Noise Impact Assessment of a Residential Development

630 Montreal Road, Ottawa, Ontario

Report Prepared for:

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February 7, 2023

Reference: 21-04-30-RD

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1 Context

MB Groupe & Associate contacted Soft dB for the Noise Impact Assessment (NIA) of road noise and stationary noise sources of the residential development project at 630 Montreal Road, Ottawa, ON, see Figure 1. The study is required by the City of Ottawa as part of the request for layout.

This study must meet the requirements of the City of Ottawa for a noise impact study and those of the Ontario Ministry of the Environment (MOECC) NPC-300.

Figure 1: General site location of the residential development (orang) and important noise sources close to the site (red), (Source: Google Maps)

The site is located at 630 Montreal Road, Ottawa, ON, in a corner lot on the southeast side of Montreal Road and adjacent to Borthwick Avenue. The area surrounding the site of interest is well developed with two three-story apartment buildings and a two-story townhouse block to the south. To the north, there is a car dealership, a one-story mall, and a two-story office / shopping complex. The east part consists of two-storey and one-storey dwellings. The nine-story proposed building is shown in Figure 2.

Figure 2: Illustrations of the proposed development

The main objectives of this study were to:

- Evaluate the impact of noise from the surrounding environment on the proposed development;
- Provide guidelines for evaluating the impact of noise generated by the proposed development on the neighborhood;
- Provide guidelines for evaluating the impact of noise generated by the proposed development on itself.
- Recommend, if necessary, mitigation measures to reduce any negative noise impact and comply with municipal and provincial directives.

2 Methodology

The methodology for this study is presented in the following table:

Table 1: Project Methodology

#	Step	• Description
1	**Characterization of noise sources**	• One (1) measuring station was installed on the site for a period of 48 hours and a site visit was carried out in order to characterize the current sound climate and to calibrate the acoustic model for the noise forecasts; • Sound pressure measurements was also taken near the site to determine any other potential source of noise from adjacent buildings and to properly calibrate the acoustic model; • On-site measurements made it possible to evaluate the LAeq, 1 hour for stationary sources, and to properly calibrate the acoustic model. The final location of the station was identified during the site visit; • Road traffic noise was characterized using road traffic data provided by the municipality.
2	**Acoustical simulation and advanced calculations**	• Following the measurement campaign and characterization of the noise sources, an acoustical simulation was conducted through the specialized software STAMSON. The main goal was to predict the noise levels at the facades, outdoor living areas and plane of windows at the residential dwelling. • As the required prediction method for transportation noise study at Ottawa is STAMSON, the road traffic levels were predicted using STAMSON and the values were utilized to revise the sound level limits, as required by the NPC-300.

#	Step	• Description
3	**Compliance assessment with respect to the noise guidelines NPC-300**	• Noise levels in the outdoor living areas (OLA) and plane of windows (POW) were compared to the noise criteria to check compliance with the municipal and provincial noise guidelines for land use planning purposes. • The simulated noise levels were then employed, if needed, to investigate acoustical recommendations aimed at reducing noise levels to acceptable values and achieve regulatory compliance.
4	**Recommendations to reduce noise transmission at planes of windows**	• Based on the noise guidelines, recommendations on warning clauses or exterior envelope (fenestration and exterior walls) were given to achieve the targets of the recommended indoor levels (relevant municipal/provincial regulations). • This assessment considered the use of the spaces, implementation costs and feasibility constraints. The most cost-effective solutions were considered.

3 Assessment criteria

3.1 Acoustic interpretation of noise

The following Table 2 shows the scale of the noise level along with its subjective human interpretation for a better understanding of the noise levels presented in this study.

Table 2: Subjective characteristics of noise level

Level	Subjective response
140 dB	Pain threshold
130 dB	
120 dB	Painful
110 dB	Unbearable
100 dB	Hard to bear
90 dB	Very noisy
80 dB	Noisy
70 dB	
60 dB	Common noise
50 dB	
40 dB	Low
30 dB	Quiet
20 dB	Very quiet

Level	Subjective response
10 dB	Silent
0 dB	Inaudible

3.2 MOECC— Environmental noise guidelines (NPC-300)

Part C of the Ministry of the Environment and Climate Change (MOECC) Publication, NPC-300 contains the guidelines for addressing and controlling the noise emissions for land use planning purposes. It also includes the sound level limits for the assessment of the noise impact on proposed noise sensitive land and specifies procedures for determining sound levels on the site of proposed development caused by transportation as well as stationary sources. For noise sensitive area, compliance with the sound level limits is typically established at the points of reception at the:

- **Plane of Window (POW):** It represents the point in the space corresponding with the location of the centre of a window in a noise sensitive space. The noise impact assessment excludes the effect of sound reflection from the noise sensitive window under assessment, and;
- **Outdoor Living Area (OLA):** It corresponds to the part of a noise sensitive land use that is intended and designed for the quiet enjoyment of the outdoor environment and readily accessible from the building environment, such as backyards, balconies, parks, etc. If the noise sensitive area is just affected by transportation noise or by combined noise from transportation and stationary sources, point of reception is placed at OLA. To qualify as OLA,
    - The point of assessment must be at least 3 metres from the building façade;
    - 1.5 metres above grade aligned with midpoint of subject façade.

  If no at-grade points satisfy these requirements, balconies and elevated terraces (e.g., rooftop, etc.) can be considered as an OLA provided, they are not enclosed and have a minimum depth of 4m.

3.2.1 Transportation sources

According to Part C of the NPC-300 guidelines, while predicting sound levels from the transportation sources, consideration should be given to future sound levels. For road, a minimum of 10-year prediction is usually taken into consideration when considering vehicular roadway traffic. For this study, all predictions were made to forecast the road traffic data until the year of **2031** (10 years) by compounding traffic growth at 2.5% per year. As mentioned in Part C of NPC-300, the sound levels should be assessed in an Outdoor Living Area (OLA) representing a space such as a patio or backyard, and in indoor environment. As mentioned above, the levels inside the building are predicted from the sound level at the facade of the respective spaces.

If the predicted sound levels (L_{eq}) at OLA during the daytime (07:00 to 23:00) does not exceed 55 dBA, and 50 dBA at the bedroom POW during the daytime (07:00 to 23:00) or nighttime (23:00 to 07:00), no noise control measures are required. If the sound level exceeds the above-mentioned limits, noise mitigation measures such as better architectural design, installing noise barriers, upgrading building envelope elements such as windows, exterior walls, doors, etc. with upgraded sound isolation performance and/or central air conditioning may be required.

The sound level limits for the proposed dwelling (for day and night period) to comply with the NPC-300 are shown in the following Table 3. The sound levels (L_{eq}) in interior spaces are predicted based on the predicted sound levels at the POW and considering the architectural elements of the proposed development.

Table 3: Sound level limits

Location	Type of space	Time Period (T)	Maximum Permissible Sound Levels, $L_{Aeq,\ T}$ (dBA)
			Road
OLA (patio, backyard, etc.)	Outdoor	07:00 – 23:00	55
Living/dining room	Indoor	07:00 – 23:00	45
		23:00 – 07:00	45
Bedroom	Indoor	07:00 – 23:00	45
		23:00 – 07:00	40

*$L_{Aeq,\ T}$ is the continuous equivalent sound level measured over the indicated time period (T), 16 hours for daytime and 8 hours for nighttime.

According to the NPC-300, ventilation requirements for the proposed development are based on sound level at the exterior building façade. If the Leq at the plane of the bedroom or living/dining room window is less than or equal to 55 dBA for daytime (07:00 – 23:00) and less than or equal to 50 dBA for nighttime (23:00 – 07:00), no noise mitigation measures for the ventilation systems are required. If these limits are exceeded but are less than or equal to 65 dBA (for daytime) and 60 dBA (for nighttime), the dwelling should be designed with a provision for the installation of a central air-conditioning in the future, at the discretion of the residents. Warning clause Type C is also recommended for this case although deviations from this may be acceptable subject to the constraints imposed by subsection C7.8.1 Air Conditioning and Transportation Sources, within NPC-300 in cases where permits are being sought to install distributed A/C systems.

As per NPC-300, "Warning clause" means a notification of or obligation to notify a potential purchaser or tenant of a potential annoyance due to an existing source of environmental noise. When circumstances warrant, agreements that are registered on title to the lands in question should incorporate provisions for using warning clauses. Warning clauses would be included in agreements of Offers of Purchase and Sale, lease/rental agreements and condominium declarations. Alternatively, easements in respect of noise may also be appropriate in some circumstances."

Specifically, "Type C: (see Section C7.1.2.1, Section C7.1.2.2 and Section C7.4), "This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment." For medium and high density developments, there are provisions for using distributed A/C systems subject to certain stipulations about the allowable interior noise level and other performance aspects related to proper ventilation of dwellings (see below).

If the sound level in the plane of a bedroom or living/dining room window is greater than 65 dBA daytime and 60 dBA for nighttime, a central air-conditioning should be installed on site and with a warning clause Type D. In addition to this air-conditioning system, building envelope components such as windows, walls, etc. should be designed so that the required indoor sound levels are compatible with the values mentioned in Table 3.

The design of the building elements (such as walls, windows, etc.) to comply with the required indoor sound level is not required if the sound levels outside the windows of noise sensitive spaces is less than or equal to 65 dBA during daytime (07:00 – 23:00) or 60 dBA during nighttime (23:00 – 07:00).

3.2.2 Stationary sources

According to the Part C of the NPC-300 guidelines, the noise criteria to be respected by the sound levels generated from the nearby stationary sources of the proposed development largely depends on the background sound levels and the location of the sensitive receptors and noise sources. The provincial guideline NPC-300 defines four separate community class areas which are mainly classified by their ambient sound level as shown in Table 4.

The compliance with the sound level limits in the noise sensitive areas is typically established at the points of reception at the POW and OLA. Additionally, the noise criteria are classified based on the time of day:

- **Daytime** is the 12-hour period between 07:00 and 19:00;
- **Evening** is the 4-hour period between 19:00 and 23:00;
- **Nighttime** is the 8-hour period between 23:00 and 07:00.

Unlike the assessment for transportation sources, where the L_{eq} 16-hours and 8-hours descriptors were used for daytime (07:00 to 23:00) and nighttime (23:00 to 07:00), for the stationary sources, the sound level limit at the noise sensitive point of reception is expressed in terms of L_{eq} one-hour. The exclusion limits to be respected by the noise emanating from the stationary source at the point of reception are shown in Table 5. During the assessment, in order to be compliant, the noise emanating from the stationary source must be under the highest of either the specified exclusion limits in Table 5 or the lowest recorded L_{Aeq} one-hour established by means of noise monitoring for at least 48 hours during the day, evening and night time period (whichever is higher). For the purpose of this assessment, in order to assess the worst-case scenario, the exclusion limits as mentioned in Table 5 was considered as the assessment criteria for the stationary source.

Please note that among sources not considered as stationary sources for the purposes of assessment are, "residential air conditioning devices including air conditioners and heat pumps." However, as per NPC-300 Section C7.1.2.2, "The location and installation of the outdoor air conditioning device should comply with sound level limits of Publication NPC-216, Reference [32], and guidelines contained in Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Reference [6], or should comply with other criteria specified by the municipality." Given this discordant language, air conditioners and heat pumps are treated as stationary noise sources for the purposes of this report.

All the sensitive receptors for this assessment are considered to be located in the Class 1 noise sensitive area because their acoustical environment is mainly dominated by the road traffic and human activities.

Table 4: Classification of areas according to the NPC-300

Type	Description
Class 1	Refers to a class of area with an acoustical environment typical to a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as "urban hum."
Class 2	Refers to a class of area with an acoustical environment that has qualities representative of both Class 1 and Class 3 areas. These are the suburban areas of the City outside of the busy core that has sound level characteristics of Class 1 area during the daytime and low evening and night background sound levels, dominated by natural activity and infrequent human activities.
Class 3	Refers to a class of area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as: A. a small community or village; B. agricultural area; C. a rural recreational area such as a cottage or a resort area; or D. a wilderness area. Within the City, Class 3 areas are found in the rural area, Greenbelt and within small residential oriented villages.
Class 4	Refers to a class of area or specific site that would otherwise be defined as Class 1 or 2 and which: A. is an area intended for development with new noise sensitive land use(s) that are not yet built; B. is in proximity to existing, lawfully established stationary source(s); and C. has formal confirmation (designation) from the City of the Class 4 area classification through Council approval.

Table 5: Exclusion limit values for stationary noise sources

Time of Day	Exclusion Limit Values of L_{Aeq},1h (dBA)							
	Class 1 Area		Class 2 Area		Class 3 Area		Class 4 Area	
	OLA	POW	OLA	POW	OLA	POW	OLA	POW
07:00 – 19:00	50	50	50	50	45	45	55	60
19:00 – 23:00	50	50	45	50	40	40	55	60
23:00 – 07:00	-	45	-	45	-	40	-	55

3.3 City of Ottawa noise requirements

The acoustical requirements for a new development are provided in the City of Ottawa's "Environmental Noise Control Guidelines" dated January 2016. The requirements outlined in this document are similar to the NPC-300 requirements without any significant distinction. Hence, for the purpose of this assessment, the requirements outlined in the NPC-300 were employed.

4 Analysis

4.1 Noise sources

4.1.1 Transportation noise source

The transportation noise source includes the noise generated by the roadway, railway traffic near the location of the site. For this assessment, the acoustical environment on the site is mainly dominated by the noise produced from the road traffic. Table 6 identifies all the roads considered for this assessment. As per the NPC-300, all the sound level predictions and recommendations provided should account for future increase in vehicular road traffic (typically 10 years).

The road traffic counts (See Appendix A) were obtained from the open data of the City of Ottawa (where available) for the roads identified in the Table 6. The assumed truck percentages were taken from this dataset.

The detailed traffic counts for the Aviation Pkwy and Montreal Rd were for the year of 2018, and for the Cummings Ave were for the year 2016 including the Average Annual Daily Traffic (AADT), and percentage of trucks. However, it should be noted that the AADT values were not directly available for the Borthwick Ave and were obtained by doing the road counts for 30 min each direction. These values were then used to project the forecasted traffic data for the year **2031** (See Table 6) considering the 2.5% annual increment in the traffic volume.

These road traffic data was used as an input parameter to simulate the acoustical model prepared in STAMSON to determine the sound level at the noise sensitive points of reception (emanating from the roads). The predicted façade noise level is then determined and used to predict the interior sound levels for the worst-case scenario.

Table 6: Road traffic data

Road	AADT					Car/ Truck Ratio	Medium/ Heavy Truck Ratio	Speed Limit (km/h)	Day/ Night Ratio
	From data (2016)	From data (2018)	From data (2019)	From data (2021)	Forecasted (2031)				
Montreal Rd	-	34883	-	-	48086.6	97/3	50/50	50	92/8
Aviation PKWY	-	48207	-	-	66453.9	97/3	50/50	60	92/8
Cummings Ave	3560	-	-	-	5155.9	97/3	50/50	40	92/8
Borthwick Ave	-	-	-	2324	2974.9	97/3	50/50	50	92/8

4.1.2 Stationary noise source

According to the site inspection done on May 11th, 2021, it was observed that there are currently no major stationary sources in the vicinity of the site that can affect the acoustical environment of the proposed development. Hence, no stationary sources were considered in this study. However, there are sources that can be expected to be added in association with this project, such as air-handling units, condensing units, and emergency generator that merit future analysis to develop requirements for noise control.

4.2 Noise sensitive points of reception

According to the guidelines provided in the Part C of the NPC-300, the sound levels due to transportation noise sources at the proposed development are assessed at the designated OLA, which in this case is the rooftop terrace and sensitive interior spaces (living room, bedroom, etc.). The balconies of the apartments are not considered to be designated OLAs within this report. In order to predict the indoor sound levels for the worst-case scenario, maximum sound level predicted amongst all the façades was considered. The location representing OLA and the evaluated façades of the proposed dwelling are shown in following Figure 3. For this assessment, the designated OLA is the rooftop terrace, and two POW locations; one at the plane of bedroom's window and another at the plane of living room's window, were considered at each façade.

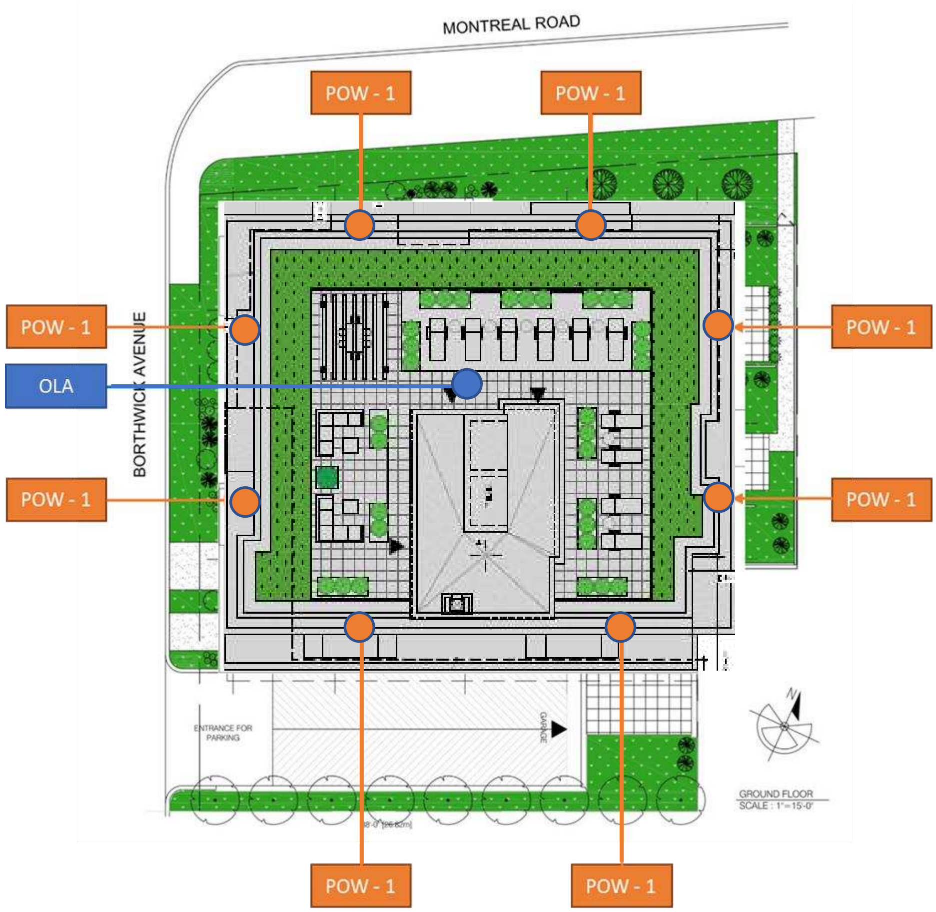

Figure 3: Location of noise sensitive receptors

4.3 Acoustic model

As per the NPC-300, the most widely used methodology for predicting road traffic noise is ORNAMENT (Ontario Road Noise Analysis Method for Environment and Transportation) and STEAM (Sound from Trains Environmental Analysis Method) for railway noise prediction. STAMSON is a computerized road and railway noise prediction software developed by MOE based on noise prediction methodologies described in ORNAMENT and STEAM. For this study STAMSON was used to predict the traffic noise levels. The input information of the roads is available in Appendix C.

4.4 Measurement data

In order to assess the simulation results, one station was installed at the location shown in Figure 4. The measurement campaign was carried out from 12:00am on May 11, 2021, until 12:00am on May 14, 2021, by Louis-Simon Poisson from *Soft dB*.

Table **11** in Appendix B shown the detail results of the measurement.

Figure 4: Site location and measurement station location (Source: Google Maps)

The following Table 7 compare the average noise level measurement of the total three days with the simulation results. As can be seen, the difference between the measurement and simulation noise levels for both day and night is 3.8 dBA, where the calculated results for the current year 2021 traffic conditions exceed what has been demonstrated through direct measurements at the site.

Table 7: Comparison between the measurement and simulation results

	Day	Night
Measurement	61.5 dBA	53.9 dBA
Simulation	65.3 dBA	57.7 dBA
Difference (Simulation less Measurement)	3.8 dBA	3.8 dBA

5 Results

5.1 Transportation sources

The sound pressure levels across all façades and for the one OLA at the rooftop garden were simulated to show the predicted values from the road traffic for the year of 2031. These façade levels were used to determine the interior level calculation. The following Table **8** presents the predicted values at OLA and across all the façades.

Table 8: Predicted sound levels from road traffic in year 2031

Location	Maximum Sound Levels					
	LA_{eq}, Daytime (07:00-23:00) (dBA)	Limit	Compliance	LA_{eq}, Nighttime (23:00-07:00) (dBA)	Limit	Compliance
OLA	59.9	55 / 60	**No / Yes**	N/A	N/A	N/A
North Façade	69.9	55	**No**	62.4	50	**No**
South Façade	57.2	55	**No**	50.0	50	**Yes**
East Façade	64.8	55	**No**	57.2	50	**No**
West Façade	65.1	55	**No**	57.7	50	**No**

According to the criteria mentioned in Section 3.2.1, as the limits at POW and OLA are not compliant across all façades, **general recommendations are provided in the subsequent section to help achieve the target indoor and outdoor sound levels** (mentioned in NPC-300).

6 Recommendations

6.1 Transportation sources

As seen from Table **8**, the sound pressure levels across all the façades during the day and nighttime are not compliant as the $LAeq_{07:00\text{-}23:00}$ at living room POW is not ≤ 55 dBA, and $LAeq_{23:00\text{-}7:00}$ at bedroom

POW is not ≤ 50 dBA. The main weakness for an exterior façade is usually the windows. The sound transmission performance of exterior walls is to be assessed as part of the detailed architectural design and should be at least 10 STC rating points higher than the performance for the windows. Acoustic weakness in building envelope can be significantly reduced by improving the airtightness of the building façade by proper installation of the façade elements such as doors and windows, sealing all acoustic leaks by acoustic sealant, etc.

The following Table 9 provides the sound isolation target for the window glazing in terms of the minimum sound transmission class (STC) rating across all facades required to comply with mandatory indoor sound level targets mentioned in NPC-300, assuming that the corresponding exterior walls will perform at least 10 STC points higher than the STC of the windows. In principle, varying windows constructions could be used for the different facades of the building in order to achieve compliance with the indoor sound-level limits. As a point of reference, double-glazed windows can generally be expected to achieve STC performance on the order of 28 to 32, which exceeds the requirements that have been documented for this project.

Table 9: Required sound isolation for the glazing across all façades

Façade	Exterior sound level (dBA) (LA_{eq}, daytime)	Target indoor sound level (dBA) (LA_{eq}, daytime)	Sound insulation target (dB)	Required Minimum Sound Transmission Class of Exterior glazing
North	69.9	45	24.9	32
South	57.2	45	12.2	19
East	64.8	45	19.8	27
West	65.1	45	20.1	27

As per WHO guidelines[1], for open windows, assuming that any wall and window assembly complying with aforementioned requirements, provides approximately 15 dB of transmission loss. Hence, a typical window assembly complying with the requirements of the OBC will be more than sufficient to attain compliance with the indoor sound level requirements within NPC-300.

It is also recommended to verify the window frame as it will be necessary to be vigilant and ensure that the frame used is not too light to withstand the noise from road. The potential presence of an empty cavity in the frame could also reduce its resistance for noise insulation. Hence, properly designed (acoustically rated) window frame incorporates extra mass into the structure (heavier metal or stronger wood), a filled cavity, a thermal insulation between the internal and external faces and, will place the glass in neoprene joints. It is recommended that the window frame manufacturer be informed of these requirements before purchasing new windows. Furthermore, if using double-pane or triple-pane windows, it is recommended not to fill the cavity of the glazing. The argon-filled cavity causes a decrease in the performance of the glazing by 1-2 STC points.

[1] Guidelines for community noise. (WHO 99), World Health Organization (1999)

6.2 Stationary sources

There is minimal information available at this point regarding accurate estimates of the heating and cooling loads for the building and the electrical requirements. As of June 30, 2021, it was determined that there will be a rooftop mechanical room with dimensions of 9’2” length, 23’11” width, and 9’6” height. This presents justification for placing constraints on noise emissions from this room given that the rooftop terrace is a designated OLA. Additionally, air-conditioning systems are to be distributed throughout the building facade and the noise from such units when mounted on an exterior wall is of potential concern for neighbouring residential properties. As such, constraints are recommended to stipulate an acceptable exterior noise-emission level from each unit based on the assumption that they could all be operating concurrently. The receptors in the neighbourhood are deemed to be Class 1 as far as the NPC-300 definition is concerned for assessing the potential for noise impacts. There are also constraints on allowable interior noise levels due to such systems, as described below.

Based on the layout of the apartments on each floor and the orientations of the building relative to nearby residences, there could be somewhere on the order of sixteen (16) such units with a line of sight to adjacent residential properties. These constraints are as follows assuming that the rooftop terrace is a Class 1 area:

- **Rooftop Mechanical Room Noise Impacts to Rooftop Terrace:** The A-weighted sound pressure level at any position on the rooftop terrace, in proximity to the outside walls or roof of the mechanical room on the rooftop, shall be limited to 40 dBA or less during daytime and evening hours and 35 dBA or less during nighttime hours. Adequate noise controls shall be implemented to reduce the noise level within the mechanical room such that, when combined with adequate construction for the walls and roof of the mechanical room, the resulting performance is achieved.
- **Distributed A/C Units Noise Impacts to nearby Residential Properties:** Operating on the assumption that such units will be installed for the 2nd through 9th floors, with two on each floor for each façade, a nominal limitation on the sound power level (PWL) re: 1 picoWatt is 63 dBA or less for each operating unit is required to achieve 50 dBA or less during daytime and 45 dBA or less during nighttime hours for adjacent residential properties as required for Class 1 properties. Noise controls such as screens should be considered if the preferred A/C units do not achieve compliance with this design target.
- **From NPC-300 regarding the utilization of distributed A/C units and their significance for interior noise levels within dwelling refer to C7.8.1 Air Conditioning and Transportation Sources:** This stipulation requires the following:
    - *Ventilation methods other than central air conditioning are acceptable for high and medium density residential developments, subject to the following conditions:*
        - *the noise produced by the proposed ventilation system in the [interior] space served does not exceed 40 dBA. In practice, this condition usually implies that window air conditioning units are not acceptable. [As such, candidate systems must be selected with some care in order for there to be a prospect for compliant construction];*
        - *the ventilation system complies with all national, provincial and municipal standards and codes;*

- *the ventilation system is designed by a heating and ventilation professional; and*
- *the ventilation system enables the windows and exterior doors to remain closed [such that noise from other stationary and transportation sources are reduced adequately to achieve the stipulated limits on interior noise levels within residential buildings].*

Further details regarding the mechanical and electrical systems have not yet been subject to detailed design by project engineers. Architecturally, some systems are expected, primarily, to be installed within the basement floors of the residential tower. Equipment such as air handling units, pumps, chillers, condensing units, and emergency backup generators will, however, have interconnections to the outside façade and other nearby areas of the building and could represent a problematic noise source both for future occupants of the residential tower and nearby residential properties. As such, the project must be analyzed in the future to account for the limits on noise levels that are applicable for these noise-sensitive receptors.

6.3 Recommendations for OLAs

Sound levels during the daytime at the OLA located at the rooftop terrace was predicted to be above 55 dBA by 4.9 dB. Based on the NPC 300, and the City of Ottawa Guidelines a 5 dB tolerance above the limit is also acceptable. Therefore, no noise control measures are required, but a warning clause Type A shall be incorporated in the contract for prospective buyers/renters of the residences presenting such facades. The noise warning clauses are used to warn the potential occupants of the likely annoyance due to existing noise sources or the exceeding sound levels above the sound limits.

For this assessment, the warning clause Type A needs to be included in the agreements of offers of purchase/sale, lease, or rental agreements, etc. as: "Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment".

7 Conclusions

Soft dB was retained to conduct a noise impact assessment for the residential development project at 630 Montreal Road, Ottawa, ON. The study is required by the City of Ottawa as part of the request for layout. The main objectives of this study were to:

- Evaluate the impact of noise from the surrounding environment on the proposed development;
- Provide guidelines for evaluating the impact of noise generated by the proposed development on the neighborhood;
- Provide guidelines for evaluating the impact of noise generated by the proposed development on itself.

- Recommend, if necessary, mitigation measures to reduce any negative noise impact and comply with municipal and provincial directives.

The assessment criteria for the transportation sources are discussed in the Section 3.2. For transportation sources, the sound pressure levels across all façades and for the OLA were simulated using STAMSON, to predict the values for the year of 2031 (See Table 6Table **8**). These façade levels were then used to determine the required sound isolation to achieve the target indoor level according to the NPC-300 (See Table **8**). From the results it can be concluded that forecasted sound levels due to road traffic noise (until year 2031) are compliant with the requirements of the NPC-300 as long as the selected window glazing provides the required sound isolation as mentioned in Table 9 for all facades and, the corresponding walls are at least 10 STC point higher than the selected windows.

According to the criteria established in NPC-300, sound levels estimated in OLA during daytime (07:00 to 23:00) should not exceed 55 dBA. If these sound levels are exceeded, noise mitigation measures with building envelope elements with higher sound isolation are required. In some case, warning clauses are required to be included in the purchase/tenancy agreements as described within the main body of this report. In this study the expected outdoor noise levels were calculated, and warning clauses have been proposed in order to comply with the regulation (55 dBA in $LAeq_{,16h}$).

For the assessment of stationary source, since the mechanical and electrical equipment has not yet been subject to analysis and design, a detailed analysis has not been provided. However, performance criteria expressed as noise limits have been provided to constrain future outcomes.

Appendix A Road Traffic Data

Table 10: Road Traffic Data

	The available road traffic counts							Forecasted data (2031)						
	AADT	Day/Night split		Total Truck	Day/Night split		AADT	Day/Night split		Total Truck	Day/Night split	
MONTREAL RD (2018)	34883	Day	32092.4	1067	Day	982	48086.6	Day	44239.7	1471	Day	1354
		Night	2790.6		Night	85		Night	3846.9		Night	118
Borthwick Ave (2018)	2324	Day	2038.1	63	Day	56	2974.9	Day	2608.9	81	Day	71
		Night	285.9		Night	8		Night	366.0		Night	10
CUMMINGS AVE (2016)	3560	Day	3275.2	97	Day	89	5155.9	Day	4743.5	141	Day	129
		Night	284.8		Night	8		Night	412.5		Night	11
AVIATION PKWY (2021)	48207	Day	44350.4	1316	Day	1211	66453.9	Day	61137.6	1814	Day	1669
		Night	3856.6		Night	105		Night	5316.3		Night	145

Appendix B Noise Measurement Data

Table 11: Noise measurement data

	May 11th	May 12th	May 13th	Average
7:00 - 8:00	62.35	62.35	62.88	62.5
8:00 - 9:00	61.94	61.86	62.34	62.0
9:00 - 10:00	64.13	61.98	64.09	63.4
10:00 - 11:00	66	61.94	63.18	63.7
11:00 - 12:00	64.53	61.08	60.94	62.2
12:00 - 13:00	61.75	61.42	60.01	61.1
13:00 - 14:00	61.61	60.77	65.03	62.5
14:00 - 15:00	63.04	60.33	60.15	61.2
15:00 - 16:00	62.39	61.72	59.88	61.3
16:00 - 17:00	62.43	61.17	60.21	61.3
17:00 - 18:00	64.25	60.43	59.93	61.5
18:00 - 19:00	65.6	59.46	62.35	62.5
19:00 - 20:00	64.28	58.58	60.14	61.0
20:00 - 21:00	60.2	59.65	60.01	60.0
21:00 - 22:00	59.46	57.69	58.31	58.5
22:00 - 23:00	58.15	63.78	56.68	59.5
23:00 - 24:00	56.52	55.72	55.48	55.9
24:00 - 1:00	53.78	55.03	53.57	54.1
1:00 - 2:00	51.84	52.99	52.01	52.3
2:00 - 3:00	50.37	51.56	49.53	50.5
3:00 - 4:00	49.24	48.62	47.36	48.4
4:00 - 5:00	51.45	52.15	51.3	51.6
5:00 - 6:00	56.83	57.2	56.79	56.9
6:00 - 7:00	62.26	61.69	60.62	61.5
Day	62.6	60.9	61.0	61.5
Night	54.0	54.4	53.3	53.9

Appendix C Simulation Data from STAMSON

STAMSON 5.0 NORMAL REPORT Date: 25-05-2021 15:56:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

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

Car traffic volume : 44240/3847 veh/TimePeriod
Medium truck volume : 677/59 veh/TimePeriod
Heavy truck volume : 677/59 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Montreal (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: Montreal (day)

Source height = 1.10 m

ROAD (0.00 + 69.91 + 0.00) = 69.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.91	0.00	0.00	0.00	0.00	0.00	0.00	69.91

Segment Leq : 69.91 dBA

Total Leq All Segments: 69.91 dBA

Results segment # 1: Montreal (night)

Source height = 1.10 m

ROAD (0.00 + 62.32 + 0.00) = 62.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	62.32	0.00	0.00	0.00	0.00	0.00	0.00	62.32

Segment Leq : 62.32 dBA

Total Leq All Segments: 62.32 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 69.91
(NIGHT): 62.32

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

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

Car traffic volume : 2609/366 veh/TimePeriod
Medium truck volume : 36/5 veh/TimePeriod
Heavy truck volume : 36/5 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

Angle1 Angle2 : 0.00 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: Borthwick (day)

Source height = 1.08 m

ROAD (0.00 + 54.37 + 0.00) = 54.37 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	57.38	0.00	0.00	-3.01	0.00	0.00	0.00	54.37

Segment Leq : 54.37 dBA

Total Leq All Segments: 54.37 dBA

Results segment # 1: Borthwick (night)

Source height = 1.07 m

ROAD (0.00 + 48.82 + 0.00) = 48.82 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	51.83	0.00	0.00	-3.01	0.00	0.00	0.00	48.82

Segment Leq : 48.82 dBA

Total Leq All Segments: 48.82 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.37
(NIGHT): 48.82

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

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

Car traffic volume : 4743/412 veh/TimePeriod
Medium truck volume : 65/6 veh/TimePeriod
Heavy truck volume : 65/6 veh/TimePeriod
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

Angle1 Angle2 : 0.00 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 : 40.00 / 40.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Cummings (day)

Source height = 1.07 m

ROAD (0.00 + 43.56 + 0.00) = 43.56 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	57.86	0.00	-7.07	-4.47	0.00	-2.77	0.00	43.56

Segment Leq : 43.56 dBA

Total Leq All Segments: 43.56 dBA

Results segment # 1: Cummings (night)

Source height = 1.09 m

ROAD (0.00 + 36.11 + 0.00) = 36.11 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	50.42	0.00	-7.07	-4.47	0.00	-2.77	0.00	36.11

Segment Leq : 36.11 dBA

Total Leq All Segments: 36.11 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 43.56

(NIGHT): 36.11

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

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

Car traffic volume : 61138/5316 veh/TimePeriod
Medium truck volume : 835/73 veh/TimePeriod
Heavy truck volume : 835/73 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 1 (Wood depth 30 to less than 60 metres)
No of house rows : 2 / 2
House density : 50 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 200.00 / 200.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Aviation (day)

Source height = 1.07 m

ROAD (0.00 + 45.65 + 0.00) = 45.65 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.37	72.83	0.00	-15.44	-3.94	-5.00	0.00	0.00	48.45
0	90	0.66	72.83	0.00	-18.67	-4.47	0.00	-4.03	0.00	45.65

Segment Leq : 45.65 dBA

Total Leq All Segments: 45.65 dBA

Results segment # 1: Aviation (night)

Source height = 1.08 m

ROAD (0.00 + 38.07 + 0.00) = 38.07 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.37	65.24	0.00	-15.44	-3.94	-5.00	0.00	0.00	40.86
0	90	0.66	65.24	0.00	-18.67	-4.47	0.00	-4.03	0.00	38.07

Segment Leq : 38.07 dBA

Total Leq All Segments: 38.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 45.65
(NIGHT): 38.07