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Bridor Developments – 3817-3843 Innes Road Apartment Buildings
Noise Impact Study

Dear Eric,

We are pleased to present the following traffic noise study for a new proposed residential development of three apartment buildings located at 3817-3843 Innes Road in Ottawa, Ontario. As part of the Site Plan Application (SPA), the City of Ottawa has requested a traffic noise study to be performed. The planned development is for three new apartment buildings (Block A, Block B and Block C) with a total of 98 units which is in proximity to Innes Road and Frank Bender Road. As per City of Ottawa requirements, noise from traffic and noise from the surrounding area onto the new buildings is to be considered, and noise from the new buildings to the surrounding area must also be considered. There is no significant or large noise-making equipment included in the design of the three new buildings, therefore noise from the new development to the surrounding area will be minimal however at the request of the City of Ottawa we have provided a brief overview of the noise from condensing units to the surrounding area.

This study considers traffic noise from Innes Road (~11m from north façade of closest building) and Frank Bender St. (~70m from east façade of building). These noise sources are the only traffic noise sources considered in this study. All other noise sources, such as principal rail lines and airport influence zone are outside of limits as per the City of Ottawa ENCG and Schedule F of the City of Ottawa Official Plan. In addition to the traffic noise, we have also conducted measurements at the proposed development site in order to determine whether noise from the adjacent commercial and retail area on the south side of Innes Road will have an impact on the development.

It was found that noise levels at the plane of window (POW) on the ground floor are above 55 dBA and a detailed building component analysis was completed. Mitigation measures above the Ontario Building Code (OBC) were found to be required for windows in closer proximity to Innes Road. Our full traffic nose analysis is provided in Section 4.0 and 5.0. In addition, our analysis of noise from the surrounding area showed that traffic noise is the only significant nearby noise source and that no equipment from the retail area will have an impact on the new development. We have also addressed any potential noise from the condensing units to the surrounding area for the new development as well and have provided some general recommendations in Section 6.0.

1.0 Introduction

State of the Art Acoustik Inc. was commissioned by Bridor Developments to complete a noise impact study as requested by the City of Ottawa for the site plan application of a proposed three building residential apartment building to be located at 3817-3843 Innes Rd. in Ottawa, Ontario. We have followed the 2016 City of Ottawa Environmental Noise Control Guidelines (ENCG), which are compliant with the Ministry of Environment, Conservation and Park's (MECP) NPC-300.

In Section 2.0, the site plan of the building is shown and surrounding area is analyzed for possible noise sources which would impact the proposed development. This section also shows angles and distances from the sources to receptor points. This study includes noise from road and LRT sources and there are no other nearby sources. In addition, this analysis does not include an analysis of stationary noise to the surrounding area, as no significant additional noise sources are anticipated.

In Section 3.0, the noise impact calculation procedure is described and in Section 4.0, the predicted noise impact from Innes Road and Frank Bender St. has been analyzed. Section 5.0 provides a detailed analysis of the building components of the development, as the noise levels at the exterior PORs is above 55 dBA.

Section 6.0 discusses other noise impacts onto the building itself, and includes the results and discussion of measurements taken on the proposed site of the development in order to determine the impact of the commercial area located across Innes Road from the development site. This section also provides a brief overview of the mechanical equipment to be used for the three buildings and their potential impact to the surrounding area.

2.0 Site Plan Evaluation

2.1 Project Description

The proposed development consists of three new residential apartment buildings, Block A, Block B and Block C, which are three storeys, five storeys and three storeys, respectively. The buildings are located at 3817 to 3843 Innes Road in Ottawa, Ontario. The area surrounding the development consists primarily of low-rise residential buildings and a retail area, including a large hardware store, pet store and bank on the south side of Innes Road and a gas station to the east. We have considered traffic noise from Innes Road and Frank Bender Street as the only traffic noise sources for this location, as per the City of Ottawa requirements, and all other potential road noise sources are outside of the distances outlined in Section 2.2.1 of the City of Ottawa Environmental Noise Control Guidelines.

2.2 Site Plan Review

The following Figure 2.1 shows the site plan of the three buildings including its proximity to Innes Road, which is located approximately 10.5m from the closest façade of Block C. Figure 2.2 shows the proposed site with distances to Innes Road and Frank Bender St., which is approximately 70m from the

nearest façade to the east. Innes Road and Frank Bender are defined as an arterial road and collector, respectively, as per City of Ottawa Schedule E.

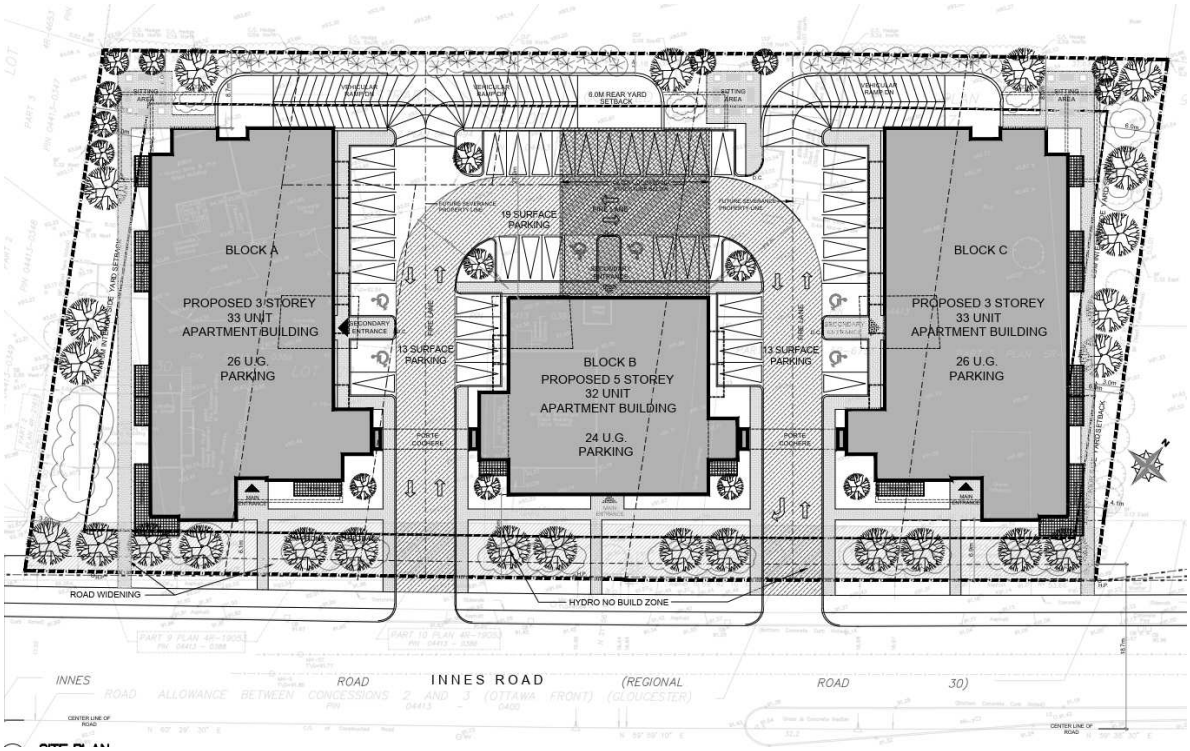

Figure 2.1 – Site plan of 3817-3843 Innes Road.

Figure 2.2 – Surrounding area 3817-3843 Innes Rd. with locations, distances and angles of relevant noise sources

3.0 NOISE IMPACT PROCEDURE

3.1 Procedure Used to Assess Noise Impacts

This assessment uses the City of Ottawa Environmental Noise Control Guidelines (ENCG), dated January 2016, to assess and mitigate noise from roads, transit ways, railways and aircraft. The maximum road noise levels for indoor areas that apply to this building are taken from Table 2.2b of the ENCG and summarized in Table 3.1 below.

Time	Indoor Leq Levels (dBA) Class 1, 2 & 3 Areas
	Road Traffic Noise Level Limit (dBA)
07:00 – 23:00	**45** for living/dining areas of residences and sleeping quarters
23:00 - 07:00	**40** for sleeping quarters

Table 3.1 – Criteria for Indoor Area Road Noise Levels

The ENCG states that noise control studies are to be prepared when the indoor area is within the following setback distances from the road, highway and railway noise sources:

- 100m from an arterial road or a major collector, light rail corridor or bus rapid transitway
- 250m from an existing or proposed highway
- 300m from a proposed or existing rail corridor or secondary main railway line
- 500m from a 400-series provincial highway or principle main railway line

Both Innes Road and Frank Bender Street are both within 100m of the planned development and therefore an analysis of the impact of traffic noise is required.

3.2 Noise Attenuation Requirements

This section outlines the required noise control measures and warning clauses and when to apply them, as stipulated by the ENCG for placement within purchase agreements.

If sound levels are predicted to be less than the specified criteria, no attenuation measures are required on the part of the proponent. If the predicted noise exceeds the criteria, the City of Ottawa recommends several attenuation measures.

These attenuation measures may include any or all of the following:

- construction of a noise barrier wall and/or berm;
- installation of a forced air ventilation system with provision for central air;
- installation of central air;
- acoustically selected building façade components

Where excessive noise levels may adversely affect the property or its use, the ENCG requires notices in the form of a Warning Clause to be placed on title in order to alert the buyer or renter of a possible

environmental noise condition or a limitation on his/her property rights. The notices on title must be included in the Development Agreement(s) and in the Agreement(s) or Offer(s) of Purchase and Sale.

The City of Ottawa requires a Warning Clause whenever noise could meet or exceed 55 dBA 16 hour L_{eq} at the Outdoor Living Area or Plane of Window of any living or sleeping area prior to any noise mitigation.

Table 3.2 provides the types of warning clauses and example text to be adapted into warning clauses. These warning clauses should be taken as *example only* and are taken from Appendix A of the ENCG which also states:
"*A warning clause is not considered a form of noise mitigation. It is not acceptable therefore to use warning clauses in place of physical noise control measures to identify an excess over the MOE or City noise limits*."

TYPE	Example Text	Notes
Generic	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transit way 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. To help address the need for sound attenuation this development has been designed so as to provide an indoor environment that is within provincial guidelines. Possible measures for sound attenuation include: • multi-pane glass; • brick veneer; • concrete panels;	The generic warning clause outlines that MOE sound levels may be exceeded but the indoor environment is within guidelines. Mitigation measures are described including urban design features. Mention is also made of landscaping to screen the development visually from the source of noise.
Extensive mitigation of indoor and outdoor amenity area	"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. To help address the need for sound attenuation this development may include: • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. 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	The warning clause makes reference to MOE sound levels being exceeded from time to time and that there are sound attenuation features and landscaping within the development that should be maintained.

	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.	
No outdoor amenity area	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic will interfere with outdoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this development may includes • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. 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.	This warning clause notes that only an indoor environment is being provided for.

Table 3.3 - Warning Clause Types and Example Text from the City of Ottawa (from ENCG Table A1)

3.3 Building Component Assessment (AIF Analysis)

According to the ENCG, when noise levels could exceed 55 dBA at the Plane of Windows (POW) of a living area (day) or sleeping quarters (night) the exterior cladding system of the building envelope must be acoustically designed to ensure the indoor noise criteria is achieved. The City of Ottawa recognizes the Acoustic Insulation Factor (AIF[1]) method as an appropriate analysis technique.

To comply with the City of Ottawa policies, the building envelope will require a minimum AIF rating to provide the indoor noise level required for living, dining and bedrooms of residential dwellings as described below.

The City of Ottawa's ENCG outlines the following maximum indoor L_{eq} limits:

- maximum daytime indoor L_{eq} for living spaces should be 45 dBA
- maximum nighttime indoor L_{eq} for bedrooms should be 40 dBA

For the overall exterior wall of any room, the required AIF for road and rail transportation noise is:

Required AIF = Outside L_{eq} - Indoor L_{eq} (Req) + 2dB **(1)**

When the exterior is comprised of components, then the AIF required of each component is determined by the following equation[1]:

Required AIF = Outside L_{eq} - Indoor L_{eq} (Req) + 10 $\log_{10}$ (Number of Components) + 2dB (2)

The required AIF is based on the Outside L_{eq}, Indoor L_{eq} required and the total number of exterior façade components. The AIF method allows for the number of components to be reduced if any component significantly exceeds the required AIF[1]:

"If the AIF of any component exceeds the required AIF by 10 or more, the calculation should be repeated for the other components with the 'total number of components' reduced by one. This reduction in the number of components lowers the required AIF for the others."

[1] J.D. Quirt, Building Research Note: Acoustic Insulation Factor: A Rating for the Insulation of Buildings against Outdoor Noise, National Rearch Council [Revised June 1980]

4.0 Surface Transportation Noise Study

The following section describes our analysis of the road noise impact on the three buildings at 3817-3843 Innes Rd.

4.1 Road Traffic Information

For this study, the only surface transportation noise sources considered was traffic from Innes Road, located just south of the development and Frank Bender Street, which is located to the east of the new development. The new proposed building is farther than 100m from any other collector or arterial road, and is not near any rail lines or within the zone of influence of the airport therefore no other surface noise sources are considered.

Table 4.1 below summarizes the roadway's parameters obtained from Table B1 on p. 75 of The City of Ottawa Environmental Noise Control Guidelines 2016, "Appendix B: Table of Traffic and Road Parameters To Be Used For Sound Level Predictions" for the respective roadway class.

Roadway	Implied Roadway Class	Annual Average Daily Traffic (AADT) Veh/Day	Posted Speed	Day/Night Split (%)	Medium Trucks (%)	Heavy Trucks (%)
Innes Road	4 Lane Urban Arterial - Divided	35,000	60 km/h	92/8	7	5
Frank Bender Street	2 Lane Urban Collector	8,000	40km/h	92/8	7	5

Table 4.1 – Summary of Major Roadway Noise Sources.

4.2 Procedure Used for Roadway Noise Analysis

In order to calculate the road noise impact at the proposed development, we utilized the Ministry of Environment's STAMSON modeling software version 5.04. This program allows us to input variables of a road such as traffic volume, types of vehicles, speed, barrier locations and topography to determine the environmental noise impact at a point of reception.

4.3 Points of Reception

To determine the worst case noise impact on the façade of the building, we have chosen three points of reception (POR); one at the south east corner of Block C which is the closest noise sensitive room (bedroom, POR1) in proximity to both Innes Road and at Frank Bender Street and one at the south west corner of Block A, which is another noise sensitive room (bedroom, POR2). We have also chosen one additional point in the bedroom in the most north east unit of Block C (POR3). POR1 is located at the Plane of Window (POW) of the corner bedroom in the north east unit on the first floor of Block C at a height of 1.5m. We have chosen this POR to represent this scenario for traffic noise from Innes Road and Frank Bender Street is a room which has a large glazing portion as a part of one its exterior walls. POR2 is located at the Plane of Window (POW) of the bedroom in the south west unit on the first floor at a height of 1.5m which also has a large area of glazing and will be mainly affected by noise from Innes Road. POR3 is analyzed in order to determine the traffic noise impact in units that are not patially shielded from Innes Road to determine whether the same mitigation measures are required in these units as for POR1 and POR2. The position of our points of reception is shown in Figure 4.1, 4.2 and 4.3 indicated by the blue cross. Table 4.2 below summarizes receiver heights and distances. Figure 4.4 shows the PORs in the elevation view from the west.

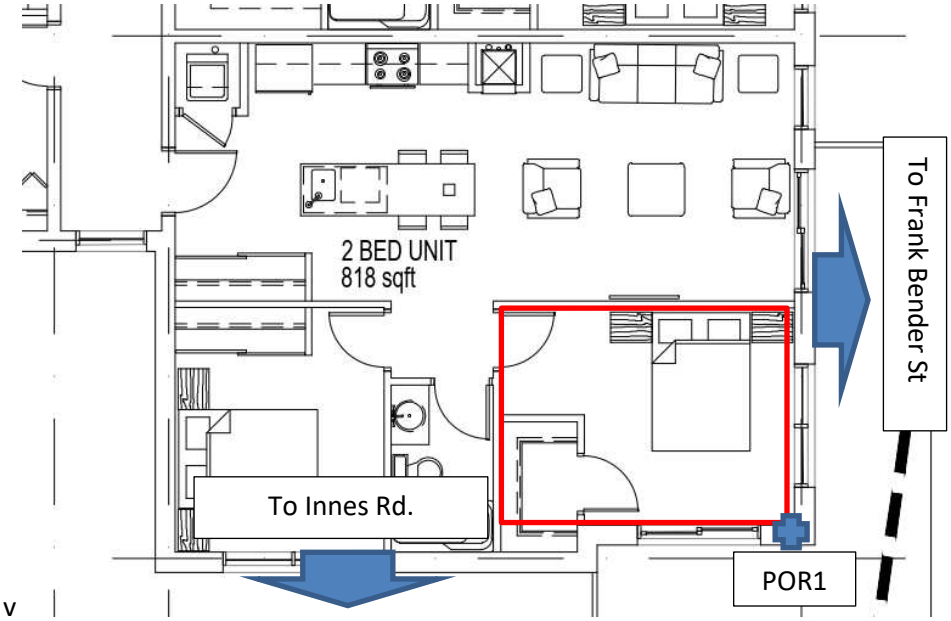

Figure 4.1 – Main level plan view showing POR1 in Block C.

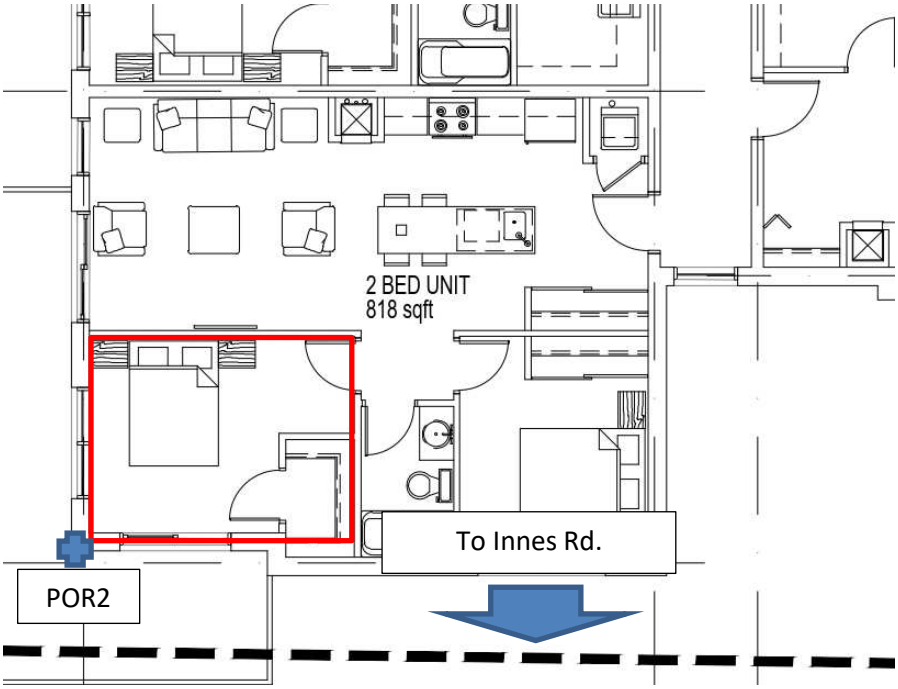

Figure 4.2 – Main level plan view showing POR2 in Block A.

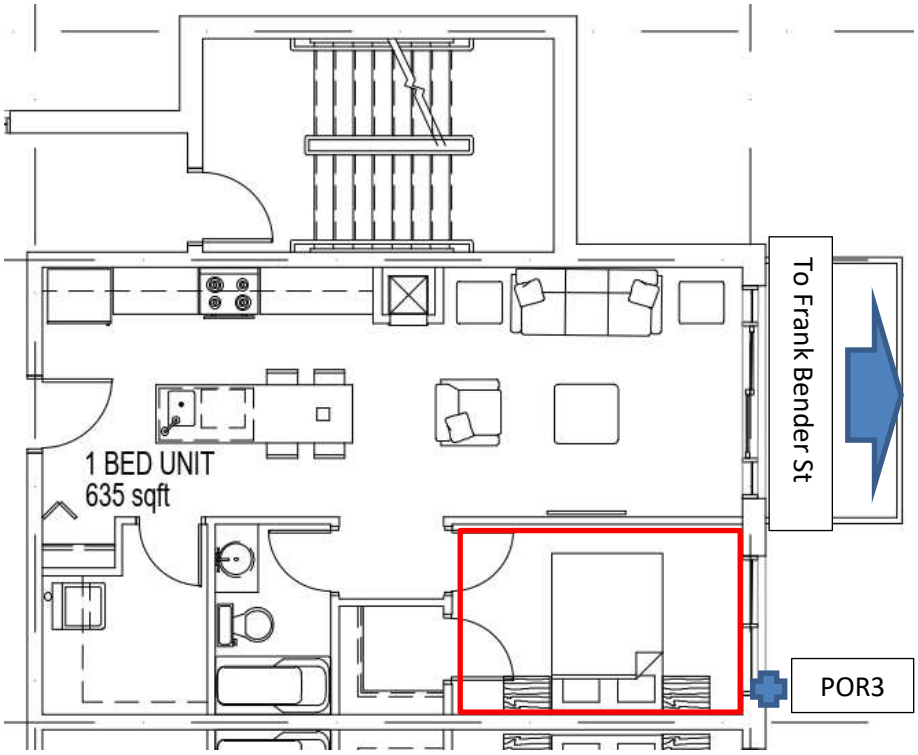

Figure 4.3 – Main level plan view showing POR3 in Block C.

BLOCK A WEST ELEVATION (BLOCK C MIRRORED)

Figure 4.4 – North face elevation view showing the Points of Reception (POR1, POR2 and POR3). Note that POR1 and POR3 are for Block C, which is a mirrored elevation of that shown here but is identical.

Receiver	Height (m)	Distance from Closest Source	Angle to source segment from POR (left)	Angle to source segment from POR (right)
POR1	1.5	~10.5m (Innes Rd.)	90°	90°
POR2	1.5	~10.5m (Innes Rd.)	90°	90°
POR3	1.5	~35m (Innes Rd.)	0°	90

Table 4.2 – Table of receiver height and distance from noise source.

4.4 Parameters Used for Analysis

The parameters used in STAMSON to assess the noise impact at POR1 are shown below in Table 4.3:

Parameter	Values Used
Noise Source:	**Innes Rd**
Time Period	16h/8h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Density of First Row%	N/A
Intermediate Surface	Reflective
Receiver Height (m)	1.5
Source Receiver Distance (m)*	15
Noise Source:	**Frank Bender Rd**
Time Period	16h/8h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Density of First Row%	N/A
Intermediate Surface	Reflective
Receiver Height (m)	1.5
Source Receiver Distance (m)	70

Table 4.3 – Parameters used in STAMSON model at POR1 (Block C bedroom)

*The minimum source-receiver distance that can be input into STAMSON is 15m.

The parameters used in STAMSON to assess the noise impact at POR2 are shown below in Table 4.4:

Parameter	Values Used
Noise Source:	**Innes Rd**
Time Period	16h/8h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Density of First Row%	N/A
Intermediate Surface	Reflective
Receiver Height (m)	1.5
Source Receiver Distance (m)	15

Table 4.4 – Parameters used in STAMSON model at POR 2 (south-west bedroom, Block A)

*The minimum source-receiver distance that can be input into STAMSON is 15m.

The parameters used in STAMSON to assess the noise impact at POR3 are shown below in Table 4.5:

Parameter	Values Used
Noise Source:	**Innes Rd**
Time Period	16h/8h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Density of First Row%	N/A
Intermediate Surface	Reflective
Receiver Height (m)	1.5
Source Receiver Distance (m)	35
Noise Source:	**Frank Bender Rd**
Time Period	16h/8h
Topography	Flat/gentle slope no barrier
Rows of Houses	0
Density of First Row%	N/A
Intermediate Surface	Reflective
Receiver Height (m)	1.5
Source Receiver Distance (m)	70

Table 4.5 – Parameters used in STAMSON model at POR3 (north-east bedroom, Block C)

We have assessed daytime levels as well as nighttime levels for each POR as they are all located within bedrooms. POR1 will be the worst case scenario, as it exposed to both Innes Road traffic and Frank Bender Road. POR 2 is exposed to Innes Road only, as Frank Bender Street is significantly further than 100m from this POR and is shielded by all three buildings. POR3 is exposed to traffic noise from Innes Road to the east as the Block C building shields from traffic noise to the west. It is also exposed to traffic noise from Frank Bender Street which is ~70m to the east. These conditions have all been reflected in our calculations.

4.5 Surface Transportation Noise Levels

Table 4.5 below summarizes the predicted sound pressure levels at the points of reception from the results of the STAMSON environmental noise software calculation (Appendix A) for 3817-3843 Innes Road.

	POR 1 (dBA)		POR 2 (dBA)		POR 3 (dBA)	
	Day	**Night**	**Day**	**Night**	**Day**	**Night**
Innes Road	72.2	64.7	72.2	64.6	63.1	55.5
Frank Bender Street	51.4	43.8	N/A	N/A	51.4	43.8
Total	**72.3**	**64.7**	**72.2**	**64.6**	**63.4**	**55.8**

Table 4.5 – Predicted Road Noise at each Point of Reception

4.6 Roadway Noise Summary and Analysis

We have calculated the predicted noise level caused by traffic using STAMSON and have shown that a 16h L_{eq} for daytime hours at POR1 is **72.3 dBA**, **72.2 dBA** at POR2, and **63.4 dBA** at POR3. The 8h L_{eq} for nighttime hours at POR1 is **64.7 dBA**, **64.6 dBA** at POR2, and **55.8 dBA** at POR3. As the levels during the day and at night are above 55 dBA, an evaluation of exterior building components (AIF analysis) is required. Detailed preliminary assemblies for the exterior walls were not yet available, however we the exterior is to be a combination of vinyl siding, stone and brick and we have based preliminary assemblies based on this information and common exterior wall assemblies. These are listed below for the PORs in this report and are analyzed in the following section.

EXTERIOR STONE / BRICK MASONRY WALL – POR1, POR2, Partial POR3

-Stone / brick masonry.
-1" rigid insulation
-6" steel studs @16" o.c. max.
-5.5" batt insulation
-5/8" type x gypsum board

EXTERIOR VINYL SIDING WALL – Partial POR3

-Vinyl siding
-1" rigid insulation
-6" steel studs @16" o.c. max.
-5.5" batt insulation
-5/8" type x gypsum board

5.0 Exterior Building Component Analysis (AIF Method)

In this section, we determine if the building complies with the City of Ottawa's ENCG indoor noise requirements based on the existing or proposed wall and window construction. We compare the required minimum façade AIF to the estimated AIF of the currently selected façade materials.

5.1.1 Building Components

The current design of each POR's façades is made up of the following components:

1) Exterior wall (Stone for POR1 and POR2, brick and vinyl siding for POR3)
2) Window (No assembly yet specified, will be determined through AIF analysis)

The existing exterior wall compositions at each POR are as given in the previous section and Table 5.1 below. The façades are composed of stone, brick and vinyl siding as shown in Figure 4.4. The wall type for POR1 and POR2 (stone) is sufficiently similar to wall type EW5 described in the Canada Mortgage and Housing Corporation (CMHC) document "Road and Rail Noise: Effects on Housing" while the vinyl

siding wall type is sufficiently similar to wall type EW2. Table 5.1 shows a comparison of these wall compositions.

Exterior Wall Assembly	CMHC Road and Rail Noise Wall Type
-Stone / brick masonry. -1" rigid insulation -6" steel studs @16" o.c. max. -5.5" batt insulation -5/8" type x gypsum board	**Wall Type EW5** -100mm brick veener -25mm airspace -Sheathing -50mm mineral wool or glass fibre batts -38x89mm wood studs -12.7mm gypsum board
-Vinyl siding -1" rigid insulation -6" steel studs @16" o.c. max. -5.5" batt insulation -5/8" type x gypsum board	**Wall Type EW2** -Wood/metal siding -Fibre backer board -Rigid insulation (25-30mm) -50mm mineral wool or glass fibre batts -38x89mm wood studs -12.7mm gypsum board

Table 5.1 – Comparison of new building exterior wall and equivalent wall from CMHC, Road and Rail Noise: Effects on Housing.

There are no glazing assemblies indicated in the drawings and therefore we have assumed a double pane window that meets minimum OBC requirements such as the following example:

Basic Window Assembly
3m glazing 13mm interplane spacing 3mm glazing

Table 5.2 –Window Assembly used in Calculations

The calculation of AIF for each building component depends on the ratio of the area of a given component on the exterior to the total floor area of the corresponding interior room. Using plan view and elevation drawings, we have determined these dimensions for the three bedrooms for which we determined the noise impact at each POR. The areas of the exterior wall components and ratios to the floor are given in Table 5.3 below. The layouts of the two spaces are shown in Figure 5.1, Figure 5.2 and Figure 5.3.

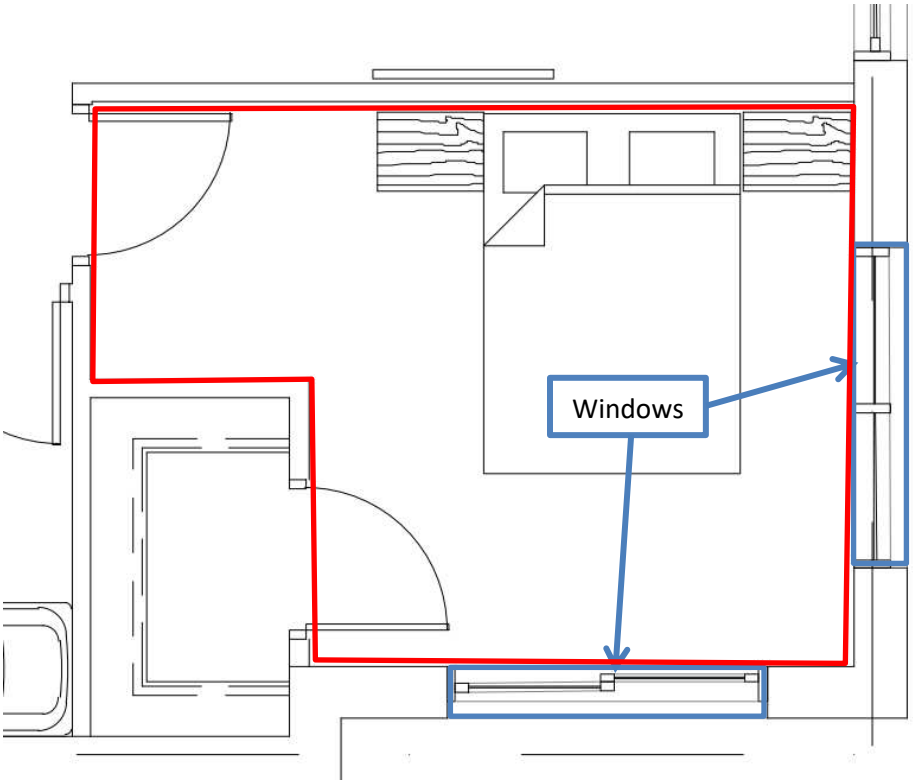

Figure 5.1 – Layout of bedroom in south east main level unit in Block C used for analysis of POR1 indicated in red. Exterior wall assembly equivalent to CMHC wall type EW5.

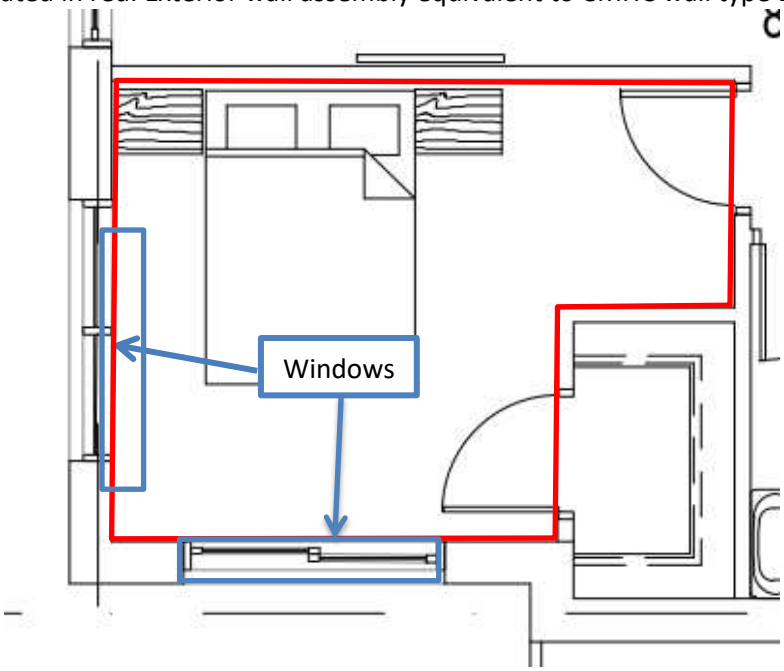

Figure 5.2 – Layout of bedroom in south west main level unit in Block A used for analysis of POR2 indicated in red. Exterior wall assembly equivalent to CMHC wall type EW5.

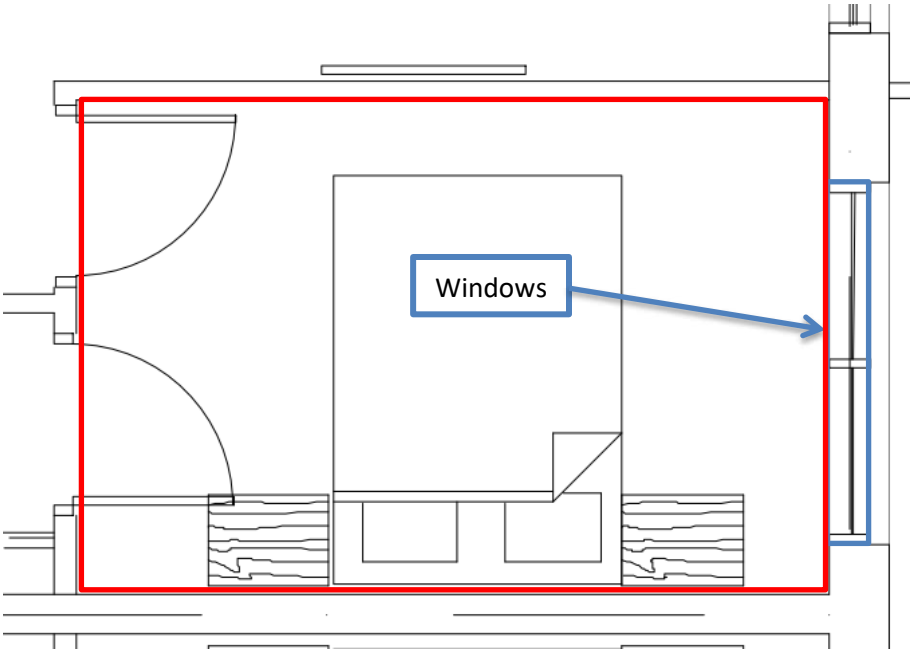

Figure 5.3 – Layout of bedroom in north east main level unit in Block C used for analysis of POR3 indicated in red. Exterior wall assembly equivalent to CMHC wall type EW2 for the vinyl siding assembly and EW5 for the brick assembly.

5.1.2 AIF Calculations

Below in Table 5.3, 5.4 and 5.5 we provide the results of our AIF calculations based on the procedure given in Section 3.3 and the building component information given in Section 5.1.1 and dimensions from the plans for each component at all PORs. Component AIFs are determined based on component area ratio to floor area given in CMHC "Road and Rail Noise: Effects on Housing" Tables 6.2 and 6.3. As stated in Section 3.3, if the AIF of any component exceeds the required AIF by 10 or more (Comp1 AIF > Init AIF +10), the calculation should be repeated for the other components with the 'total number of components' reduced by one. This gives the Final Required AIF for component 2 for which the component AIF is compared to.

POR 1												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
11.4	2	1	Exterior Wall	10.1	89%	72.3	45	32	47	Yes	29	**Yes**
11.4	2	2	Window	8.5	75%	72.3	45	32	25	Yes	29	**No**

Table 5.3 – POR1 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if component AIF is acceptable.

POR 2												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
11.4	2	1	Exterior Wall	10.1	89%	72.2	45	32	47	Yes	29	**Yes**
11.4	2	2	Window	8.5	75%	72.2	45	32	25	Yes	29	**No**

Table 5.4 – POR2 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if component AIF is acceptable.

POR 3												
Room Floor Area (m2)	Number of Components	Component Number	Component Type	Component Area (m2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
8.9	3	1	Exterior Wall	2.0	22%	63.4	45	25	53	Yes	23	**Yes**
8.9	3	2	Exterior Wall	1.5	17%	63.4	45	25	40	Yes	23	**Yes**
8.9	3	3	Window 2	4.2	47%	63.4	45	25	27	Yes	23	**Yes**

Table 5.5 – POR3 AIF parameters used in calculations, resulting required AIF and component AIF, and statement if component AIF is acceptable.

As noted in the final column of Tables 5.3 and 5.4, the window assembly used in our calculation does not meet the AIF requirement and needs to be improved.

For both cases, the window assembly must be a minimum AIF of AIF 29, which can be translated into an STC rating for the glazing, using the percentage area of the window to the total floor area in Table D2 in Appendix D of CMHC "Road and Rail Noise: Effects on Housing". By using this table, we obtain that a glazing assembly of at least STC 34 is to be used and have provided options in Table 5.6 below for meeting this requirement.

Recommended Glazing Assembly	STC Rating
6mm glazing 13mm airspace 6mm glazing	STC 35 (Test ID RAL-TL85-294
6mm laminated glazing 6mm airspace 3mm glazing	STC 35 (Test ID RAL-TL95-296

Table 5.6 – Example glazing assemblies to meet AIF requirements at POR1 and POR2.

5.2 Warning Clauses

Since the predicted noise level from surface transportation exceeds 55 dBA, a generic warning clause must be added to the development agreement.

The City of Ottawa requires a Warning Clause whenever noise could meet or exceed 55 dBA 16 hour Leq at the Outdoor Living Area or Plane of Window of any living or sleeping area prior to any noise mitigation.

Table 5.7 provides the types of warning clauses and example text to be adapted into warning clauses. These warning clauses should be taken as *example only* and are taken from Appendix A of the ENCG which also states:
"*A warning clause is not considered a form of noise mitigation. It is not acceptable therefore to use warning clauses in place of physical noise control measures to identify an excess over the MOE or City noise limits*."

TYPE	Example Text	Notes
Generic	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transit way 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. To help address the need for sound attenuation this development has been designed so as to provide an indoor environment that is within provincial guidelines. Measures for sound attenuation include: • multi-pane glass; • brick veneer; • concrete panels;	The generic warning clause outlines that MOE sound levels may be exceeded but the indoor environment is within guidelines. Mitigation measures are described including urban design features. Mention is also made of landscaping to screen the development visually from the source of noise.

Extensive mitigation of indoor and outdoor amenity area	"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. To help address the need for sound attenuation this development may include: • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. 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.	The warning clause makes reference to MOE sound levels being exceeded from time to time and that there are sound attenuation features and landscaping within the development that should be maintained.
No outdoor amenity area	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic will interfere with outdoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this development may includes • multi-pane glass; • brick veneer; • construction of a solid fence in backyard area To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features. 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.	This warning clause notes that only an indoor environment is being provided for.

Table 5.7 – Warning Clause Types and Example Text from the City of Ottawa (from ENCG Table A1)

5.3 Traffic Noise Assessment Summary

Exterior Walls

Exterior Wall Assemblies

EXTERIOR STONE / BRICK MASONRY WALL

-Stone / brick masonry.
-1" rigid insulation
-6" steel studs @16" o.c. max.
-5.5" batt insulation
-5/8" type x gypsum board

EXTERIOR VINYL SIDING WALL

-Vinyl siding
-1" rigid insulation
-6" steel studs @16" o.c. max.
-5.5" batt insulation
-5/8" type x gypsum board

The AIF value for the exterior wall exceeds the requirements significantly and no changes are required.

Exterior Glazing

We have provided recommended window assemblies for POR1 and POR2 in Table 5.6 but as demonstrated in the analysis of POR3, it is not necessary to maintain the STC 34 requirement along the full perimeter of each building. Based on results of our calculations, we have included a drawing in the Appendix in order to demonstrate where the STC 34 glazing is to be implemented. Note that this glazing is required for the full façade for all units on each floor where indicated in the drawing.

Overall, no modifications are necessary to the existing or proposed façade components. In addition, because the predicted noise level from surface transportation exceeds 55 dBA, a generic warning clause must be added to the development agreement.

6.0 Site Measurements and Stationary Noise to the Surrounding Area

6.1 Site Measurements and Observations

As noted above, at the request of the City of Ottawa, the noise impact from the surrounding area was to be considered in the noise impact study. The main concern is that mechanical equipment serving the retail area across Innes Road may have an impact on the new proposed development. Therefore, we went to the site and performed brief measurements in two locations, approximately at the location of points of reception POR1 and POR2 in the traffic noise study above, in order to determine whether there was any other noise impact other than traffic. We performed the measurements for approximately 15 minutes at each POR during a Thursday afternoon (beginning at approximately 2:30pm) when any equipment would be operational during a normal day. Below in Figure 6.1, the dBA level at each minute of the measurement at each POR location is given. While results vary to some degree, they are between 62 dBA and 72 dBA in all cases and from observations made on site, noise was almost exclusively due to traffic and there were no other apparent noise sources either from the retail area on the south side of Innes Road or otherwise.

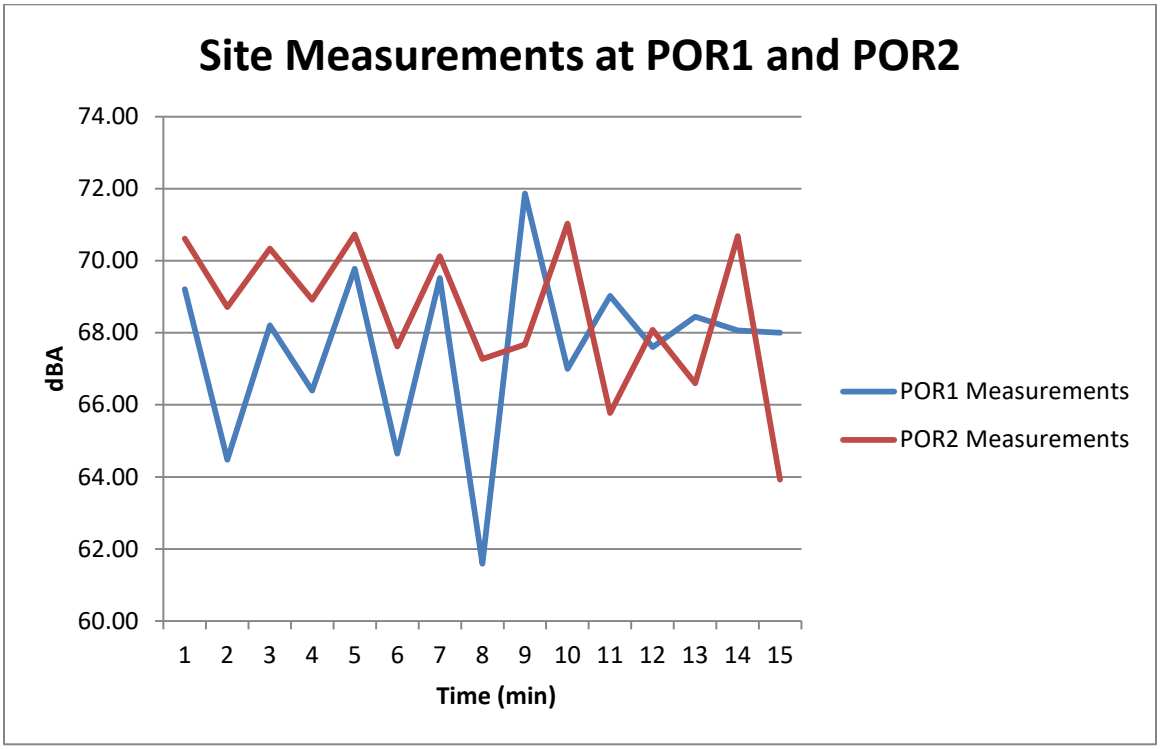

Figure 6.1 – Results of measurements taken at each minute at POR1 and POR2 locations of proposed new development.

6.2 Stationary Noise to Surrounding Area

In addition to the noise impact from traffic and the surrounding area onto the new development, it was also requested that the impact from equipment from the new development be addressed. Bridor Developments has indicated that there will not be any significant noise-making equipment associated with the proposed development such as MUA/AHUs, chillers, cooling towers, generators, etc. and that residential units are intended to have an internal boiler system with a small air handler in each unit with an AC condenser on the balcony. Therefore the only exterior noise generating equipment is the condensers on the balcony of each unit which do not generate a significant amount of noise. We have been provided with the proposed condensing units to be used, which are to be located on balconies, meaning that the closest condensing unit to an adjacent property will be approximately 6.75m from the abutting property line. The units that will be used, as shown in the Appendix, have sound power levels of 54 dBA from which we can determine the sound pressure at a certain distance away. With a basic calculation, using the distance from the property line (6.75m), we can see that the resulting sound pressure levels are well below 45 dBA in Figure 6.2 and that even multiple units at this distance will not result in a sound pressure level even close to 45 dBA.

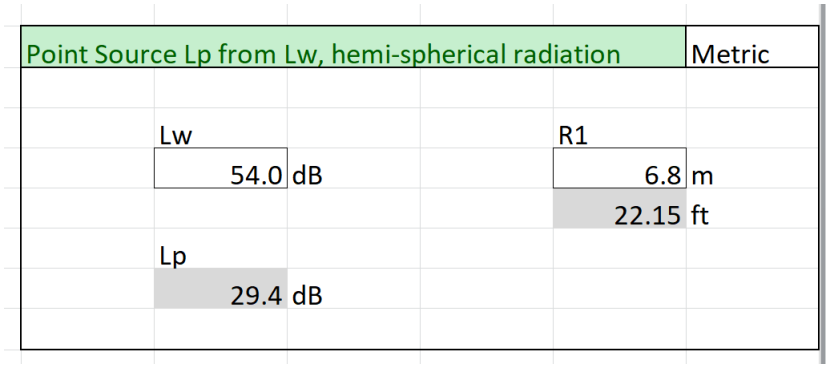

Figure 6.2 – Sound pressure level calculation at a distance of 6.75m at the closest property line.

Even combining two sources of the same sound power levels at the same distance away will result in a 3 dBA increase of the resulting sound power levels at the given distance. Therefore, the condensing units will not have a significant noise impact on the surrounding existing properties. We have also provided some general recommendations for these condensing units:

- Install units on neoprene mounts or pads such as Mason BR mounts or Mason SW pads so that minimal vibration is transmitted to the balcony and to the structure itself.
- Shield condensing units as much as possible from adjacent balconies, ideally with solid balcony dividers.
- Select quiet versions of condensing unit models if possible.

7.0 Conclusion

We have analyzed the traffic noise impact for road sources for the new proposed three building development to be located at 3817-3843 Innes Road. A detailed building component analysis was required as noise levels from the traffic noise sources (Innes Road and Frank Bender Street) was greater than 55 dBA at the Plane of Window (POW) at each of the PORs. After completing a detailed AIF analysis of the exterior building components, the proposed exterior wall assemblies as listed in Section 5.1 are acceptable. Windows that meet the OBC requirement in Table 5.2 meet or exceed AIF requirements for only certain sections of the three buildings, and façades which are closer to Innes Road require a glazing assembly that has an STC rating of at least STC 34. We have provided sample assemblies to meet this requirement in Table 5.6. The areas where the higher STC glazing is required are presented in the Appendix.

We have also addressed noise from the surrounding area and have found that traffic is by far the most significant noise source impacting the new development and that any mechanical equipment from the commercial area across the street is not a concern. In addition, the only noise generating equipment from the development to the surrounding area will be small condensing units on residential balconies, which should not be problematic for neighbouring properties however we have provided some general recommendations in order to minimize issues to adjacent units within the same building in Section 6.2.

If you have any questions or concerns regarding this report, please let us know.

Sincerely,

Patrick Richard, M.Sc.E.
Acoustic Consultant

Approved By:

Donald Buchan, P.Eng
Principal
Buchan Lawton Parent Ltd.

Appendix A
STAMSON Calculations
STC 34 Window Requirements Drawing
Condensing Unit Preliminary Selections

STAMSON 5.0 NORMAL REPORT Date: 02-12-2020 16:56:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: innes1.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 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): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
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: Innes (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 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Frank Bender (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 : 40 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): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
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: Frank Bender (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 : 70.00 / 70.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Innes (day)

Source height = 1.50 m

ROAD (0.00 + 72.22 + 0.00) = 72.22 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	73.68	0.00	0.00	-1.46	0.00	0.00	0.00	72.22

Segment Leq : 72.22 dBA

Results segment # 2: Frank Bender (day)

Source height = 1.50 m

ROAD (0.00 + 51.39 + 0.00) = 51.39 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	63.96	0.00	-11.11	-1.46	0.00	0.00	0.00	51.39

Segment Leq : 51.39 dBA

Total Leq All Segments: 72.26 dBA

Results segment # 1: Innes (night)

Source height = 1.50 m

ROAD (0.00 + 64.62 + 0.00) = 64.62 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 90 0.66 66.08 0.00 0.00 -1.46 0.00 0.00 0.00 64.62

Segment Leq : 64.62 dBA

Results segment # 2: Frank Bender (night)

Source height = 1.50 m

ROAD (0.00 + 43.80 + 0.00) = 43.80 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 90 0.66 56.36 0.00 -11.11 -1.46 0.00 0.00 0.00 43.80

Segment Leq : 43.80 dBA

Total Leq All Segments: 64.66 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 72.26
(NIGHT): 64.66

STAMSON 5.0 NORMAL REPORT Date: 02-12-2020 16:56:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: innes2.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *

Heavy truck volume : 1610/140 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): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
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: Innes (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 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Innes (day)

Source height = 1.50 m

ROAD (0.00 + 72.22 + 0.00) = 72.22 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	73.68	0.00	0.00	-1.46	0.00	0.00	0.00	72.22

Segment Leq : 72.22 dBA

Total Leq All Segments: 72.22 dBA

Results segment # 1: Innes (night)

Source height = 1.50 m

ROAD (0.00 + 64.62 + 0.00) = 64.62 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	66.08	0.00	0.00	-1.46	0.00	0.00	0.00	64.62

Segment Leq : 64.62 dBA

Total Leq All Segments: 64.62 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 72.22
(NIGHT): 64.62

STAMSON 5.0 NORMAL REPORT Date: 02-12-2020 16:57:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: innes3.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 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): 35000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
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: Innes (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 / 35.00 m

Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Frank Bender (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 : 40 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): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 10.00
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: Frank Bender (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 : 70.00 / 70.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Innes (day)

Source height = 1.50 m

ROAD (0.00 + 63.10 + 0.00) = 63.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	73.68	0.00	-6.11	-4.47	0.00	0.00	0.00	63.10

Segment Leq : 63.10 dBA

Results segment # 2: Frank Bender (day)

Source height = 1.50 m

ROAD (0.00 + 51.39 + 0.00) = 51.39 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	63.96	0.00	-11.11	-1.46	0.00	0.00	0.00	51.39

Segment Leq : 51.39 dBA

Total Leq All Segments: 63.38 dBA

Results segment # 1: Innes (night)

Source height = 1.50 m

ROAD (0.00 + 55.50 + 0.00) = 55.50 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	66.08	0.00	-6.11	-4.47	0.00	0.00	0.00	55.50

Segment Leq : 55.50 dBA

Results segment # 2: Frank Bender (night)

Source height = 1.50 m

ROAD (0.00 + 43.80 + 0.00) = 43.80 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	56.36	0.00	-11.11	-1.46	0.00	0.00	0.00	43.80

Segment Leq : 43.80 dBA

Total Leq All Segments: 55.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.38

(NIGHT): 55.78