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IDEA – Ronald McDonald House Expansion
Noise Impact Study

Dear Debbie,

We are pleased to present the following noise impact study for the newly proposed addition to the Ronald McDonald House, located at 407 Smyth Road in Ottawa. The City of Ottawa has requested a noise impact study be completed and included as part of the Site Plan Application (SPA) for this project. As per City of Ottawa requirements, an environmental noise study from the proposed rooftop equipment is required, as well as a review of the existing noise levels at the site to ensure the new development is not negatively impacted by the local background noise.

The environmental noise study considers all 6 rooftop units planned for the development and predicts the noise impact onto the nearby residential zones, hotels, and hospital.

To review the existing noise levels from mechanical equipment on nearby buildings, we conducted 24-hour noise monitoring on the proposed site and determined if the proposed building façade compositions were required to maintain acceptable interior noise levels.

Due to the distance between the proposed addition and the nearest road/rail noise source, a traffic noise study was not required for this site.

We provide a general description of the project in Section 2.0, with the environmental noise study in Section 3.0 and the review of existing background noise in Section 4.0.

1.0 Introduction

State of the Art Acoustik Inc. has been commissioned to complete a noise impact study, as requested by the City of Ottawa, for the Site Plan Application detailing the construction of a new addition to the Ronald McDonald House located at 407 Smyth Rd. The following report follows the 2016 City of Ottawa ENCG, which is compliant with the Ministry of Environment, Conservation, and Park's (MECP) NPC-300.

In Section 2.0, we provide a description of the site and project, in Section 3.0 we present the environmental noise study and in Section 4.0 we present the results of our 24-hour noise monitoring and interior noise calculations.

2.0 Site Plan Evaluation

2.1.1 Project and Site Description

The proposed development consists of a three storey addition to the Ronald McDonald House, with a gross area of approximately 1800m^2. The building is to be located to the north of the existing RMH on Smyth Road. The site is surrounded by the Ottawa Health Science Centre to the East, a small hotel and residential area to the south, an office campus to the west and a Transalta power and heating plant to the north.

All locations surrounding the development are noise sensitive receptors, excepting the Transalta power and heating plant.

2.1.2 Site Plan Review

Figure 2.1 shows the site plan of the proposed addition and figure 2.2 shows the nearby area and identifies sensitive noise receptors as well as the Transalta plant.

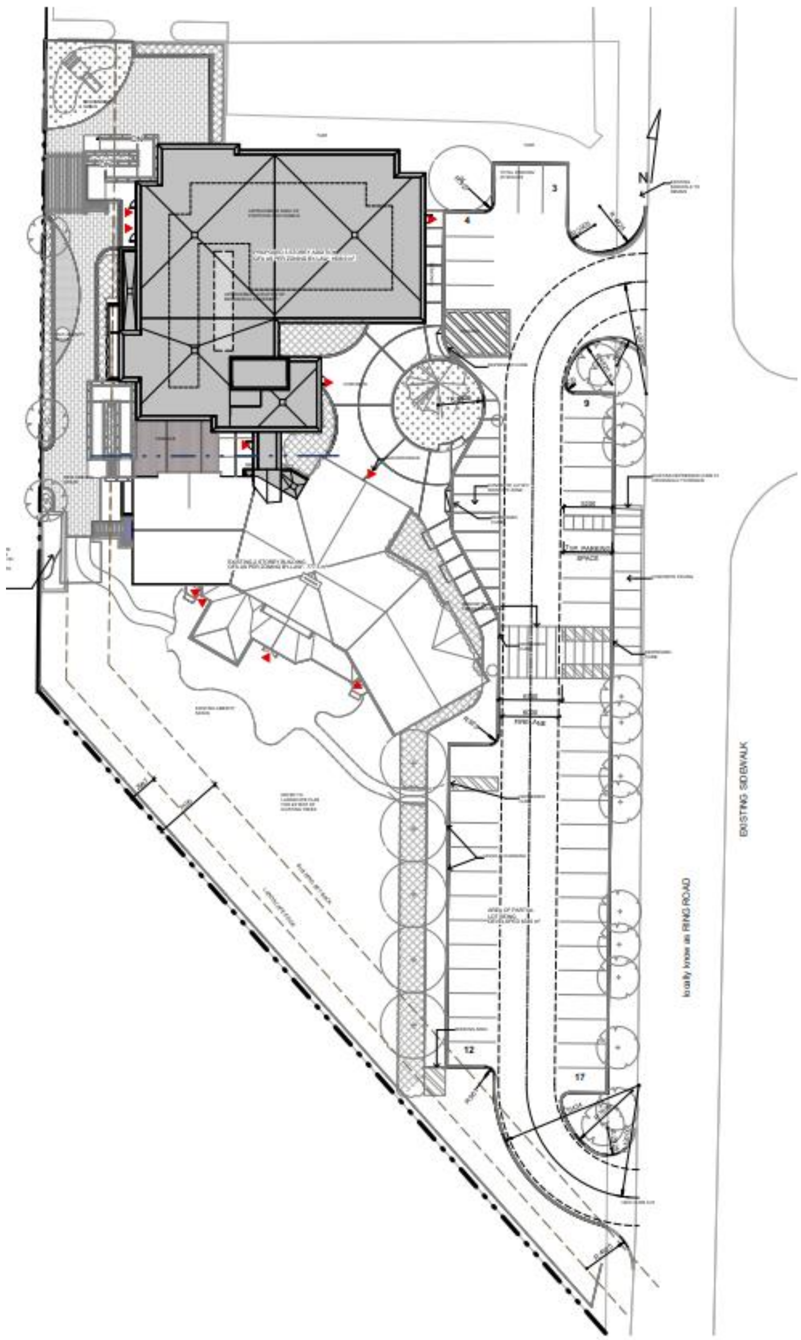


Figure 2.1 – Site plan of 407 Smyth Road

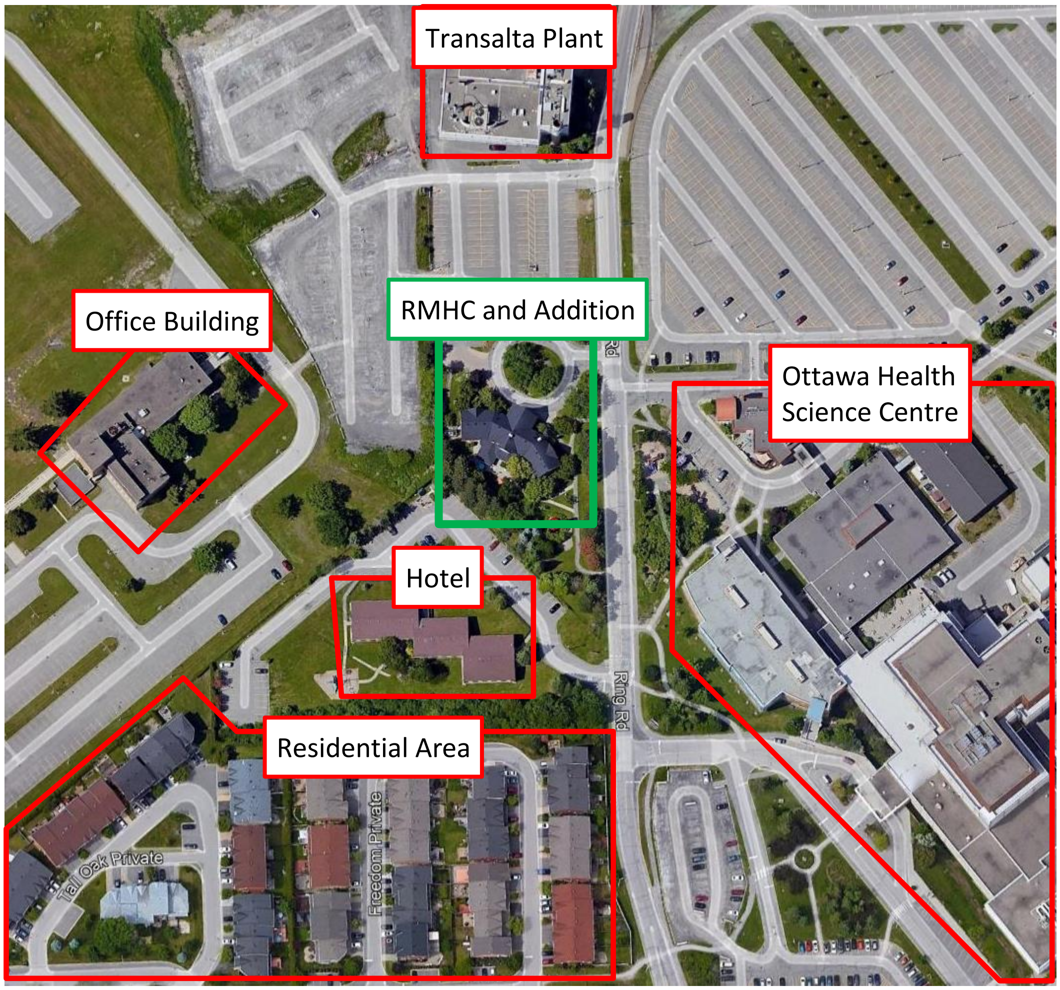


Figure 2.2 – Satellite view of 407 Smyth Road and surrounding environment. Imagery taken from Google Earth.

3.0 Environmental Noise Assessment

The following sections describe our analysis of the environmental noise impact expected from the six mechanical rooftop units to the surrounding area.

3.1.1 Equipment Site Plan & Operation Hours

The sources considered in this assessment of the stationary noise to nearby receptors include five rooftop condensing units (CU-1 through 5) and one domestic water heat pump (HP-1). In accordance with the predictable worst-case operating scenario, all exterior mechanical elements are assumed to be in constant operation, under a full load. Figure 3.1 below shows a rooftop plan with all units identified. The sound power levels of these units are provided in Table 3.1.

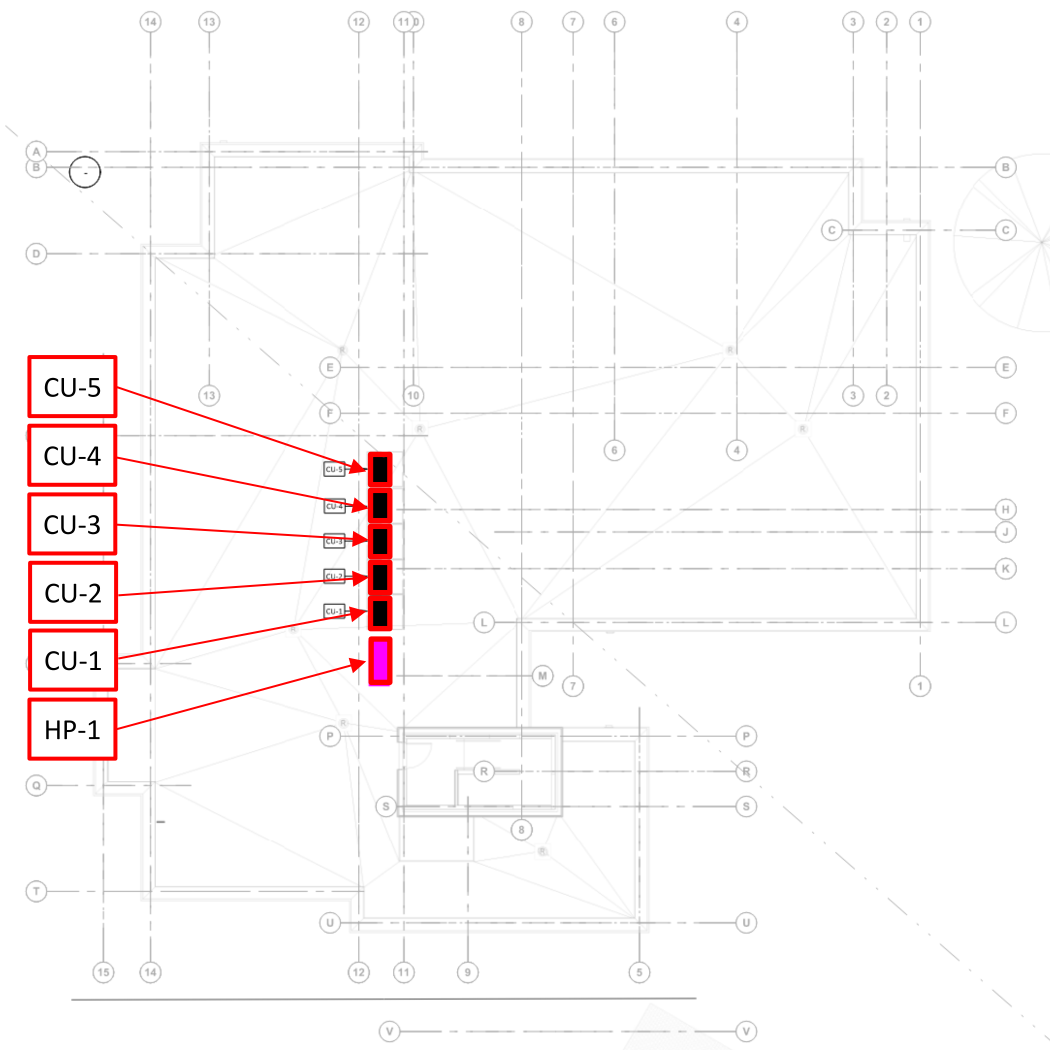


Figure 3.1 – 407 Smyth Road Rooftop plan with mechanical units identified.

3.1.2 Noise Sources

The sound power levels for the mechanical equipment are presented in Table 3.1, below. All data was provided in Sound Power Level from the manufacturer. This data may be found in the appendix.

Noise Source	Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
CU-1 (Condensing Unit)	-	84	82	77	72	62	58	56	78.5
CU-2 (Condensing Unit)	-	86	82	79	73	67	64	62	80.0
CU-3 (Condensing Unit)	-	85	87	84	81	73	70	65	85.6
CU-4 (Condensing Unit)	-	92	89	86	84	77	74	69	88.4
CU-5 (Condensing Unit)	-	92	89	86	84	77	74	69	88.4
HP-1 (Domestic Water Heat Pump)[1]	70	64	66	60	61	55	54	47	65.0

Table 3.1 – Octave band sound power levels of noise sources.

[1]Sound data for the heat pump is sound pressure level, measured at 1 meter from the unit.

3.1.3 Applicable By-Laws

The City of Ottawa Noise Bylaw has the same limit as the MECP NPC-300 for daytime permissible Sound Pressure Level (SPL) at a noise sensitive location in a Class 1 area of 50 dBA and 45 dBA at night. The Bylaw is to be used in conjunction with the ENCG, which are based on the MECP NPC-300 Noise Control Guidelines. The nearby receptors are a mix of residential zones, hotels and office areas. The associated sound pressure level limits are indicated in Table 3.2.

3.1.4 Points of Reception for Environmental Noise

The Points of Reception for the environmental noise study are listed in Table 3.2 and identified in Figure 3.2. Each POR represents the worst-case plane of window location on the respective building. We also evaluated sound pressure levels at properties beyond those shown, but the impact was negligible.

PORs which are residential, or hotel (POR 1 through POR 4) must meet the nighttime sound pressure level limit of 45 dBA, while the office building (POR 5) must meet the daytime limit of 50 dBA.

Receiver	Height [m]	Address	Sound Pressure Level Limit
POR 1	4.5	407 Smyth Road	45
POR 2	7.5	401 Smyth Road (Roger Neilson House)	45
POR 3	7.5	401 Smyth Road (CHEO Foundation)	45
POR 4	4.5	411 Smyth Road	45
POR 5	7.5	1745 Alta Vista Drive	50

Table 3.2 – Environmental points of reception.

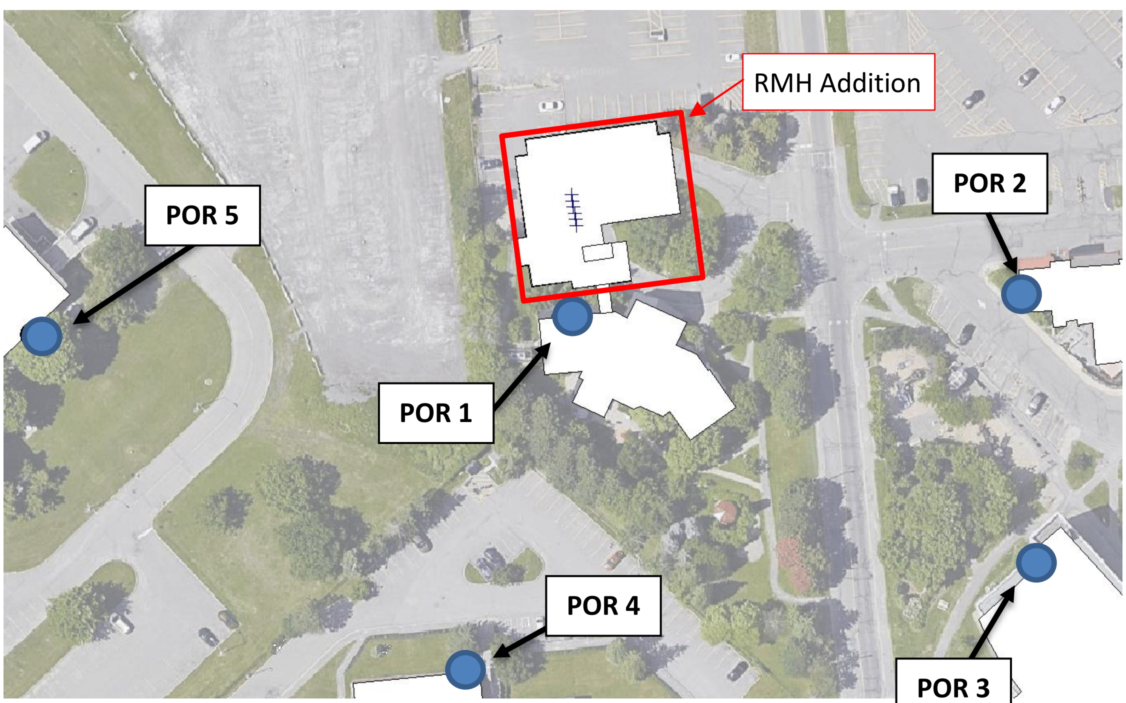


Figure 3.2 – Locations of points of reception (PORs). The RMH addition is identified in red.

3.1.5 Methodology Used in Noise Impact Calculation

The environmental noise analysis was completed using an environmental noise modeling software called CadnaA, which references ISO 9613. CadnaA predicts environmental noise through calculations based on a 3D model which uses geometrical, landscape, and topography data, combined with details of the proposed construction, and the noise source power levels.

We created a 3D rendering of the neighbourhood around the site, placed the noise sources in the model at the appropriate locations, and then and applied the sound power levels described in Table 3.1.

In addition to the modelling process described above, the following table lists the parameters used in the CadnaA model:

Parameter	Value/Condition
Temperature (°C)	10
Relative Humidity (%)	70
All Buildings, Roads and Land Fully Reflective	Absorption Coefficient Alpha = 0
Maximum Order of Reflection	2
No Sub. of Neg. Ground Att.	ON
No Neg. Path Difference	ON

Table 3.3 – Parameters used in CadnaA modeling.

3.1.6 Results & Noise Control Measures and Recommendations

Figure 3.3 shows the noise prediction grid generated by CadnaA at a height of 4.5 m for daytime operations, that is, with all noise generating equipment running at full capacity. The predicted noise levels at the PORs are also provided in Table 3.4.

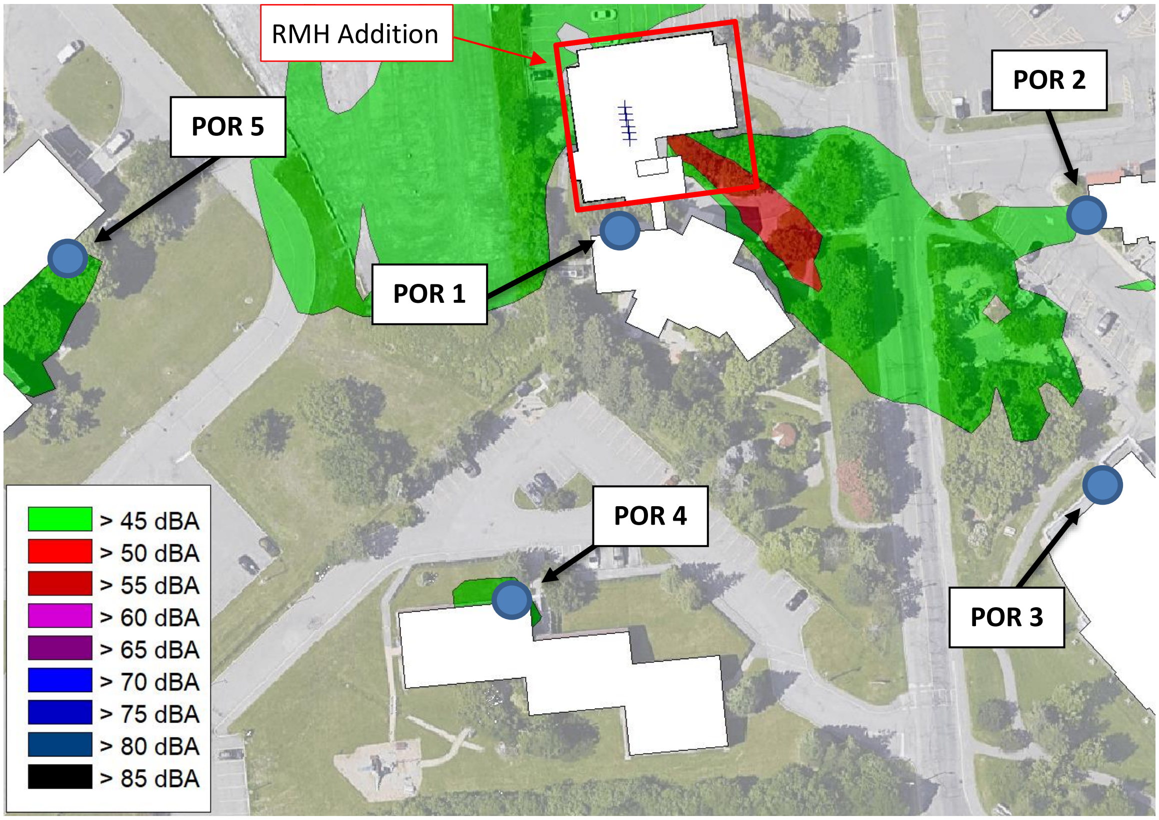


Figure 3.3 – Sound pressure level heatmap and locations of points of reception (PORs). Legend provided in dBA SPL.

Note: The sound pressure level given for each POR is calculated at the worst-case plane of window on the respective building.

Receiver	Height [m]	Address	Sound Pressure Level Limit	Predicted Sound Pressure Level	Within Limit?
POR 1	4.5	407 Smyth Road	45	43.8	Yes
POR 2	7.5	401 Smyth Road (Roger Neilson House)	45	44.6	Yes
POR 3	7.5	401 Smyth Road (CHEO Foundation)	45	45.0	Yes
POR 4	4.5	411 Smyth Road	45	43.7	Yes
POR 5	7.5	1745 Alta Vista Drive	50	45.4	Yes

Table 3.4 – Environmental points of reception and predicted sound pressure level

Based on the predicted sound levels shown in Table 3.4, no environmental noise mitigation measures are required for the site, provided that the maximum allowable sound power levels provided in Table 3.1 are respected.

4.0 Background Noise Assessment

Due to the proximity of the proposed addition to the nearby Transalta plant and Hospital, which contain a significant amount of outdoor mechanical equipment, we conducted a background noise survey at the site. This survey was to determine if the existing noise levels were below the maximal noise threshold (60 dBA for nighttime, 65 dBA for daytime), or if a building components analysis was required to ensure that interior sound levels comply with the sound level limits described in NPC-300.

A sound level meter was set up just outside the existing RMH for a period of 24 hours, between November 11th and November 12th, 2022. The recorded sound pressure levels are shown in Figure 4.1.

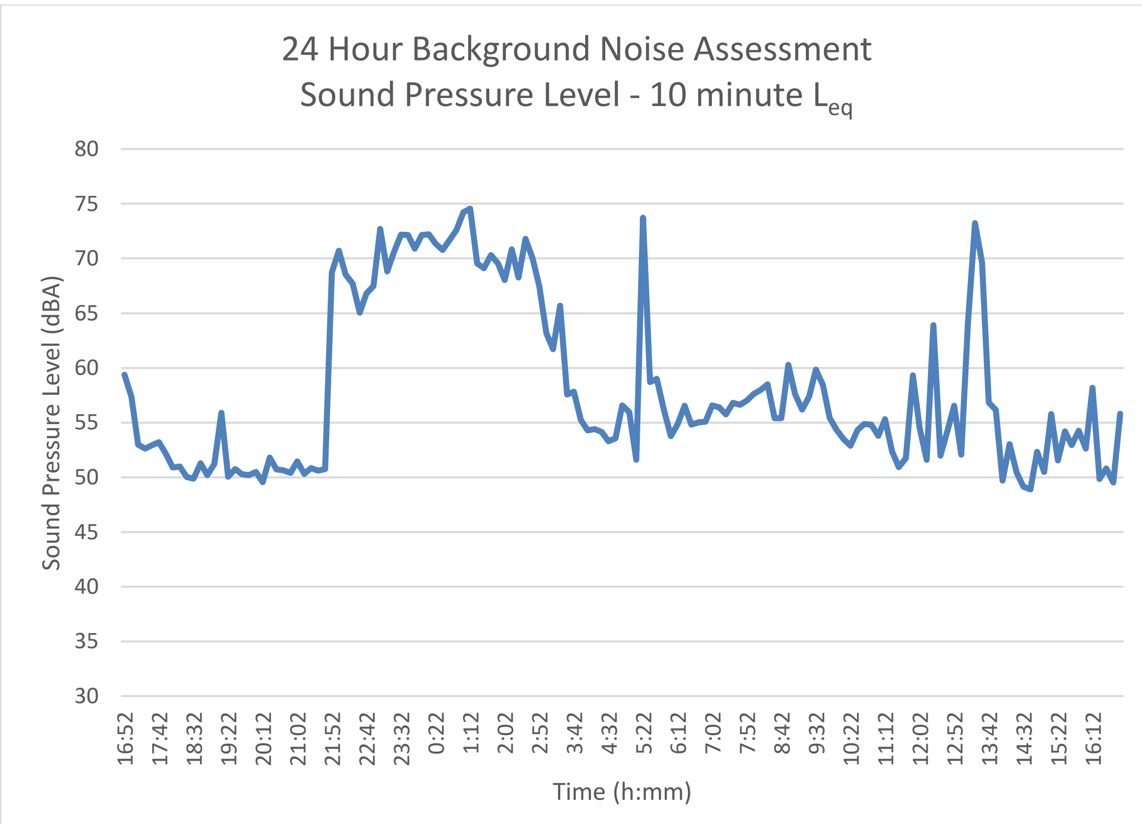


Figure 4.1 – Measured background noise over 24 hours, from November 11th to November 12th.

Our noise monitoring identified a period of high noise levels between approximately 10:00pm and 4:00am, where the average background noise over the period was near 70 dBA. Several other peaks also occurred near 5:30am and 2:00pm, however the short duration of the peaks indicates that they are likely due to delivery trucks or other vehicles idling near the noise monitor.

During the period of high noise levels, the average L_{eq} was 70.2 dBA, which exceeds the threshold to require a component analysis for the proposed development. We have used this sound pressure level as the exterior noise level to determine the requirements for the sound isolation of the façade components.

4.1 Interior Noise Assessment

To determine the required sound isolation of the façade elements, we calculated the noise transmission from outdoors to a sample unit in the building. The floor plan of the sample unit, as well as its exterior elevation are shown in figures 4.2 and 4.3, with the associated room dimensions in table 4.1.

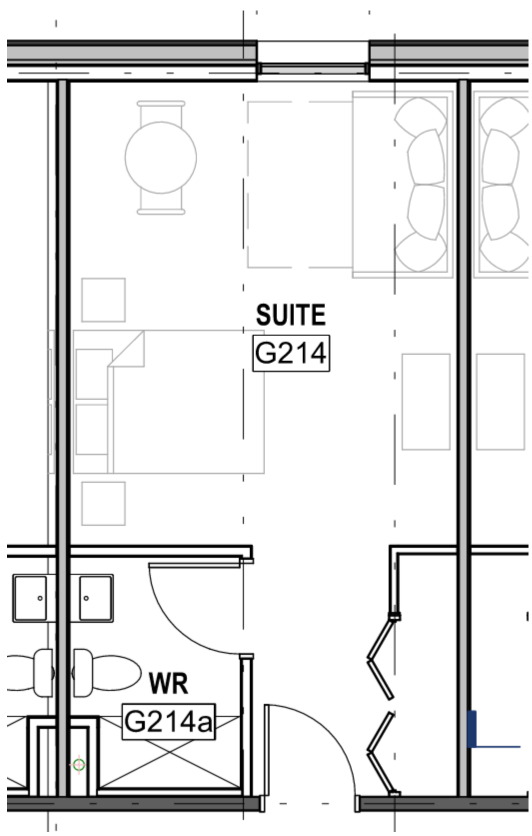


Figure 4.2 – Plan layout of suite G214, used in interior noise calculations.

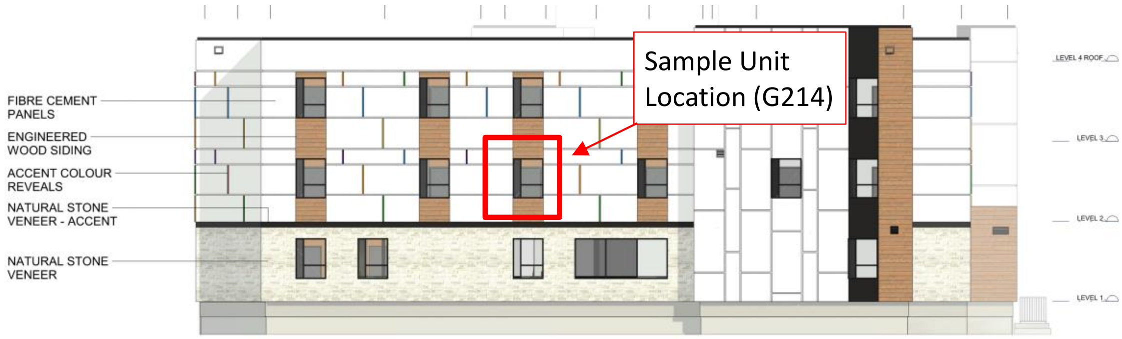


Figure 4.3 – Exterior elevation of the building.

The exterior wall is comprised of the following compositions:

Fibre Cement Panels

- 6mm Fibre cement panel
- 19mm wood furring
- Thermally broken girt system @ 457mm o.c.
- 203mm stone wool insulation
- 2 x 6 wood studs with OSB both sides
- STC 52 based on INSUL modeling

Engineered Wood Siding

- 12mm engineered wood
- 19mm wood furring
- Thermally broken girt system @ 457mm o.c.
- 203mm stone wool insulation
- 2 x 6 wood studs with OSB both sides
- STC 49 based on INSUL modeling

Basic Window Assembly

- Triple Glazed Window Assembly
- STC 45 based on TR16-116

4.1.1 Interior Noise Calculations (AIF Method)

To determine the interior noise resulting from the high background noise, we have used the Acoustic Insulation Factor method. This method uses the façade elements and wall areas along with the exterior background noise and required interior noise to determine the sound isolation requirements of the façade. For this calculation, we have used the proposed compositions listed in Section 4.1. Based on the ENCG and NPC-300 guidelines, the interior noise limit for a sleeping area is 45 dBA.

Below in Table 5.3 and 5.4, we provide the results of our AIF calculations for the sample unit. 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.

3 Component Façade												
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
24.5	3	1	Fibre Cement	7.1	29%	70.2	45	32	47	N/A	32	**Yes**
24.5	3	2	Engineered Wood	1.2	5%	70.2	45	32	51	Yes	30	**Yes**
24.5	3	3	Window	1.9	8%	70.2	45	32	34	Yes	30	**Yes**

Table 4.1 – 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 Table 4.1, the proposed components meet the sound isolation (AIF) requirements for the measured background noise. No additional changes or additions to the proposed compositions are required.

5.0 Conclusion

As a part of the Site Plan Application for the addition to the Ronald McDonald House at 407 Smyth Road, we have completed an environmental noise study for the site. We have reviewed both the impact of the newly proposed equipment onto nearby noise sensitive receptors, as well as the existing noise levels on the site from nearby mechanical noise sources.

The environmental noise assessment found that the 6 proposed rooftop units will not generate noise that exceeds the applicable noise limits from the City of Ottawa Noise By-Law and the Ministry of Environment, Conservation and Parks' NPC-300. The maximum allowable sound power levels for the proposed units may be found in Section 3.2 of this report.

The existing background noise on the site was assessed using a 24-hour background noise measurement at the proposed location for the addition. Over the course of the measurement period, the background noise was found to be over acceptable levels for a hotel or residential building, therefore an acoustic component analysis was completed for a sample unit in the building. This analysis found that the proposed components provide sufficient sound isolation to meet the required interior noise levels. Details of our measurements and analysis may be found in Section 4.0 of this report.

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

Sincerely,

Alexandre Fortier, B.Sc.,
Principal

LICENSED PROFESSIONAL ENGINEER
D. E. BUCHAN
19 DEC 2022
PROVINCE OF ONTARIO

Approved By:

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

Appendix A
Sound Data for Rooftop Equipment

Table 15: Outdoor Unit Sound Power Levels.

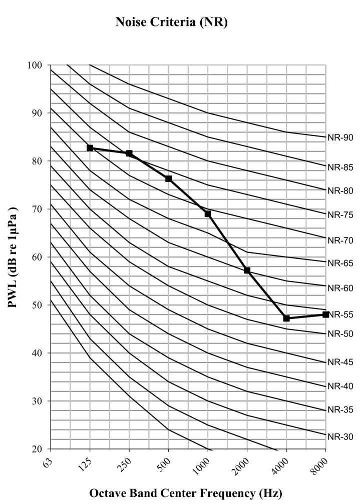
Outdoor Unit Models			dB(A)
Nominal Tons	208-230V	460V	
6	ARUM072BTE5	ARUM072DTE5	77.0
8	ARUM096BTE5	ARUM096DTE5	78.0
10	ARUM121BTE5	ARUM121DTE5	79.0
12	ARUM144BTE5	ARUM144DTE5	83.0
14	ARUM168BTE5	ARUM168DTE5	85.0
16	ARUM192BTE5	ARUM192DTE5	87.0
18	ARUM216BTE5	ARUM216DTE5	88.0
20	ARUM241BTE5	ARUM241DTE5	88.0
22	ARUM264BTE5	ARUM264BTE5	86.0
24	ARUM288BTE5	ARUM288DTE5	87.0
26	ARUM312BTE5	ARUM312DTE5	88.0
28	ARUM336BTE5	ARUM336DTE5	88.0
30	ARUM360BTE5	ARUM360DTE5	89.0
32	ARUM384BTE5	ARUM384DTE5	89.0
34	ARUM408BTE5	ARUM408DTE5	90.0
36	ARUM432BTE5	ARUM432DTE5	89.0
38	ARUM456BTE5	ARUM456DTE5	89.0
40	ARUM480BTE5	ARUM480DTE5	89.0
42	ARUM504BTE5	ARUM504DTE5	90.0

x2

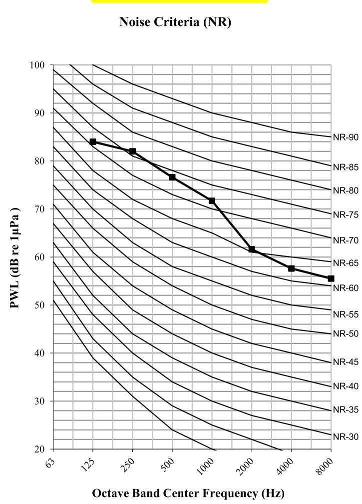
- Data is valid under diffuse field conditions.
- Data is valid under nominal operating conditions.
- Sound level may be increased in static pressure mode or if air guide is used.
- Sound power level is measured using rated conditions, and tested in a reverberation room per ISO 3741 standards.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) of particular area in which the equipment is installed.
- Reference acoustic intensity: 0dB = 10E-6μW/m^2

Figure 11: ARUM072-096-121BTE5 / DTE5 Sound Power Levels.

ARUM072BTE5 / DTE5



ARUM096BTE5 / DTE5



ARUM121BTE5 / DTE5