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187 Boteler Street – Embassy of the State of Qatar in Ottawa
Traffic and Stationary Noise Study

This report assesses two items: (1) the environmental noise impact from the mechanical and electrical equipment located at the proposed Embassy of the State of Qatar in Ottawa to be located at 187 Boteler Street, to determine the effect of this equipment on noise levels at nearby noise sensitive buildings, and (2) the traffic noise impact on the exterior envelope of the building, to determine the effect of traffic noise on the indoor areas.

This report is based on:

- Site plan and architectural drawings with plans and elevations dated December 6, 2021
- Sound data from the manufacturer equipment data sheets provided by the mechanical engineer
- Floor plans with exterior wall and window types provided by the architect, received on December 16, 2021

The noise impact from the mechanical and electrical equipment to the surrounding area must not exceed the City of Ottawa Noise Bylaw limit of 50 dBA during the day and the City of Ottawa Environmental Noise Control Guidelines (ENCG) and Ontario Ministry of Environment, Conservation and Parks limit of 45 dBA at night. We have constructed a 3D model to predict sound pressure levels at the locations of nearby residences and buildings resulting from noise from the mechanical and electrical equipment at the proposed new embassy building to be located at 187 Boteler Street. Based on the equipment data currently available, we have determined that no additional noise control measures are necessary. Our predictions are described in Section 2.0.

The traffic noise must meet the requirements in the ENCG for maximum road noise levels for indoor areas. For the traffic noise assessment, the noise impact from the A5 highway directly to the north of the new building were calculated. All other road noise sources are outside of the 100m limit for collectors and arterials and there is no rail or aircraft noise to be considered as per the City of Ottawa ENCG. Using the Ministry of Environment's STAMSON modeling software, we have calculated the noise impact, and performed a building component assessment using the AIF method. It has been determined that no changes are required to the exterior wall or window assemblies proposed in the architectural drawings due to noise from traffic on nearby roads.

Contents

1.0 Introduction & Site Description

State of the Art Acoustik Inc. has been commissioned by Embassy of the State of Qatar in Ottawa to complete a noise study for the development of a new embassy building to be located at 187 Boteler Street, Ottawa, Ontario. The building consists of a multi-story building with a DOAS unit and fluid cooler as rooftop equipment, and a generator on the ground outside of the building. It is located mainly near current residential areas as well as other embassies. We have analyzed the noise from the new equipment at the closest points of reception in order to determine the worst-case scenario.

1.1 Scaled Area Location Plan

Figure 1.1, Figure 1.2 and Figure 1.3 below show the site plan location of the new embassy at 187 Boteler Street, including the surrounding area and site plan. Adjacent noise sensitive buildings include mainly current residential homes and other embassy buildings.

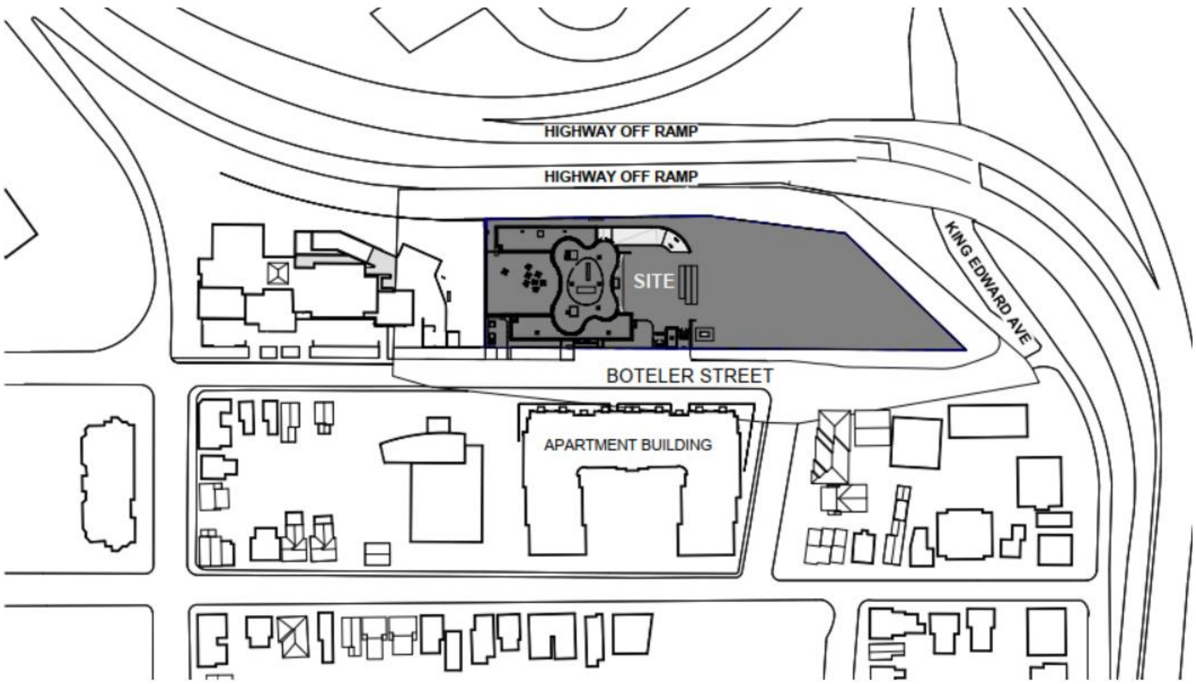


Figure 1.1 – Site plan context plan of 187 Boteler and surrounding area.

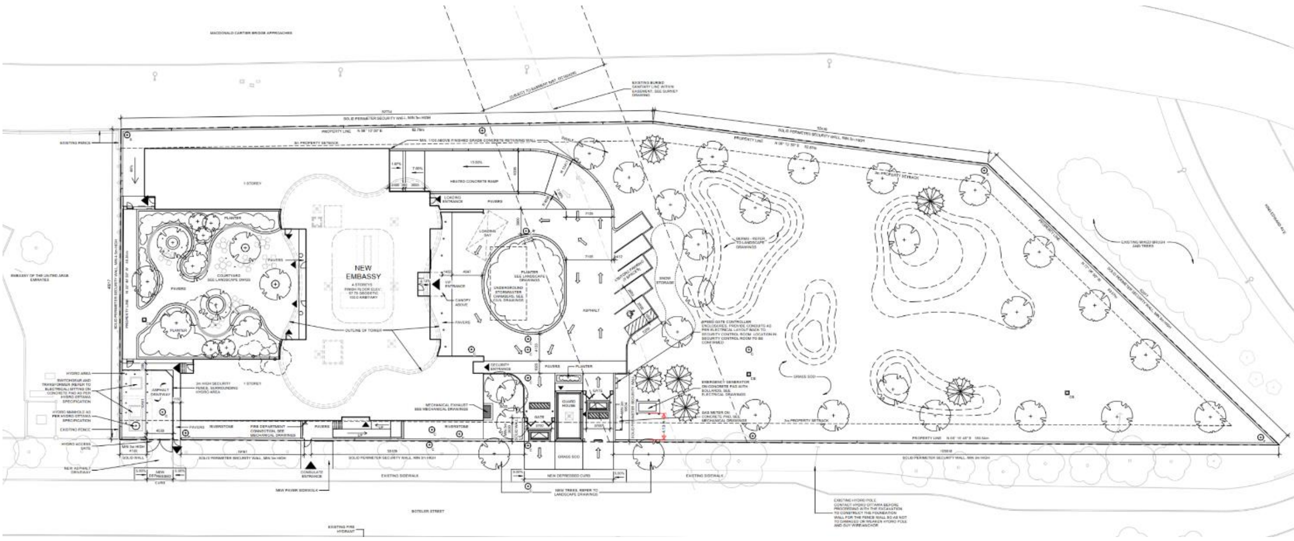


Figure 1.2 – Site plan of 187 Boteler Street.

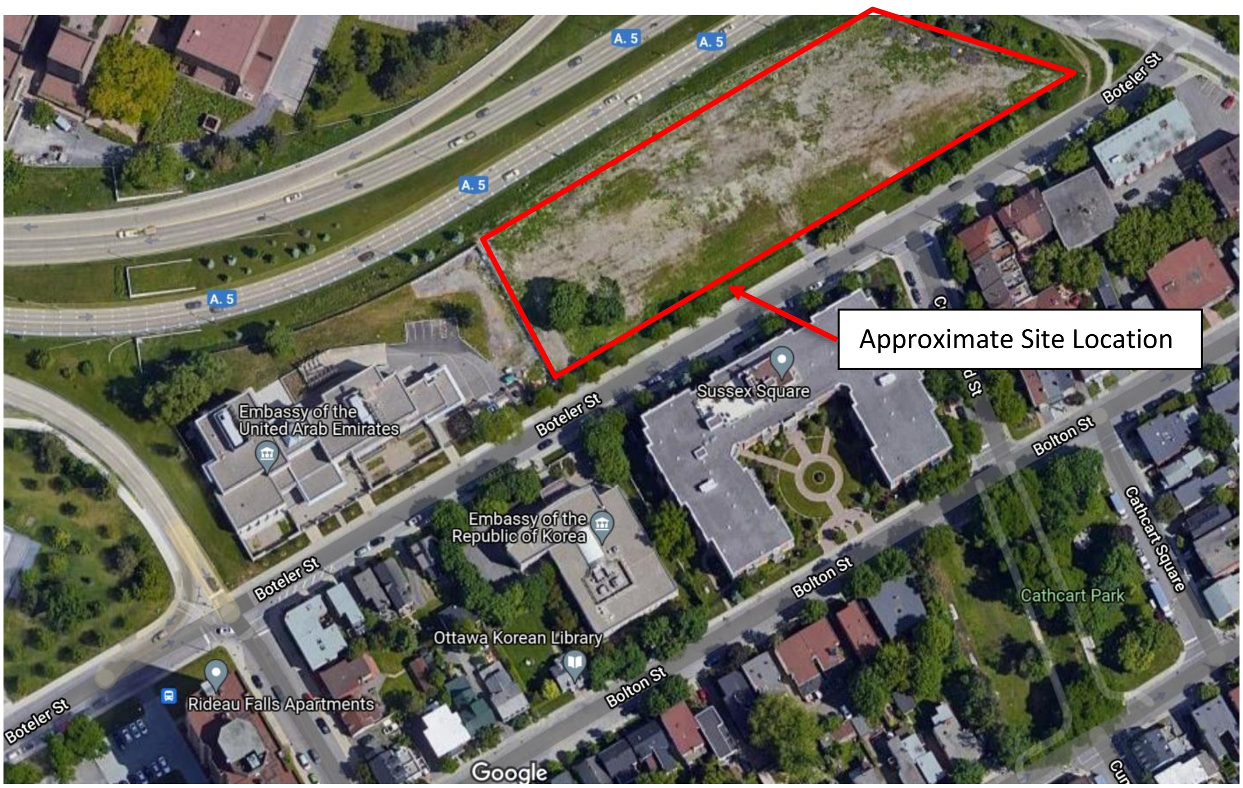


Figure 1.3 – Surrounding area around 187 Boteler from Google Maps imagery.

2.0 Environmental Noise Assessment

In this section we provide our environmental noise assessment. We detail the noise limits, noise sources, points of reception used in our modeling, modeling and calculation procedures, and predicted noise levels.

2.1 City of Ottawa Noise Bylaw & Enviornmental Noise Control Guidelines

The City of Ottawa Noise Bylaw and Environmental Noise Control Guidelines (ENCG) have the same limit for daytime permissible Sound Pressure Level (SPL) at a noise sensitive location in a Class 1 area of 50 dBA. The Bylaw is to be used in conjunction with the City of Ottawa Environmental Noise Control Guidelines (ENCG), which are based on the Ministry of Environment, Conservation and Parks (MOECP) NPC-300 Noise Control Guidelines. The City of Ottawa ENCG requires a 45 dBA SPL at night or ambient noise, whichever is higher. Therefore, when analyzing equipment for environmental noise studies, all non-emergency equipment in operation during the day must meet the Bylaw and ENCG limit of 50 dBA during the day and the ENCG limit of 45 dBA at night.

In addition, the MOECP allows emergency equipment such as generators to be analyzed separately from all other equipment and allows for a limit of 55 dBA during non-emergency use such as testing. However, the City of Ottawa Bylaw does not make this distinction and therefore, the daytime limit of 50 dBA must still be met at each noise sensitive point of reception in the nearby area. The points of reception (POR) are chosen at the nearest current and potential residential homes, which will allow us to calculate the largest noise impact and mitigate it accordingly. These are discussed in further detail below.

2.2 Significant Noise Sources

The noise sources which are being considered for this assessment of the mechanical noise to nearby residences are summarized in Table 2.1 below.

Noise Source	**Quantity**	**Location**
Fluid Cooler	1	Rooftop
DOAS Unit	1	Rooftop
Generator	1	Ground, Exterior

Table 2.1 – Quantity and location of noise sources considered.

Table 2.1 shows that the noise sources are located on the rooftop of the building except for the generator. In order to analyze the worst-case noise impact on the surrounding area, our analysis will include all sources in operation during the day, including the generator to simulate when testing is being done in non-emergency scenarios. The nighttime analysis includes only the fluid cooler and DOAS unit on the rooftop, as the generator will not be running at night under non-emergency scenarios.

Note that the DOAS unit has two large fans, one supply fan and one return fan. We have taken the sound data provided by the manufacturer for the supply fan inlet as well as the exhaust air outlet to represent noise emanated from the DOAS unit. Generator sound data is taken from a data sheet of a

Level III sound enclosure and is equivalent to a sound pressure level of 69 dBA at 7m. The sound data for the equipment considered in our evaluation is summarized in Table 2.2 below.

	Octave Band Sound Power Levels (dB)								
Noise Source	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dBA**
Fluid Cooler	74 dBA at 10 feet*								
DOAS Supply Air Inlet	87	84	92	88	89	86	80	73	93
DOAS Exhaust Air Outlet	86	86	76	69	69	64	59	54	75
Generator Level III Enclosure**	54.7	64.5	62.2	64.0	60.3	56.0	47.5	42.2	69.4

Table 2.2 – Octave band sound power levels of noise sources.

*Fluid cooler sound data was input into model as 12 separate fans with equivalent sound pressure levels based on the available manufacturer data in order to better model the entire unit. See Appendix for model number and additional information.

**Sound pressure levels are equivalent to 69 dBA at 7m.

2.3 Equipment Site Plan

The figures below show the plans identifying the locations of the sound generating equipment. Figure 2.1 below shows the rooftop equipment and generator on the ground.

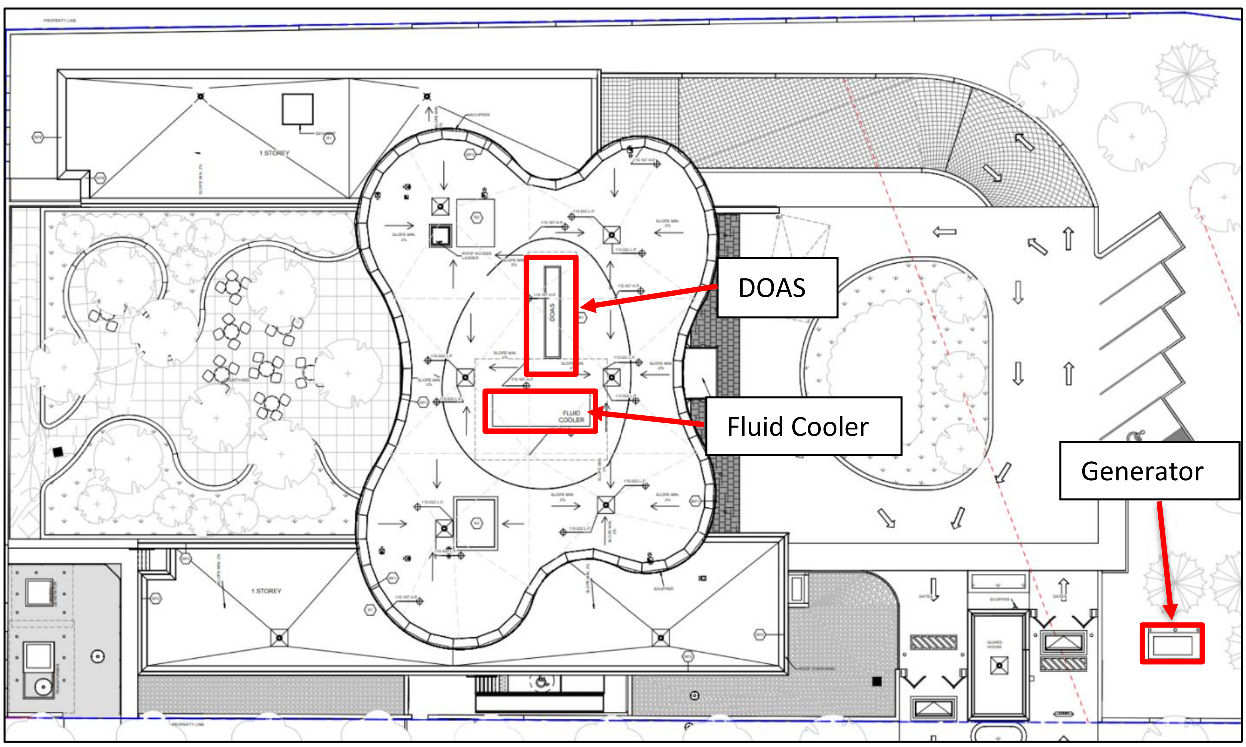


Figure 2.1 – Rooftop mechanical plan showing locations of equipment, including generator on the ground to the east of the guard house.

2.4 Points of Reception

Points of reception (PORs) have been selected to evaluate the noise levels at locations of nearby noise sensitive buildings. Figure 2.2 shows the locations and heights of the PORs used. POR 1 is located at ground height on the east side of 125 Boteler St, which is the Embassy of the United Arab Emirates. We have also included a POR, POR2, on the east façade of the higher portion of 125 Boteler St. in order to ensure that noise from both the generator on the ground as well as noise from the rooftop equipment are considered. POR1 is located at a height of 1.5m and POR2 is located at a height of 10.5m. POR 3 and 4 are located to the south of 187 Boteler St, on the north façade of the residential building at 205 Bolton St. POR3 is at a height of 1.5m and is located towards the center of the building across from the generator location at 187 Boteler St. POR4 is at a height of 12m and is representative of approximately the height of the top floor of the residential building which will be most affected by noise from the rooftop equipment at 187 Boteler St. Any other nearby noise sensitive buildings are further away from the noise sources at 187 Boteler St. and therefore if noise limits at PORs 1 through 4 are addressed, noise limits will be met at the rest of the surrounding area. In addition, there is a concrete barrier surrounding the building, which has a varying height relative to the ground around the entire site.

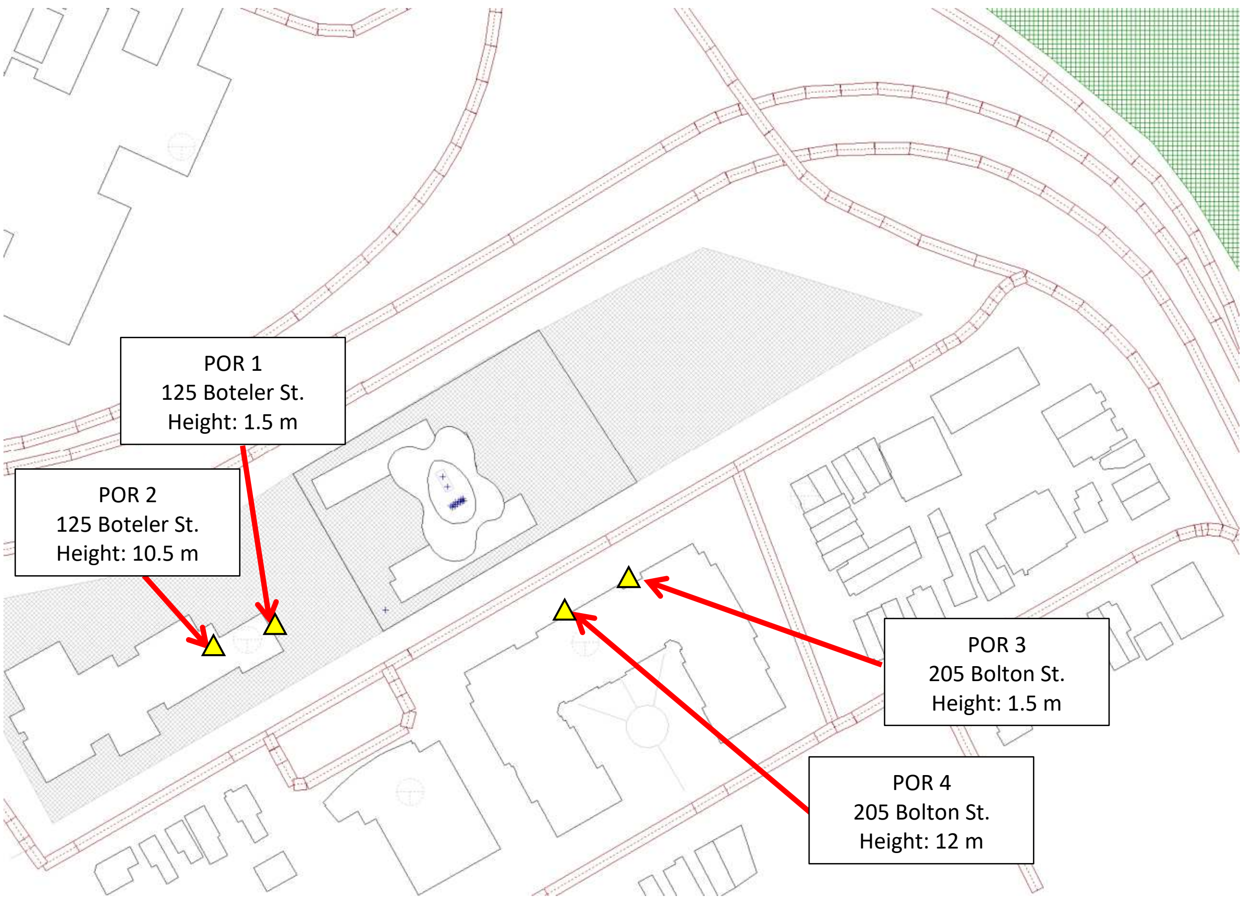


Figure 2.2 – Illustration showing locations and heights of points of reception for stationary noise assessment of equipment at 187 Boteler St**.**

2.5 Methodology Used in Environmental Noise Impact Calculation

The following sections describe the methodology and software used to model the sound pressure levels at the points of reception due to the noise sources while considering parameters such as source levels, distance, topography, barriers, and building geometry.

2.5.1 Procedure Used to Assess Noise Impact at Each Point of Reception

This environmental noise analysis was done 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 topographical data, combined with details of the proposed construction and the noise source power levels.

We created a 3D rendering of the neighbourhood around the building and placed the noise sources in the model at the appropriate locations and then and applied the sound power levels described in this report. The colours on the ground and building represent the sound pressure level in that area. Sound power levels per octave band were entered into CadnaA at the source's location and the resulting sound pressure levels were calculated at the points of reception.

2.5.2 Other Parameters/Assumptions Used in Calculations

The following table describes the parameters used in the CadnaA model:

Parameter	Value/Condition
Ground Absorption	Default value of 0
Building Reflections	On
Temperature (°C)	10
Relative Humidity (%)	70

Table 2.3 – Parameters used in CadnaA modeling

2.6 Environmental Noise Levels

This section summarizes the CadnaA noise mapping results. Section 2.6.1 below illustrates the steady state sound pressure levels generated by all the noise sources with the currently selected equipment described above for daytime operations, including non-emergency use of the generator. Section 2.6.2 illustrates the steady state sound pressure levels generated by all the noise sources with the currently selected equipment described above for nighttime operations, which does not include the generator but assumes regular operation of the rooftop equipment.

2.6.1 Results with Current Selections for Daytime Operations

Figure 2.3 shows the noise grid prediction at 1.5 m height and the sound pressure levels predicted at all the 1.5m height PORs (POR1 and POR3) with the daytime equipment operating, including the generator in what would be a scenario where the generator would be being tested. The City of Ottawa Noise

Bylaw and ENCG daytime limit of 50 dBA must be met, as it does not provide exemptions for emergency equipment in non-emergency scenarios. Figure 2.4 shows the same grid at a height of 10m, with the higher PORs (POR2 and POR4) in order to better show the noise map of the rooftop equipment. Figure 2.3 shows that the sound pressure levels do not exceed the daytime limit of 50 dBA at any nearby noise sensitive location.

Figure 2.3 – Noise map at 1.5 m height with current equipment selections for daytime operations, with generator on.

Figure 2.4 – Noise map at 10 m height with current equipment selections for daytime operations, with generator on.

2.6.2 Results with Current Selections for Nighttime Operations

Figure 2.5 shows the grid at a height of 10m, with the higher PORs (POR2 and POR4) which is a visualization of the map for noise from the rooftop equipment, as the generator is off at night. Figure 2.5 shows that the sound pressure levels do not exceed the nighttime limit of 45 dBA at all PORs and therefore no additional mitigation measures are required for the rooftop equipment.

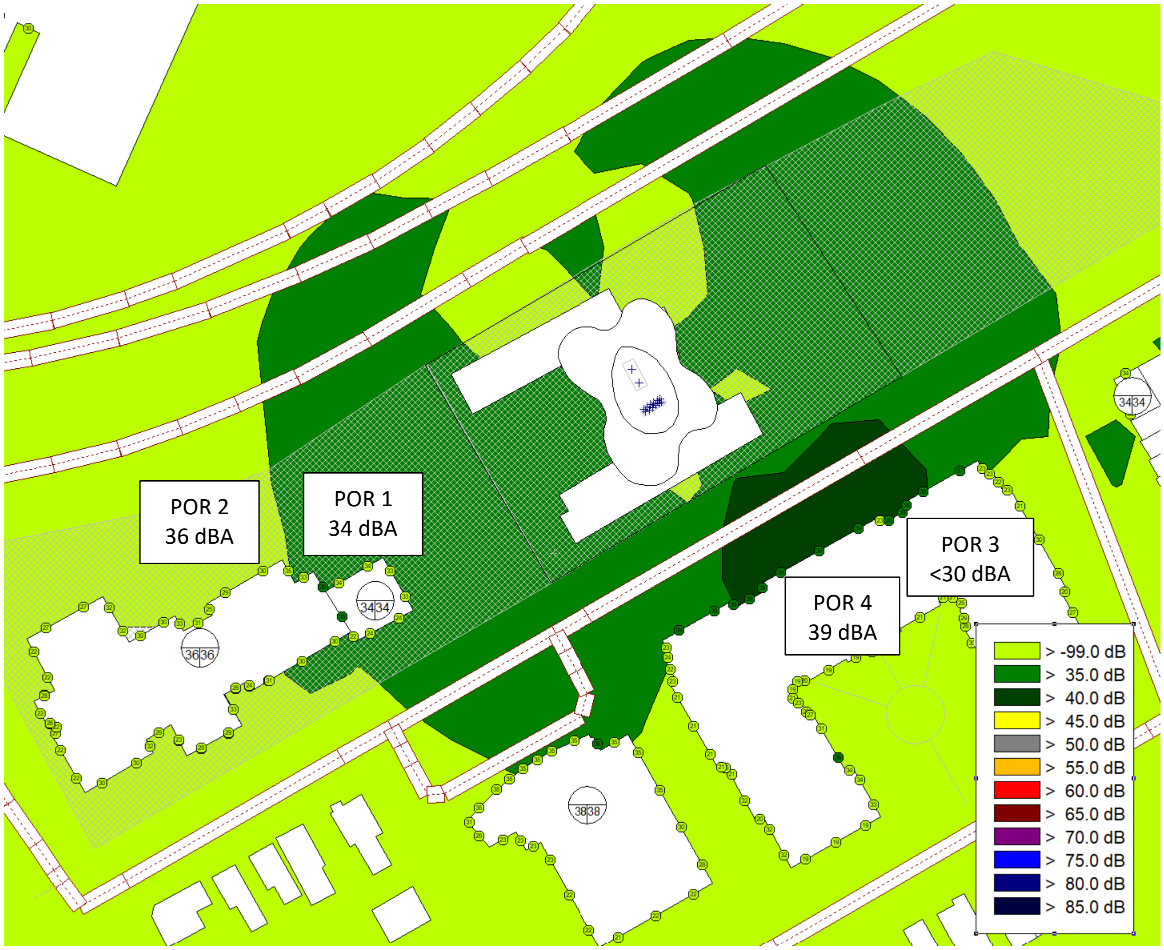


Figure 2.5 – Noise map at 10 m height with current equipment selections for nighttime operations, with generator off.

As daytime noise levels do not exceed the ENCG and City of Ottawa Bylaw limit of 50 dBA and do not exceed the ENCG nighttime limit of 45 dBA, no additional mitigation measures are required, provided that an enclosure

3.0 Traffic Noise Study

The following section describes our analysis of the road noise impact on the proposed new building at 187 Boteler Street.

3.1 City of Ottawa Environmental Noise Guidelines for Traffic Noise (Road & Rail)

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 and rail noise levels for indoor and outdoor living areas are taken from Table 2.2a and 2.2b of the ENCG and summarized in Table 3.1 and Table 3.2 below.

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

Table 3.1 – Criteria for Indoor Area Road Noise Levels

	Outdoor Leq Levels (dBA) Class 1, 2 & 3 Areas
	Road/Rail Traffic Noise Level Limit (dBA)
07:00 – 23:00	**55** for Outdoor Living Areas

Table 3.2 – Criteria for Outdoor Living Area Road/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

Highway A5 is within 100m of the planned development and therefore an analysis of the impact of traffic noise is required. No rail or aircraft noise sources are required to be part of the traffic noise study.

3.2 Traffic Noise Sources

There is only one traffic noise source within range which is Highway A5, which is the link between King Edward Avenue in Ottawa and the Macdonald-Cartier Bridge to Gatineau. The inbound Ottawa traffic lane is approximately 15m from the new embassy building at its' closest point and the outbound lane to the bridge is approximately 31m from the new embassy building. These sources are detailed in Figure 3.1 below and Table 3.3 below summarizes the road parameters which were used in this analysis. In order to better represent the actual traffic flow, we have taken the traffic volumes from the 4-lane urban arterial divided road in Appendix B of the ENCG and divided it in half to essentially create two separate roadways, due to the large distance between the inbound and outbound lanes of the highway to the development.

Road	Road Class	Posted Speed	AADT Vehicles/Day	Day/Night Split (%)	Medium Trucks (%)	Heavy Trucks (%)
Highway A5 (East Inbound Lanes)	4-Lane Urban Arterial-Divided (4-UAD)	30 km/hr*	17500	92/8	7	5
Highway A5 (West Outbound Lanes)	4-Lane Urban Arterial-Divided (4-UAD)	50 km/hr	17500	92/8	7	5

Table 3.3 – Summary of Major Road Noise Sources.

*Note that the minimum speed that can be input into STAMSON is 40 km/h, which has been used in our calculations below. It should also be noted that the actual speed of vehicles using this offramp is likely higher than 40 km/h, however we have completed these calculations as per City of Ottawa guidelines and have used 40 km/h as the input into STAMSON.

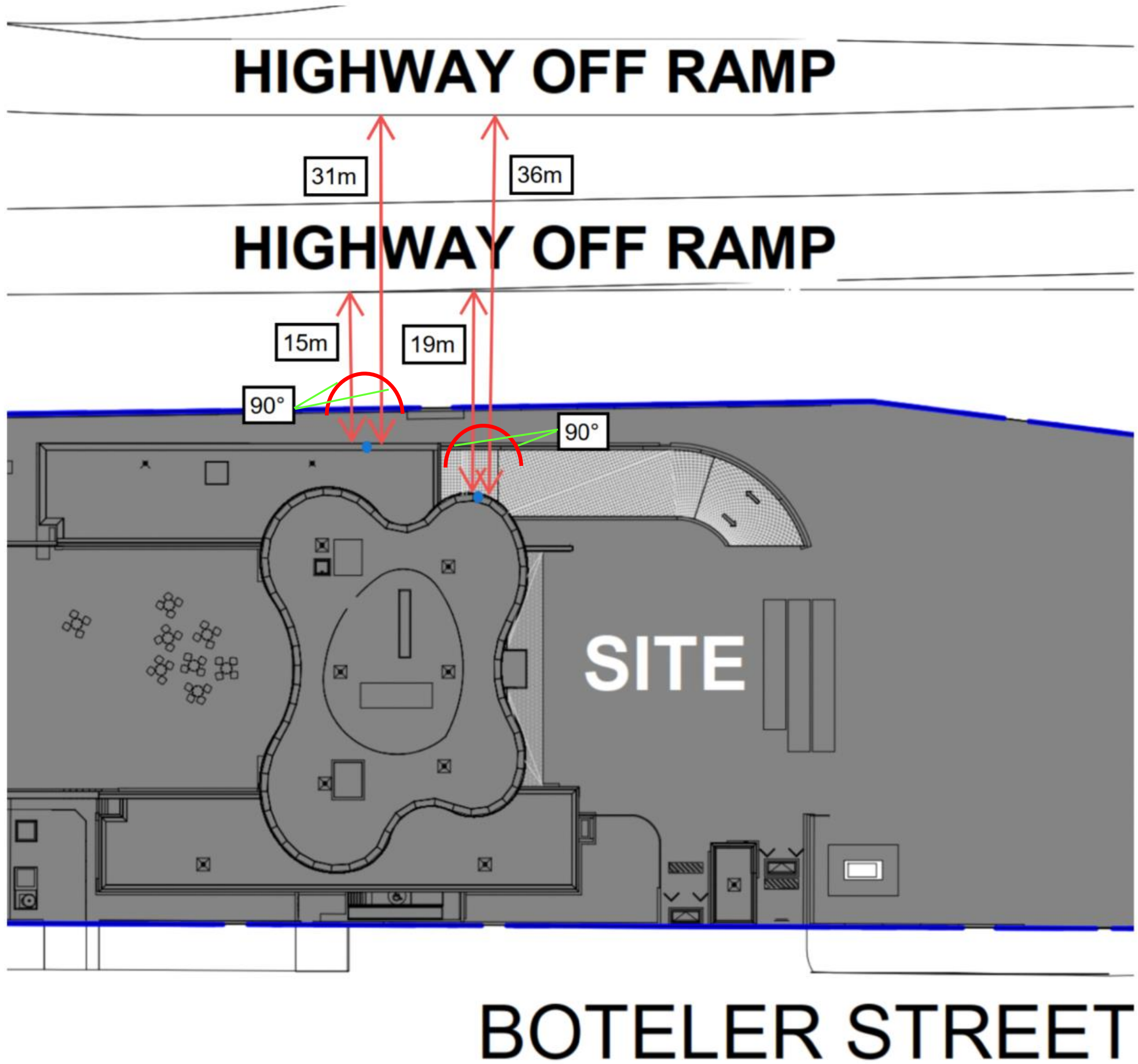


Figure 3.1 – Site plan of 187 Boteler Street showing locations and distances of relevant noise sources.

3.3 Points of Reception

To determine the worst-case noise impact on the façade of the building, we have chosen points of reception based on proximity to relevant noise sources, i.e. the adjacent highway. POR A is located at the ground floor room (1.5m height) and POR B is located at a 2nd floor room (7.5m height). POR heights are shown in Figure 3.2 on the North elevation facing Highway A5. Figure 3.3 and Figure 3.4 show the embassy floor plans for POR A and B. Table 3.4 below summarizes the POR heights, distances to relevant noise sources, and angles to the sources.

Receiver	Height (m)	Noise Source					
		Highway A5 Inbound (East)			Highway A5 Outbound (West)		
		Distance from Source (m)	Angle to source from left	Angle to source from right	Distance from Source (m)	Angle to source from left	Angle to source from right
POR A	1.5	15	90	90	31	90	90
POR B	7.5	19	90	90	36	90	90

Table 3.4 – POR height, distance from noise sources, and angles to noise sources.

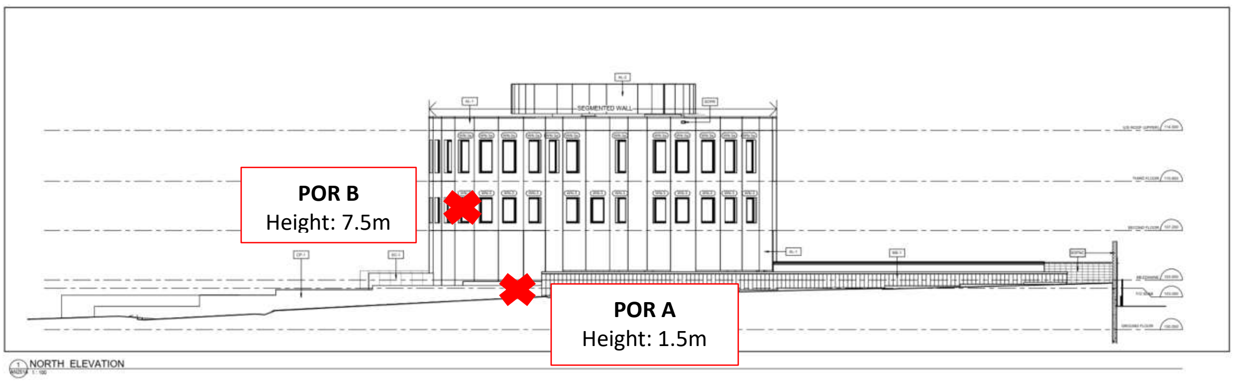


Figure 3.2 – North elevation of 187 Boteler St showing location and heights of points of reception.

There are no outdoor living areas within the development, therefore there are no outdoor living area points of reception included in our analysis.

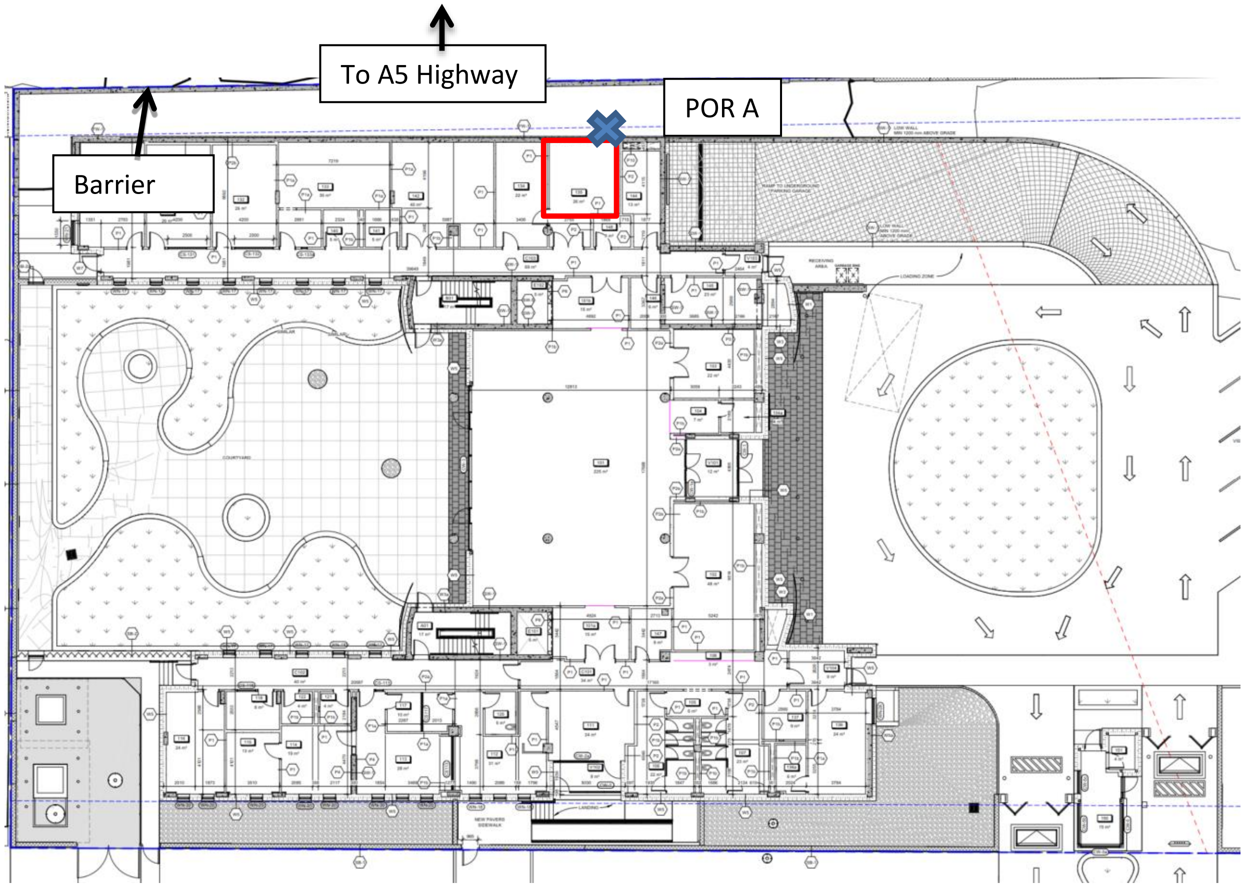


Figure 3.3 – Floor plan section of ground floor showing the plane of window (POW) point of reception, POR A location

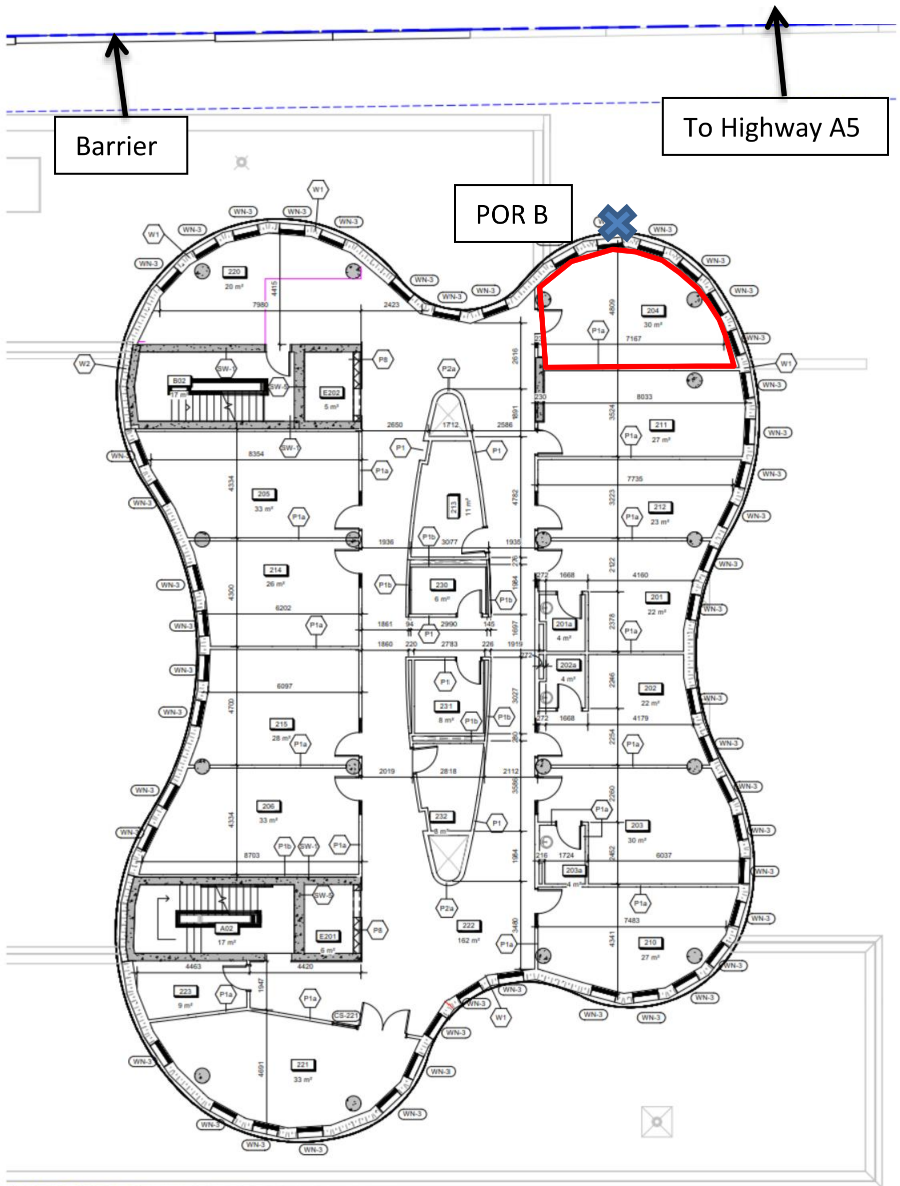


Figure 3.4 – Floor plan section of 2nd floor showing the plane of window (POW) point of reception, POR B location

3.4 Methodology Used in Traffic Noise Impact Calculation

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

According to the City of Ottawa, when noise levels could exceed 65 dBA at the Plane of Window (POW) of a noise sensitive building, 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.

3.4.1 STAMSON Analysis Parameters

The parameters used in STAMSON to assess the noise impact at POR A and POR B are indicated in Table 3.5 and 3.6 below, respectively. These are used in conjunction with the parameters for road traffic volume given in Table 3.2.

Parameter	Values Used
Roadway	Highway A5 East
Time Period	16h/8h
Topography	Flat/gentle slope with barrier
Rows of Houses	0
Intermediate Surface	Reflective
Receiver Height (m)	POR A: 1.5m, POR B: 7.5m
Source Receiver Distance (m)	POR A: 15 m; POR B: 19 m;
Barrier Angles	ϴ1= -90°, ϴ2=90°
Barrier to Receiver Distance	PORA: 3m, PORB: 8m
Barrier Height	3m
Source Elevation	0m
Receiver Elevation	0m
Barrier Ground Elevation	0m

Table 3.5 – Parameters used in the STAMSON model for Highway A5 East.

Parameter	Values Used
Roadway	Highway A5 West
Time Period	16h/8h
Topography	Flat/gentle slope with barrier
Rows of Houses	0
Intermediate Surface	Reflective
Receiver Height (m)	POR A: 1.5m, POR B: 7.5m
Source Receiver Distance (m)*	POR A: 31 m; POR B: 36 m;
Barrier Angles	ϴ1= -90°, ϴ2=90°
Barrier Height	3m
Barrier to Receiver Distance	PORA: 3m, PORB: 8m
Source Elevation	0m
Receiver Elevation	0m
Barrier Ground Elevation	0m

Table 3.6 – Parameters used in the STAMSON model for Highway A5 West.

3.4.2 Building Component Assessment (AIF Analysis)

To comply with the City of Ottawa policies, the building envelope will require a minimum Acoustic Insulation Factor (AIF) rating to provide the indoor noise level required for living and working spaces described below.

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

- maximum daytime indoor L_{eq} for general office space or reception areas should be 50 dBA
- maximum daytime indoor L_{eq} for living areas 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 Research Council [Revised June 1980]

3.5 Predicted Surface Transportation Noise Levels

Table 3.7 below shows the predicted sound pressure levels at the points of reception from the results of the STAMSON noise software calculation (Appendix A).

Noise Source	POR A (dBA)		POR B(dBA)	
	Day	Night	Day	Night
A5 Highway East	56.6	48.7	66.3	58.7
A5 Highway West	55.3	47.7	65.4	57.8
Sum	**58.8**	**51.2**	**68.8**	**61.3**

Table 3.7 – Predicted traffic noise at the PORs, broken down per source.

POR A is mostly protected from traffic noise by the 3m barrier surrounding the site, however POR B is high enough so that it has a direct line of site to traffic and the resulting noise levels are much higher. We have calculated the predicted noise level caused by traffic using STAMSON and have shown that the daytime 16h L_{eq} at POR B is above 65dBA, at a level of **68.8dBA**. The calculated daytime levels account for a worst-case scenario in terms of traffic noise. As the levels during the day are above 65 dBA the following is required:

1) An evaluation of exterior building components using the AIF method is undertaken in Section 3.6 in order to verify that building components will achieve the required daytime indoor sound level of 45 dBA for living or work spaces. Due to the nature of the building function, an embassy, we have also assumed that it will be in use during the evenings and at night as well.
2) Addition of a Warning Clause to the development agreement. The ENGC requires a Warning Clause whenever noise could meet or exceed 55 dBA 16 hour L_{eq} at the Plane of Window of any living, working or sleeping area prior to any noise mitigation. General Warning Clause guidelines are provided in Section 3.7. Note that this item should be clarified with the City of Ottawa, as warning clauses are typically applied to residential buildings.

Note that because the STAMSON parameter of the intermediate surface has been set to reflective between the roads and the building, STAMSON will not differentiate between different POR heights after a certain height. The height of POR B is a “bright zone” meaning that the barrier no longer influences sound levels at this point and above. Therefore, any height above this will have the same predicted noise level because of STAMSON’s calculation procedure.

Because the noise levels on the ground floor are below 65 dBA, the AIF analysis will only be conducted for POR B.

3.6 Exterior Building Component Analysis (AIF Method)

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

3.6.1 Building Components

The current design of the building's façade is made up of 2 different components:

1) Exterior wall
2) Window

The existing exterior wall composition was provided by the architect in Drawing AN-102, as shown in Table 3.8. This wall type is sufficiently similar to wall type EW1 plus the addition of rigid insulation, which is then equivalent to EW2 as described in the Canada Mortgage and Housing Corporation (CMHC) document "Road and Rail Noise: Effects on Housing". Table 3.6 shows a comparison of these wall compositions. Note that based on the thickness of steel studs, batt insulation and gypsum board of the proposed wall type W1 as compared to those given in the CMHC wall type EW2, the proposed wall will likely perform even better than the EW2, however for these calculations, this comparison will suffice.

Exterior Wall Assembly (W1)	**Wall Type EW2 from CMHC Road and Rail Noise**
-6mm thick curved aluminum plate screen -Pre-engineered support system -178mm semi-rigid insulation -Single-ply air/vapour barrier -16mm steel studs- engineered c/w 140mm batt insulation -16mm gypsum board - Finish as per room finish schedule	-Metal/wood siding with backer board -Sheathing -50mm batt insulation -38x89mm studs c/w 50mm or thicker mineral wool -Vapour barrier -12.7 mm gypsum board

Table 3.8 – Comparison of building exterior wall (W1) and equivalent wall from CMHC, Road and Rail Noise: Effects on Housing (EW2).

As noted in Figure 3.6, taken from Drawing AN-102, the window types for the façade of POR B and the room being analyzed in WN-3 which are indicated as Cascadia Universal Series, Double Glazed, Tilt and Turn windows. The information below in Table 3.8 was taken from the Cascadia Windows data sheet provided by GRC and the interpane spacing is assumed to be 13mm as it is not indicated in the data sheet.

Basic Window Assembly
6 mm glazing
13 mm interplane spacing
4 mm glazing

Table 3.9 – Indicated WN-3 assembly from Drawing AN-102.

The calculation of AIF for each building component depends on the ratio of the area of a given component of the exterior wall to the total floor area of the corresponding interior room. Using plan view and elevation drawings, we have determined these dimensions for the room for which we determined the noise impact at POR B. The layout of the room is shown in Figure 3.5.

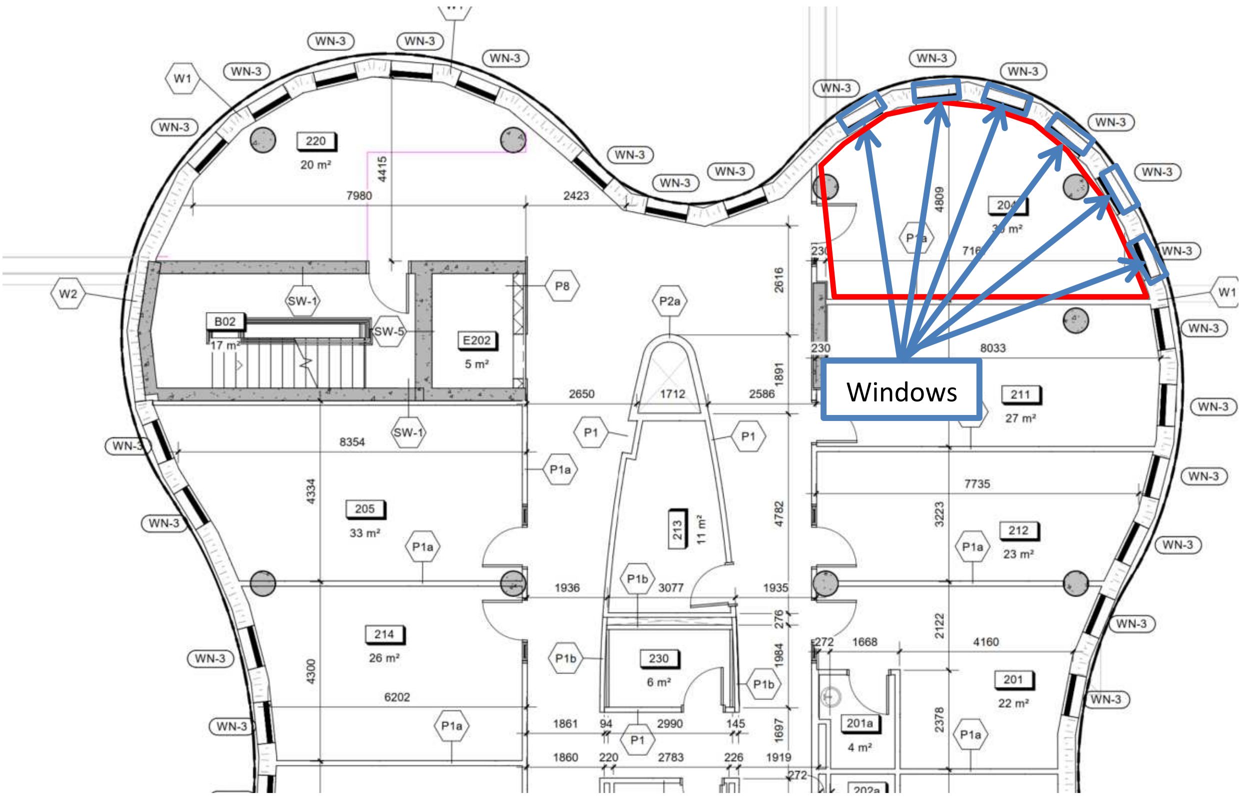


Figure 3.5 – Layout of Room 204 used for analysis of POR B, indicated in red with windows indicated in blue.

3.6.2 AIF Calculations

In Tables 3.10 and 3.11 below, we provide the results of our AIF calculations based on the procedure given in Section 3.4.2, the building component information given in section 3.6.1, and the dimensions from the plans for each component at all PORs. Component AIFs are determined based on component area ratio to floor area given in CMHC "Road and Rail Noise: Effects on Housing" Tables 6.2 and 6.3.

POR B												
Room Floor Area (m^2)	Number of Components	Component Number	Component Type	Component Area (m^2)	Component Area ratio to Floor Area (%)	Outside Leq	Required Indoor Leq	Initial Required AIF	Component AIF	Comp1 AIF > Init AIF +10	Final Required AIF	Acceptable Component AIF
30.0	2	1	Exterior Wall	19.2	64%	68.8	45	29	35	No	29	**Yes**
30.0	2	2	Window	10.8	36%	68.8	45	29	30	No	29	**Yes**

Table 3.10 – POR B AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable. Calculations are for daytime hours (7am-11pm) and uses POR B 16hr daytime Leq from Table 3.6.

POR B												
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
30.0	2	1	Exterior Wall	19.2	64%	61.3	40	26	30	No	26	**Yes**
30.0	2	2	Window	10.8	36%	61.3	40	26	30	No	26	**Yes**

Table 3.11 – POR B AIF parameters used in calculations, resulting required AIF and component AIF, and statement if AIF is acceptable. Calculations are for nighttime hours (11pm-7am) and uses POR B 8hr nighttime Leq from Table 3.6.

All components have acceptable AIFs for all PORs. No changes are required to the exterior façade.

3.7 Warning Clauses

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

Table 3.12 provides the types of warning clauses which are taken from Section C8.1 Transportation Sources of the MOECP NPC-300 which also states:

"The use of warning clauses or easements in respect of noise are recommended when circumstances warrant. Noise warning clauses may be used to warn of potential annoyance due to an existing source of noise and/or to warn of excesses above the sound level limits. Direction on the use of warning clauses should be included in agreements that are registered on title to the lands in question. The warning clauses would be included in agreements of Offers of Purchase and Sale, lease/rental agreements and condominium declarations."

In addition, Section Section C8 also notes: "*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	Warning Clause Text
Type A	Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transit way traffic may occasionally interfere with some activities of the occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment.
Type B	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 occasions interfere with some activities of the occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment.
Type C	This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air condition 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 City and the Ministry of Environment.
Type D	This dwelling has been supplied with a central air conditioning system 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 Environment.

Table 3.12 - Warning Clause Types (from MOECP NPC-300 Section C8.1)

As the current space is an embassy and not a residential development, a warning clause may not be required and should be clarified with the City of Ottawa. If a warning clause is required, a **Type B Warning Clause** is applicable to the building. Noise control features include the proposed exterior assemblies of the building and barrier surrounding the site.

4.0 Conclusion

We have reviewed the sound pressure levels in our 3D acoustical model of the new mechanical and electrical equipment from the proposed embassy building at 187 Boteler St. in Ottawa, Ontario. We have found that given the new rooftop mechanical configuration and generator on the ground, noise levels from the generator exceed the City of Ottawa Environmental Noise Control Guidelines and City of Ottawa limit of 50 dBA during the day to neighbouring properties. No noise mitigation is required to the new rooftop mechanical equipment if the sound data used in the design process are equivalent or lower than those used in our calculations.

The traffic noise from the A5 highway near the proposed classroom addition was also analyzed. It was found that the traffic noise from this source was greater than 65 dBA at the 2nd floor plane of window point of the development and warranted an AIF analysis of the exterior building components. This analysis showed that the planned exterior wall and window assembly for the exterior façade was acceptable, provided that the pane spacing assumed in Table 3.9 is used. No changes are required. A Type B warning clause, as discussed in Section 3.7 should be added to the development agreement, however due to the function of this building as an embassy, it should be clarified with the City of Ottawa whether a warning clause is required.

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

Sincerely,

Patrick Richard, M.Sc.E.
Acoustic Consultant

Approved By:

LICENSED PROFESSIONAL ENGINEER
D. E. BUCHAN
28/2/2022
PROVINCE OF ONTARIO

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

APPENDIX

STAMSON Calculations
Noise Source Sound Data

STAMSON 5.0 NORMAL REPORT Date: 16-02-2022 13:14:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 187botb.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: A5 East (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 17500
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: A5 East (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 : 19.00 / 19.00 m
Receiver height : 7.50 / 7.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 3.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Road data, segment # 2: A5 West (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: A5 West (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 : 36.00 / 36.00 m
Receiver height : 7.50 / 7.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 3.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: A5 East (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 !        7.50 !        4.97 !        4.97
```

ROAD (0.00 + 66.33 + 0.00) = 66.33 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	67.36	0.00	-1.03	0.00	0.00	0.00	-0.24	66.09*
-90	90	0.00	67.36	0.00	-1.03	0.00	0.00	0.00	0.00	66.33

* Bright Zone !

Segment Leq : 66.33 dBA

Results segment # 2: A5 West (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 !        7.50 !        6.17 !        6.17
```

ROAD (0.00 + 65.35 + 0.00) = 65.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.15	0.00	-3.80	0.00	0.00	0.00	-0.11	65.23*
-90	90	0.00	69.15	0.00	-3.80	0.00	0.00	0.00	0.00	65.35

* Bright Zone !

Segment Leq : 65.35 dBA

Total Leq All Segments: 68.88 dBA

Results segment # 1: A5 East (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	7.50	4.97	4.97

ROAD (0.00 + 58.73 + 0.00) = 58.73 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	59.76	0.00	-1.03	0.00	0.00	0.00	-0.24	58.50*
-90	90	0.00	59.76	0.00	-1.03	0.00	0.00	0.00	0.00	58.73

* Bright Zone !

Segment Leq : 58.73 dBA

Results segment # 2: A5 West (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.50	7.50	6.17	6.17

ROAD (0.00 + 57.75 + 0.00) = 57.75 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

```
--------------------------------------------------------------------------
  -90    90  0.00  61.55   0.00  -3.80   0.00   0.00   0.00  -0.11  57.64*
  -90    90  0.00  61.55   0.00  -3.80   0.00   0.00   0.00   0.00  57.75
--------------------------------------------------------------------------
```

* Bright Zone !

Segment Leq : 57.75 dBA

Total Leq All Segments: 61.28 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.88
(NIGHT): 61.28

STAMSON 5.0 NORMAL REPORT Date: 16-02-2022 13:14:59
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 187botb.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: A5 East (day/night)

```
------------------------------------------
Car traffic volume  : 14168/1232  veh/TimePeriod  *
Medium truck volume :  1127/98    veh/TimePeriod  *
Heavy truck volume  :   805/70    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)
```

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

```
  24 hr Traffic Volume (AADT or SADT):  17500
  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: A5 East (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 : 19.00 / 19.00 m
Receiver height : 7.50 / 7.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 3.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Road data, segment # 2: A5 West (day/night)

Car traffic volume : 14168/1232 veh/TimePeriod *
Medium truck volume : 1127/98 veh/TimePeriod *
Heavy truck volume : 805/70 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): 17500
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: A5 West (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 : 36.00 / 36.00 m

```
Receiver height          :  7.50 / 7.50   m
Topography               :     2      (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 90.00 deg
Barrier height           :  3.00 m
Barrier receiver distance :  8.00 / 8.00   m
Source elevation         :  0.00 m
Receiver elevation       :  0.00 m
Barrier elevation        :  0.00 m
Reference angle          :  0.00

Results segment # 1: A5 East (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 !        7.50 !        4.97 !         4.97

ROAD (0.00 + 66.33 + 0.00) = 66.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  67.36   0.00  -1.03   0.00   0.00   0.00  -0.24  66.09*
   -90     90   0.00  67.36   0.00  -1.03   0.00   0.00   0.00   0.00  66.33
--------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 66.33 dBA

Results segment # 2: A5 West (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 !       7.50 !       6.17 !        6.17

ROAD (0.00 + 65.35 + 0.00) = 65.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
  -90     90   0.00  69.15   0.00  -3.80   0.00   0.00   0.00  -0.11  65.23*
  -90     90   0.00  69.15   0.00  -3.80   0.00   0.00   0.00   0.00  65.35
--------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 65.35 dBA

Total Leq All Segments: 68.88 dBA


Results segment # 1: A5 East (night)
-----------------------------------

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 !       7.50 !       4.97 !        4.97

ROAD (0.00 + 58.73 + 0.00) = 58.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
  -90     90   0.00  59.76   0.00  -1.03   0.00   0.00   0.00  -0.24  58.50*
  -90     90   0.00  59.76   0.00  -1.03   0.00   0.00   0.00   0.00  58.73
--------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 58.73 dBA
```

```
Results segment # 2: A5 West (night)
-----------------------------------

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 !      7.50 !      6.17 !       6.17

ROAD (0.00 + 57.75 + 0.00) = 57.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
  -90     90   0.00  61.55   0.00  -3.80   0.00   0.00   0.00  -0.11  57.64*
  -90     90   0.00  61.55   0.00  -3.80   0.00   0.00   0.00   0.00  57.75
------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 57.75 dBA

Total Leq All Segments: 61.28 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.88
                         (NIGHT): 61.28
```

comefri fans of energy saving

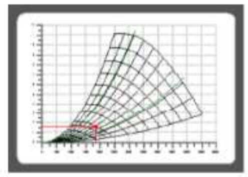
8/20/2021
Aeolus4 1.0.20126.1

Customer			
Project		**Description**	
Your Ref.	- -	**Our Ref.**	Tempeff

Input data

Volume	1850 CFM	**Temperature**	68.0 °F	**Density**	0.075 lb/cu.ft
Static Pressure	1.63 In.W.G.	**Altitude**	0 ft	**Free Inlet - Free Outlet**	

	Catalogue data		
Selected Fan **ANPA12 -**	n Max 1/min	Pw Max BHP	J lb ft²
	4500		3.08



Fan Information

c ft/min	p tot * In.W.G.	p sta In.W.G.	p dyn ** In.W.G.	tip speed ft/min	RPM 1/min	eta Tot * %	eta Sta %	P fan BHP	Min Mot. BHP	P mot BHP	Shaft diameter in
	1.83	1.63	0.20	6392	1968	72.79	64.84	0.73			0.00

(*)Theoric value calculated taking into account the dynamic pressure at the impeller outlet
(**)Theoric value, calculated at the impeller outlet

fm[Hz]		**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Tot.**
Lw3 Total Sound Power Level in the inlet duct- Lwi Inlet Duct Sound Power Level includes the effect of duct end correction										
Level Lw3	**dB/dB(A)**	74 / 48	68 / 52	73 / 64	67 / 64	64 / 64	65 / 66	56 / 57	50 / 49	**78 / 71**
Lw5 Inlet Total Sound Power Level - Lwmi Inlet Sound Power Level (free inlet) do not includes the effect of duct end correction										
Level Lw5	**dB/dB(A)**	65 / 39	66 / 50	81 / 72	76 / 73	69 / 69	67 / 68	63 / 64	57 / 56	**83 / 77**
Lw6 Total Sound Power Level at the free outlet - Lwmo Outlet Sound Power Level (free outlet) do not includes the effect of duct end correction										
Level Lw6	**dB/dB(A)**	74 / 48	73 / 57	77 / 68	74 / 71	74 / 74	72 / 73	68 / 69	63 / 62	**82 / 79**

comefri fans of energy saving

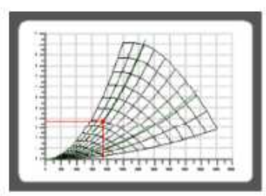
8/20/2021
Aeolus4 1.0.20126.1

Customer			
Project		**Description**	
Your Ref.	- -	**Our Ref.**	Tempeff

Input data

Volume	1850 CFM	**Temperature**	68.0 °F	**Density**	0.075 lb/cu.ft
Static Pressure	3.73 In.W.G.	**Altitude**	0 ft	**Free Inlet - Free Outlet**	

	Catalogue data		
Selected Fan **ANPA12 -**	n Max 1/min	Pw Max BHP	J lb ft²
	4500		3.08



Fan Information

c ft/min	p tot * In.W.G.	p sta In.W.G.	p dyn ** In.W.G.	tip speed ft/min	RPM 1/min	eta Tot * %	eta Sta %	P fan BHP	Min Mot. BHP	P mot BHP	Shaft diameter in
	3.93	3.73	0.20	8517	2623	71.58	67.94	1.60			0.00

(*)Theoric value calculated taking into account the dynamic pressure at the impeller outlet
(**)Theoric value, calculated at the impeller outlet

fm[Hz]		**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Tot.**
Lw3 Total Sound Power Level in the inlet duct- Lwi Inlet Duct Sound Power Level includes the effect of duct end correction										
Level Lw3	**dB/dB(A)**	81 / 54	76 / 60	73 / 64	78 / 74	72 / 72	72 / 73	65 / 66	62 / 61	**84 / 79**
Lw5 Inlet Total Sound Power Level - Lwmi Inlet Sound Power Level (free inlet) do not includes the effect of duct end correction										
Level Lw5	**dB/dB(A)**	69 / 43	71 / 55	79 / 70	84 / 81	73 / 73	71 / 73	69 / 70	66 / 65	**86 / 83**
Lw6 Total Sound Power Level at the free outlet - Lwmo Outlet Sound Power Level (free outlet) do not includes the effect of duct end correction										
Level Lw6	**dB/dB(A)**	72 / 46	72 / 56	72 / 64	81 / 78	78 / 78	78 / 80	72 / 73	71 / 70	**85 / 84**

2 FAN WIDE

MODEL	FAN ARRAN.	COIL ROW	6 POLES MOTOR (HS) 95°F AMB 115°F-105°F EG50% MAX 10 PSI PD (+/- 1)		SOUND RATING				INTERNAL VOLUME (FT^3)	FLUID VOLUME (US GAL.)	APPROX. DRY WEIGHT (LB)
					6 POLES MOTOR (FBY)		8 POLES MOTOR (FVY)				
			CAPACITY (MBH)	GPM	1.0 HP 680 RPM	2.6 HP 970 RPM	0.5 HP 510 RPM	1.25 HP 730 RPM			
F*Y-212F-*-F	2x1	2	183.2	42.5	56	66	54	62	1.02	7.6	1624
F*Y-213F-*-F	2x1	3	251.5	58.3	56	66	54	62	1.53	11.4	1731
F*Y-214F-*-F	2x1	4	287.5	66.7	56	66	54	62	2.05	15.3	1835
F*Y-222F-*-F	2x2	2	366.5	85	59	69	56	64	1.94	14.5	2465
F*Y-223F-*-F	2x2	3	502.9	116.6	59	69	56	64	2.91	21.8	2685
F*Y-224F-*-F	2x2	4	612.8	142.1	59	69	56	64	3.88	29.0	2892
F*Y-232F-*-F	2x3	2	549.5	127.4	61	71	58	66	2.85	21.3	3305
F*Y-233F-*-F	2x3	3	754.4	174.9	61	71	58	66	4.28	32.0	3634
F*Y-234F-*-F	2x3	4	862.2	199.9	61	71	58	66	5.71	42.7	3941
F*Y-243F-*-F	2x4	3	935.6	216.9	62	72	60	68	5.66	42.3	4668
F*Y-244F-*-F	2x4	4	1225.4	284.1	62	72	60	68	7.55	56.5	5078
F*Y-253F-*-F	2x5	3	1190.5	276	63	73	61	69	7.03	52.6	5712
F*Y-254F-*-F	2x5	4	1377.4	319.3	63	73	61	69	9.38	70.2	6225
F*Y-263F-*-F	2x6	3	1508.5	349.7	64	74	62	70	8.41	62.9	6934
F*Y-264F-*-F	2x6	4	1724.1	399.7	64	74	62	70	11.21	83.9	7549
F*Y-273F-*-F	2x7	3	1829.9	424.2	65	75	63	71	9.78	73.2	8197
F*Y-274F-*-F	2x7	4	2086.2	483.6	65	75	63	71	13.05	97.6	8915
F*Y-283F-*-F	2x8	3	2153.9**	499.3	66	76	64	72	11.16	83.5	9163
F*Y-284F-*-F	2x8	4	2450.7	568.1	66	76	64	72	14.88	111.3	9984
F*Y-294F-*-F	2x9	4	2816.9**	653	67	77	65	73	16.71	125.0	11188
F*Y-2X4F-*-F	2x10	4	3184.7**	738.3	68	78	66	74	18.55	138.8	12345

- (*) Motor and voltage
- Data is for 12 FPI. 8, 10 & 14 FPI also available
- Internal volume does not include headers
- Weight does not include options and fluid
- Sound pressure rating at 10 ft from side of unit in an open field
- (**) Between 12 and 18 PSI P.D.