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Succession Development Corporation – 890-900 Bank St.
Phase 1 Feasibility Noise Study Including Building Component Evaluation

This phase 1 noise study has been amended with a building component evaluation to determine the required sound isolation of the exterior building components. The site plan, and all other relevant plans and information regarding the building have also been updated. The new information may be found in section 4.0. and 5.0 with a summary in section 6.0.

Dear Emilie,

We are pleased to present the following phase 1 environmental feasibility noise study for the new development at 890-900 Bank St. in Ottawa which contains commercial and residential space. This type of study is newly required by the City of Ottawa under the Environmental Noise Control Guidelines 2016 (ENCG), which are compliant with the Ministry of Environment's NPC-300.

This study considered three different acoustic concerns: The acoustic impact this new development will have on the surrounding environment; the noise impact of adjacent buildings to the proposed development and the noise generated from Bank Street and Fifth Avenue to the plane of window of the new development

The summary of our results may be found in section 5.0 along with our acoustical recommendations.

If you have any questions, please do not hesitate to contact me.

Regards,

Alexandre Fortier, M.Sc.
Acoustical Consultant

1.0 Introduction

State of the Art Acoustik Inc. was commissioned by Succession Development to complete a Phase 1 feasibility noise study as required by the City of Ottawa for the proposed 9 storey commercial/residential development at 890-900 Bank Street in Ottawa. This report references the 2016 Environmental Noise Control Guidelines, which are complaint with the Ministry of Environment's NPC-300.

We have conducted an on-site inspection with noise measurements of the existing location and present this data in section 2.0. In section 3.0, we analyze the surrounding area using a scaled area plan and determine the noise impact of the rooftop equipment to the surrounding environment, with general recommendations on how to minimize this impact.

In section 4.0, we present the predicted noise impact from Bank Street and Fifth Avenue onto this development and in section 5.0, we calculate and show the required building components.

2.0 On-Site Measurements

We conducted a site visit to the proposed development location and took several measurements around the area. Our measurement positions are found in figure 2.1 below. These measurements were used to determine the current background sound level of the area as well as find any possible stationary noise sources that could disrupt the residents at 890-900 Bank Street. Also identified in figure 2.1 is the only planned outdoor living area of the site.

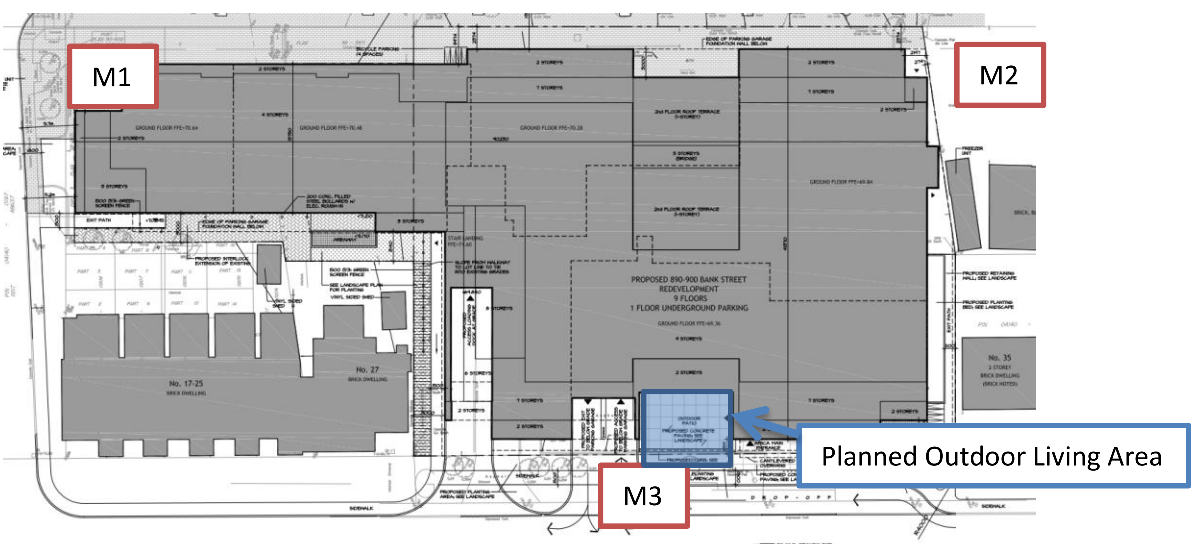

Figure 2.1 – Scaled area location plan showing the new development with background sound measurement locations (M1, M2, M3) and the planned outdoor living area identified. This site plan was provided by Fotenn Planning and Design.

These measurements were taken over the period of 30 minutes, each measurement being the average sound pressure level over 10 minutes at the respective position. Our measurement results are shown in Table 2.1

Measurement position	Measured Sound Pressure Level (dBA)
M1	68.7
M2	68.7
M3	57.4

Table 2.1 – Background sound level measurements at 3 measurement positions, given in dBA.

The noise levels on the Bank Street side of the new development are significantly higher, approximately 10 dBA higher, than on the Monk street side. This is to be expected as the traffic, both vehicular and pedestrian, is much greater on Bank Street.

During our site inspection, we did not notice any pieces of mechanical equipment on adjacent buildings that had the potential to generate more noise than the traffic on Bank Street. We will therefore not consider noise generated by other buildings for the remainder of this analysis.

Based on discussions with the developer and City planner, we have assumed, in this study, that the 2nd floor roof terrace is not considered an outdoor living area for the occupants of this building, and it is therefore not considered as a part of this noise study.

3.0 Site Plan/Stationary Noise Story Evaluation

3.1 Project Description

The proposed development consists of a 9 storey mixed commercial and residential space. The proposed development is located at 890-900 Bank Street in Ottawa, ON. A nearby residential area, directly adjacent to the proposed site is the most nearby noise sensitive area. For the purpose of this study, we have used a grade elevation of this area of 64m.

3.2 Outdoor Living Areas (OLA)

There is a single planned outdoor living area on the ground floor on the Monk street side of the development. Based on the background sound level measured around the proposed site, it is likely that the sound level at the outdoor rooftop terrace will not exceed 55 dBA, the imposed limit by the City of Ottawa. Our existing measurement, M3, shows the current noise level from traffic and urban hum at 57.4 dBA. The traffic noise calculations, as presented in section 4., show that this will be reduced with the construction of this project, as the building will shield the OLA from noise.

3.3 Site Plan Review

Figure 3.1, shows a scaled site plan. It identifies the proposed development, as well as noise sensitive areas in the surrounding environment. Highlighted in red is the proposed development, with the nearest residential areas in green. The nearest receiver, 17-27 Monk Street, is directly adjacent to the building, within the same block. There is also a retirement home approximately 55m to the south and a dense residential area approximately 15m to the west.

3.4 Recommended Equipment Locations

We recommend having most mechanical equipment on the rooftop. The eastern face of the building, adjacent to Bank Street, is the preferred location for all equipment. This will shield the nearby residential homes on Monk Street with the building edge. However, there is a high rise retirement home 55m to the south of the development and acoustic barriers may be required to mitigate the noise generated by the equipment, this will depend on the sound power levels of the selected units. See section 3.7 for a description of maximum allowable sound power levels.

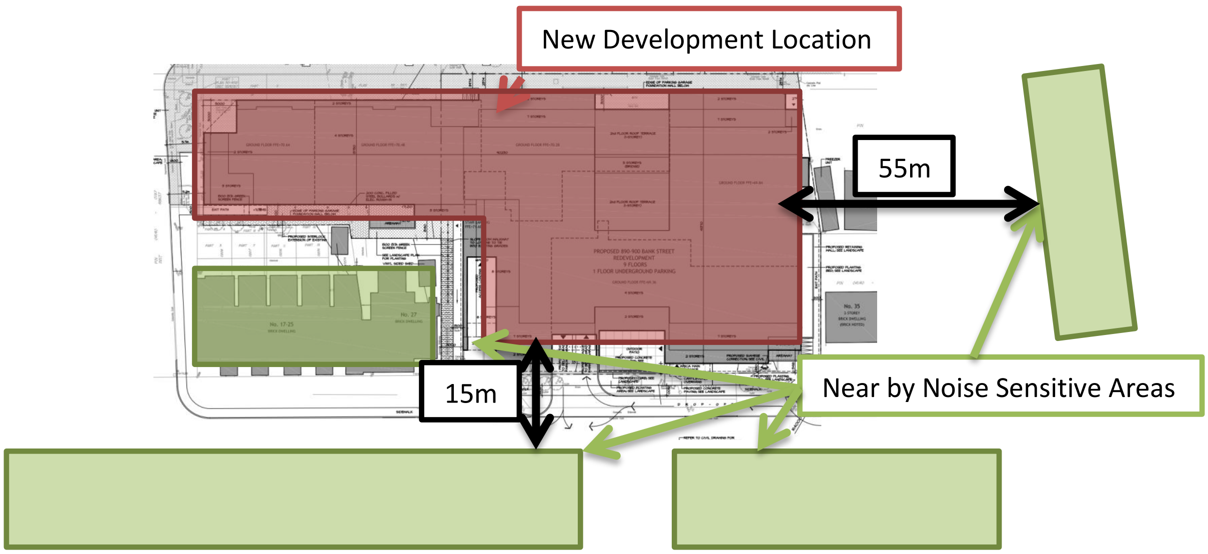

Figure 3.1 – Scaled area location plan showing the new development and nearby noise sensitive areas. This site plan was provided by Fotenn Planning and Design.

3.4.1 Generator

Generators can often make a significant amount of noise during their routine testing. If a generator is planned for this development, due to the proximity to the nearby residential homes, we recommend placing the generator in an enclosed room on the roof. Locate the exhaust/air inlet/air outlet for the generator on the eastern side of its enclosure, facing Bank Street. If an enclosed room for the generator is not possible, use a package unit rated to the dBA shown in section 3.6.

3.5 Approximate Maximum Sound Power Levels

In order to be under the City of Ottawa ENCG maximum noise levels on the property of the nearby residents we have calculated the approximate sound power levels for the equipment on the roof. These values can be found in this section. These maximum noise levels are, for a Class 1 area, 50 dBA during the day and 45 dBA at night.

3.5.1 Rooftop Equipment Total Sound Power

This is a preliminary calculation of the total sound power level limit generated by the rooftop equipment, excluding the generator, at 890-900 Bank Street.

This calculation assumes the majority of the noise producing equipment will be located on the Bank Street side of the rooftop. If equipment is placed elsewhere, the maximum sound power level limit will reduce.

The nearest point of reception is located approximately 55m to the south from where the rooftop equipment will be located. Other nearby residential areas are shielded by the building edge, therefore the point of reception to the south is taken as the worst case scenario. The ENCG (and NPC-300) states that the maximum noise level for an outdoor point of reception during the day (7am-11pm) is 50 dBA and, at night (11pm-7am) is 45 dBA. In order to achieve these levels, the sum of all sound power levels of the mechanical equipment on the roof should not exceed 88 dBA at night and 93 dBA during the day. These results are based on point source sound power level propagation from a hemi-spherical radiation. The results are summarized in table 3.2.

3.5.1.1 Generator

The ENCG and publication NPC-300 from the MoE states that generators are to be considered independently of all other stationary sources of noise. They are also subject to a greater noise limit, 5 dB above the typical limit (p.35). In this case, the limit is 55dBA.

Using the same methodology for calculation as above, the maximum allowable sound power level for a package generator is 98 dBA or 73 dBA (SPL) at 7m. If the generator is located inside an enclosed room on the roof, this sound level limit is for the sum of the exhaust, air inlet and air outlet of the generator.

3.5.1.2 Garage Exhaust Fans and Loading Dock

There is a loading dock planned to be directly adjacent to a nearby residence on Monk Street. A large number of trucks serving the commercial space may cause high levels of disturbing noise for this resident. We recommend installing a barrier for sound that blocks line of sight from truck exhaust to the highest window of the residence at 27 Monk Street. This will mitigate the sound from the trucks as well as create a visual barrier to obscure the source of noise.

If any exhaust fans are planned for the garage, they should not be located directly adjacent to the residence at 27 Monk Street. Instead, locate the exhaust fans on the western face of the building, away from 27 Monk Street. The total sound power level of these exhaust fans should not exceed 75 dBA if used at night, or 80 dBA if only used during the day, in order to remain below the noise level limits for the residential homes opposite Monk Street

3.6 Summary of Maximum Allowable Sound Power Levels

Table 3.2 summarizes the maximum allowable sound power levels of the mechanical equipment on this building.

Maximum Sound Power Level (SWL)		
Equipment	**Day/Night**	**SWL (dBA)**
Sum of Rooftop equipment (without generator)	Day	93
	Night	88
Generator	Day	98[1]
	Night[2]	-[2]
Garage Exhaust Fans	Day	80
	Night	75

Table 3.2 – Predicted maximum sound power levels of rooftop equipment.

[1]or 73 dBA sound pressure level at 7m.
[2]It is assumed all generator testing and maintenance will occur during the day.

At this time, the exact number of pieces of mechanical equipment on the roof is unknown. As an example, if there were a total of 8 units on the roof, they could each have a sound power level of 84 dBA and match the maximum sound power level during the day shown in table 3.2, or a total of 79 dBA to match the nighttime level. These numbers assume identical units. These numbers are achievable, although careful selection of rooftop equipment, done with acoustics in mind, will be required to ensure the total sound power is not above these values.

Because these maximum levels are achievable, we will not consider different orientations of the site plan. Careful consideration when selecting equipment should be enough to provide a quiet enjoyment of space at the nearby residential areas.

4.0 Surface Transportation Study

The following section describes our analysis of the road noise impact on the proposed development at 890-900 Bank Street.

4.1 Road Traffic Information

For this study, the two transportation noise source considered are the Bank Street and Fifth Avenue. These are the only two noise sources which are to be considered for this development, according the ENCG.

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 (%)
Bank Street	4-Lane Urban Arterial-Undivided	30,000	50km/h	92/8	7	5
Fifth Avenue	2-Lane Urban Collector	8,000	50km/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 or railway 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 the point of reception (POR1) on the North-Eastern corner of the building, which is closest to the road noise source. The position of this point of reception is shown in figure 4.1 . We also calculate the traffic noise at the outdoor living area, on Monk Street.

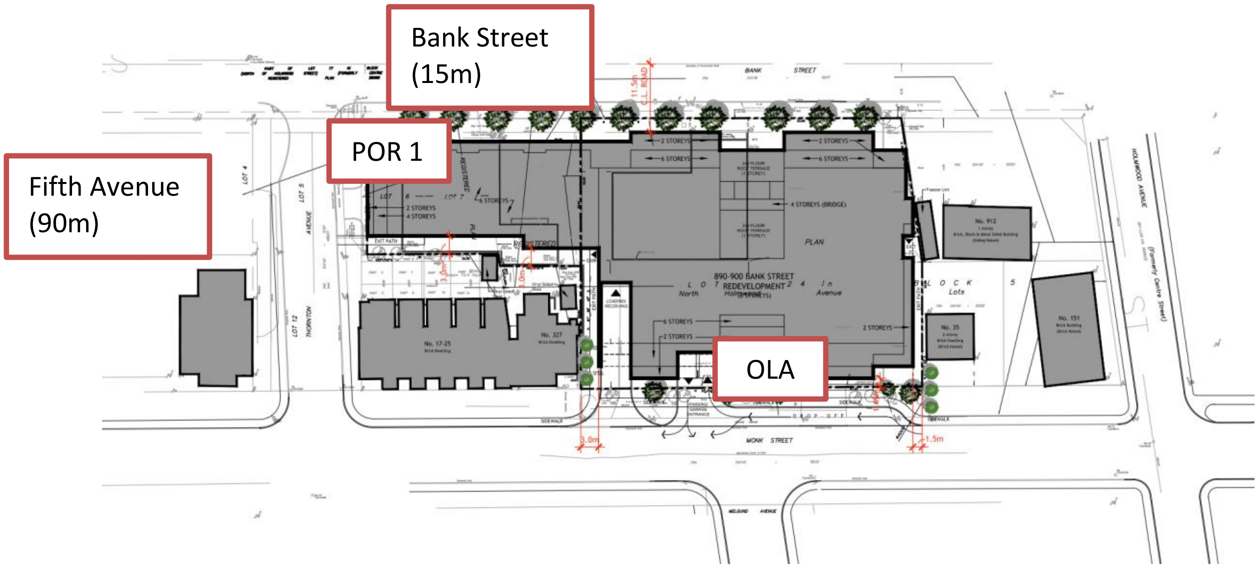

Figure 4.1 – Site Plan showing the point of reception, the outdoor living area and the approximate distance of the nearby sources to POR 1.

4.4 Parameters Used for Analysis

The parameters used in STAMSON to assess the noise impact at POR1 are shown below in Table 4.2:

Parameter	Values Used
Roadway:	**Bank Street**
Time Period	16h/8h
Topography	Flat/gentle slope with no barrier
Rows of Houses	0
Density of Houses	20%
Intermediate Surface	Reflective
Receiver Height (m)	8.0m
Source Receiver Distance (m)	15.0m
Angle 1/Angle 2	-90°/90°
Roadway:	**Fifth Avenue**
Time Period	16h/8h
Topography	Flat/gentle slope with no barrier
Rows of Houses	1
Density of Houses	50%
Intermediate Surface	Reflective
Receiver Height (m)	8.0m
Source Receiver Distance (m)	90.0m
Angle 1/Angle 2	-90°/90°

Table 4.2 – Parameters used in STAMSON model

4.5 Surface Transportation Noise Levels

Table 4.3 shows the predicted sound pressure levels at the plane of window for the worst case scenario point of reception on the 890-900 Bank Street development. These results are from the STAMSON environmental noise software calculation (Appendix A).

Sound Pressure Levels L_{eq} (dBA) due to Surface Transportation Noise		
Bank Street	Day	71.5
	Night	63.9
Fifth Avenue	Day	50.6
	Night	43.0
Total	Day	**71.5**
	Night	**63.9**

Table 4.3 – Predicted Road Noise at the Point of Reception

The Background sound during the day, or 16h L_{eq}, at the point of reception located on the northern-eastern corner of the building is 71.5 dBA and 63.9 dBA over the 8h L_{eq} at night. This noise level is high enough to warrant the acoustic selection of the building envelope components, which we show in the following section

4.6 OLA Noise Levels

Below, we calculate the traffic noise at the outdoor living area, identified in figure 4.1. The distance to bank street, the only nearby source of the OLA is 55 meters, with the proposed 9 storey structure acting as a solid barrier. The calculated noise levels are shown below.

Sound Pressure Levels L_{eq} (dBA) due to Surface Transportation Noise		
Bank Street	Day	46.3
	Night	-
Fifth Avenue	Day	-
	Night	-
Total	Day	**46.3**
	Night	**-**

Table 4.4 – Predicted Road Noise at the Outdoor Living Area

The overall background sound during the day, or 16h L_{eq}, at the outdoor living area is 46.3 dBA, below the requirement from the ENCG. No noise control measures are required.

5.0 Building Component Evaluation

In this section, we determine the minimum required façade AIF for the building to comply with the City of Ottawa's ENCG indoor noise requirements. Recommendations are given for wall and window compositions that meet the minimum required AIF values.

5.1 Building Component Assessment (AIF Analysis)

According to the ENCG, when noise levels could exceed 55 dBA at the Plane of Window (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 Leq limits:

- maximum daytime indoor L_{eq} for living spaces should be 45 dBA
- maximum nightime 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]

5.2 Building Components and Room Dimensions

The current design of the building’s second floor North East façade is made up of 2 different components:

1) Glazing
2) Brick Veneer/Stone Veneer

The final exterior compositions have not yet been selected, therefore we will propose a basic brick veneer wall type and determine the required glazing thickness.

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 the small bedroom of the second floor 1 bedroom unit closest to Bank Street. This is where we determined the noise impact at POR1. The areas of the exterior wall components and ratios to the floor are given in Table 5.1 below. Layouts of the living spaces and bedrooms are shown in figure 5.1.

	POR1 (Bedroom)
Floor Area [m^2]	**12**
North Façade Window Area [m^2] (ratio to floor area)	5.3 (44.0%)
North Façade Wall Area [m^2] (ratio to floor area)	9.1 (75.5%)
East Façade Window Area [m^2] (ratio to floor area)	0 (0%)
East Façade Wall Area [m^2] (ratio to floor area)	11.8 (98.7%)

Table 5.1 – Areas of the Exterior Building Components and Floor Area at POR1

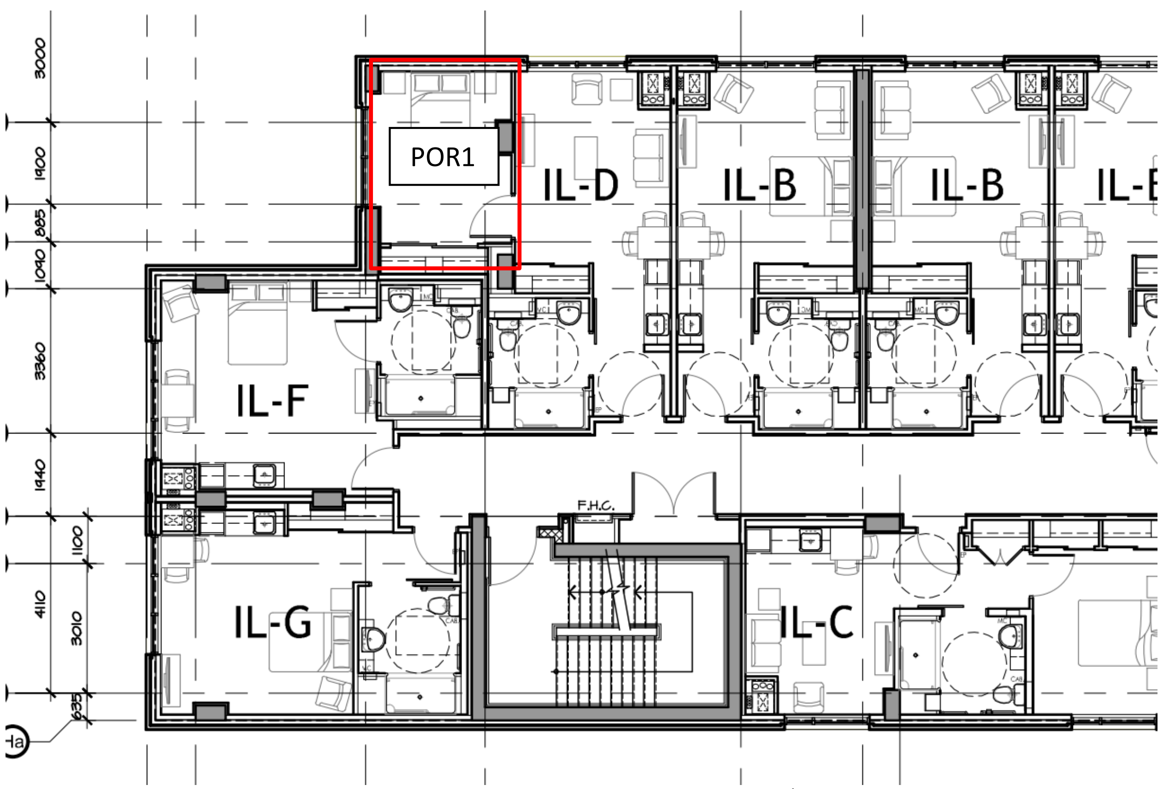

Figure 5.1 – Layout of the 1 bedroom unit adjacent to bank and 5th street. The unit is highlighted in red.

5.3 Required Overall AIF

Using equation (2) from section 5.1, the required overall AIF for POR1 (Bedroom) for the envelope is calculated as follows, allowing for the possibility of noise-sensitive uses requiring an indoor level for living areas of 45 dBA during the day and 40 dBA at night:

POR1 (day): Required AIF = 71.5 (Outside L_{eq}) – 45 (Required Indoor L_{eq}) + $10\log_{10}(2)$ + 2 = 31.5

POR1 (night): Required AIF = 63.9 (Outside L_{eq}) – 40 (Required Indoor L_{eq}) + $10\log_{10}(2)$ + 2 = 29

The required AIF at POR1 is 31.5 during the day and 29 at night. The worst case scenario is selected; therefore the exterior wall compositions must meet the 31.5 AIF.

5.4 Exterior Wall Requirements Based on Minimum AIF

The building exterior at POR1 is made up of two components as described above. The calculation of the number of components is outlined in the CMHC "Road and Rail Noise: Effects on Housing" publication. As shown in section 3.1, we have calculated that the required overall AIF for the 2-component façade is 31.5.

In order to relate the required AIF to STC, which is the typical sound isolation rating, table D3 on page 80 of the CMHC "Road and Rail Noise: Effect on Housing" document is used. For the wall to floor area ratio of 175% at POR1, the minimum required STC value is the minimum required AIF value plus 9, which is STC 40.5, rounded to STC 41.

The final exterior wall composition is not yet defined, but is of a brick veneer finish. Below, we propose a wall composition which meets the AIF requirement calculated in section 5. (STC 52 NRC test TLA-99-098a).

- 89mm Brick Veneer
- 16mm Airspace
- 11mm OSB
- 140mm Mineral Wool Insulation
- 140mm Heavy Gauge Steel Studs
- 13mm Gypsum Board

This composition has an STC of 52 and a corresponding AIF of 43, over 10 points higher than the required AIF. As discussed in section 5.1, this reduces the overall AIF of the glazing portion. This is described in more detail in the following section.

5.5 Exterior Glazing Requirements Based on Minimum AIF

Due to the exterior wall exceeding the required AIF by 10 points, we recalculate the required AIF for the window, by reducing the number of components to 1, in equation (2). The AIF becomes:

POR1 (day): Required AIF = 71.5 (Outside L_{eq}) – 45 (Required Indoor L_{eq}) + $10\log_{10}(1)$ + 2 = 28.5

If the exterior wall envelope is constructed as described above, the minimum AIF values of 29 dictates the overall window construction at POR1.

Using ratios of window area to floor area of 44% for POR1, and table 6.2 in the CMHC "Road and Rail Noise: Effect on Housing" we conclude that the minimum required window composition is double pane glass with two 4 mm panes separated by a 13 mm airspace. Table 5.2 summarizes the glass requirements in terms of AIF.

	Minimum Required Window Composition			
Location	**Glass Thickness**	**Interplane Spacing**	**Window area to floor area**	**AIF of minimum required window composition**
POR1 - Bedroom	4 mm & 4 mm	13 mm	44%	29

Table 5.2 – Glazing analysis for building's exterior wall facing 5th Street.

6.0 Conclusion and Summary

This noise study is prepared in accordance with the City of Ottawa Environmental Noise Control Guidelines (2016). Three acoustic items are covered: The acoustic impact this new development will have on the surrounding environment; the noise produced by adjacent properties onto the development and the traffic noise generated from nearby roads onto the building

For the acoustic impact to the environment, maximum sound power levels are specified for the mechanical equipment of the building. For any generator required on, the sum of the sound power level of all generator elements must be a maximum of 98 dBA or 73 dBA (SPL) at 7m. Garage exhaust fans may also not exceed 75 dBA if used at night (11pm-7am) or 80 dBA if only used during the day. If any equipment is louder than specified above, acoustic barriers will likely be necessary. More specific recommendations, such as ideal equipment location, may be found in section 3.

The exterior wall compositions were evaluated based on the predicted noise levels due to nearby traffic. The proposed brick veneer wall type, as described in section 5.4, has sufficiently high sound isolation and the minimum glazing type must be of a double glazing type (4mm glazing, 13mm airspace, 4mm glazing).

The city of Ottawa requires a warning clause to be placed in the tenant agreement to inform the tenants that preventative measures for sound isolation are included in this building. The following warning clause is taken from the ENCG and may serve as an example clause.

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: • Double Glazing • Brick and Stone Veneer Walls;	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.

More information on traffic noise and component calculation may be found in section 5.

Furthermore, the traffic noise calculations, in combination with the results from our on-site measurements and observations, show that the acoustic impact of the adjacent buildings onto the new development is negligible, and that the planned outdoor living area is within the ENCG limit of 55 dBA. See section 2 for additional information.

Regards,
Alexandre Fortier, M.Sc.
Acoustical Consultant

Approved by :
Don Buchan, P.Eng.
Buchan Lawton Parent Ltd.
Principal

LICENSED PROFESSIONAL ENGINEER
D. E. BUCHAN
PROVINCE OF ONTARIO

Appendix A
Stamson Calculations

STAMSON 5.0 NORMAL REPORT Date: 28-02-2018 11:00:19
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 890bank.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 24288/2112 veh/TimePeriod
Medium truck volume : 1932/168 veh/TimePeriod
Heavy truck volume : 1380/120 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 55.00 / 15.00 m
Receiver height : 1.50 / 8.00 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 27.00 m
Barrier receiver distance : 2.00 / 10.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Bank (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	1.50	1.50

ROAD (0.00 + 46.29 + 0.00) = 46.29 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	71.49	0.00	-5.64	0.00	0.00	0.00	-19.56	46.29

Segment Leq : 46.29 dBA

Total Leq All Segments: 46.29 dBA

Barrier table for segment # 1: Bank (day)

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
28.50	28.50	46.26	46.26
29.00	29.00	46.25	46.25
29.50	29.50	46.24	46.24
30.00	30.00	46.24	46.24
30.50	30.50	46.23	46.23
31.00	31.00	46.22	46.22
31.50	31.50	46.21	46.21
32.00	32.00	46.21	46.21
32.50	32.50	46.20	46.20
33.00	33.00	46.19	46.19

TOTAL Leq FROM ALL SOURCES (DAY): 46.29

STAMSON 5.0 NORMAL REPORT Date: 28-02-2018 11:05:30
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 890bank.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 24288/2112 veh/TimePeriod
Medium truck volume : 1932/168 veh/TimePeriod
Heavy truck volume : 1380/120 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 15.00 / 15.00 m
Receiver height : 8.00 / 8.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: 5thave (day/night)

Car traffic volume : 6477/563 veh/TimePeriod
Medium truck volume : 515/45 veh/TimePeriod
Heavy truck volume : 368/32 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: 5thave (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 1
House density : 50 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 90.00 / 90.00 m
Receiver height : 8.00 / 8.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank (day)

Source height = 1.50 m

ROAD (0.00 + 71.49 + 0.00) = 71.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	71.49	0.00	0.00	0.00	0.00	0.00	0.00	71.49

Segment Leq : 71.49 dBA

Results segment # 2: 5thave (day)

Source height = 1.50 m

ROAD (0.00 + 50.59 + 0.00) = 50.59 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.47	65.75	0.00	-11.40	-1.11	0.00	-2.65	0.00	50.59

Segment Leq : 50.59 dBA

Total Leq All Segments: 71.53 dBA

Results segment # 1: Bank (night)

Source height = 1.50 m

ROAD (0.00 + 63.89 + 0.00) = 63.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.89	0.00	0.00	0.00	0.00	0.00	0.00	63.89

Segment Leq : 63.89 dBA

Results segment # 2: 5thave (night)

Source height = 1.50 m

ROAD (0.00 + 43.00 + 0.00) = 43.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.47	58.16	0.00	-11.40	-1.11	0.00	-2.65	0.00	43.00

Segment Leq : 43.00 dBA

Total Leq All Segments: 63.93 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.53
(NIGHT): 63.93