2018-08-07

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**Blueprint Builds – 119-121 Beechwood**
**Phase 2 Feasibility Noise Study**

Dear Phil,

We are pleased to present the following phase 2 environmental feasibility noise study for the proposed development at 119-121 Beechwood Avenue in Ottawa, Ontario. The new development will consist of a 2 storey office building located on the corner of Chapleau and Beechwood Avenue. This type of study is required by the City of Ottawa under the Environmental Noise Control Guidelines 2016 (ENCG), compliant with the Ministry of Environment's NPC-300.

This study considers acoustic concerns regarding traffic noise from Beechwood Avenue, which is located approximately 11.5 m to the South from the property. This noise source is the only source considered in this study and is the only source of noise that will have an impact on the new development. Noise impact from the building to the environment is not considered in this study.

The summary of our results may be found in Section 5 along with our acoustic recommendations.

Should you have any questions or comments regarding this report, please do not hesitate to contact us.

Prepared by,

Adrien Amyotte, Ing. Jr.
Acoustic Consultant

Rebecca Sondermeyer
Acoustic Consultant

## Introduction

State of the Art Acoustik Inc. was commissioned by Blueprint Builds to complete a Phase 2 feasibility noise study as required by the City of Ottawa for the proposed development at the corner of Beechwood Avenue and Chapleau Avenue in Ottawa, Ontario. We have followed the 2016 Environmental Noise Control Guidelines, which are compliant with the Ministry of Environment's NPC-300.

In Section 2.0, the site plan of the proposed development is shown and the surrounding area is analyzed for possible noise sources which would impact the proposed development. This study only includes noise from road sources.

In Section 3.0, the noise impact calculation procedure is described and in Section 4.0, the predicted noise impact from Beechwood Avenue onto this development has been analyzed. Section 5.0 is an AIF analysis and recommendations for the exterior envelope of the building are discussed.

There are no rooftop units or mechanical equipment susceptible to bothering nearby noise sensitive areas. A stationary noise study is therefore not required.

## Site Plan Evaluation

### 1.1 Project Description

The proposed development consists of an office building located at the corner of Chapleau Avenue and Beechwood Avenue in Ottawa, Ontario. The area surrounding the development consists mostly of low rise residential buildings and commercial spaces. We have considered traffic noise from Beechwood Avenue as the only noise source for this location as the only other collector roads are 200 and 300 meters away. No mechanical noise from any surrounding building or other sources of noise is anticipated as no large mechanical equipment is present on nearby buildings. The proposed building does not have any outdoor amenities areas as it is a commercial building.

### 1.2 Site Plan Review

Figure 2.1 shows the location of the proposed development and the surrounding area including surface transportation noise sources. Beechwood Avenue is the only surface transportation noise sources that must be considered as it is located 11.5 m away from the building. According to the City of Ottawa Environmental Noise Control Guidelines, if the development is within 100 m of an arterial road, a noise study is required. The type of road is defined in the City of Ottawa Schedules E and F. Figure 2.2 shows the site plan of the proposed office building.


**Figure 2.1 –** Surrounding area and location of the proposed development at the corner of Chapleau Avenue and Beechwood Avenue

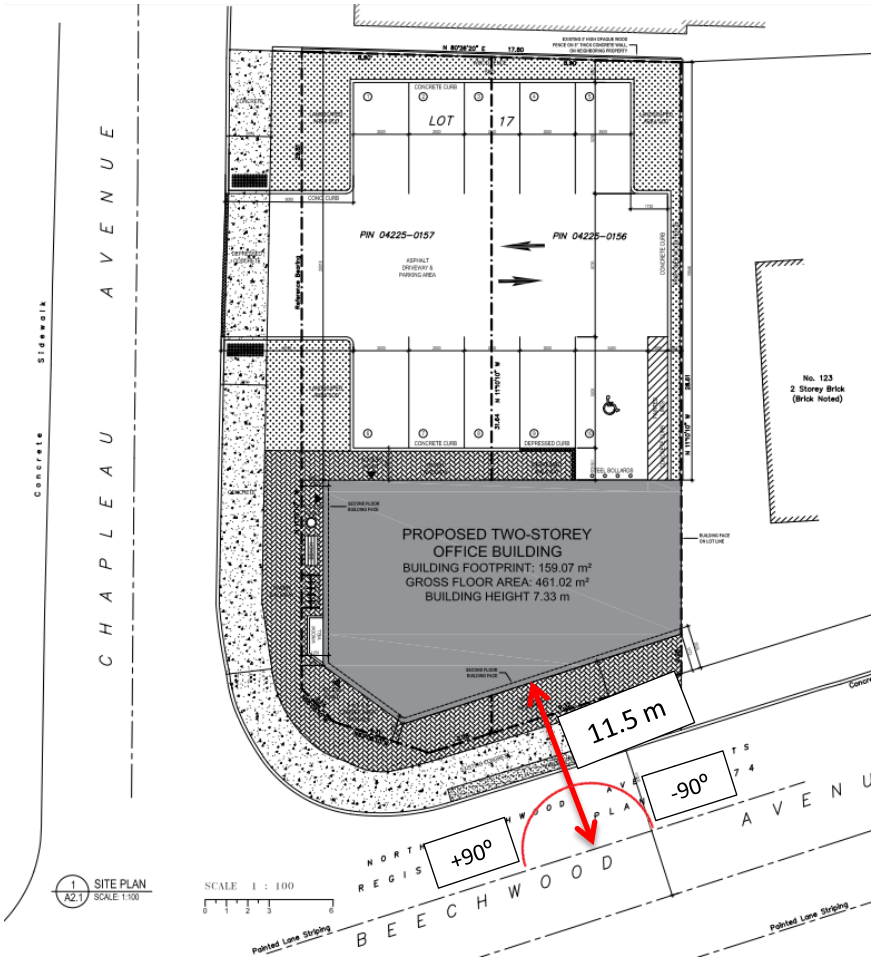



**Figure 2.2 –** Site plan of proposed commercial building at the Corner of Chapleau and Beechwood

## NOISE IMPACT PROCEDURE

### 1.3 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 2.2c of the ENCG and summarized in Table 3.1 below.

| Time | Indoor Leq Levels (dBA) Class 1, 2 & 3 Areas |
|---|---|
| | Road Traffic/Light Rail Noise Level Limit (dBA) |
| **07:00 – 23:00** | **50** for General offices, reception areas, retail stores, etc. |
| **07:00 – 23:00** | **45** Individual or semi-private offices, conference rooms, etc |

**Table 3.1 –** Criteria for Indoor Area Road and Rail 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

This noise control study is required as the building is less than 100 m from Beechwood Avenue.

### 1.4 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 Leq 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. Measures for sound attenuation include:<br>• multi-pane glass;<br>• brick veneer;<br>• 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.<br>To help address the need for sound attenuation this development may include:<br>• multi-pane glass;<br>• brick veneer;<br>• construction of a solid fence in backyard area<br>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.<br>To help address the need for sound attenuation this development may includes<br>• multi-pane glass;<br>• brick veneer;<br>• construction of a solid fence in backyard area<br>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 | This warning clause notes that only an indoor environment is being provided for. |

| | | |
|---|---|---|
| | 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. | |

**Table 3.2 –** Warning Clause Types and Example Text from the City of Ottawa (from ENCG Table A1)

### 1.5 Building Component Assessment (AIF Analysis)

According to the ENCG, when noise levels could exceed 55 dBA at the Plane of Window (POW) of an office area (day) 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 general office space or reception areas should be 50 dBA
- maximum daytime indoor $L_{eq}$ for individual or semi-private offices should be 45 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]

## Surface Transportation Study

The following section describes our analysis of the road noise impact on the proposed Beechwood Avenue Office building.

### 1.6 Road Traffic Information

For this study, the only surface transportation noise source considered is traffic from Beechwood Avenue. This building is farther than 100 m from any other urban collector and arterial road, 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 (%) |
|---|---|---|---|---|---|---|
| **Beechwood Avenue** | 4-Lane Urban Arterial-Undivided | 30,000 | 50 km/h | 92/8 | 7 | 5 |

**Table 4.1 –** Summary of Major Roadway Noise Source

### 1.7 Procedure Used for Roadway and Railway 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.

### 1.8 Points of Reception

To determine the worst case noise impact on the façade of the building, we have chosen three locations at the South side of the building. Both points of reception (PORs) are located on the first floor: on the façade of a small personal office closest to Beechwood Avenue (POR 1), on the plane of window of the second floor in the room directly above POR 1 furthest from Chapleau Avenue (POR 2), and on the plane of window of the reception area on the first floor (POR 3). We have chosen these PORs to be representative of the typical worst case scenario for traffic noise from Beechwood. The small office area on the first floor was chosen as the smallest room adjacent to Beechwood Avenue, the second floor office was chosen because the exterior cladding differs from the first floor and the reception area was chosen because of the large window area adjacent to Beechwood Avenue. The position of these points is shown in Figure 4.1 and 4.2, indicated by the blue cross.

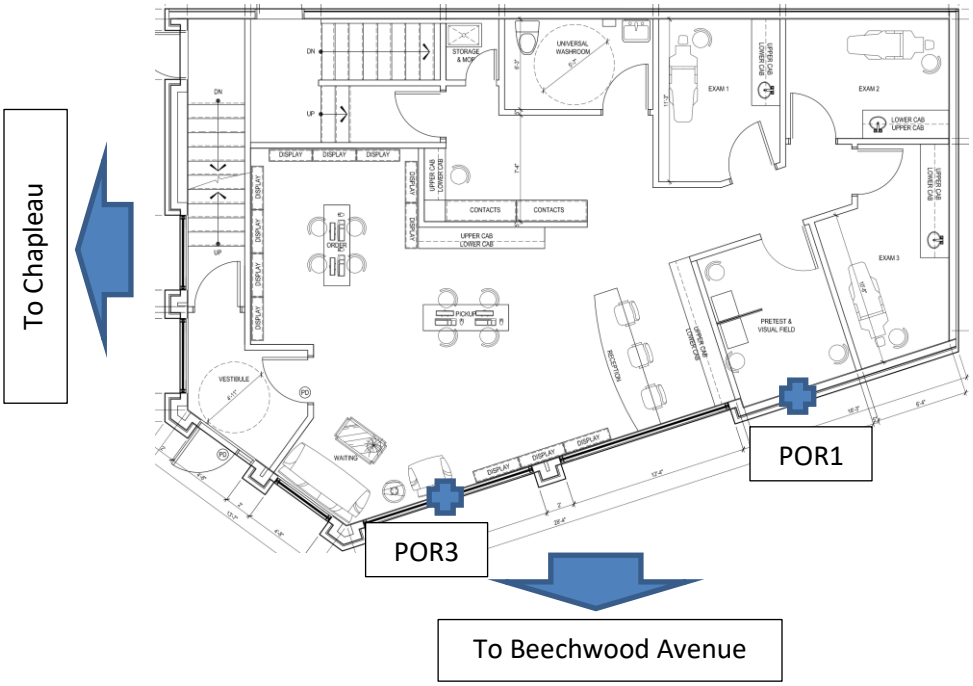



**Figure 4.1 –** Floor Plan of the 1st floor showing the Plane of Window Point of Reception POR1.

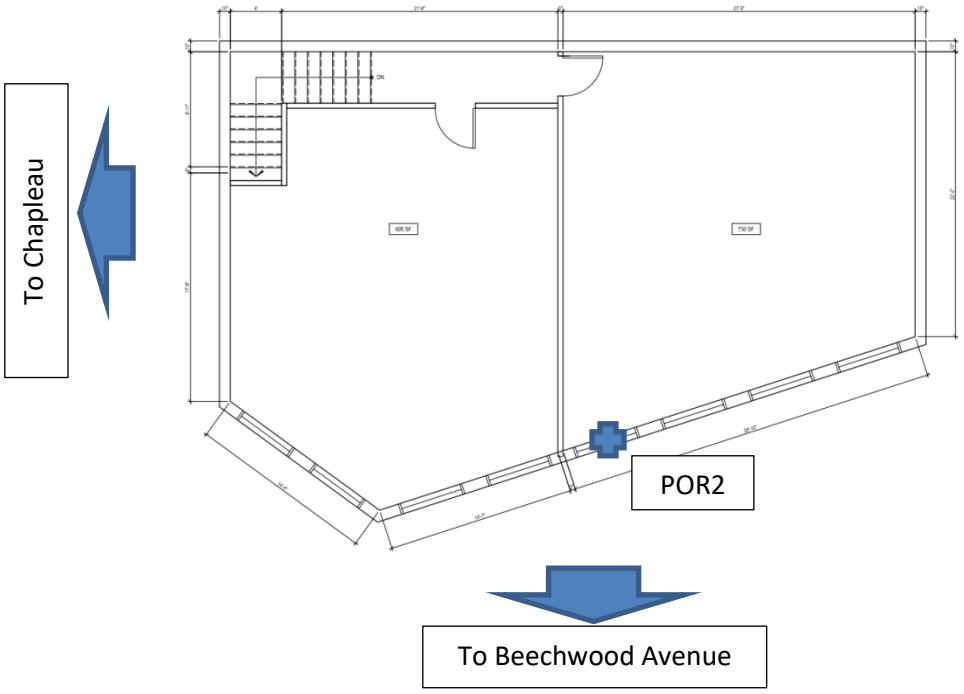



**Figure 4.2 –** Floor Plan of the 2nd floor showing the Plane of Window Point of Reception POR2.

### 1.9 Parameters Used for Analysis

The parameters used in STAMSON to assess the noise impact at POR 1 and POR 3 are the same as both points of reception are located at an equal distance from the only noise source: Beechwood Avenue. The parameters for POR 2 are very similar, however the receiver height is set to 4.5 m as it is on the second floor. These parameters are shown below in Table 4.2:

| Parameter | Values Used |
|---|---|
| **Roadway:** | **Beechwood** |
| **PORs 1 & 3** | |
| Time Period | 16h/8h |
| Topography | Gradual slope; no barrier |
| Rows of Houses | 0 |
| Intermediate Surface | Reflective |
| Receiver Height (m) | 1.5 |
| Elevation Change (m) | 0 |
| Source Receiver Distance (m) | 15* |
| **POR 2** | |
| Time Period | 16h/8h |
| Topography | Gradual slope; no barrier |
| Rows of Houses | 0 |
| Intermediate Surface | Reflective |
| Receiver Height (m) | 4.5 |
| Elevation Change (m) | 0 |
| Source Receiver Distance (m) | 15* |

*The source-receiver distance is set at a minimum of 15 m in STAMSON.

**Table 4.2 –** Parameters used in the STAMSON model

We have assessed daytime levels for POR 1, POR 2 and POR 3 as this is a commercial building in which no one is expected to spend the night.

### 1.10 Surface Transportation Noise Levels

Table 4.5 summarizes the predicted sound pressure levels at the points of reception from the results of the STAMSON environmental noise software calculation (Appendix A). The noise levels at POR 1, POR 2 and POR 3 are corrected for a source-receiver distance of 11.5 m using equation (3) for an acoustic line source, which is representative of a road.

$$L_p = L_N - \log(4\pi r) \qquad (3)$$

In equation 3, $L_p$ is the sound pressure level at a certain distance r and $L_N$ is the sound power obtained from this equation and the STAMSON data.

| | POR 1 (dBA) | POR 2 (dBA) | POR 3 (dBA) |
|---|---|---|---|
| | Day | Day | Day |
| **Beechwood Avenue** | 71.5* | 71.5* | 71.5* |

* Corrected from STAMSON data using equation 3.

**Table 4.5 –** Predicted Road and Rail Noise at the Points of Reception

### 1.11 Roadway Noise Summary and Analysis

We have calculated the predicted noise level caused by traffic using STAMSON and have shown that a 16 h $L_{eq}$ at POR 1, POR 2 and POR 3, located on the 1$^{st}$ and 2$^{nd}$ floors of the South façade of the building, is 71.5dBA in all cases. As these levels are above 55 dBA, an evaluation of exterior building components is undertaken in section 5 in order to verify that building components will achieve the required daytime indoor sound level of 50 dBA for general offices or reception areas and 45 dBA for individual or semi-private offices.

## Exterior Building Component Analysis

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.

### 1.12 Building Components and Room Dimensions

The current design of the building's both floors South façade are made up of 2 different components:

**1)** Glazing
**2)** Exterior wall

POR 1 only has a single component: an exterior wall.

The exterior wall composition is different on each floor. For this study, the wall types will be approximated with their most similar analogues in the Canada Mortgage and Housing Corporation (CMHC) document "Road and Rail Noise: Effects on Housing". The wall type on the first floor is sufficiently similar to CMHC wall type EW5, while the wall type on the second floor is sufficiently similar to CMHC wall type EW1. These wall types are described in table 5.1.

| **First Floor Ext. Wall Assembly** | **Equivalent CMHC wall type EW5** |
|---|---|
| -Masonry exterior cladding | -100 mm Brick Veneer |
| -Continuous insulation | -25 mm Air Space |
| -Batt insulation in cavities | -Sheathing |
| -150 mm wood studs | -39x89 mm Studs |
| -13 mm gypsum board | -50 mm Fiber Glass Insulation |
| | -Vapour Barrier |
| | -13 mm gypsum board |
| **Second Floor Ext. Wall Assembly** | **Equivalent CMHC wall type EW2** |
| -EIFS exterior cladding | -Exterior wood, metal or fiber sheathing |
| -Batt insulation in cavities | -Rigid Insulation |
| -150 mm wood studs | -39x89 mm Studs |
| -13 mm gypsum board | -50 mm Fiber Glass Insulation |
| | -Vapour Barrier |
| | -13 mm gypsum board |

There is currently no selected window composition and as such minimum required window assemblies will be recommended in this section.

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 small office on the first floor, for the larger room on the second floor and for the reception area. This is where we determined the noise impact at POR 1, POR 2 and POR 3. The areas of the exterior wall components and ratios to the floor are given in Table 5.2 below. Layouts of the small office and the larger room directly above the first point of reception are shown in Figure 5.1.

| | **POR 1 (Small Office)** | **POR 2 (Large Office)** | **POR 3 (Reception)** |
|---|---|---|---|
| Floor Area [$m^2$] | **8.1** | **67.8** | **54.3** |
| South Façade Window Area [$m^2$]<br>(ratio to floor area) | 0<br>(0%) | 8.7<br>(13%) | 21.8<br>(40%) |
| South Façade Wall Area [$m^2$]<br>(ratio to floor area) | 10.6<br>(130%) | 24.6<br>(36%) | 21.8<br>(40%) |

**Table 5.2 –** Areas of the Exterior Building Components and Floor Area at each POR

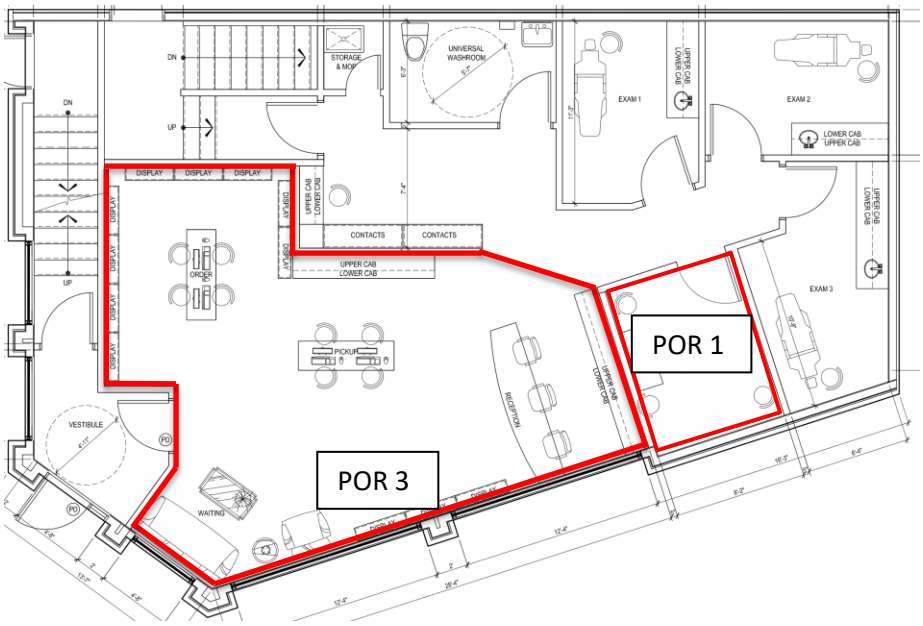



**Figure 5.1 –** Layout of the first floor office building indicating PORs 1 & 3 to Beechwood and furthest from Chapleau

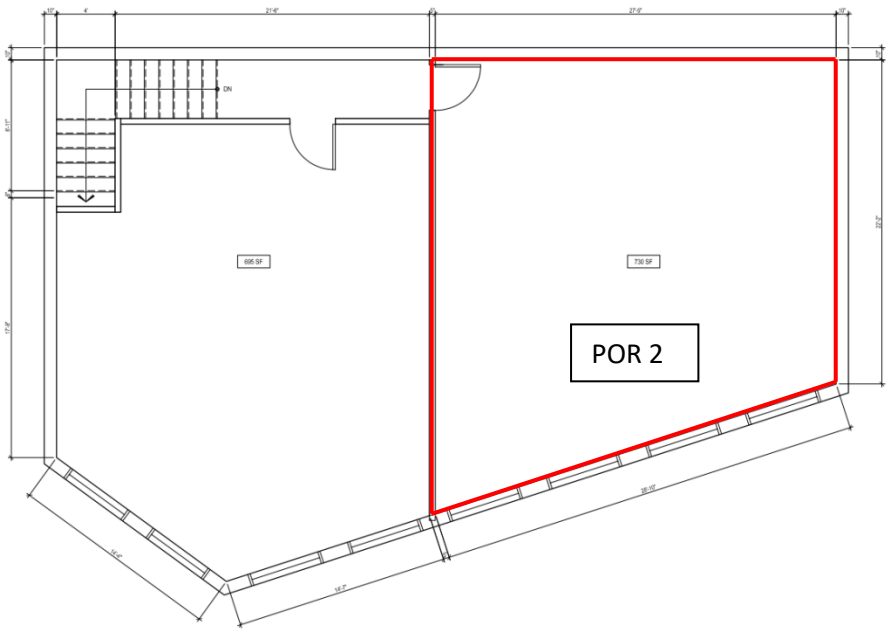



**Figure 5.2 –** Layout of the second floor indicating POR 2 to Beechwood and furthest from Chapleau

### 1.13 Required Overall AIF

Using equation (1), the required overall AIF for POR1 (small office) for the envelope is calculated as follows, allowing for the possibility of noise-sensitive uses requiring an indoor level for general offices and reception areas of 50 dBA and of individual or semi-private offices of 45 dBA:

**POR 1: Required AIF = 72 (Outside $L_{eq}$) – 45 (Required Indoor $L_{eq}$) + 2 = 29 (4)**

Thus the minimum required overall AIF for the exterior façade at this location is 29. The number of building components used is two: the exterior wall and the windows on the south façade.

The required overall AIF for POR2 for the envelope is calculated using equation (2) as it is composed of 2 exterior wall components and in this case the indoor requirement is 50 dBA as it is a general office area.

**POR 2: Required AIF = 72 (Outside $L_{eq}$) – 50 (Required Indoor $L_{eq}$) + $10\log_{10}(2)$ + 2 = 27 (5)**

Finally, the required overall AIF for POR 3 is calculated in the same was for POR 2.

**POR 3: Required AIF = 72 (Outside $L_{eq}$) – 50 (Required Indoor $L_{eq}$) + $10\log_{10}(2)$ + 2 = 27 (6)**

In summary, the required AIF at POR 1 is 29 and the required AIF at PORs 2 & 3 is 27.

### 1.14 Exterior Wall Requirements Based on Minimum AIF

The building exterior at POR1 is made up of a single component, the exterior wall itself. At PORs 2 & 3 the exterior is made up of the wall and window. As shown by Equations (4), (5) and (6), we have calculated that the required overall AIF for the 1-component façade (POR 1) is 29 and 27 for the two component façades (PORs 2 & 3).

In order to determine the minimum required wall composition based on the minimum required We first determine the AIF of the currently designed exterior walls for all PORs, according to Table 6.3 in CMHC "Road and Rail Noise: Effects on Housing".

On the first floor, using a ratio of 130% of wall area to floor area for POR 1, the AIF for the exterior wall, which we have assumed to be sufficiently similar to CMHC wall type EW5, is **45**. The AIF was calculated from CMHC data and wall area to floor area ratios.

As stated in Section 3.3 from the CMHC "Road and Rail Noise: Effect on Housing" document, if the AIF of any component exceeds the minimum required AIF by more than 10, the minimum AIF should be re-calculated with the number of components reduced. This does not apply to POR 1 as the exterior façade only has 1 component, however it will be relevant to PORs 2 & 3.

**POR 1:** No changes from section 5.2

On the second floor, using a wall area to floor area ratio of 36% for POR 2, the AIF for the exterior wall, which we have assumed to be sufficiently similar to CMHC wall type EW2 is 37. This is much greater than the minimum overall AIF of 27 for POR 2. We can re-calculate the minimum required AIF with a reduced number of components as the exterior wall exceeds the minimum required AIF by more than 10. This is calculated below in Equation (5).

**POR 2: Required AIF = 72 (Outside $L_{eq}$) – 50 (Required Indoor $L_{eq}$) + 2 = 24** **(5)**

Therefore the new minimum AIF is 24 at POR 2, which will dictate the window requirement.

In the first floor reception area, using a ratio of 60% of wall area to floor area for POR 3, the AIF for the exterior wall, which we have assumed to be sufficiently similar to CMHC wall type EW5, is **49** at POR 3. We can re-calculate the minimum required AIF with a reduced number of components as the exterior wall exceeds the minimum required AIF by more than 10. This is calculated below in Equation (6).

**POR 3: Required AIF = 72 (Outside $L_{eq}$) – 50 (Required Indoor $L_{eq}$) + 2 = 24** **(6)**

Therefore the new minimum AIF is 27 at POR 3, which will dictate the window requirement. It should be noted that this does not apply to POR 1 as there are no windows in the office and is already a single-component wall.

Detailed shop drawings including material specifications must be provided by construction contractor to ensure adequate sound isolation through exterior walls.

### 1.15 Exterior Glazing Requirements Based on Minimum AIF

If the exterior wall envelope is constructed as described above, the minimum AIF values of 24 dictates the overall window construction at POR 2 and POR 3. It should be noted that the exterior wall at POR 1 does not contain windows and is therefore not discussed in this section.

Using ratios of window area to floor area of 13% and 40% for POR 2 and POR 3, and table 6.2 in the CMHC "Road and Rail Noise: Effect on Housing" we recommended a minimum window composition of two 3 mm glass panes separated by a 13 mm airspace. Table 5.2 summarizes our window recommendations in terms of AIF.

| | **Minimum Required Window Composition** | | | | |
|---|---|---|---|---|---|
| **Location** | **Glass Thickness** | **Interplane Spacing** | **Window area to floor area** | **AIF of minimum recommended window composition** | **AIF Requirement** |
| **POR 1 – Small Office** | N/A | N/A | 0% | N/A | N/A |
| **POR 2 – Large Room** | 3 mm & 3 mm | 13 mm | 13% | 33 | 24 |
| **POR 3 – Reception** | 3 mm & 3 mm | 13 mm | 40% | 28 | 24 |

**Table 5.2** – Glazing analysis for building's exterior wall facing Beechwood Avenue, data taken from CMHC "Road and Rail Noise: Effect on Housing" table 6.2.

Detailed shop drawings including material specifications must be provided by construction contractor to ensure adequate sound isolation through windows.

## 1.16 Summary

This summary gives the minimum requirements for exterior building elements for the proposed apartment building at the corner of Chapleau and Beechwood and is based on the most stringent requirements of the AIF analysis above.

**Exterior Walls (Section 5.3)**

The exterior wall compositions are as follows:

| **First Floor Ext. Wall Assembly** | **Second Floor Ext. Wall Assembly** |
|---|---|
| -Masonry exterior cladding | -EIFS exterior cladding |
| -Continuous insulation | -Batt insulation in cavities |
| -Batt insulation in cavities | -150 mm wood studs |
| -150 mm wood studs | -13 mm gypsum board |
| -13 mm gypsum board | |

These walls are adequate and exceed the minimum AIF requirements by more than 10 points. Therefore the wall can be considered to be composed of a single component.

**Exterior Glazing (Section 5.4)**

We recommend the following window composition to meet the minimum AIF requirement of 24 at PORs 2 & 3 with window to floor ratios of 13% and 40% :

- 3 mm pane of glass
- 13 mm airspace
- 3 mm pane of glass

Detailed shop drawings including material specifications must be provided by construction contractor to ensure adequate sound isolation through exterior walls and windows.

## 6.0 Conclusion

We have analyzed the traffic noise impact for road sources for the proposed apartment building on the corner of Chapleau and Beechwood. A detailed building component analysis was completed due to sound levels over 55 dBA at the Plane of Window (POW). The minimum wall and window composition requirements were determined and are presented in detail in sections 5.3 and 5.4, and are summarized in section 5.5. Warning clauses for road and rail traffic noise should also be included in the rental agreement for the building. STAMSON calculations have been included in the Appendix.

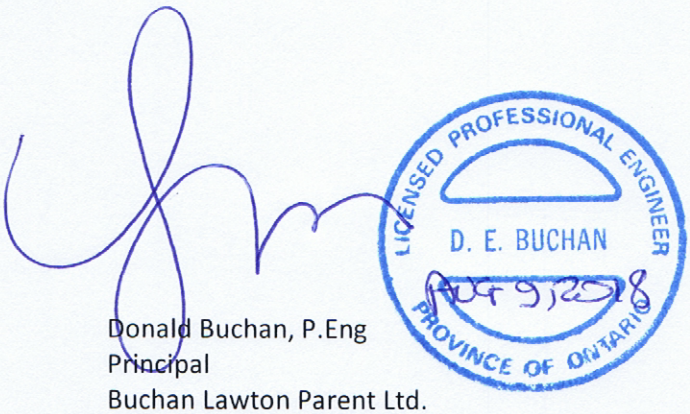
Should you have any questions or comments regarding this report, please do not hesitate to contact us.

Sincerely,

Adrien Amyotte, Ing. Jr.
Acoustic Consultant

Rebecca Sondermeyer
Acoustic Consultant

Approved By:




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

# Appendix A
# STAMSON Calculations

Description:

STAMSON 5.0 NORMAL REPORT Date: 30-07-2018 16:02:31
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 119beec1.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: (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)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 30000
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: (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 : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1:  (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

Total Leq All Segments: 71.49 dBA

STAMSON 5.0 NORMAL REPORT Date: 30-07-2018 16:03:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 119beec2.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: (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)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 30000
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: (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 : 4.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1:  (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

Total Leq All Segments: 71.49 dBA

STAMSON 5.0 NORMAL REPORT Date: 30-07-2018 16:03:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 119beec3.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: (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)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 30000
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: (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 : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1:  (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

Total Leq All Segments: 71.49 dBA

**ADDENDUM – Layout Changes, Residential Additions and Impact on Noise 25/02/2019**

The layout of this development has been modified from a 2-storey commercial building to a 3-storey building mixed use commercial and residential building since the original study was completed. The purpose of this addendum is to evaluate the traffic and environmental noise impacts of the modifications to the development. Figures A1, A2 and A3 below show the updated floor plans for the 2nd storey, the new 3rd storey plans and the new rooftop terraces.


**Figure A1** – Second floor residential floor plans

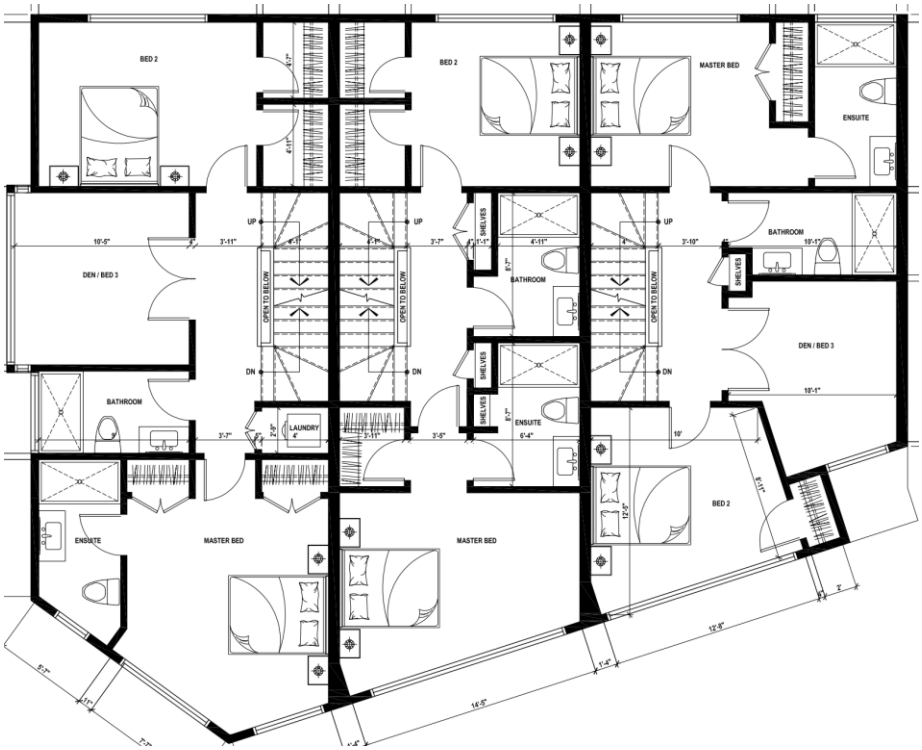



**Figure A2** – Third floor residential floor plans

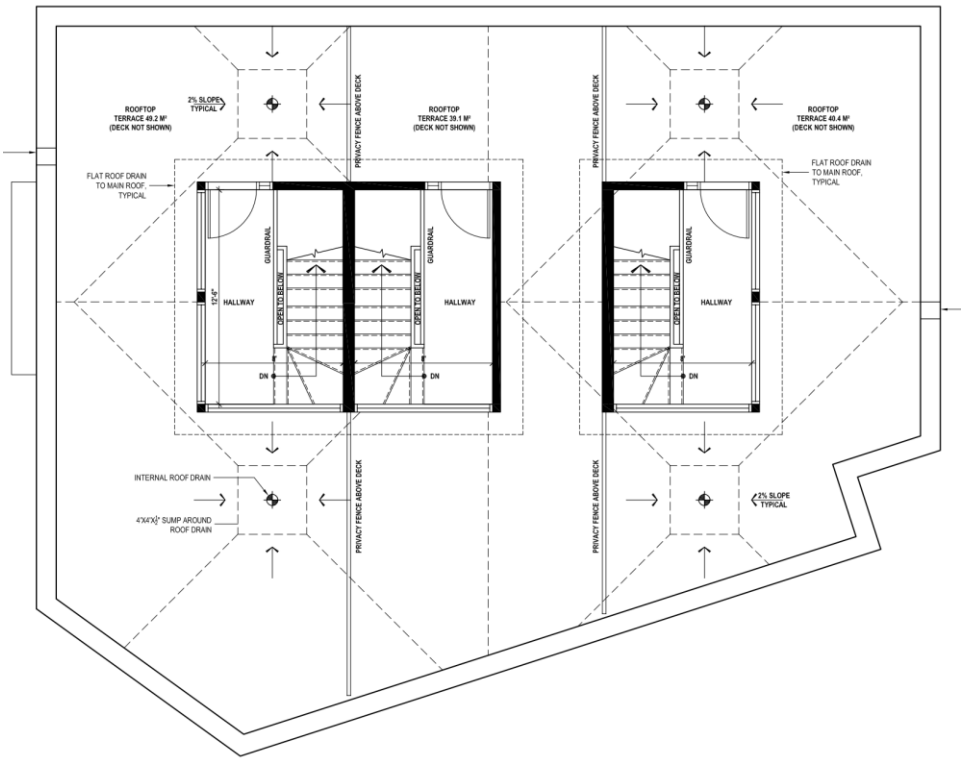



**Figure A3** – Rooftop terraces

The required interior noise levels are affected by these changes as residential properties have stricter interior noise requirements than commercial spaces in the city of Ottawa ENCG. Further, nighttime noise levels must now also be considered as residential units are presumed to be occupied 24 hours a day, rather than only during daytime hours as with commercial properties. The interior noise requirements for residential units are 45 dB during the day and 40 dB in sleeping quarters during nighttime as compared to the 50 dB interior noise requirements for commercial spaces.

Daytime traffic noise levels were calculated at the plane of window in the original report and still apply. The nighttime noise levels were calculated for this addendum using STAMSON data, included as an appendix, and equation 3 from the original report. The worst case scenario daytime noise levels are 71.5 dB, while the nighttime noise levels are 64.0 dB.

While the layout of the commercial floor has been modified from the original drawings, the area of the worst case scenario has been increased and thus the original analysis for the first floor is still valid. This addendum only addresses the 2nd and 3rd storey residential floors and the rooftop terraces.

Using equation 2 from the original report, the required AIF using the daytime limit for daytime is:

**Required AIF = 71.5 dB(Outside $L_{eq}$) – 45 dB(Indoor $L_{eq}$) + 10 $\log_{10}$(2) + 2dB = 31.5 (A1)**

Using the same equation, the required AIF using the nighttime limit for sleeping quarters is:

**Required AIF = 64.0 dB(Outside $L_{eq}$) – 40 dB(Indoor $L_{eq}$) + 10 $\log_{10}$(2) + 2dB = 29 (A2)**

The worst case scenario location for this analysis is therefore the daytime, with an AIF requirement of 31.5. The east most unit's bedroom 2 on the third floor has been selected as the worst case scenario POR for this analysis as it is located directly on the Beechwood facing wall, has a large window and the smallest surface area of the bedrooms located along this wall. Table A1 the wall and window area as a ratio of floor area for this location.

| **Floor Area ($m^2$)** | **10.8** |
|---|---|
| **Wall Area ($m^2$)** **(ratio to floor area)** | 3.8 (35%) |
| **Window Area ($m^2$)** **(ratio to floor area)** | 7.9 (73%) |

**Table A1** – Building Components and Floor Areas

**Exterior Wall Analysis**

Using the above calculated wall to floor ratio of 35% and table 6.3 of CMHC "Road and Rail Noise: Effects on Housing", we conclude that the AIF value of the exterior wall composition is 37, which is above the minimum requirement of AIF 31.5 and is therefore acceptable.

Because the exterior wall composition does not exceed the required AIF requirement by more than 10, the number of components cannot be reduced in our analysis and as such the glazing and door components will need to achieve a minimum AIF requirement of 33.

**Exterior Glazing Analysis**

Table A2 below shows the recommended window composition to obtain AIF 31.5 using table 6.2 of CMHC "Road and Rail Noise: Effects on Housing" and a 73% window to floor ratio. This is a rather high AIF requirement for windows and will require laminated glass to achieve, as non-laminated glass would require very large airspaces (40 mm or more). Because the CMHC document does not include laminated glass, the AIF requirement must be converted to an STC requirement using table D2 of the document. Using this table with a window to floor area of 73%, the STC requirement for the glazing is 36.5.

| **Minimum Required Window Composition** | | | | | |
|---|---|---|---|---|---|
| **Glass Thickness** | **Interplane Spacing** | **Laminated Glass** | **Window area to floor area** | **STC of minimum recommended window composition** | **STC Requirement** |
| 3 mm | 12 mm | 6 mm , 1.5 mm film | 73% | 38 | 36.5 |
| 3 mm | 12 mm | 8 mm, 0.75 mm film | 73% | 38 | 36.5 |

**Table A2** – Minimum Glazing Requirements for 119-121 St. Joseph Boulevard

The required minimum window composition for this building is therefore either a double pane window with one 3 mm glass pane, a 12 mm airspace and a 6 mm pane laminated with 1.5 mm film or, if preferable, a double pane window with one 3 mm glass pane, a 12 mm airspace and one 8 mm glass pane laminated with 0.75 mm film. Note that this requirement is stricter than in the original report.

If the use of laminated glass is unacceptable, the total window area of rooms facing Beechwood Avenue must be reduced to a maximum of 3.5 $m^2$, in which case the use of a double pane glass with one 3 mm pane, a 16 mm airspace and one 6 mm pane would be acceptable.

**Outdoor living areas**

The rooftop terraces proposed for this building under the following City of Ottawa ENCG definition:

"*Balconies and elevated terraces, provided they are the only outdoor living areas for the occupant and meet the following conditions:*

- *Minimum depth of 4 m;*
- *Outside the exterior building facade;*
- *Unenclosed;"*

According to the ENCG, noise control measures are required for outdoor living areas if the daytime traffic noise is in excess of 55 dB. In this case, noise levels have been calculated to be 71.5 dB, and therefore require mitigation measures.

The primary recommendations from the ENCG are to setback the terraces or insert noise insensitive land between the terraces and the road. These primary recommendations are unfeasible as the site plan does not permit significant relocation of these areas.

Our recommendation for a mitigation measure is therefore to include an acoustic barrier along the edge of the terraces between Beechwood Avenue and the terraces. An acoustic barrier must be of solid construction with no gaps. The barrier must have a minimum height of 1.5 m and the gap between the floor and barrier must be a maximum of 100 mm. We recommend that this barrier extend along the East and West edges of terraces as well as the South edge as all these sides are also exposed to noise from Beechwood Avenue.

This will reduce the traffic noise in the Outdoor Living Area from 71.5 dB to 57.2 dBA, according to the STAMSON calculation included in the appendix. While this is still above the ENCG limit of 55 dBA, it now much lower than what was predicted with no barrier. Short of relocating the entire building further away from Beechwood, very little can be done to further attenuate noise on the terraces of the development. A Warning Clause, similar to those listed in table 3.2 of the original report, should be included in the purchase agreement for the residential units noting that despite the inclusion of noise mitigation measures, the noise levels will exceed 55 dBA due to proximity of Beechwood Avenue.

**Summary**

The addition of residential units and the layout modifications of 119-121 Beechwood entail stricter requirements for windows, as well as the requirement for an acoustic barrier along the rooftop terraces between the terraces and Beechwood avenue.

The minimum required window compositions are listed below:

| | | |
|---|---|---|
| 3 mm glass | | 3 mm glass |
| 12 mm airspace | | 12 mm airspace |
| 3 mm glass | or | 4 mm glass |
| 1.5 mm film | | 0.75 mm film |
| 3 mm glass | | 4 mm glass |

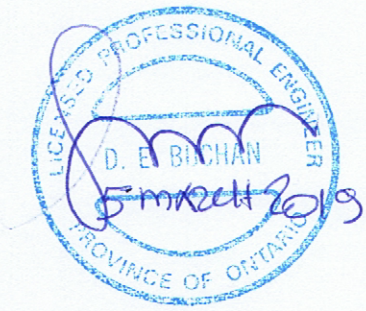
A minimum 1.5 m solid acoustic barrier with no gaps is required along the South, East and West edges of the rooftop terraces to block noise from Beechwood Avenue. Further, A Warning Clause, similar to those listed in table 3.2 of the original report, should be included in the purchase agreement.

Should you have any comments or questions regarding this addendum, please do not hesitate to communicate with us.

Sincerely,

Adrien Amyotte, Ing. Jr.
Acoustic Consultant

Approved By:




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

**APPENDIX – STAMSON Night and Barrier Calculations**

Results segment # 1: (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

Total Leq All Segments: 63.89 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.49
(NIGHT): 63.89

Results segment # 1: (day)
---

Source height = 1.50 m

Barrier height for grazing incidence
---
Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
---
1.50 ! 10.50 ! 10.20 ! 10.20

ROAD (0.00 + 57.17 + 0.00) = 57.17 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 -14.32 57.17
---

Segment Leq : 57.17 dBA

Total Leq All Segments: 57.17 dBA