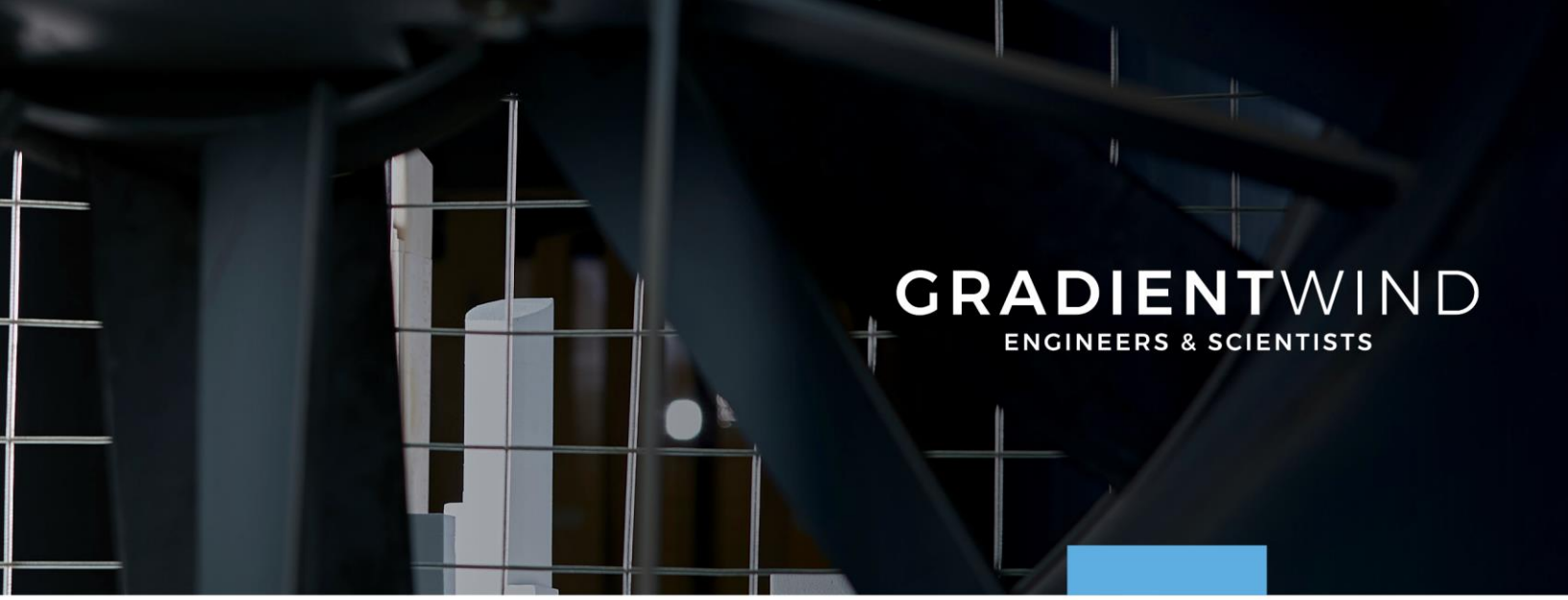
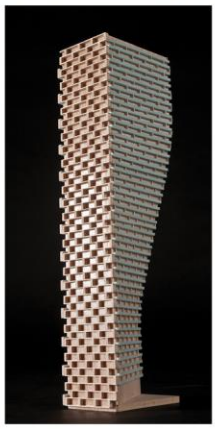


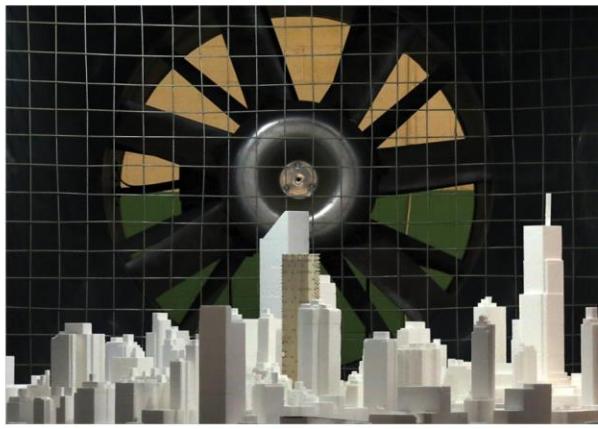
GRADIENTWIND
ENGINEERS & SCIENTISTS

ENVIRONMENTAL NOISE ASSESSMENT

Rideau Centre Registry Project
70 Nicholas Street
Ottawa, Ontario

REPORT: GW21-097-Environmental Noise





August 16, 2022

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EXECUTIVE SUMMARY

Gradient Wind Engineering Inc. (Gradient Wind) was retained by The Cadillac Fairview Corporation Ltd. to undertake an environmental noise assessment in support of concurrent Zoning By-law Amendment (ZBA) and Site Plan Control (SPA) applications a new multi-unit residential building in downtown Ottawa, Ontario. The present scope of this study is to evaluate noise levels received at the proposed development caused by local roadway traffic and stationary noise sources. The major sources of roadway traffic noise are Nicholas Street and Mackenzie King Bridge which border the site to east and south, respectively. The rooftop air-handling equipment serving the CF Rideau Centre located on the adjacent Nordstrom department store are sources of stationary noise for which impacts were considered.

The development is located on a rectangular parcel of land to the east of the Rideau Centre, adjacent to the Nordstrom department store. The proposed development comprises approximately 18,350 m^2 (197,500 square feet) of residential floor area. The building comprises one tower that is massed as two distinct components. For the purposes of this report, they are referred to as Portion 1 towards the southeast corner of the lot, and Portion 2 to the northwest corner.

The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa and Ministry of the Environment, Conservation and Parks (MECP) guidelines. Noise calculations were based on architectural drawings received from Zeidler Architecture Inc., dated September 24, 2021, with future roadway traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications. The stationary noise assessment was based on rooftop equipment drawings and corresponding equipment specifications received from The Cadillac Fairview Corporation Ltd.

The results of the current analysis indicate that noise levels will range between 43 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the northeast façade of Portion 1, which is nearest and most exposed to both Nicholas Street and the MacKenzie King Bridge. Building components with a higher Sound Transmission Class (STC) rating will be required where noise levels exceed 65 dBA, as indicated in Figure 4.

In addition to upgraded windows, the installation of central air conditioning (or similar mechanical system) will be required for all units in the development, which will allow occupants to keep windows closed and maintain a comfortable living environment. A Warning Clause[1] will be required in all Agreements of Lease as summarized in Section 6.

Results indicate that stationary noise emitted by rooftop equipment of the Rideau Centre, using initial sound power levels-based manufacturer's data, causes exceedances of the ENCG noise level limits stipulated in Section 4.3.1 at multiple points of reception. The maximum permissible sound power level for each piece of equipment in order to achieve the ENCG Class 1 noise criteria at the study site is summarized in Appendix B. Maximum permissible sound power levels will be achieved through a combination of noise control measures, including retrofit noise control packages from the manufacturer, aftermarket silencers, and replacement of old units for new low-noise units. Noise screens are not an effective form of noise control for stationary sources, due to the exposure to elevated receptors on the study building.

Regarding the Outdoor Living Areas (OLAs), the following conclusions were made. Note that the OLAs included in this study are the rooftop garden and terrace planned for level-3, and the rooftop pool area on level-21. Private balconies are excluded as they are less than 4 meters in depth, as per ENCG. The ground-level patio on the east side of the building is also excluded, as it serves a commercial section of the building which is not noise-sensitive. Noise control measures are required where roadway traffic noise levels exceed 60 dBA, and are recommended where they exceed 55 dBA.

- For the rooftop garden area on level-3 towards the southwest corner, a 1.1 m solid perimeter guard with a surface density of 20 kg/m^2 is recommended to reduce noise levels to a more comfortable level. The perimeter guard must be of solid construction and contain no gaps.

- Roadway traffic noise levels at all remaining OLAs are below 55 dBA, therefore noise control measures are not required.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by The Cadillac Fairview Corporation Ltd. to undertake an environmental noise assessment in support of concurrent Zoning By-law Amendment (ZBA) and Site Plan Control (SPA) applications a new multi-unit residential building in downtown Ottawa, Ontario. The complete scope of work within our mandate, as outlined in GWE proposal #21-136P R1, dated March 19 2021, also includes the study of pedestrian level winds. This report summarizes the methodology, results, and recommendations related to an environmental noise assessment, while the pedestrian level wind study is presented in a separate report.

The present scope of work involves assessing exterior and interior noise levels generated by local roadway traffic and existing stationary sources. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[2] and Ministry of the Environment, Conservation and Parks (MECP)[3] guidelines. Noise calculations were based on architectural drawings received from Zeidler Architecture Inc., dated September 24, 2021, with future roadway traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications. The stationary noise assessment was based on rooftop equipment drawings and corresponding equipment specifications received from The Cadillac Fairview Corporation Ltd.

2. TERMS OF REFERENCE

The focus of this environmental noise assessment is a proposed multi-unit residential building in downtown Ottawa, Ontario. The development is located on a rectangular parcel of land to the east of the CF Rideau Centre, adjacent to the Nordstrom department store.

The proposed development comprises approximately 18,350 m^2 (197,500 square feet) of residential floor area. The building comprises one tower that is massed as two distinct components. For the purposes of this report, they are referred to as Portion 1 towards the southeast corner of the lot, and Portion 2 to the northwest corner. Portions 1 and 2 rise 20 and 11 storeys above grade, respectively. The ground level will

[2] City of Ottawa Environmental Noise Control Guidelines, January 2016
[3] Ontario Ministry of the Environment, Conservation and Parks – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

contain a lobby, lounge, leasing office space, bicycle storage, retail space, various building support functions, a patio fronting Nicholas Street, and a connection to the historic City Registry Office. Level 2 contains primarily locker space and building services. Level 3 comprises amenity space, a gym, residential suites, with a rooftop garden and terrace to the rear (west side) of the building. Levels 4 and above contain residential suites, with Portion 2 featuring a rooftop terrace and pool area. For all directions from northeast clockwise to west, the site surroundings comprise low-rise commercial, and high-rise residential/office buildings. Outdoor Living Areas (OLAs) included in this study are the rooftop garden and terrace planned for level-3, and the rooftop pool area on level-21. Private balconies are excluded as they are less than 4 meters in depth, as per ENCG. The ground-level patio on the east side of the building is also excluded, as it serves a commercial section of the building which is not noise-sensitive.

The major sources of roadway traffic noise are Nicholas Street and Mackenzie King Bridge which border the site to east and south, respectively. Besserer Street and Waller Street have been excluded from the noise analysis as they are arterial roadways outside of 100 meters from the proposed development, as per the ENCG. A vibration study is not required because the study building is not within 75 m of the O-Train Confederation LRT Line (Line 1) system[4].

An assessment of stationary noise impacts was also conducted as part of this study. The rooftop air-handling equipment serving the CF Rideau Centre are sources of stationary noise for which impacts were considered. Specifically, the equipment affecting the proposed development is located on the rooftop of Nordstrom, bordering the site to the southwest. Gradient Wind visited the site on October 5, 2021, to confirm rooftop layout, and ensure accurate modelling by taking measurements with a Bruel and Kjaer 2250 Sound Level Meter. Figure 1 illustrates a complete site plan and the surrounding context.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the study building produced by local roadway traffic and stationary sources, (ii) ensure that interior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4 of this report.

[4] Guidelines for New Development in Proximity to Railway Operations, J.E. Coulter Associates LTD, May 2013.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is a characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level that has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 50, 45 and 40 dBA for retail, living rooms and sleeping quarters, respectively, as listed in Table 1. However, to account for deficiencies in building construction and control peak noise, these levels should be targeted toward 47, 42 and 37 dBA.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [5]

Type of Space	Time Period	Leq (dBA) Road
General offices, reception areas, **retail** stores, etc.	07:00 – 23:00	50
Living/dining/den areas of **residences**, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while a standard closed window is capable of providing a minimum 20 dBA noise reduction[6]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning (or similar systems). Where noise levels exceed 65 dBA daytime and 60 dBA nighttime building components will require higher levels of sound attenuation[7].

Noise levels at outdoor living areas should be limited to 55 dBA where technically and administratively feasible. The City of Ottawa preferences for noise control prescribe the following hierarchy:

(i) Increased distance setback with absorptive ground cover (vegetation)
(ii) Relocation of noise sensitive areas away from roadways
(iii) Earth berms
(iv) Acoustic barriers

[5] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[6] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[7] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.2 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[8] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway line included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Nicholas Street	2-UAU	50	**15,000**
MacKenzie King Bridge	2-UAU	50	**15,000**

4.2.3 Theoretical Roadway Traffic Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road and rail analysis. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as a separate line source of noise, and by using existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split was taken to be 92%/8% respectively for all streets.
- Ground surfaces were taken to be absorptive and reflective based on specific source-receiver path ground characteristics.
- Site topography was assumed to be a flat/gentle slope surrounding the study building.
- The MacKenzie King Bridge is elevated 3 metres above ground-level of the development.
- Noise receptors were strategically placed at 10 locations around the study building (see Figure 2).

[8] City of Ottawa Transportation Master Plan, November 2013

- Receptor height was taken to be 60.5 meters at level 20 for the center of the window (height to 20th floor slab + 1.5 meters) for Receptors 1-7. Receptor heights for the Outdoor Living Areas were taken at 8.5 m for Receptors 8 & 9, and 63.5 m for Receptor 10.
- For select sources where appropriate, Receptors 1-7 considered the near-field high-rise buildings as barriers partially or fully obstructing exposure to the sources.
- Receptor distances and exposure angles are illustrated in Appendix A Figures A1 and A2.

4.2.4 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, concrete and masonry walls can achieve STC 50 or more. Curtainwall systems typically provide around STC 35, depending on the glazing elements. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40 depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

According to the ENCG, when daytime noise levels (from road and rail sources) at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[9] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

[9] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

Based on published research[10], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, which was prepared for site plan approval, final detailed floor layouts and building elevations were unavailable and therefore detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

4.3 Stationary Noise

4.3.1 Criteria for Stationary Noise

For stationary sources, the L_{eq} is commonly calculated on an hourly interval, while for roadways, the L_{eq} is calculated on the basis of a 16-hour daytime/8-hour nighttime split as previously mentioned in Section 4.2.1. This applies to the plane of window and outdoor amenity spaces serving the development. The surrounding area of the development would be defined as a Class 1 (Urban) environment, as background noise levels are dominated by human activities such as roadway and transit sources.

TABLE 3: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

Time of Day	Class 1	
	Outdoor Points of Reception	Plane of Window
07:00 – 19:00	50	50
19:00 – 23:00	50	50
23:00 – 07:00	N/A	45

[10] CMHC, Road & Rail Noise: Effects on Housing

4.3.2 Assumptions

The Rideau Centre directly adjacent to the study building has rooftop equipment which produces stationary noise. The following assumptions have been included in the analysis:

(i) The quantity, location and initial sound power of rooftop equipment has been based on drawings and manufacturer's data provided by The Cadillac Fairview Corporation Ltd., and confirmed by on-site measurements taken by Gradient Wind with a Bruel and Kjaer 2250 Sound Level Meter on October 5, 2021.

(ii) Operational conditions for the rooftop air handling units are based on information obtained from The Cadillac Fairview Corporation Ltd.

(iii) Initial sound power levels for RTU-9,10,11, and 12 assume that units are equipped with low-noise fans and compressor blankets.

(iv) A concrete barrier enclosing the entire rooftop of Nordstrom was included in the analysis with a height of 5.15 meters.

4.3.3 Determination of Noise Source Power Levels

Sound power data for the rooftop equipment was based on equipment specifications provided by The Cadillac Fairview Corporation Ltd. Stationary sources are defined in the ENCG as "all sources of sound and vibration, whether fixed or mobile, that exist or operate on a premises, property or facility, the combined sound and vibration levels of which are emitted beyond the property boundary of the premises, property or facility, unless the source(s) is (are) due to construction". Appendix B summarizes the initial sound power level for each piece of equipment based on the equipment specifications, and the maximum permissible sound power level for each piece of equipment in order to achieve the ENCG Class 1 noise criteria at the study site. Maximum permissible sound power levels will be achieved through a combination of noise control measures, including retrofit noise control packages from the manufacturer, aftermarket silencers, and replacement of old units for new low-noise units.

4.3.1 Stationary Source Noise Predictions

The impact of the surrounding stationary noise sources on the subject development was determined by computer modelling. Stationary noise source modelling is based on the software program *Predictor-Lima* developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2. This computer program is capable of representing three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. The methodology has been used on numerous assignments and has been accepted by the MECP as part of Environmental Compliance Approvals applications.

Five (5) individual noise sensor locations were selected in the *Predictor-Lima* model to measure the noise impact at points of reception (POR) during the daytime (07:00 – 23:00) and nighttime (23:00 – 07:00) periods (see Figure 3). POR locations included the outdoor living areas (OLA's) and the plane of windows (POW's) of the subject development that are exposed to the stationary noise sources atop the CF Rideau Centre. All mechanical equipment was represented as point sources in the model. Air temperature, pressure and humidity were set to 10°C, 101.3 kPA and 70%, respectively. Ground absorption over the study area was determined based on topographical features (such as water, concrete, grassland, etc.). A coefficient of 0 was used for hard surfaces, such as concrete and paved areas, and 1 for soft surfaces, such as grass and vegetative areas. Directivity was used in the model to account for the directions of makeup air unit inlets and outlets. Existing and proposed buildings were added to the model to account for screening and reflection effects from building façades. Modelling files and outputs are available upon request. Receptor locations are identified in Table 4 and illustrated in Figure 3. Calculation settings are presented in Table 5.

TABLE 4: RECEPTOR LOCATIONS

Receptor Number	Receptor Location	Height Above Grade (m)
1	POW - Portion 1 - South Façade	30
2	POW - Portion 1 - Southwest Façade	30
3	POW - Portion 2 - West Façade	30
4	OPOR - Level 3 - Amenity Southwest Side	8.5
5	OPOR - Level 3 - Amenity Northwest Side	8.5

TABLE 5: CALCULATION SETTINGS

Parameter	Setting
Meteorological correction method	Single value for C0
Value C0	2.0
Ground attenuation factor for roadways and paved areas	0
Temperature (K)	283.15
Pressure (kPa)	101.33
Air humidity (%)	70

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway noise calculations are summarized in Table 6 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 6: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC NOISE SOURCES

Receptor Number	Plane of Window Receptor Location	STAMSON 5.04 Noise Level (dBA)	
		Day	Night
1	POW - Portion 1 - Northeast Façade	69	61
2	POW - Portion 1 - Southeast Façade	68	61
3	POW - Portion 1 - South Façade	65	57
4	POW - Portion 1 - Southwest Façade	61	54
5	POW - Portion 2 - West Façade	56	48
6	POW - Portion 2 - North Façade	62	54
7	POW - Portion 2 - East Façade	66	59
8	OLA - Level 3 - Amenity - Southwest Side	58	N/A*
9	OLA - Level 3 - Amenity - Northwest Side	50	N/A*
10	OLA - Level 21 - Amenity - Portion 2	43	N/A*

*Nighttime noise levels not considered at OLA receptors per ENCG

The results of the current analysis indicate that noise levels will range between 43 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the northeast façade of the Portion 1, which is nearest and most exposed to both Nicholas Street and the MacKenzie King Bridge.

5.2 Stationary Noise Levels

The anticipated sound levels across the development are summarized in Table 7 and are based on the assumptions outlined in Section 4.3.2 and maximum permissible sound power levels for each piece of equipment, as summarized in Appendix B.

TABLE 7: NOISE LEVELS FROM STATIONARY SOURCES

Receptor Number	Receptor Location	Noise Level (dBA)		Exclusionary Limits		Meets ENCG Class 1 Criteria	
		Day	Night	Day	Night	Day	Night
1	POW - Portion 1 - South Façade	43	40	50	45	YES	YES
2	POW - Portion 1 - Southwest Façade	48	44	50	45	YES	YES
3	POW - Portion 2 - West Façade	49	45	50	45	YES	YES
4	OPOR - Level 3 - Amenity Southwest Side	33	30	50	N/A*	YES	N/A*
5	OPOR - Level 3 - Amenity Northwest Side	33	29	50	N/A*	YES	N/A*

Noise contours along the building façades can be seen in Figures 5 and 6 for daytime and nighttime conditions, respectively. The most impacted areas of the proposed development are the southwest and west façades of Portions 1 and 2, respectively, with the highest noise levels occurring in the middle of the Portion 2 west façade.

5.3 Noise Control Measures

5.3.1 Roadway Traffic Noise

The noise levels predicted due to roadway traffic sources exceed the criteria listed in the ENCG for building components. As discussed in Section 4.4, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels). As per City of Ottawa requirements, detailed STC calculations will be required prior to building permit application for each unit type. The STC requirements for the windows are summarized in Table 8 below for various units within the development (see Figure 4). The requirements of Table 8 would apply to windows, doors, spandrel panels and curtainwall elements.

TABLE 8: STC REQUIREMENTS FOR WINDOWS

Location	Façade	Bedroom window STC	Living Room window STC	Office and Retail window STC
Portion 1	Northeast	27	22	17
	Southeast	27	22	17
Portion 2	East	24	19	14

Note: Exterior wall components on these façades are recommended to have a minimum STC of 45 where a window/wall system is used. Wall assemblies meeting STC 45 would include steel stud walls, minimum 92 mm, deep filled with batt insulation, exterior dense glass sheeting, and 16 mm gypsum board on the inside.

A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have not specified any particular window configurations, as there are several manufacturers and various combinations of window components that will offer the necessary sound attenuation rating. However, it is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors. As per City of Ottawa requirements, all specified building components will require review by a qualified acoustical engineer for conformance to the recommendations of this report prior to building permit application.

Results of the calculations also indicate that all units in the development will require air conditioning (or similar mechanical system), which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required be placed on all Lease Agreements, as summarized in Section 6.

5.3.2 Noise Barrier Investigation

Noise levels at some OLAs exceed the ENCG criteria of 55 dBA for outdoor noise. For the rooftop garden area on level-3 towards the southwest corner, a 1.1-meter solid perimeter guard with a surface density of 20 kg/m^2 is recommended to reduce noise levels to a more comfortable level. The perimeter guard must be of solid construction and contain no gaps.

5.3.3 Stationary Noise

Results indicate that stationary noise emitted by rooftop equipment of the Rideau Centre, using initial sound power levels-based manufacturer's data, causes exceedances of the ENCG noise level limits stipulated in Section 4.3.1 at multiple points of reception. The maximum permissible sound power level for each piece of equipment in order to achieve the ENCG Class 1 noise criteria at the study site is summarized in Appendix B. Maximum permissible sound power levels will be achieved through a combination of noise control measures, including retrofit noise control packages from the manufacturer, aftermarket silencers, and replacement of old units for new low-noise units. Noise screens are not an effective form of noise control for stationary sources, due to the exposure to elevated receptors on the study building.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 43 and 69 dBA during the daytime period (07:00-23:00) and between 48 and 61 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 69 dBA) occurs along the northeast façade of the Portion 1, which is nearest and most exposed to both Nicholas Street and the MacKenzie King Bridge. Building components with a higher Sound Transmission Class (STC) rating will be required where noise levels exceed 65 dBA, as indicated in Figure 4.

In addition to upgraded windows, the installation of central air conditioning (or similar mechanical system) will be required for all units in the development, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Type D Warning Clause[11] will be required in all Agreements of Lease:

[11] City of Ottawa Environmental Noise Control Guidelines, January 2016

"This dwelling unit 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 Municipality and the Ministry of the Environment, Conservation and Parks."

Results indicate that stationary noise emitted by rooftop equipment of the Rideau Centre, using initial sound power levels-based manufacturer's data, causes exceedances of the ENCG noise level limits stipulated in Section 4.3.1 at multiple points of reception. The maximum permissible sound power level for each piece of equipment in order to achieve the ENCG Class 1 noise criteria at the study site is summarized in Appendix B. Maximum permissible sound power levels will be achieved through a combination of noise control measures, including retrofit noise control packages from the manufacturer, aftermarket silencers, and replacement of old units for new low-noise units. Noise screens are not an effective form of noise control for stationary sources, due to the exposure to elevated receptors on the study building.

Regarding the Outdoor Living Areas (OLAs), the following conclusions were made. Note that the OLAs included in this study are the rooftop garden and terrace planned for level-3, and the rooftop pool area on level-21. Private balconies are excluded as they are less than 4 meters in depth, as per ENCG. The ground-level patio on the east side of the building is also excluded, as it serves a commercial section of the building which is not noise-sensitive. Noise control measures are required where roadway traffic noise levels exceed 60 dBA and are recommended where they exceed 55 dBA.

- For the rooftop garden area on level-3 towards the southwest corner, a 1.1 m solid perimeter guard with a surface density of 20 kg/m2 is recommended to reduce noise levels to a more comfortable level. The perimeter guard must be of solid construction and contain no gaps.

- Roadway traffic noise levels at all remaining OLAs are below 55 dBA, therefore noise control measures are not required.

This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

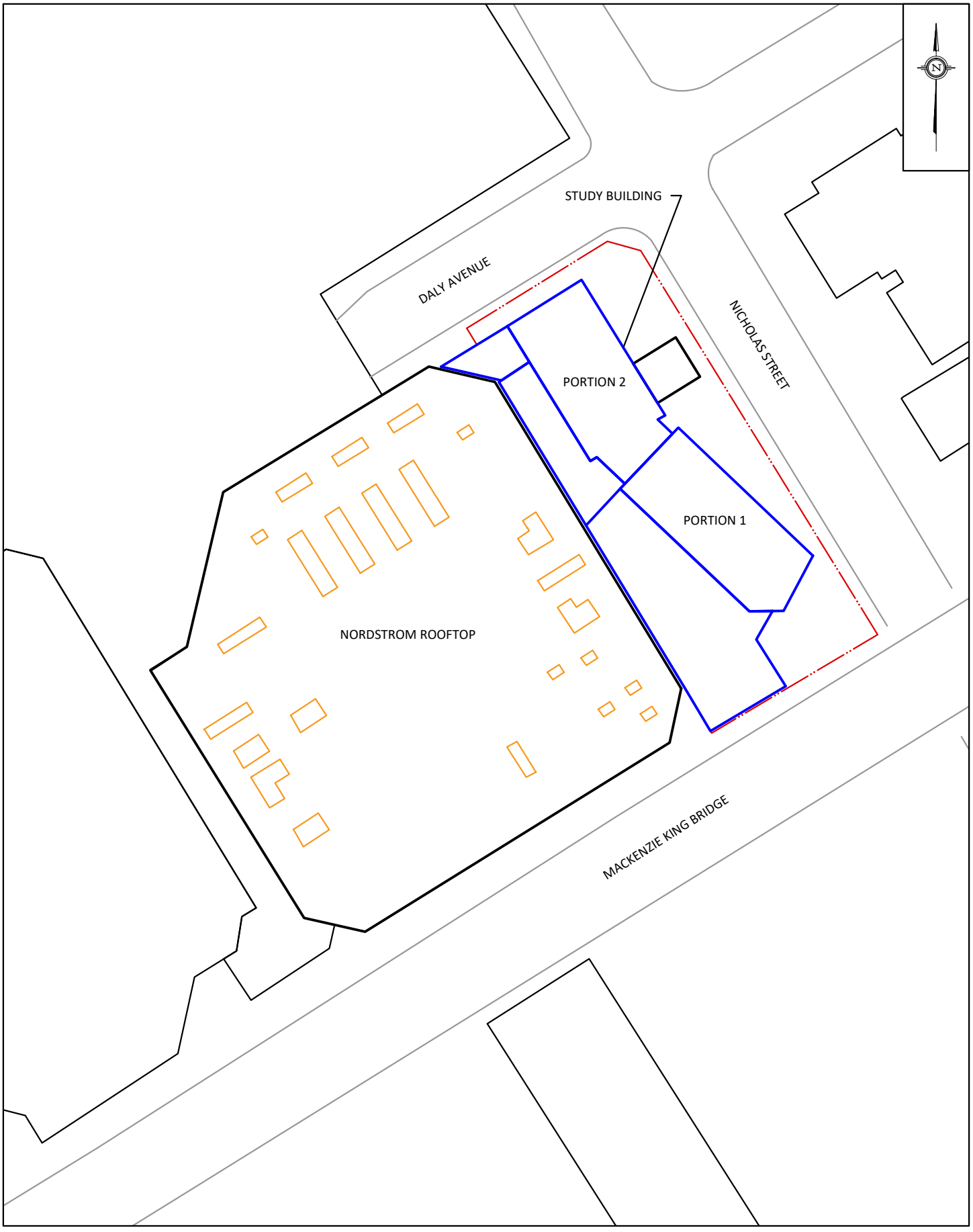
Sincerely,

Gradient Wind Engineering Inc.

Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #21-097-Environmental Noise



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PROJECT	RIDEAU CENTRE REGISTRY PROJECT, OTTAWA ENVIRONMENTAL NOISE ASSESSMENT
SCALE	1:1700 (APPROX.)
DRAWING NO.	GW21-097-1
DATE	NOVEMBER 10, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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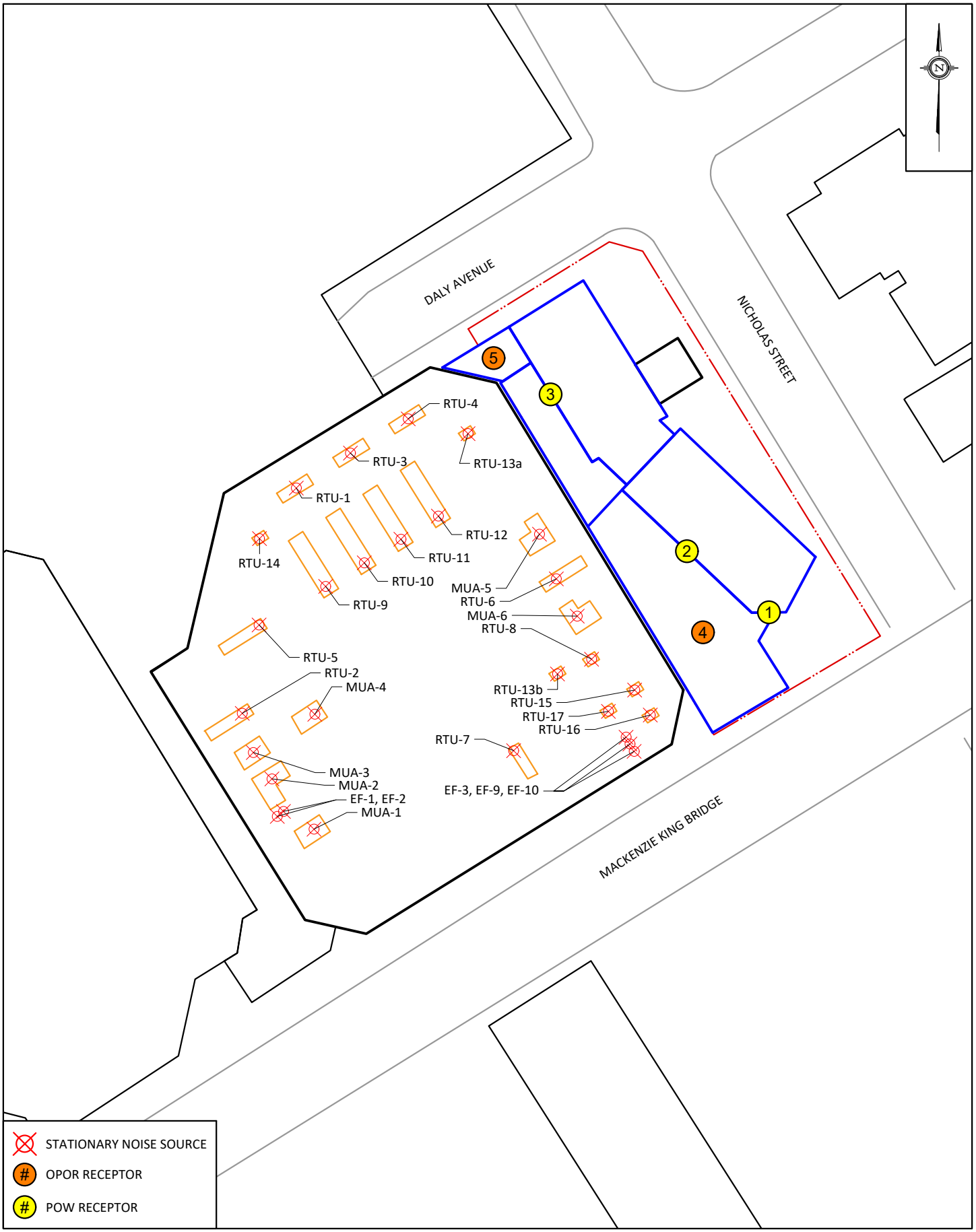
SCALE	1:1700 (APPROX.)
DRAWING NO.	GW21-097-2
DATE	NOVEMBER 10, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 2:
TRAFFIC NOISE SOURCE AND RECEPTOR LOCATIONS



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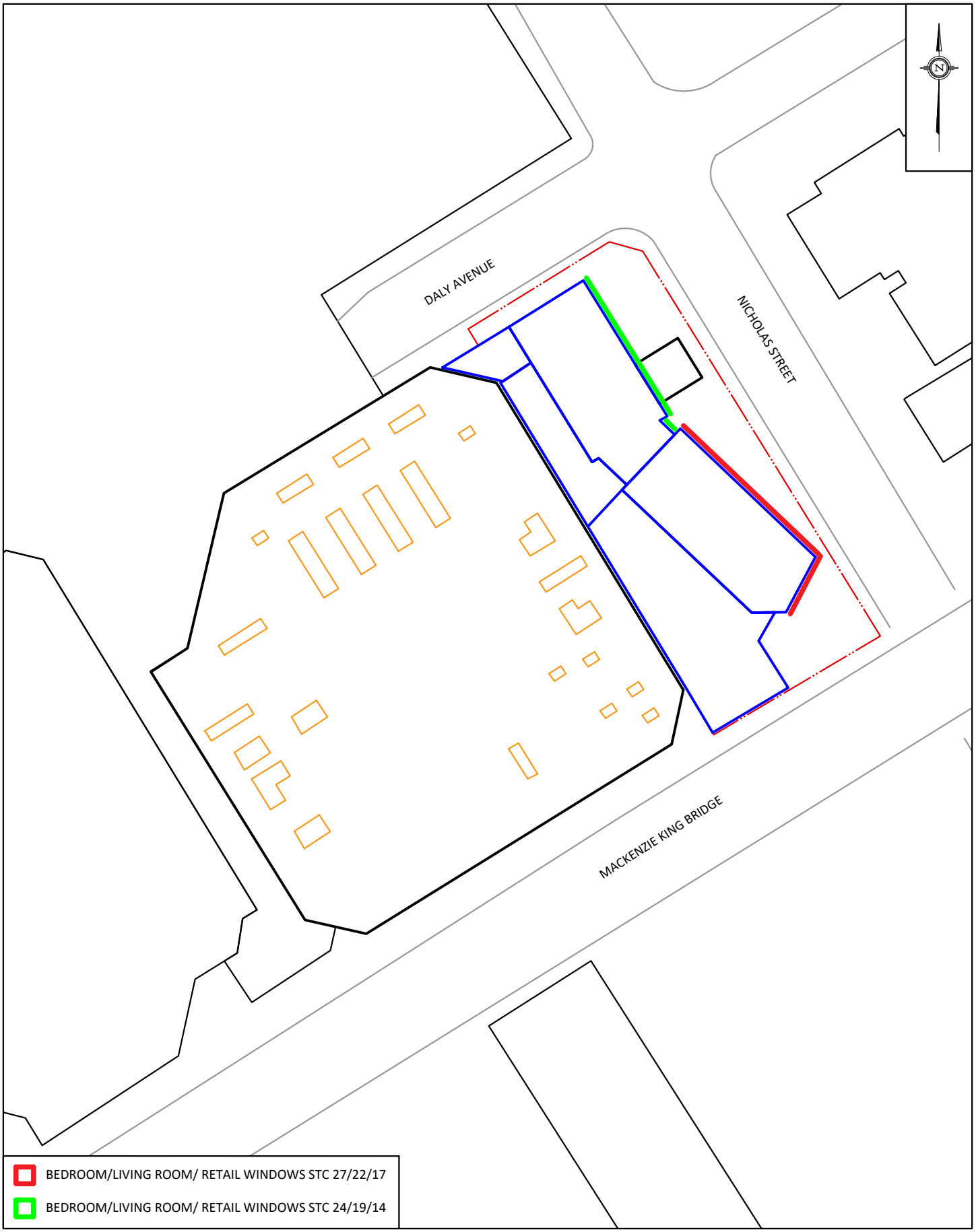
SCALE	1:1700 (APPROX.)
DRAWING NO.	GW21-097-3
DATE	NOVEMBER 10, 2021
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 3:
STATIONARY NOISE SOURCE
AND RECEPTOR LOCATIONS



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PROJECT	RIDEAU CENTRE REGISTRY PROJECT, OTTAWA ENVIRONMENTAL NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1700 (APPROX.)	DRAWING NO.	GW21-097-4
DATE	NOVEMBER 10, 2021	DRAWN BY	T.M.F.

FIGURE 4:
WINDOW STC REQUIREMENTS

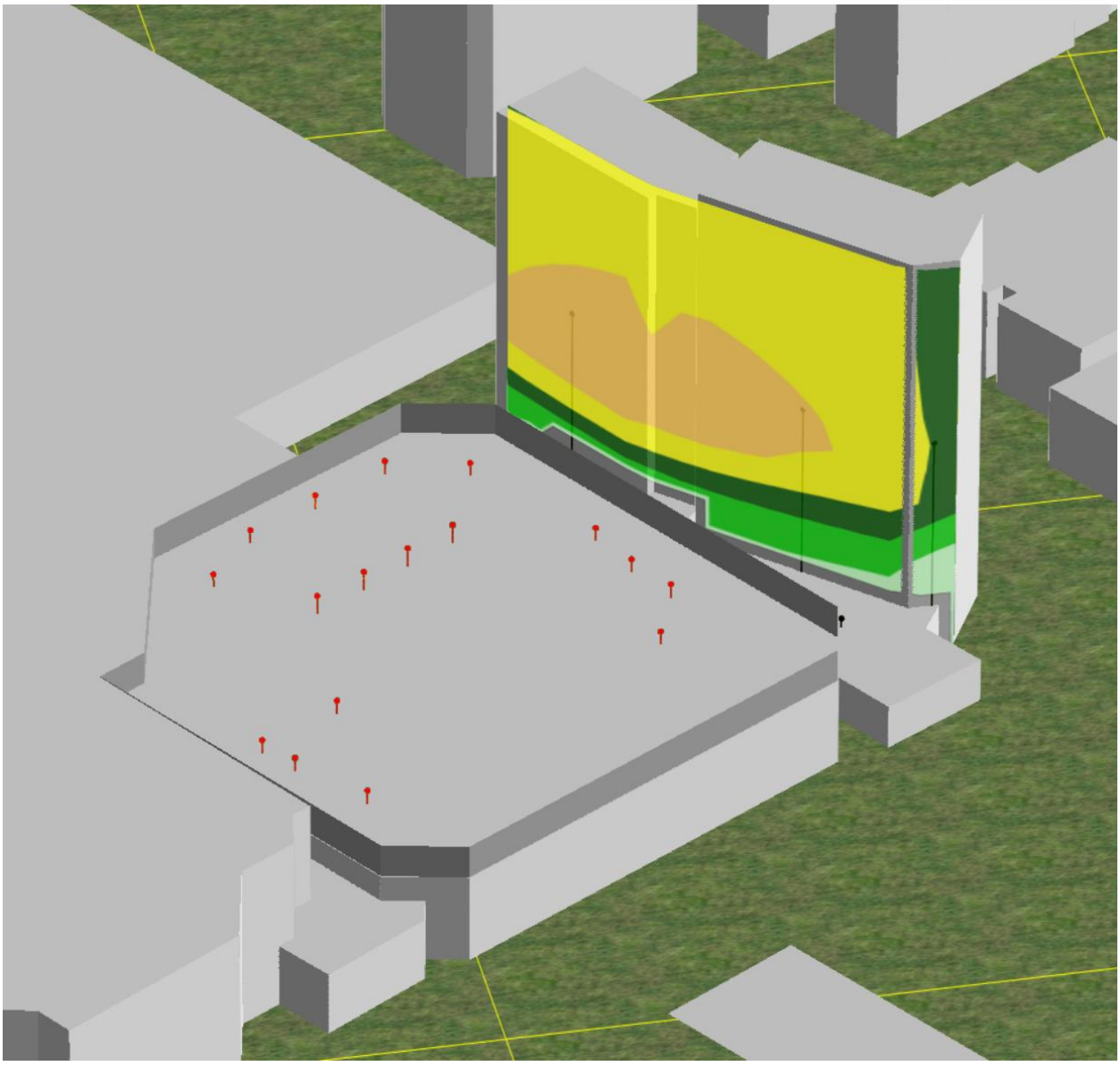


FIGURE 5: DAYTIME STATIONARY NOISE CONTOURS

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

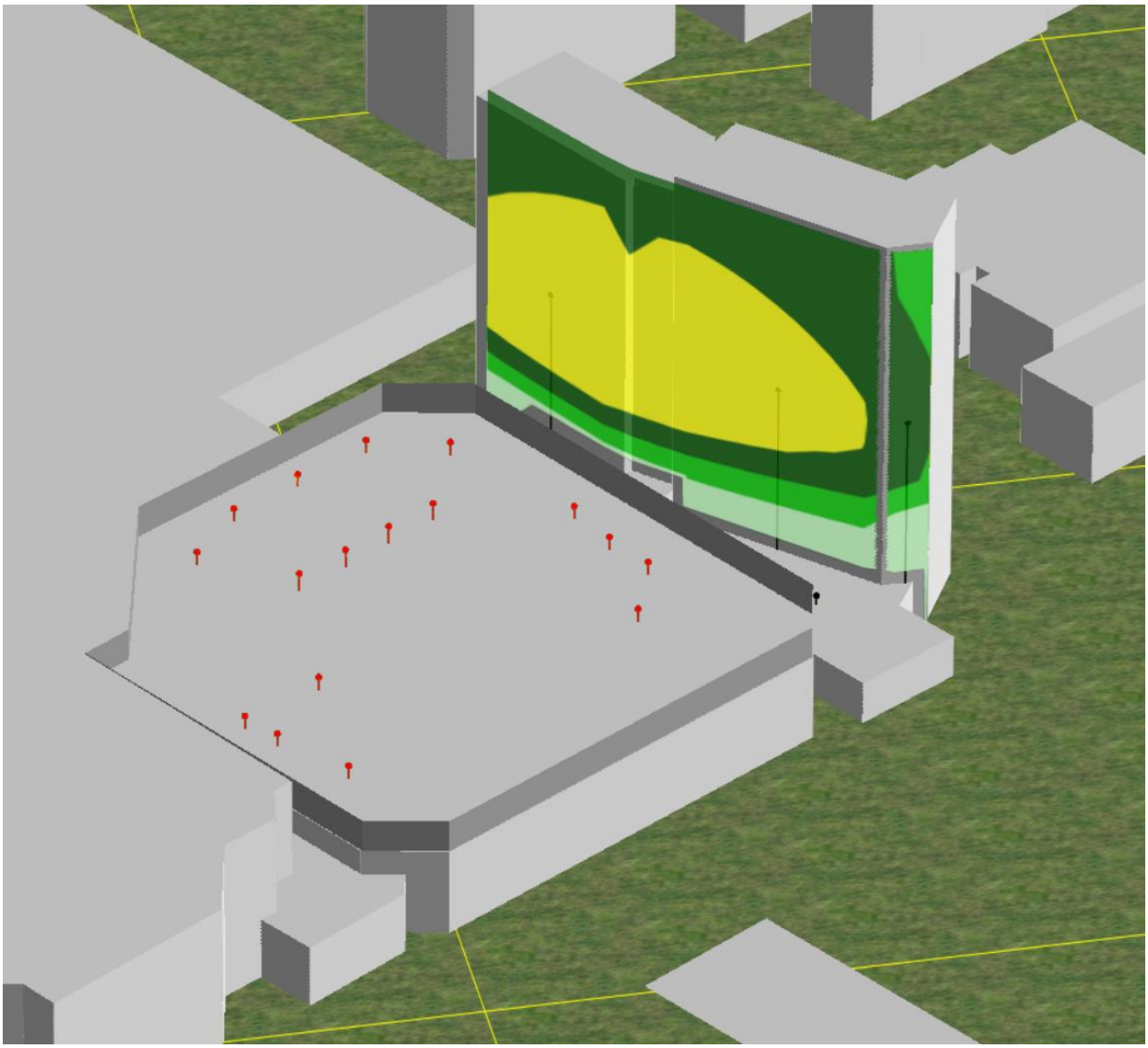
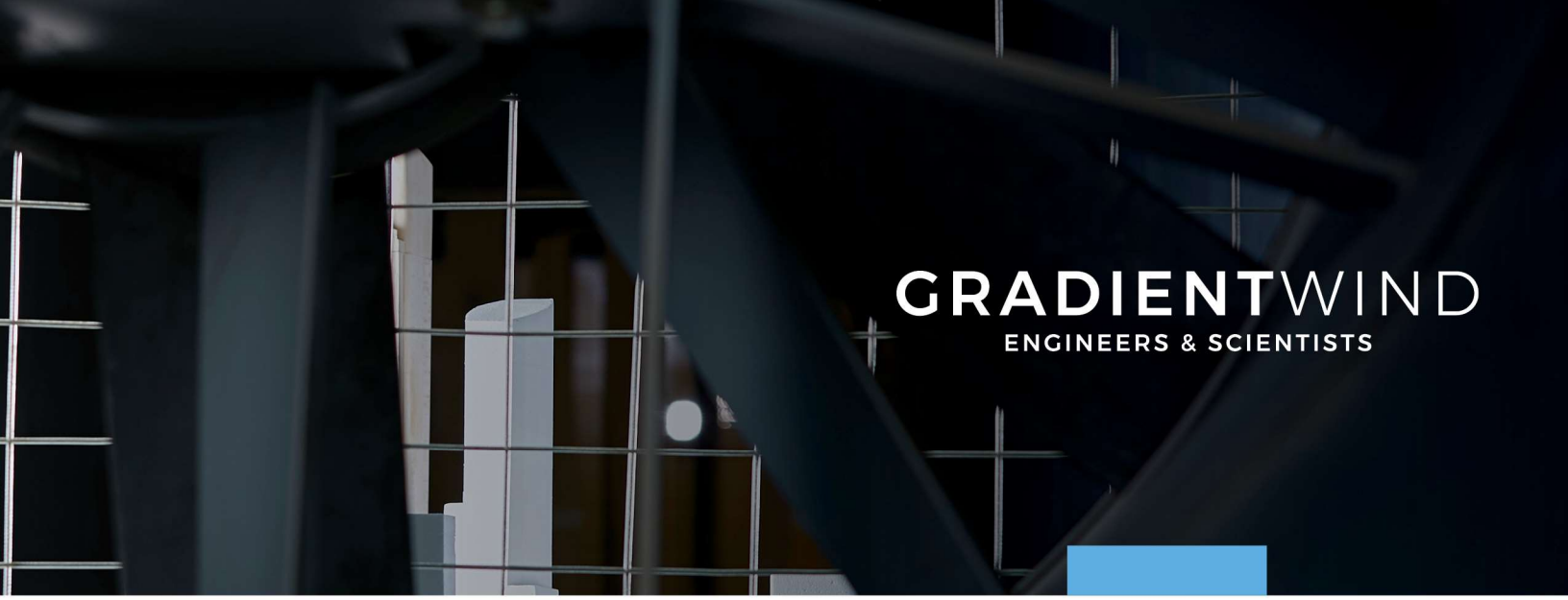


FIGURE 6: NIGHTTIME STATIONARY NOISE CONTOURS

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB



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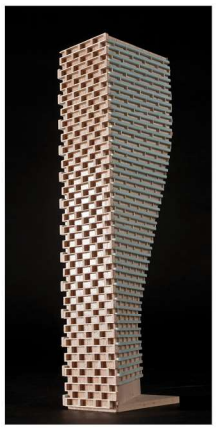

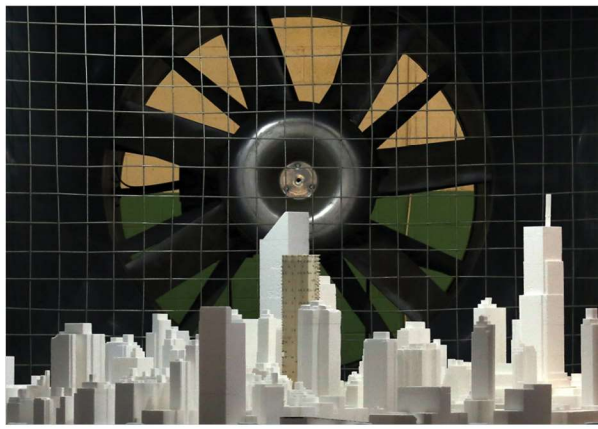

APPENDIX A

STAMSON 5.04 INPUT PARAMETERS

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```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:44:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: MK BRG (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK BRG (day/night)
----------------------------------------
Angle1   Angle2           : -69.00 deg   -15.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  41.00 / 41.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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: NICH (day/night)
--------------------------------------
Angle1   Angle2           : -90.00 deg   75.00 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           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: MK BRG (day)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.88 + 0.00) = 58.88 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -69    -15   0.00  68.48   0.00  -4.37  -5.23   0.00   0.00   0.00  58.88
-------------------------------------------------------------------------------

Segment Leq : 58.88 dBA

Results segment # 2: NICH (day)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 68.10 + 0.00) = 68.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     75   0.00  68.48   0.00   0.00  -0.38   0.00   0.00   0.00  68.10
-------------------------------------------------------------------------------

Segment Leq : 68.10 dBA

Total Leq All Segments: 68.59 dBA
```

```
Results segment # 1: MK BRG (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.29 + 0.00) = 51.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -69    -15   0.00  60.88   0.00  -4.37  -5.23   0.00   0.00   0.00  51.29
-------------------------------------------------------------------------------

Segment Leq : 51.29 dBA

Results segment # 2: NICH (night)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.51 + 0.00) = 60.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     75   0.00  60.88   0.00   0.00  -0.38   0.00   0.00   0.00  60.51
-------------------------------------------------------------------------------

Segment Leq : 60.51 dBA

Total Leq All Segments: 61.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.59
                           (NIGHT): 61.00
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:48:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: MK BRG (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK BRG (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   60.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  30.00 / 30.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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: NICH (day/night)
--------------------------------------
Angle1   Angle2           : -31.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  18.00 / 18.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: MK BRG (day)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.68 + 0.00) = 64.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     60   0.00  68.48   0.00  -3.01  -0.79   0.00   0.00   0.00  64.68
-------------------------------------------------------------------------------

Segment Leq : 64.68 dBA

Results segment # 2: NICH (day)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.96 + 0.00) = 65.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -31     90   0.00  68.48   0.00  -0.79  -1.72   0.00   0.00   0.00  65.96
-------------------------------------------------------------------------------

Segment Leq : 65.96 dBA

Total Leq All Segments: 68.38 dBA
```

```
Results segment # 1: MK BRG (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.08 + 0.00) = 57.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     60   0.00  60.88   0.00  -3.01  -0.79   0.00   0.00   0.00  57.08
-------------------------------------------------------------------------------

Segment Leq : 57.08 dBA

Results segment # 2: NICH (night)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.37 + 0.00) = 58.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -31     90   0.00  60.88   0.00  -0.79  -1.72   0.00   0.00   0.00  58.37
-------------------------------------------------------------------------------

Segment Leq : 58.37 dBA

Total Leq All Segments: 60.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.38
                           (NIGHT): 60.78
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:51:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: MK BRG (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK BRG (day/night)
----------------------------------------
Angle1   Angle2           : -59.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  28.00 / 28.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: MK BRG (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.95 + 0.00) = 64.95 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -59     90   0.00  68.48   0.00  -2.71  -0.82   0.00   0.00   0.00  64.95
-------------------------------------------------------------------------------

Segment Leq : 64.95 dBA

Total Leq All Segments: 64.95 dBA

Results segment # 1: MK BRG (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.35 + 0.00) = 57.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -59     90   0.00  60.88   0.00  -2.71  -0.82   0.00   0.00   0.00  57.35
-------------------------------------------------------------------------------

Segment Leq : 57.35 dBA

Total Leq All Segments: 57.35 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.95
                           (NIGHT): 57.35
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:53:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: MK BRG (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK BRG (day/night)
----------------------------------------
Angle1   Angle2           : -15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  47.00 / 47.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: MK BRG (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.18 + 0.00) = 61.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -15     90   0.00  68.48   0.00  -4.96  -2.34   0.00   0.00   0.00  61.18
-------------------------------------------------------------------------------

Segment Leq : 61.18 dBA

Total Leq All Segments: 61.18 dBA
Results segment # 1: MK BRG (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 53.58 + 0.00) = 53.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -15     90   0.00  60.88   0.00  -4.96  -2.34   0.00   0.00   0.00  53.58
-------------------------------------------------------------------------------

Segment Leq : 53.58 dBA

Total Leq All Segments: 53.58 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.18
                           (NIGHT): 53.58
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:56:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: MK BRG (day/night)
-------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK BRG (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  :  89.00 / 89.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  13.00 deg   Angle2 : 51.00 deg
Barrier height            :  19.00 m
Barrier receiver distance :  72.00 / 72.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: MK BRG (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 !       60.50 !       14.10 !        14.10

ROAD (49.33 + 40.99 + 54.10) = 55.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     13   0.00  68.48   0.00  -7.73 -11.41   0.00   0.00   0.00  49.33
-------------------------------------------------------------------------------
    13     51   0.00  68.48   0.00  -7.73  -6.75   0.00   0.00 -13.00  40.99
-------------------------------------------------------------------------------
    51     90   0.00  68.48   0.00  -7.73  -6.64   0.00   0.00   0.00  54.10
-------------------------------------------------------------------------------

Segment Leq : 55.51 dBA

Total Leq All Segments: 55.51 dBA
```

```
Results segment # 1: MK BRG (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 !       60.50 !       14.10 !        14.10

ROAD (41.74 + 33.39 + 46.51) = 47.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     13   0.00  60.88   0.00  -7.73 -11.41   0.00   0.00   0.00  41.74
-------------------------------------------------------------------------------
    13     51   0.00  60.88   0.00  -7.73  -6.75   0.00   0.00 -13.00  33.39
-------------------------------------------------------------------------------
    51     90   0.00  60.88   0.00  -7.73  -6.64   0.00   0.00   0.00  46.51
-------------------------------------------------------------------------------

Segment Leq : 47.91 dBA

Total Leq All Segments: 47.91 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.51
                           (NIGHT): 47.91
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 12:59:02
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: NICH (day/night)
--------------------------------------
Angle1   Angle2           : -72.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  28.00 / 28.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: NICH (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 61.79 + 0.00) = 61.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -72      0   0.00  68.48   0.00  -2.71  -3.98   0.00   0.00   0.00  61.79
-------------------------------------------------------------------------------

Segment Leq : 61.79 dBA

Total Leq All Segments: 61.79 dBA

Results segment # 1: NICH (night)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.19 + 0.00) = 54.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -72      0   0.00  60.88   0.00  -2.71  -3.98   0.00   0.00   0.00  54.19
-------------------------------------------------------------------------------

Segment Leq : 54.19 dBA

Total Leq All Segments: 54.19 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.79
                           (NIGHT): 54.19
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 13:09:02
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: NICH (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  :  24.00 / 24.00  m
Receiver height           :  60.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: NICH (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 66.44 + 0.00) = 66.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.48   0.00  -2.04   0.00   0.00   0.00   0.00  66.44
-------------------------------------------------------------------------------

Segment Leq : 66.44 dBA

Total Leq All Segments: 66.44 dBA

Results segment # 1: NICH (night)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.84 + 0.00) = 58.84 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  60.88   0.00  -2.04   0.00   0.00   0.00   0.00  58.84
-------------------------------------------------------------------------------

Segment Leq : 58.84 dBA

Total Leq All Segments: 58.84 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 66.44
                           (NIGHT): 58.84
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 13:17:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: MK1 (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: MK1 (day/night)
-------------------------------------
Angle1   Angle2           : -58.00 deg   -35.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  37.00 / 37.00  m
Receiver height           :   8.50 / 60.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -58.00 deg   Angle2 : -35.00 deg
Barrier height            :   7.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   3.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: mk2 (day/night)
---------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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: mk2 (day/night)
-------------------------------------
Angle1   Angle2           : -35.00 deg   -20.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  37.00 / 37.00  m
Receiver height           :   8.50 / 4.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -35.00 deg   Angle2 : -20.00 deg
Barrier height            :   7.00 m
Barrier receiver distance :  18.50 / 18.50  m
Source elevation          :   3.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: mk3 (day/night)
---------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 3: mk3 (day/night)
-------------------------------------
Angle1   Angle2           : -20.00 deg   22.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  37.00 / 37.00  m
Receiver height           :   8.50 / 4.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -20.00 deg   Angle2 : 22.00 deg
Barrier height            :   7.00 m
Barrier receiver distance :  23.00 / 23.00  m
Source elevation          :   3.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 4: mk4 (day/night)
---------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 4: mk4 (day/night)
-------------------------------------
Angle1   Angle2           :  22.00 deg   37.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  37.00 / 37.00  m
Receiver height           :   8.50 / 4.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  22.00 deg   Angle2 : 37.00 deg
Barrier height            :   7.00 m
Barrier receiver distance :  18.50 / 18.50  m
Source elevation          :   3.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: MK1 (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 !        8.50 !        7.20 !         7.20

ROAD (0.00 + 55.62 + 0.00) = 55.62 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -58    -35   0.00  68.48   0.00  -3.92  -8.94   0.00   0.00  -4.91  50.71*
   -58    -35   0.00  68.48   0.00  -3.92  -8.94   0.00   0.00   0.00  55.62
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 55.62 dBA

Results segment # 2: mk2 (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 !        8.50 !        6.50 !         6.50

ROAD (0.00 + 48.17 + 0.00) = 48.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -35    -20   0.00  68.48   0.00  -3.92 -10.79   0.00   0.00  -5.60  48.17
-------------------------------------------------------------------------------

Segment Leq : 48.17 dBA
```

```
Results segment # 3: mk3 (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 !        8.50 !        6.01 !         6.01

ROAD (0.00 + 50.90 + 0.00) = 50.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -20     22   0.00  68.48   0.00  -3.92  -6.32   0.00   0.00  -7.34  50.90
-------------------------------------------------------------------------------

Segment Leq : 50.90 dBA

Results segment # 4: mk4 (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 !        8.50 !        6.50 !         6.50

ROAD (0.00 + 48.18 + 0.00) = 48.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    22     37   0.00  68.48   0.00  -3.92 -10.79   0.00   0.00  -5.59  48.18
-------------------------------------------------------------------------------

Segment Leq : 48.18 dBA

Total Leq All Segments: 57.92 dBA
```

```
Results segment # 1: MK1 (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 !       60.50 !       47.07 !        47.07

ROAD (0.00 + 48.03 + 0.00) = 48.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -58    -35   0.00  60.88   0.00  -3.92  -8.94   0.00   0.00   0.00  48.03*
   -58    -35   0.00  60.88   0.00  -3.92  -8.94   0.00   0.00   0.00  48.03
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 48.03 dBA

Results segment # 2: mk2 (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 !        4.50 !        4.50 !         4.50

ROAD (0.00 + 33.64 + 0.00) = 33.64 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -35    -20   0.00  60.88   0.00  -3.92 -10.79   0.00   0.00 -12.53  33.64
-------------------------------------------------------------------------------

Segment Leq : 33.64 dBA
```

```
Results segment # 3: mk3 (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 !        4.50 !        4.50 !         4.50

ROAD (0.00 + 37.47 + 0.00) = 37.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -20     22   0.00  60.88   0.00  -3.92  -6.32   0.00   0.00 -13.17  37.47
-------------------------------------------------------------------------------

Segment Leq : 37.47 dBA

Results segment # 4: mk4 (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 !        4.50 !        4.50 !         4.50

ROAD (0.00 + 33.72 + 0.00) = 33.72 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    22     37   0.00  60.88   0.00  -3.92 -10.79   0.00   0.00 -12.45  33.72
-------------------------------------------------------------------------------

Segment Leq : 33.72 dBA

Total Leq All Segments: 48.68 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.92
                           (NIGHT): 48.68
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 13:19:12
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r9.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: NICH (day/night)
--------------------------------------
Angle1   Angle2           : -39.00 deg   -31.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  48.00 / 48.00  m
Receiver height           :   8.50 / 60.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: NICH (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.91 + 0.00) = 49.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -39    -31   0.00  68.48   0.00  -5.05 -13.52   0.00   0.00   0.00  49.91
-------------------------------------------------------------------------------

Segment Leq : 49.91 dBA

Total Leq All Segments: 49.91 dBA

Results segment # 1: NICH (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 42.31 + 0.00) = 42.31 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -39    -31   0.00  60.88   0.00  -5.05 -13.52   0.00   0.00   0.00  42.31
-------------------------------------------------------------------------------

Segment Leq : 42.31 dBA

Total Leq All Segments: 42.31 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 49.91
                           (NIGHT): 42.31
```

```
STAMSON 5.0        NORMAL REPORT        Date: 21-10-2021 13:22:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r10.te               Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: NICH (day/night)
----------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    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):  15000
    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 # 1: NICH (day/night)
--------------------------------------
Angle1   Angle2           : -72.00 deg   42.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  33.00 / 33.00  m
Receiver height           :  63.50 / 60.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -72.00 deg   Angle2 : 42.00 deg
Barrier height            :  62.00 m
Barrier receiver distance :   9.00 / 9.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: NICH (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 !       63.50 !       46.59 !        46.59

ROAD (0.00 + 43.12 + 0.00) = 43.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -72     42   0.00  68.48   0.00  -3.42  -1.98   0.00   0.00 -19.95  43.12
-------------------------------------------------------------------------------

Segment Leq : 43.12 dBA

Total Leq All Segments: 43.12 dBA

Results segment # 1: NICH (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 !       60.50 !       49.50 !        49.50

ROAD (0.00 + 36.49 + 0.00) = 36.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -72     42   0.00  60.88   0.00  -3.42  -1.98   0.00   0.00 -18.99  36.49
-------------------------------------------------------------------------------

Segment Leq : 36.49 dBA

Total Leq All Segments: 36.49 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 43.12
                           (NIGHT): 36.49
```

APPENDIX B

STATIONARY NOISE SOUND POWER LEVELS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

Unit	Description	Height Above Roof (m)	Parameter	Sound Power (dBA)								
				63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total
			Intial Sound Power	60	70	71	73	76	75	67	62	**81**
RTU-1	3 fans, 30 ton	2.2	Insertion Loss Requirement			1	2	7	6			
			Maximum Permissible Sound Power	60	70	71	70	70	69	67	62	**78**
			Intial Sound Power	61	71	71	73	74	73	68	63	**80**
RTU-2	4 fans, 40 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	61	71	71	73	72	72	68	63	**80**
			Intial Sound Power	60	70	70	72	73	72	67	62	**79**
RTU-3	4 fans, 40 ton	2.2	Insertion Loss Requirement			1	3	6	5			
			Maximum Permissible Sound Power	60	70	69	68	68	67	67	62	**76**
			Intial Sound Power	60	70	70	72	73	72	67	62	**79**
RTU-4	4 fans, 40 ton	2.2	Insertion Loss Requirement		2	4	6	8	7	1		
			Maximum Permissible Sound Power	60	68	67	66	65	65	66	62	**74**
			Intial Sound Power	60	69	69	71	72	71	66	61	**78**
RTU-5	4 fans, 40 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	60	69	69	71	72	71	66	61	**78**
			Intial Sound Power	60	69	69	71	72	71	67	62	**78**
RTU-6	4 fans, 40 ton	2.2	Insertion Loss Requirement			1	3	5	5			
			Maximum Permissible Sound Power	60	69	68	68	67	66	67	62	**76**
			Intial Sound Power	56	67	68	71	74	73	64	59	**79**
RTU-7	3 fans, 25 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	56	67	68	71	71	71	64	59	**79**
			Intial Sound Power	60	69	79	88	90	85	84	80	**94**
RTU-9	8 fans, 80 ton	3	Insertion Loss Requirement				10	13	9	6		
			Maximum Permissible Sound Power	60	69	79	78	77	77	79	80	**86**
			Intial Sound Power	60	69	79	88	90	85	84	80	**94**
RTU-10	8 fans, 80 ton	3	Insertion Loss Requirement			2	11	14	10	7	0	
			Maximum Permissible Sound Power	60	69	78	77	76	76	78	80	**85**
			Intial Sound Power	60	69	79	88	90	85	84	80	**94**
RTU-11	8 fans, 80 ton	3	Insertion Loss Requirement				7	11	6	4		
			Maximum Permissible Sound Power	60	69	79	81	79	79	81	80	**88**
			Intial Sound Power	60	69	79	88	90	85	84	80	**94**
RTU-12	8 fans, 80 ton	3	Insertion Loss Requirement			5	14	17	13	10	2	
			Maximum Permissible Sound Power	60	69	75	74	73	73	74	79	**83**
			Intial Sound Power	60	72	77	81	83	80	76	72	**87**
RTU-13a	10 ton	2.2	Insertion Loss Requirement		2	9	13	16	14	9		
			Maximum Permissible Sound Power	60	70	68	68	67	66	67	72	**77**
			Intial Sound Power	60	72	77	81	83	80	76	72	**87**
RTU-13b	10 ton	2.2	Insertion Loss Requirement			6	10	14	11	5		
			Maximum Permissible Sound Power	60	72	71	71	70	70	71	72	**79**
			Intial Sound Power	60	72	77	81	83	80	76	72	**87**
RTU-14	10 ton	2.2	Insertion Loss Requirement			5	10	13	10	5		
			Maximum Permissible Sound Power	60	72	72	71	70	70	71	72	**80**
			Intial Sound Power	62	67	67	71	71	68	65	59	**77**
RTU-8	5 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	62	67	67	70	69	68	65	59	**77**
			Intial Sound Power	62	67	67	71	71	68	65	59	**77**
RTU-15	5 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	62	67	67	71	71	68	65	59	**77**
			Intial Sound Power	62	67	67	71	71	68	65	59	**77**
RTU-16	5 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	62	67	67	71	71	68	65	59	**77**
			Intial Sound Power	62	67	67	71	71	68	65	59	**77**
RTU-17	5 ton	2.2	Insertion Loss Requirement									
			Maximum Permissible Sound Power	62	67	67	71	70	68	65	59	**77**
			Intial Sound Power	65	76	92	92	85	83	79	73	**96**
MUA-1	4 ton	2.2	Insertion Loss Requirement			17	18	13	11	4		
			Maximum Permissible Sound Power	65	76	76	74	72	73	75	73	**83**
			Intial Sound Power	65	75	90	91	84	82	78	72	**95**
MUA-2	7 ton	2.2	Insertion Loss Requirement			15	18	12	10	3		
			Maximum Permissible Sound Power	65	75	75	73	72	73	75	72	**82**
			Intial Sound Power	58	69	83	88	87	84	80	71	**92**
MUA-3	4 ton	2.2	Insertion Loss Requirement			9	15	15	12	5		
			Maximum Permissible Sound Power	58	69	74	73	72	72	75	71	**81**
			Intial Sound Power	64	75	84	89	84	81	78	71	**92**
MUA-4	6 ton	2.2	Insertion Loss Requirement			11	16	12	9	3		
			Maximum Permissible Sound Power	64	75	74	73	73	73	75	71	**82**
			Intial Sound Power	65	76	92	92	85	83	79	73	**96**
MUA-5	9 ton	2.2	Insertion Loss Requirement		2	20	20	14	13	7		
			Maximum Permissible Sound Power	65	74	72	72	71	71	72	73	**81**
			Intial Sound Power	69	78	82	87	87	84	81	75	**92**
MUA-6	10 ton	2.2	Insertion Loss Requirement			7	13	18	19	16	12	
			Maximum Permissible Sound Power	69	78	75	74	69	65	65	63	**82**
			Intial Sound Power	49	60	66	70	70	68	66	58	**76**
Exhaust Fan	N/A	0.75	Insertion Loss Requirement									
			Maximum Permissible Sound Power	49	60	66	70	70	68	66	58	**76**