.8	71.05	1.5	0.25			
S	Façade	S		Bronson - NB	-9	+90	26.20	70.8	71.05	1.5	0.25			
				Bronson - SB	-9	+90	16.70	70.8	71.05	1.5	0.25			
				Queen Elizabeth Dr	-90	+72	115.00	66.5	71.05	1.5	4.55			
E	Façade	E		Bronson - NB	-88	+90	16.80	70.8	71.05	1.5	0.25			
				Bronson - SB	-88	+90	7.40	70.8	71.05	1.5	0.25			
W	Façade	W		Queen Elizabeth Dr	-74	+90	164.50	65.8	71.05	1.5	5.25			
OLA-1	Outdoor Amenity	OLA1		Queen Elizabeth Dr	-31	+30	161.00	66.5	70.80	1.5	4.30			
				Queen Elizabeth Dr	-37	+90	119.40	65.8	70.80	1.5	5.00			
OLA-2	Outdoor Amenity	OLA2-NB	OLA2-B	Queen Elizabeth Dr	-34	+42	173.10	65.8	81.00	1.5	15.20	5.70	81.00	15.20
				Queen Elizabeth Dr	-90	+33	122.40	66.5	81.00	1.5	14.50	4.00	81.00	14.50
				Bronson - NB	-35	+90	25.80	70.8	81.00	1.5	10.20	7.00	81.00	10.20
				Bronson - SB	-35	+90	16.50	70.8	81.00	1.5	10.20	7.00	81.00	10.20

Appendix C - Architectural Plans

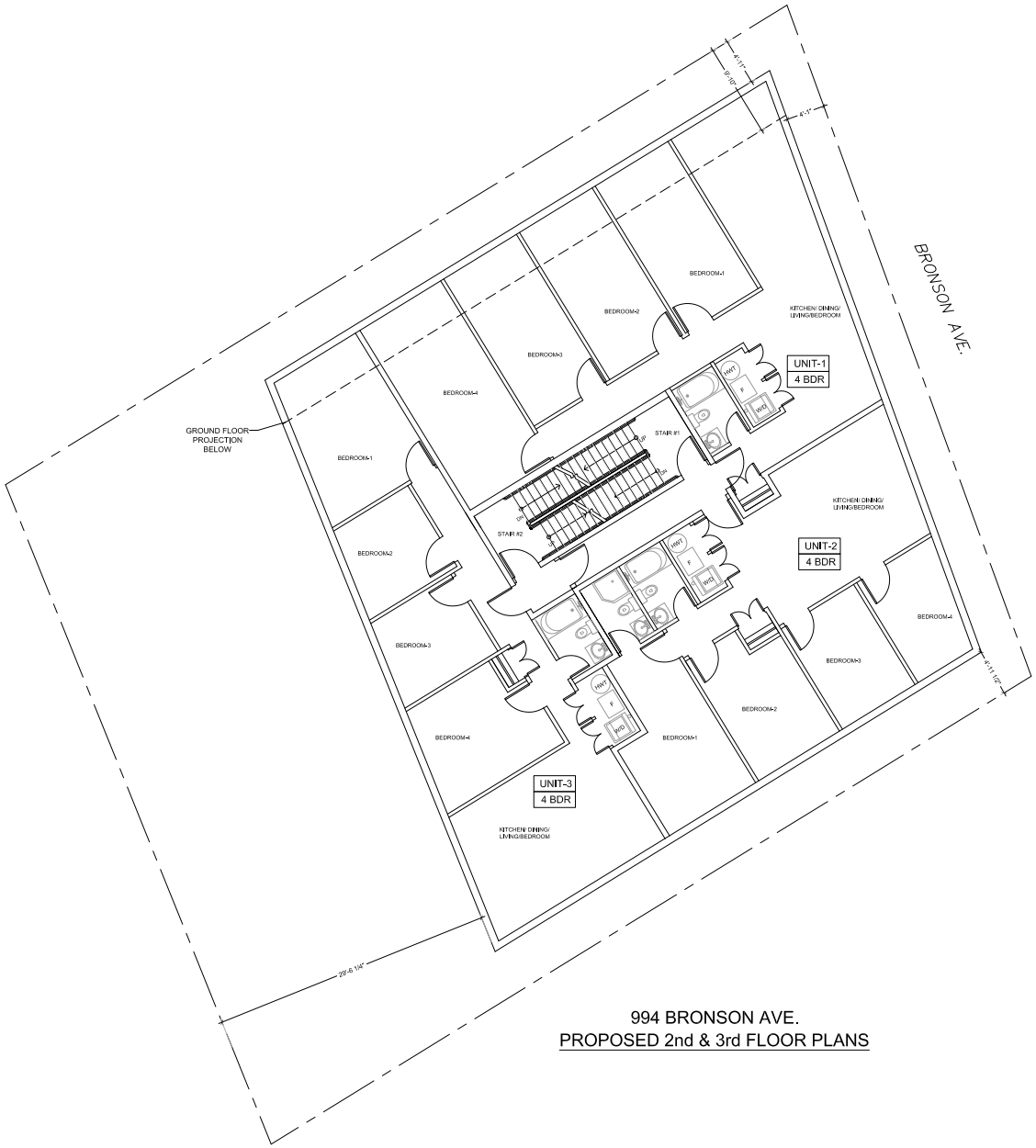


994 BRONSON AVE.

PROPOSED BASEMENT PLAN



994 BRONSON AVE.
PROPOSED GROUND FLOOR PLAN



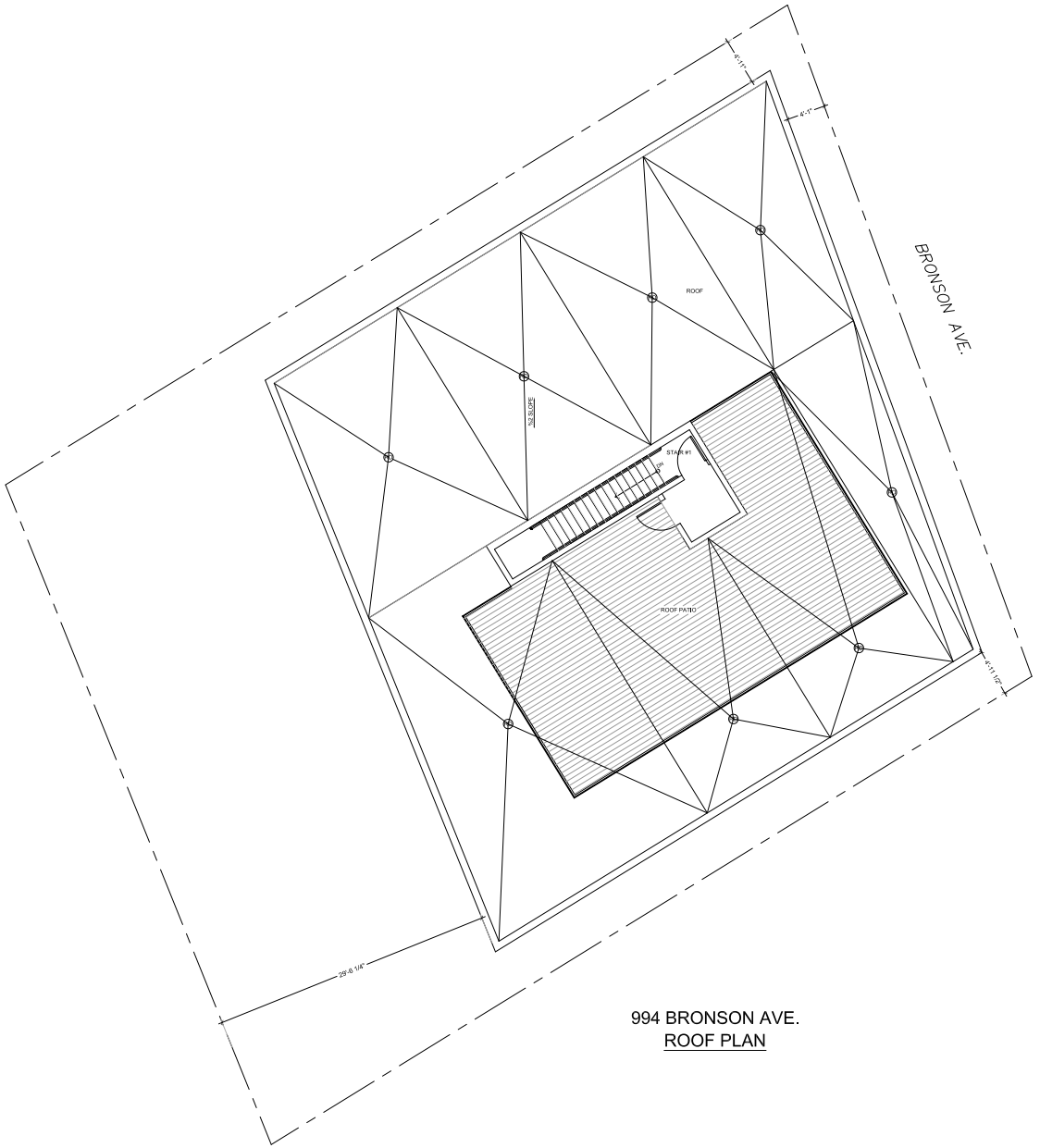
994 BRONSON AVE.
PROPOSED 2nd & 3rd FLOOR PLANS

994 BRONSON, UNIT TYPES					
UNIT TYPE	FLOOR NAME				TOTAL
	BASEMENT	GROUND FLOOR	SECOND FLOOR	THIRDFLOOR	
BACHELOR	3				3
2 BEDROOM	1				1
4 BEDROOM	1	2	3	3	9
				TOTAL	13

994 BRONSON	
FLOOR NAME	NUMBER OF BEDROOMS
BASEMENT	9
GROUND FLOOR	8
SECOND FLOOR	12
THIRD FLOOR	12
TOTAL	41

994 BRONSON	
FLOOR NAME	BUILDING AREA (sq.ft)
BASEMENT	3,625
GROUND FLOOR	3,625
SECOND FLOOR	3,932
THIRD FLOOR	3,932
TOTAL	15,114

NOTE: MECHANICAL/ELECTRICAL ROOM, GARBAGE ROOM AND AMENITIES WILL BE ON THE GROUND FLOOR. ALSO TWO EXTERIOR PARKING SPACES WILL BE PROVIDED AT THE REAR YARD OF THE BUILDING



994 BRONSON AVE.
ROOF PLAN

PROPOSED FRONT ELEVATION

Appendix D – STAMSON Output

E

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 13:23:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: e.te Time Period: Day/Night 16/8 hours
Description: EAST FACADE

Road data, segment # 1: BRONSON-NB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: BRONSON-NB (day/night)

Angle1 Angle2 : -88.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.80 / 16.80 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

↟
Road data, segment # 2: BRONSON-SB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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:

E

24 hr Traffic Volume (AADT or SADT): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: BRONSON-SB (day/night)

Angle1 Angle2 : -88.00 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 : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

↟
Results segment # 1: BRONSON-NB (day)

Source height = 1.50 m

ROAD (0.00 + 68.61 + 0.00) = 68.61 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-88	90	0.00	69.15	0.00	-0.49	-0.05	0.00	0.00	0.00	68.61

Segment Leq : 68.61 dBA

↟
Results segment # 2: BRONSON-SB (day)

Source height = 1.50 m

ROAD (0.00 + 69.10 + 0.00) = 69.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-88	90	0.00	69.15	0.00	0.00	-0.05	0.00	0.00	0.00	69.10

Segment Leq : 69.10 dBA

E

Total Leq All Segments: 71.87 dBA

Results segment # 1: BRONSON-NB (night)

Source height = 1.50 m

ROAD (0.00 + 61.01 + 0.00) = 61.01 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-88	90	0.00	61.55	0.00	-0.49	-0.05	0.00	0.00	0.00	61.01

Segment Leq : 61.01 dBA

Results segment # 2: BRONSON-SB (night)

Source height = 1.50 m

ROAD (0.00 + 61.50 + 0.00) = 61.50 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-88	90	0.00	61.55	0.00	0.00	-0.05	0.00	0.00	0.00	61.50

Segment Leq : 61.50 dBA

Total Leq All Segments: 64.27 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.87
(NIGHT): 64.27

N

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 12:45:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: n.te Time Period: Day/Night 16/8 hours
Description: NORTH FACADE

Road data, segment # 1: BRONSON-NB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: BRONSON-NB (day/night)

Angle1 Angle2 : -78.00 deg -9.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 25.80 / 25.80 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

↟
Road data, segment # 2: BRONSON-SB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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:

N

24 hr Traffic Volume (AADT or SADT): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: BRONSON-SB (day/night)

Angle1 Angle2 : -78.00 deg -9.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.50 / 16.50 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

↟
Results segment # 1: BRONSON-NB (day)

Source height = 1.50 m

ROAD (0.00 + 62.63 + 0.00) = 62.63 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	-9	0.00	69.15	0.00	-2.36	-4.16	0.00	0.00	0.00	62.63

Segment Leq : 62.63 dBA

↟
Results segment # 2: BRONSON-SB (day)

Source height = 1.50 m

ROAD (0.00 + 64.57 + 0.00) = 64.57 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	-9	0.00	69.15	0.00	-0.41	-4.16	0.00	0.00	0.00	64.57

Segment Leq : 64.57 dBA

N

Total Leq All Segments: 66.72 dBA

↟

Results segment # 1: BRONSON-NB (night)

Source height = 1.50 m

ROAD (0.00 + 55.03 + 0.00) = 55.03 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	-9	0.00	61.55	0.00	-2.36	-4.16	0.00	0.00	0.00	55.03

Segment Leq : 55.03 dBA

↟

Results segment # 2: BRONSON-SB (night)

Source height = 1.50 m

ROAD (0.00 + 56.97 + 0.00) = 56.97 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-78	-9	0.00	61.55	0.00	-0.41	-4.16	0.00	0.00	0.00	56.97

Segment Leq : 56.97 dBA

Total Leq All Segments: 59.12 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 66.72
(NIGHT): 59.12

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 13:12:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: ola1.te Time Period: Day/Night 16/8 hours
Description: OLA 1

Road data, segment # 1: QED1 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: QED1 (day/night)

Angle1 Angle2 : -31.00 deg 30.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 161.00 / 161.00 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.30 m
Reference angle : 0.00

Road data, segment # 2: QED2 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: QED2 (day/night)

Angle1 Angle2 : -37.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 119.40 / 119.40 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 5.00 m
Reference angle : 0.00

Results segment # 1: QED1 (day)

Source height = 0.50 m

ROAD (0.00 + 42.78 + 0.00) = 42.78 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-31	30	0.56	63.68	0.00	-16.09	-4.82	0.00	0.00	0.00	42.78

Segment Leq : 42.78 dBA

Results segment # 2: QED2 (day)

Source height = 0.50 m

ROAD (0.00 + 41.79 + 0.00) = 41.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-37	90	0.54	63.68	0.00	-13.87	-2.42	0.00	-5.60	0.00	41.79

Segment Leq : 41.79 dBA

Total Leq All Segments: 45.32 dBA

Results segment # 1: QED1 (night)

Source height = 0.50 m

ROAD (0.00 + 35.18 + 0.00) = 35.18 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-31	30	0.56	56.09	0.00	-16.09	-4.82	0.00	0.00	0.00	35.18

Segment Leq : 35.18 dBA

Results segment # 2: QED2 (night)

Source height = 0.50 m

ROAD (0.00 + 39.79 + 0.00) = 39.79 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-37	90	0.54	56.09	0.00	-13.87	-2.42	0.00	0.00	0.00	39.79

Segment Leq : 39.79 dBA

Total Leq All Segments: 41.08 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 45.32
(NIGHT): 41.08

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 13:39:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: ola2b.te Time Period: Day/Night 16/8 hours
Description: OLA 2 - WITH BARRIER

Road data, segment # 1: QED1 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: QED1 (day/night)

Angle1 Angle2 : -34.00 deg 42.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 173.10 / 173.10 m
Receiver height : 1.50 / 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -34.00 deg Angle2 : 42.00 deg
Barrier height : 1.70 m
Elevation : 15.20 m
Barrier receiver distance : 5.70 / 5.70 m
Source elevation : 65.80 m
Receiver elevation : 81.00 m
Barrier elevation : 81.00 m
Reference angle : 0.00

↟
Road data, segment # 2: QED2 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *

Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: QED2 (day/night)

Angle1 Angle2 : -90.00 deg 33.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 122.40 / 122.40 m
Receiver height : 1.50 / 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 33.00 deg
Barrier height : 1.70 m
Elevation : 14.50 m
Barrier receiver distance : 4.00 / 4.00 m
Source elevation : 66.50 m
Receiver elevation : 81.00 m
Barrier elevation : 81.00 m
Reference angle : 0.00

↟
Road data, segment # 3: BRONSON-NB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
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 # 3: BRONSON-NB (day/night)
--------------------------------------------
Angle1   Angle2           : -35.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  25.80 / 25.80  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -35.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.70 m
Elevation                 :  10.20 m
Barrier receiver distance :   7.00 / 7.00   m
Source elevation          :  70.80 m
Receiver elevation        :  81.00 m
Barrier elevation         :  81.00 m
Reference angle           :   0.00

♠
Road data, segment # 4: BRONSON-SB (day/night)
----------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 4: BRONSON-SB (day/night)
--------------------------------------------
Angle1   Angle2           : -35.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.50 / 16.50  m
Receiver height           :   1.50 / 1.50   m
```



```
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -35.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.70 m
Elevation                 :  10.20 m
Barrier receiver distance :   7.00 / 7.00   m
Source elevation          :  70.80 m
Receiver elevation        :  81.00 m
Barrier elevation         :  81.00 m
Reference angle           :   0.00

♠
Results segment # 1: QED1 (day)
-------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !        1.50 !        0.97 !        81.97

ROAD (0.00 + 40.86 + 0.00) = 40.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -34     42   0.13  63.68   0.00 -12.02  -3.79   0.00   0.00  -7.01  40.86
-------------------------------------------------------------------------------

Segment Leq : 40.86 dBA

♠
Results segment # 2: QED2 (day)
-------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !        1.50 !        0.99 !        81.99

ROAD (0.00 + 44.28 + 0.00) = 44.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     33   0.15  63.68   0.00 -10.51  -1.97   0.00   0.00  -6.93  44.28
```

Segment Leq : 44.28 dBA

↟
Results segment # 3: BRONSON-NB (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-1.27	79.73

ROAD (0.00 + 51.87 + 0.00) = 51.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	69.15	0.00	-2.36	-1.58	0.00	0.00	-13.34	51.87

Segment Leq : 51.87 dBA

↟
Results segment # 4: BRONSON-SB (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-2.83	78.17

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
-35	90	0.00	69.15	0.00	-0.41	-1.58	0.00	0.00	-16.19	50.97

Segment Leq : 50.97 dBA

Total Leq All Segments: 55.02 dBA

↟
Results segment # 1: QED1 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	1.50	0.97	81.97

ROAD (0.00 + 33.27 + 0.00) = 33.27 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-34	42	0.13	56.09	0.00	-12.02	-3.79	0.00	0.00	-7.01	33.27

Segment Leq : 33.27 dBA

↟
Results segment # 2: QED2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	1.50	0.99	81.99

ROAD (0.00 + 36.68 + 0.00) = 36.68 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	33	0.15	56.09	0.00	-10.51	-1.97	0.00	0.00	-6.93	36.68

Segment Leq : 36.68 dBA

↟
Results segment # 3: BRONSON-NB (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-1.27	79.73

ROAD (0.00 + 44.28 + 0.00) = 44.28 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	61.55	0.00	-2.36	-1.58	0.00	0.00	-13.34	44.28

Segment Leq : 44.28 dBA

Results segment # 4: BRONSON-SB (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	1.50	-2.83	78.17

ROAD (0.00 + 43.37 + 0.00) = 43.37 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	61.55	0.00	-0.41	-1.58	0.00	0.00	-16.19	43.37

Segment Leq : 43.37 dBA

Total Leq All Segments: 47.43 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.02
(NIGHT): 47.43

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 13:21:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: ola2.te Time Period: Day/Night 16/8 hours
Description: OLA 2 - FREEFIELD

Road data, segment # 1: QED1 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: QED1 (day/night)

Angle1 Angle2 : -34.00 deg 42.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 173.10 / 173.10 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 15.20 m
Reference angle : 0.00

Road data, segment # 2: QED2 (day/night)

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: QED2 (day/night)

Angle1 Angle2 : -90.00 deg 33.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 119.40 / 119.40 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 14.50 m
Reference angle : 0.00

Road data, segment # 3: BRONSON-NB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
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 # 3: BRONSON-NB (day/night)

Angle1 Angle2 : -35.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 25.80 / 25.80 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)

```
Elevation                :  10.20 m
Reference angle          :   0.00
```

Road data, segment # 4: BRONSON-SB (day/night)

```
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    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):  17500
    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 # 4: BRONSON-SB (day/night)

```
Angle1   Angle2           : -35.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.50 / 16.50  m
Receiver height           :   1.50 / 1.50   m
Topography                :      3       (Elevated; no barrier)
Elevation                 :  10.20 m
Reference angle           :   0.00
```

Results segment # 1: QED1 (day)

Source height = 0.50 m

ROAD (0.00 + 46.75 + 0.00) = 46.75 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-34	42	0.23	63.68	0.00	-13.11	-3.82	0.00	0.00	0.00	46.75

Segment Leq : 46.75 dBA

Results segment # 2: QED2 (day)

Source height = 0.50 m

ROAD (0.00 + 50.23 + 0.00) = 50.23 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	33	0.25	63.68	0.00	-11.31	-2.15	0.00	0.00	0.00	50.23

Segment Leq : 50.23 dBA

Results segment # 3: BRONSON-NB (day)

Source height = 1.50 m

ROAD (0.00 + 65.21 + 0.00) = 65.21 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	69.15	0.00	-2.36	-1.58	0.00	0.00	0.00	65.21

Segment Leq : 65.21 dBA

Results segment # 4: BRONSON-SB (day)

Source height = 1.50 m

ROAD (0.00 + 67.15 + 0.00) = 67.15 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	69.15	0.00	-0.41	-1.58	0.00	0.00	0.00	67.15

Segment Leq : 67.15 dBA

Total Leq All Segments: 69.38 dBA

Results segment # 1: QED1 (night)

Source height = 0.50 m

ROAD (0.00 + 39.16 + 0.00) = 39.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-34	42	0.23	56.09	0.00	-13.11	-3.82	0.00	0.00	0.00	39.16

Segment Leq : 39.16 dBA

Results segment # 2: QED2 (night)

Source height = 0.50 m

ROAD (0.00 + 42.63 + 0.00) = 42.63 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	33	0.25	56.09	0.00	-11.31	-2.15	0.00	0.00	0.00	42.63

Segment Leq : 42.63 dBA

Results segment # 3: BRONSON-NB (night)

Source height = 1.50 m

ROAD (0.00 + 57.61 + 0.00) = 57.61 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	61.55	0.00	-2.36	-1.58	0.00	0.00	0.00	57.61

Segment Leq : 57.61 dBA

Results segment # 4: BRONSON-SB (night)

Source height = 1.50 m

ROAD (0.00 + 59.56 + 0.00) = 59.56 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-35	90	0.00	61.55	0.00	-0.41	-1.58	0.00	0.00	0.00	59.56

Segment Leq : 59.56 dBA

Total Leq All Segments: 61.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 69.38
(NIGHT): 61.78

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STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 12:44:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: s.te Time Period: Day/Night 16/8 hours
Description: SOUTH FACADE

Road data, segment # 1: BRONSON-NB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: BRONSON-NB (day/night)

Angle1 Angle2 : -9.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 26.20 / 26.20 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

↟
Road data, segment # 2: BRONSON-SB (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: BRONSON-SB (day/night)

Angle1 Angle2 : -9.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.70 / 16.70 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 0.25 m
Reference angle : 0.00

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

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

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

Angle1 Angle2 : -90.00 deg 72.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 115.00 / 115.00 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)

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Elevation : 4.55 m
Reference angle : 0.00

Results segment # 1: BRONSON-NB (day)

Source height = 1.50 m

ROAD (0.00 + 64.13 + 0.00) = 64.13 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-9	90	0.00	69.15	0.00	-2.42	-2.60	0.00	0.00	0.00	64.13

Segment Leq : 64.13 dBA

Results segment # 2: BRONSON-SB (day)

Source height = 1.50 m

ROAD (0.00 + 66.09 + 0.00) = 66.09 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-9	90	0.00	69.15	0.00	-0.47	-2.60	0.00	0.00	0.00	66.09

Segment Leq : 66.09 dBA

Results segment # 3: QED (day)

Source height = 0.50 m

ROAD (0.00 + 48.47 + 0.00) = 48.47 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	72	0.55	63.68	0.00	-13.74	-1.47	0.00	0.00	0.00	48.47

Segment Leq : 48.47 dBA

Total Leq All Segments: 68.28 dBA

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Results segment # 1: BRONSON-NB (night)

Source height = 1.50 m

ROAD (0.00 + 56.53 + 0.00) = 56.53 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-9	90	0.00	61.55	0.00	-2.42	-2.60	0.00	0.00	0.00	56.53

Segment Leq : 56.53 dBA

Results segment # 2: BRONSON-SB (night)

Source height = 1.50 m

ROAD (0.00 + 58.49 + 0.00) = 58.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-9	90	0.00	61.55	0.00	-0.47	-2.60	0.00	0.00	0.00	58.49

Segment Leq : 58.49 dBA

Results segment # 3: QED (night)

Source height = 0.50 m

ROAD (0.00 + 40.87 + 0.00) = 40.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	72	0.55	56.09	0.00	-13.74	-1.47	0.00	0.00	0.00	40.87

Segment Leq : 40.87 dBA

Total Leq All Segments: 60.68 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.28

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(NIGHT): 60.68

STAMSON 5.0 NORMAL REPORT Date: 30-03-2017 13:03:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: w.te Time Period: Day/Night 16/8 hours
Description: WEST FACADE

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

Car traffic volume : 13800/1200 veh/TimePeriod *
Medium truck volume : 0/0 veh/TimePeriod *
Heavy truck volume : 0/0 veh/TimePeriod *
Posted speed limit : 60 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): 15000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 0.00
Heavy Truck % of Total Volume : 0.00
Day (16 hrs) % of Total Volume : 92.00

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

Angle1 Angle2 : -74.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 164.50 / 164.50 m
Receiver height : 1.50 / 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 5.25 m
Reference angle : 0.00

Results segment # 1: QED (day)

Source height = 0.50 m

ROAD (0.00 + 46.34 + 0.00) = 46.34 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-74	90	0.53	63.68	0.00	-15.94	-1.41	0.00	0.00	0.00	46.34

Segment Leq : 46.34 dBA

Total Leq All Segments: 46.34 dBA

Results segment # 1: QED (night)

Source height = 0.50 m

ROAD (0.00 + 38.74 + 0.00) = 38.74 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-74	90	0.53	56.09	0.00	-15.94	-1.41	0.00	0.00	0.00	38.74

Segment Leq : 38.74 dBA

Total Leq All Segments: 38.74 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 46.34
(NIGHT): 38.74