Transportation Noise Assessment

Salvation Army Multi-Purpose Building
102 Bill Leathem Drive

Ottawa, Ontario

REPORT: GWE15-009 - Transportation Noise R3

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July 10, 2017

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EXECUTIVE SUMMARY

This document describes a transportation noise assessment performed for a proposed multi-purpose single-storey development at 102 Bill Leathem Drive in Ottawa, Ontario. Phases 1 and 2 will rise approximately 9.5 and 10.5 meters above local grade, respectively. Figure 1 illustrates a site plan with surrounding context. The major sources of roadway noise are Bill Leathem Drive and Leikin Drive. The site is also situated inside the Airport Operating Influence Zone [Noise Exposure Forecast (NEF) or Noise Prediction Forecast (NEP) 30]. The development represents an infill project on a severed lot in an established business park. Under provincial and City noise guidelines, the site is not considered to be noise sensitive; however, due to sensitivity of some spaces, a noise study was competed in conforming to good engineering practice.

The assessment is based on: (i) theoretical noise prediction methods that conform to the Ontario Ministry of the Environment and Climate Change (MOECC) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; (iv) future airport operation composite NEF and NEP contours, and (v) architectural drawings received from Vandenberg & Wildeboer Architects.

The results of the current study indicate that predicted noise levels due to roadway traffic over the site will range between 60 and 68 dBA during the daytime period (07:00-23:00) and between 53 and 60 dBA during the nighttime period (23:00-07:00). The highest predicted noise level (i.e. 68 dBA) occurs on the south façade of Phase 1 (Receptor 3), which is nearest and most exposed to Leikin Drive.

In addition to surface transportation, the site is also impacted by aircraft noise. The site is situated between NEF/NEP contours of 30 and 35, just inside the NEF/NEP 30 contour (corresponding to a 24-hour equivalent sound pressure level (L_{eq}) or 61 dBA). To verify predicted existing (NEF) noise levels, on-site monitoring was conducted 24-hours a day for a period of one month. Results of on-site monitoring indicate existing noise levels from airport operations are below an equivalent of the NEF 30 contour (61 dBA 24-hour L_{eq}). The on-site monitoring also accounted for impacts of roadway traffic. To protect the building from possible future increases in airport noise, the building components were designed to a

maximum predicted 24-hour equivalent sound pressure level of 66 dBA, due to aircraft flyovers, corresponding to the NEF/NEP 35 contour. This is a conservative approach as the NEF/NEP 35 contour is more than one kilometer from the site.

For noise control measures, upgraded Sound Transmission Class (STC) ratings are required for building components as predicted noise levels are above the ENCG criteria for roadway traffic and aircraft traffic noise, respectively, as per Section 5. In addition to upgraded building components, the installation of central air conditioning (or similar mechanical system) will be required for the development. Furthermore, Warning Clauses will be required on all purchase, sale, and lease agreements, as per Section 6.

Under the ENCG and NPC-300, the development is not considered noise sensitive; therefore, in keeping with Federal[1] and Provincial policies, it is permissible between NEF 30 and 35. In addition, the Provincial Policy Statement indicates that if the development were considered noise sensitive, noise sensitive land uses may be considered above the NEF/NEP 30 for infill and redevelopment developments where it is demonstrated that there will be no negative impact on the long term function of the airport. Based on the proposed architectural drawings, building components are expected to achieve the required sound transmission ratings to control indoor noise levels to below ENCG criteria for places of worship at the proposed site. Furthermore, on-site monitoring has indicated that existing noise levels at the site are well below predicted sound levels. Therefore, no long-term impact on airport operations are anticipated.

[1] Transportation Canada, Land Use In The Vicinity of Aerodromes, Ninth Edition 2013/14

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1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by The Salvation Army to undertake a transportation noise study of a proposed multi-purpose single-floor building development at 102 Bill Leathem Drive in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to a transportation noise assessment. GWE's scope of work involved assessing exterior and interior noise levels generated by local roadway traffic and aircraft. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[2] and Ontario Ministry of the Environment and Climate Change[3] guidelines as well as on-site monitoring of roadway traffic and aircraft flyovers. Noise calculations were based on architectural drawings received from Vandenberg & Wildeboer Architects (see Appendix A), with future roadway traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this transportation noise assessment is a proposed single-storey, two-phase, multi-purpose building, to be used as a place of worship and a community centre. The development is located on vacant land at the northwest corner of the Bill Leathem Drive and Leikin Drive intersection, and as such is considered an infill development within an established business park. The Ottawa International Airport is located approximately 4 km to the northeast. The major sources of roadway noise are Bill Leathem Drive and Leikin Drive. The site is surrounded on all sides with mixed-use land, specifically Light Industrial and Parks and Open Space zones. Figure 1 illustrates a complete site plan with surrounding context.

Upon completion, Phases 1 and 2 will rise approximately 9.5 and 10.5 meters above local grade, respectively. No Outdoor Living Areas (OLAs) are currently located on or proposed for the site.

Under the City of Ottawa Noise Control Guidelines (ENCG) and the Ontario Ministry of Environment and Climate Change Environment Noise Guidelines (NPC-300), the proposed land uses, place of worship and community centre, are not considered noise sensitive. The guidelines only make reference to place of worship and identifies this on Tables 2.2c and 4.2b of ENCG and Tables C-9 and C-10 of NPC 300. In both

[2] City of Ottawa, Environmental Noise Control Guidelines, January 2016
[3] Ontario Ministry of the Environment and Climate Change, Environmental Noise Guideline – Publication NPC-300, August 2013

cases, the preamble to these tables identifies the criteria for *land uses not generally considered noise sensitive but are provided as good design objectives.*

3. OBJECTIVES

The main objectives of this work are to: (i) calculate the future noise levels on the study building produced by local roadway traffic and aircraft traffic, (ii) determine the feasibility of incorporating noise sensitive land uses, such as places of worship and gathering centres, within the site, (iii) ensure that interior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG) as outlined in Section 4 of this report, and (iv) demonstrate that there will be no negative impacts on the long-term function of the airport.

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 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.

The ENCG specifies that surface transportation noise (road and rail) and airport noise should be evaluated separately. The overall building attenuation parameters are than combined. Section 4.2 and 4.3 address the methodology for the evaluation of roadway and aircraft noise respectively. Section 4.2 also provides criteria for railway noise as background information, there is however no railway noise influencing the site.

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, which 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 45 dBA for conference rooms and places of worship, as listed in Table 1. The criteria listed in Table 1 relates to land uses "**not generally considered noise sensitive**" but are "good practice design objectives"[4].

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

Type of Space	Time Period	L_{EQ} (dBA)	
		Road	Rail
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50	45
Theatres, **places of worship**, libraries, individual or semi-private offices, conference rooms, reading rooms etc.	07:00 – 23:00	45	40
Sleeping quarters of hotels/motels	23:00 – 07:00	45	40
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40	35

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

[4] ENCG, Part 1, Section 2.2, Page 3
[5] Adapted from ENCG 2016 – Table 2.2b,c
[6] Burberry, P.B.. (2014). Mitchell's Environment and Services. Routledge, Page 125

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].

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 provides 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 included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Roadway	Roadway Class	Speed Limit (km/h)	Official Plan AADT
Bill Leathem Drive	2-UMCU	60	**12,000**
Leikin Drive	2-UMCU	60	**12,000**

4.2.3 Theoretical Roadway Noise Predictions

Noise predictions were performed with the aid of the Ontario Ministry of the Environment and Climate Change (MOECC) computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix B includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise, and by using existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 4, 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

[7] MOECC, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[8] City of Ottawa Transportation Master Plan, November 2013

- Absorptive and reflective intermediate ground surfaces based on specific source-receiver path ground characteristics
- The study site was treated as having flat topography

Noise receptors were strategically placed at seven locations around the study area (see Figure 2).

4.2.4 Indoor Noise Calculations Roadway

When calculations reveal that outdoor noise levels are sufficiently high as to require investigation of indoor noise levels, calculations are performed to verify the Sound Transmission Class (STC) requirements for building components. 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[9] built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, brick veneered walls can achieve STC 55. 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[10] 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] Bradley, J.S., Birta J.A. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council of Canada, October 2000

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

Based on published research[11], exterior walls and windows possess specific sound attenuation characteristics that are used as a basis for calculating the indoor noise levels to ensure compliance with ENCG criteria. Calculations were based on the architectural assemblies and are available in Appendix C.

4.3 Aircraft Traffic Noise

4.3.1 Criteria for Aircraft Traffic Noise

The ENCG outlines the sound level criteria for aircraft noise based on a site's location near the Ottawa International Airport. The Ottawa Airport Vicinity Development Zone (AVDZ) is a zone around the airport defined by Noise Exposure Forecast (NEP) of Noise Exposure Projections (NEP) contour lines that follow fixed features, such as roads or lot boundaries. NEF/NEP contours reflect the predetermined noise levels which would impact sensitive areas around airports. These contours include the influences of noise levels from aircraft flight, take-off, and ground operations to specific urban areas. Noise generated from aircraft traffic is represented as Effective Perceived Noise Levels (EPNL), a unit of noise measurement that accounts for variations in the human perception of pure tones and noise duration. Predicted noise levels are plotted geographically to generate NEF/NEP contour maps, where lower NEF/NEP levels correspond to lower average outdoor noise levels. The AVDZ represents the 25 NEF/NEP contour. The Ottawa Airport Operating Influence Zone (AOIZ) represents the NEF/NEP 30 contour, where commercial aircraft traffic may negatively influence noise-sensitive developments. Within the AOIZ, noise-sensitive development is not permitted, although infill and redevelopment may occur in specific areas within the zone in keeping with the criteria set out in the Official Plan, and be subject to detailed studies to demonstrate there will be no negative impact on long term airport operations. As stated previously, the proposed development is not considered to be noise sensitive, however, good engineering practices should incorporate noise mitigation into the design of the building to minimize noise impacts.

According to accepted research[12], Health and Welfare Canada states that people continuously exposed to NEF/NEP values less than 35 will not suffer adverse physical or psychological effects. Sociological surveys[13] have indicated that negative community reactions to noise levels may start at about 25 NEF/NEP. Table 5 identifies the sound level criteria for relevant indoor spaces exposed to aircraft noise. Transport Canada

[11] CMHC, Road & Rail Noise: Effects on Housing
[12] Report of the Special Meeting on Aircraft Noise in the Vicinity of Aerodromes, Montreal ICAO, 1969.
[13] Noise in Urban and Suburban Areas. Bolt, Beanik and Newman, Inc., Washington, January 1967.

guidelines related to aircraft noise indicated churches and other places of worship can tolerate noise levels up to NEF/NEP 35 where noise attenuation is considered in the building construction[14]. Where developments are within the AVDZ, building components must be designed to achieve the indoor criteria outlined in Table 3.

TABLE 3: SUPPLEMENTARY SOUND LEVEL CRITERIA[15]

Type of Space	NEF/NEP	Approximate $L_{eq(24Hr)}$
General offices, reception areas, retail stores, etc.	15	46 dBA
Individual or semi-private offices, conference rooms, etc.	10	41 dBA
Sleeping quarters of, hospitals/motels, nursing/retirement homes, etc. Living/dining areas of, theatres, libraries, **places of worship**, etc.	5	36 dBA

4.3.2 Theoretical Aircraft Noise Predictions

The impact of aircraft noise on the indoor environment was determined using IBANA-CALC, a software package developed by the National Research Council of Canada. This software calculates indoor noise levels for standard roof, wall and window construction details for appropriate aircraft noise source spectra. Since aircraft produce uniform noise levels over large areas, building construction is more carefully considered than specific building location for interior noise level calculations. For this project, the building components were designed to an NEF value of 35 as a conservative measure to protect long term operations of the airport. However, the site is just inside the NEF contour 30, as illustrated in Figure 1. The NEF 35 contour is situated more than one kilometer from the site and noise levels are expected to be closer to NEF 30. No Outdoor Living Areas (OLAs) are currently located on or proposed for the site.

The influence of aircraft noise is based on NEF/NEP contours, geographically plotted values that quantify the noise levels from airport traffic on adjacent properties. The ENCG guidelines state that locations corresponding to NEF/NEP 25 or greater require improvements to the typical building envelope components, including exterior walls, roofs, windows and doors, to ensure adequate noise attenuation by the building envelope. In IBANA-CALC, construction elements are rated on the basis of STC and Outdoor-Indoor Transmission Class (OITC). The procedure for determining STC / OITC ratings is based on

[14] https://www.tc.gc.ca/eng/civilaviation/publications/tp1247-part4-1436.htm
[15] Adapted from ENCG 2016 – Tables 4.2a and b

experimental test data from the National Research Council of Canada, which is built into the IBANA-Calc software. Supplemental estimates of STC performance of building assemblies have been determined using the software INSUL by Marshal Day Acoustics, which is based on extensive empirical data from countries around the world.

Based on the STC/OITC performance of the building assemblies, IBANA-Calc determines indoor sound levels based on room size, partition area, and room absorption. Building elements with the lowest STC/OITC rating of the proposed assemblies were selected as a worst-case approach for the calculations. The resulting interior noise level was then determined using similar construction elements and room dimensions. Calculations were based on a worst-case representation of the most sensitive rooms, comprising the following construction elements: metal sided 2" × 6" walls, wood truss roof, and standard glazing elements. Details of the wall assemblies proposed are included in Appendix A. Acoustically equivalent assemblies which match the available assemblies in IBANA-CALC were chosen for calculations for worship spaces and meeting rooms. Details of the calculations are provided in Appendix D.

4.3.3 Noise Monitoring

In addition to theoretical calculations, assessment of aircraft and roadway noise across the site was also studied through on-site noise monitoring over a period of four weeks. Noise levels were measured using a single Brüel and Kjær (B&K) noise monitoring station, model 365-C-DMO. The unit consists of an integrating sound level meter (Type 2250), a weather-proof microphone (Type 4952), wireless modem, power pack and batteries. The unit was powered by a solar panel and 12-volt marine battery. The monitoring station setup is illustrated in Photograph 1. The station monitored continuously 24 hours per day with data sent wirelessly over an LTE/3G network to B&K's cloud storage service, "Noise Sentinel on Demand". Noise measurements were conducted from August 23 through to September 19, 2016. A four-week time frame was selected to capture a statistically relevant set of data, allowing for daily changes in airport operations and meteorological conditions. Meteorological data showed that during the testing period, wind directions were such that the majority of planes would be taking off and landing on Runway 07-25, the approach path for which is aligned with the 102 Bill Leathem Drive site. The consistency within the data set proved the four-week measurement period was sufficient. The location of the noise monitoring station is illustrated in Figure 1 and Photographs 1 to 3 below.

PHOTOGRAPH 1: NOISE MONITOR STATION

PHOTOGRAPH 2: NOISE MONITOR STATION

PHOTOGRAPH 3: NOISE MONITOR STATION

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

Appendix B contains the complete set of input and output data from all STAMSON 5.04 calculations. The results of the roadway noise calculations are summarized in Table 4 below.

TABLE 4: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Receptor Number	Plane of Window	Noise Level (dBA)	
		Day	Night
1	POW – Phase 1 – 7 m – North Façade	63	56
2	POW – Phase 1 – 3.2 m – East Façade	65	57
3	POW – Phase 1 – 7 m – South Façade	68	60
4	POW – Phase 1 – 1.5 m – West Façade	62	55
5	POW – Phase 1 – 1.5 m – West Façade	62	54
6	POW – Phase 2 – 1.5 m – West Façade	60	53
7	POW – Phase 2 – 7 m – South Façade	65	57

The results of the current analysis indicate that noise levels will range between 60 and 68 dBA during the daytime period (07:00-23:00) and between 53 and 60 dBA during the nighttime period (23:00-07:00). The

highest noise level (i.e. 68 dBA) occurs on the south façade of Phase 1 (Receptor 3), which is nearest and most exposed to Leikin Drive.

Because of elevated noise levels from traffic, central air conditioning (or similar mechanical system) will be required to allow windows and doors to remain closed while maintaining a comfortable and quiet indoor environment.

Under the ENCG guidelines, surface transportation and aircraft noise are evaluated separately, and aircraft noise was found to be the governing source when considering a 24-hour L_{EQ} up to 67 dBA for design of the building components. It should also be noted that the indoor criteria for aircraft is more stringent (see Section 5.2.1. as well as Table 1 and 5).

5.1.1 Roadway Traffic Noise STC Requirements

The current selected exterior wall and window assemblies for the development, as described below, have been rated for a particular STC rating based on the performance evaluated using INSUL software. As a conservative approach, the exterior wall assembly with the lowest STC rating was considered in our analysis and consisted of the following:

Typical Exterior Wall Construction (EX2)

- Pre-Finished Metal Siding
- 25 mm XPS Insul. On Horiz. Z-bar
- 25 mm XPS Insul. On Vert. Z-bar
- Sheathing Membrane (No Acoustic Value)
- 13 mm Exterior Sheathing (OSB)
- Wood Sheathing
- 140 mm Wood Stud
- Batt Insulation
- Vapour Barrier (No Acoustic Value)
- 16 mm Type X Gypsum Board

STC 48 – INSUL Test Data

Typical Glazing Construction

- 6 mm Inner Pane
- 13 mm Air Space
- 8 mm Outer Pane

STC 34 – INSUL Test Data

Note: Glazing elements assumed based on STC 35 (OITC 29) requirements. Window assembly may vary provided STC requirements are maintained.

The noise levels predicted due to roadway traffic exceed the criteria for upgraded building components. As discussed in Section 4.3, the anticipated indoor noise levels in various sensitive rooms have been estimated based on the methodology developed by the National Research Council. Appendix C contains the complete set of calculations performed to verify the required exterior wall and window STC performance. Detailed STC calculations show that key façades, built to a typical EX2 wall construction or better with STC 35 rated windows, would provide the necessary attenuation to control interior noise levels. The indoor noise level results are summarized in Table 5 below.

TABLE 5: INDOOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Room Location	Indoor Noise Level $L_{eq(16\ Hr)}$ (dBA)	
	NRC Calculation	ENCG Criteria
Worship/Gymnasium (Phase 1)	38	45
Sanctuary (Phase 2)	34	45
Multi-Purpose Room	34	45

5.2 Noise Monitoring Results

Based on the on-site monitoring, the equivalent sound pressure levels (L_{eq}) for each day are presented as 24-hour daily averages ($L_{eq(24Hr)}$), 16-hour daytime averages ($L_{eq(16\ Hr)}$) and 8-hour nighttime averages ($L_{eq(8\ Hr)}$). The daytime period is defined between 07:00 and 23:00 and the nighttime period from 23:00 to 07:00.

Following the monitoring period, it was brought to GWE's attention by the Ottawa International Airport Authority that Runway 07-25 saw limited operations due to construction on Taxiway Bravo during the month of August, as noted in Table 8. In addition, Runway 07-25 was closed on August 31 and September

2 for rubber removal maintenance. Comparing $L_{EQ\ 24}$ noise levels on days with regular operations suggests that aircraft noise is not the primary influence on ambient noise on-site as in most instances the variance is less than 3 dBA, which is imperceptible to human hearing. Correspondence from the Ottawa International Airport Authority can be found in Appendix E.

As can be seen from Table 6, the average $L_{eq\ (24\ hr)}$ was found to be 56 dBA, which is below the predicted aircraft noise exposure NEF /NEP 30 contours equivalent to 61 dBA. Additionally, the standard deviation in noise levels is no greater than 3 dBA. This change is barely perceptible to most human observers and the quality of the data is proven to be reliable and relevant. It can therefore be concluded that the assumptions of the theoretical analysis are acceptable, and that the proposed wall and window assemblies will be adequate to ensure ENCG compliance for indoor sound levels and maintaining compatibility with adjacent land uses. A sample of the time history of hourly and daily L_{eq} is presented in Charts 1 and 2 below. The highest noise levels occur on the first day of monitoring and are likely due to setting up the instrument versus environmental noise.

TABLE 6: MEASURED EQUIVALENT SOUND PRESSURE LEVELS (dBA)

Date	$L_{EQ(24HR)}$	$L_{EQ(8HR)}$	$L_{EQ(16HR)}$	Wind Speed (km/h)	Temperature (°C)	Weather
23-Aug*	61	54	62	10 - 30	10-27	Clear
24-Aug*	57	55	58	6 - 22	17-29	Cloudy
25-Aug*	59	56	60	6 - 23	20-29	Cloudy and shower
26-Aug*	58	60	57	3 - 22	21 - 28	Clear
27-Aug*	55	52	56	9 - 18	17 - 27	Clear and cloudy
28-Aug*	55	54	55	9 - 24	18 - 28	Cloudy and thunderstorm
29-Aug*	56	52	58	7 - 29	17 - 25	Clear
30-Aug*	57	52	58	5 - 21	13 - 25	Cloudy
31-Aug†	56	54	57	7 - 22	19 - 26	Cloudy
01-Sep	56	48	57	9 - 27	12 - 22	Clear
02-Sep†	57	N/A	57	10 - 24	11 - 20	Clear
03-Sep	N/A	N/A	N/A	2 - 11	8 - 23	Clear
04-Sep	54	51	55	3 - 9	11 - 26	Cloudy
05-Sep	55	47	57	2 - 11	12 - 28	Clear
06-Sep	54	48	55	4 - 16	13 - 29	Clear
07-Sep	54	50	56	6 - 12	16 - 28	Cloudy
08-Sep	57	N/A	57	5 - 17	21 - 25	Cloudy and fog
09-Sep	54	46	55	7 - 22	15 - 20	Clear
10-Sep	52	52	52	1 - 30	17 - 25	Cloudy
11-Sep	54	53	55	19 - 36	11 - 21	Cloudy
12-Sep	54	53	56	5 - 16	9 - 23	Clear
13-Sep	56	48	57	4-27	10-27	Clear and cloudy
14-Sep	53	49	54	9-33	11-20	Cloudy and rain
15-Sep	55	50	56	4-12	6-17	Clear
16-Sep	53	50	54	1-16	6-22	Clear and cloudy
17-Sep	52	48	53	4-26	10-21	Cloudy and rain
18-Sep	52	45	53	7-23	17-26	Cloudy
Average	56	52	57			
Max	61	60	62			
Min	52	45	52			
Std Dev	2	3	2			
L10	57					
L95	38					

Note: Average is a logarithmic average of values, Std Dev = standard deviation

*- Limited activity of runway 07-25 due to closure of taxiway Bravo

†- No activity on runway 07-25 due to rubber removal maintenance

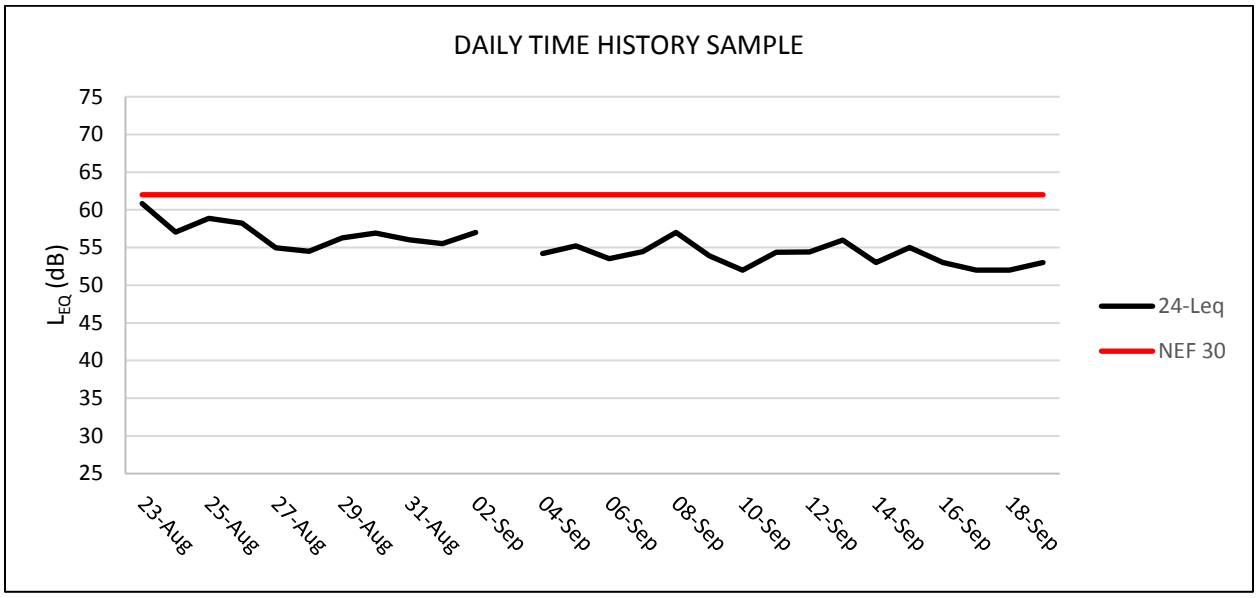


CHART 1: DAILY TIME HISTORY

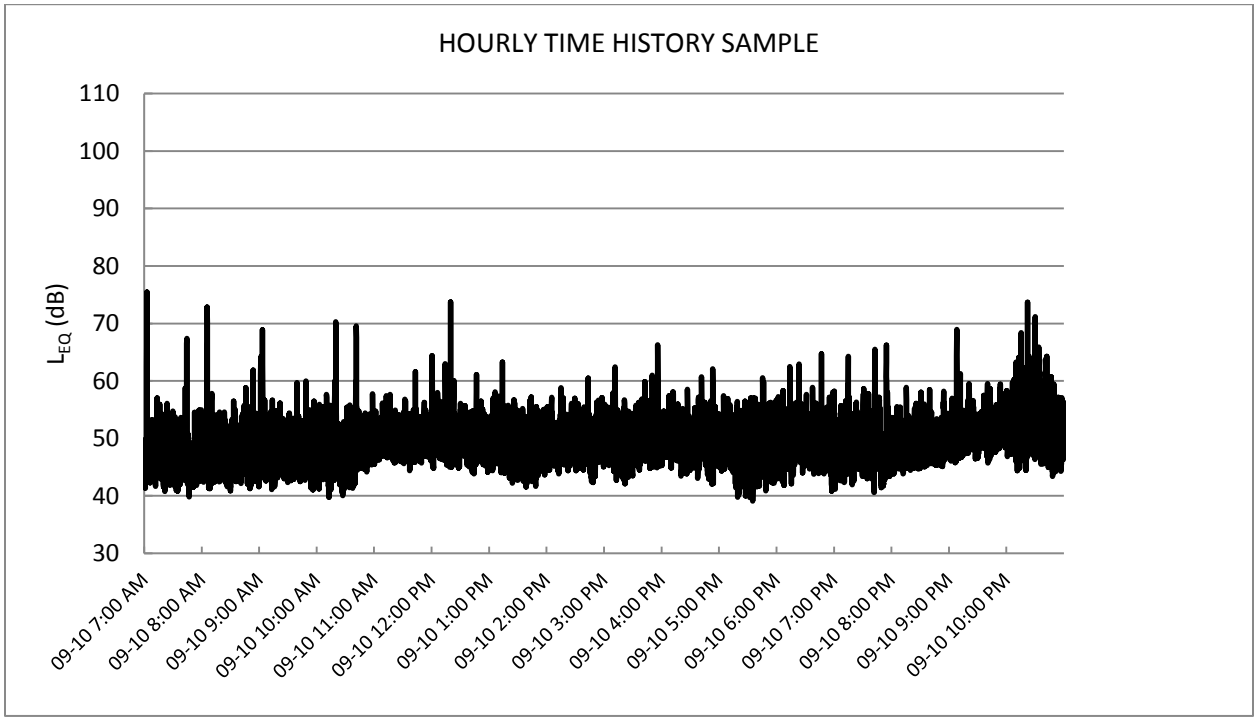


CHART 2: HOURLY TIME HISTORY

5.2.1 Aircraft Noise STC Requirements

Similar to roadway traffic noise, the roof assembly was evaluated for sound transmission to control aircraft noise. The current selected roof assembly for the development, as described below, has been rated for a particular STC rating based on INSUL software. As a conservative approach, the roof assembly with the lowest STC rating is considered, as a worst case example.

Typical Roof Assembly Construction:

- Asphalt Shingles (no acoustic value)
- Synthetic Felt Sheet Underlayment (no acoustic value)
- Rubberized Membrane (no acoustic value)
- Wood Roof Sheathing
- 400 mm Sloped Roof Trusses w/ 600 mm Spacing
- Spray Foam Insulation (no acoustic value)
- Resilient Channel @ 400 mm O.C.
- 2 Layers 16 mm Type X Gypsum Board

(STC 48) INSUL Test Data

The window and wall assemblies in Section 5.1.1 were also considered in the IBANA-Calc calculations. Appendix D contains the complete set of input and output data from all IBANA-Calc calculations. The results of the aircraft noise assessment are summarized in Table 7 below.

TABLE 7: INDOOR NOISE LEVELS DUE TO AIRCRAFT

Room Location	Indoor Noise Level $L_{eq(24\ Hr)}$ (dBA)	
	IBANA-Calc	ENCG Criteria
Worship/Gymnasium (Phase 1)	31	36
Sanctuary (Phase 2)	30	36
Multi-Purpose Room	31	36

The results of the current analysis indicate that with the proposed wall and window assemblies, predicted noise levels will be compliant to the ENCG criteria for aircraft noise. Due to aircraft noise, central air conditioning (or similar mechanical system) will be required to allow windows and doors to remain closed to maintain a comfortable and quiet indoor environment.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that predicted noise levels due to roadway traffic over the site will range between 60 and 68 dBA during the daytime period (07:00-23:00) and between 53 and 60 dBA during the nighttime period (23:00-07:00). The highest predicted noise level (i.e. 68 dBA) occurs on the south façade of Phase 1 (Receptor 3), which is nearest and most exposed to Leikin Drive.

In addition to surface transportation, the site is also impacted by aircraft noise. The site is situated between NEF/NEP contours of 30 and 35, just inside the NEF/NEP 30 contour (corresponding to a 24-hour equivalent sound pressure level ($L_{eq\ (24\ Hr)}$) or 61 dBA). To verify predicted noise levels, on-site monitoring was conducted 24-hours a day for a period of one month. Results of on-site monitoring indicate existing noise levels from airport operations are below an equivalent of the NEF 30 contour (61 dBA $L_{eq\ (24\ Hr)}$). The on-site monitoring also accounted for impacts of roadway traffic. To protect the building from possible future increases in airport noise, the building components were designed to a maximum predicted 24-hour equivalent sound pressure level of 66 dBA, due to aircraft flyovers, corresponding to the NEF/NEP 35 contour. This is a conservative approach, as the NEF/NEP 35 contour is more than one kilometer from the site.

For noise control measures for the building, upgraded Sound Transmission Class (STC) ratings are required for building components where noise levels are above the ENCG criteria for roadway traffic and aircraft traffic noise, respectively, as per Section 5. The development will be serviced with central air conditioning, which meet the ventilation requirements for noise control. As per ENCG requirements, the following Warning Clause[16] in all Agreements of Lease, Purchase and Sale will be required:

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

"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 roadway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and Ministry of the Environment

To help address the need for sound attenuation, this development includes:

Upgraded exterior walls comprising the following features or brick veneer:

Typical Exterior Wall Construction:

- *38 mm Pre-Finished Metal Siding*
- *25 mm XPS Insul. On Horiz. Z-bar*
- *25 mm XPS Insul. On Vert. Z-bar*
- *13 mm Exterior Sheathing*
- *Wood Sheathing*
- *140 mm Wood Stud*
- *Batt Insulation*
- *Vapour Barrier*
- *16 mm Type X Gypsum Board*

Minimum STC 48

Upgraded glazing elements comprising the following features:

Minimum STC 35

Typical Roof Assembly Construction or higher rated assembly:

- *Asphalt Shingles*
- *Synthetic Felt Sheet Underlayment*
- *Rubberized Membrane*
- *Wood Roof Sheathing*
- *400 mm Sloped Roof Trusses w/ 600 mm Spacing*
- *Spray Foam Insulation*
- *Resilient Channel @ 400 mm O.C.*
- *2 Layers 16 mm Type X Gypsum Board*

Minimum STC 48

To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features.

This development has also been designed with central air conditioning (or similar mechanical system) for all units. Installation of central air conditioning will allow windows

and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment."

Also, because the development is located inside the Airport Operating Influence Zone (AOIZ) but outside the NEP 35 contour, the following Warning Clause related to aircraft noise influence on-site will be required:

"Purchasers/building occupants are forewarned that this property is located in a noise sensitive area due to its proximity to Ottawa Macdonald-Cartier International Airport.

In order to reduce the impact of aircraft noise in the indoor spaces, the unit has been designed and built to meet provincial standards for noise control by the use of components and building systems that provide sound attenuation. In addition to the building components (i.e. walls, windows, doors, ceiling-roof), since the benefit of sound attenuation is lost when windows or doors are left open, this unit has been fitted with central air conditioning (or similar mechanical system).

Despite the inclusion of noise control features within the development, noise due to aircraft operations may continue to interfere with some indoor activities and with outdoor activities, particularly during the summer months. The purchaser/building occupant is further advised that the Airport is open and operates 24 hours a day, and that changes to operations or expansion of the airport facilities, including the construction of new runways, may affect the living environment of the residents of this property/area.

The Ottawa Macdonald-Cartier International Airport Authority, its acoustical consultants and the City of Ottawa are not responsible if, regardless of the implementation of noise control features, the purchaser/occupant of this development finds that the indoor and/or outdoor noise levels due to aircraft operations are offensive."

Under the ENCG and NPC-300, the development is not considered noise sensitive; therefore, in keeping with Federal[17] and Provincial policies, it is permissible between NEF 30 and 35. In addition, the Provincial Policy Statement indicates that if the development were considered noise sensitive, noise sensitive land

[17] Transportation Canada, Land Use In The Vicinity of Aerodromes, Ninth Edition 2013/14

uses may be considered above the NEF/NEP 30 for infill and redevelopment developments where it is demonstrated that there will be no negative impact on the long term function of the airport. Based on the proposed architectural drawings, building components are expected to achieve the required sound transmission ratings to control indoor noise levels to below ENCG criteria for places of worship at the proposed site. Furthermore, on-site monitoring has indicated that existing noise levels at the site are well below predicted sound levels. Therefore, no long-term impact on airport operations are anticipated.

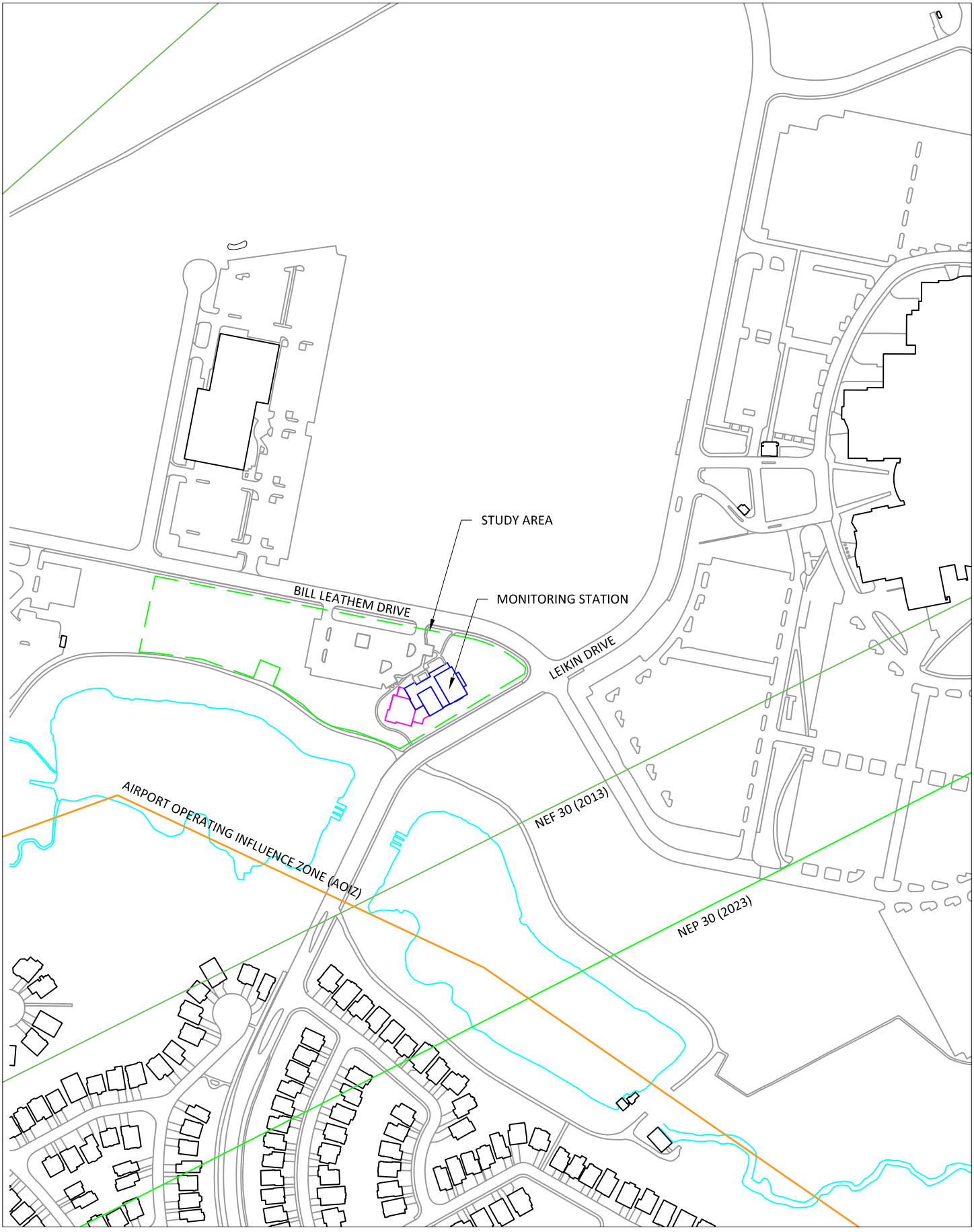
This concludes our assessment and report. If you have any questions or wish to discuss our findings please advise us. In the interim, we thank you for the opportunity to be of service.

Yours truly,

Gradient Wind Engineering Inc.

Michael Lafortune
Environmental Scientist
GWE15-009 - Transportation Noise R3

Joshua Foster, P.Eng.
Partner



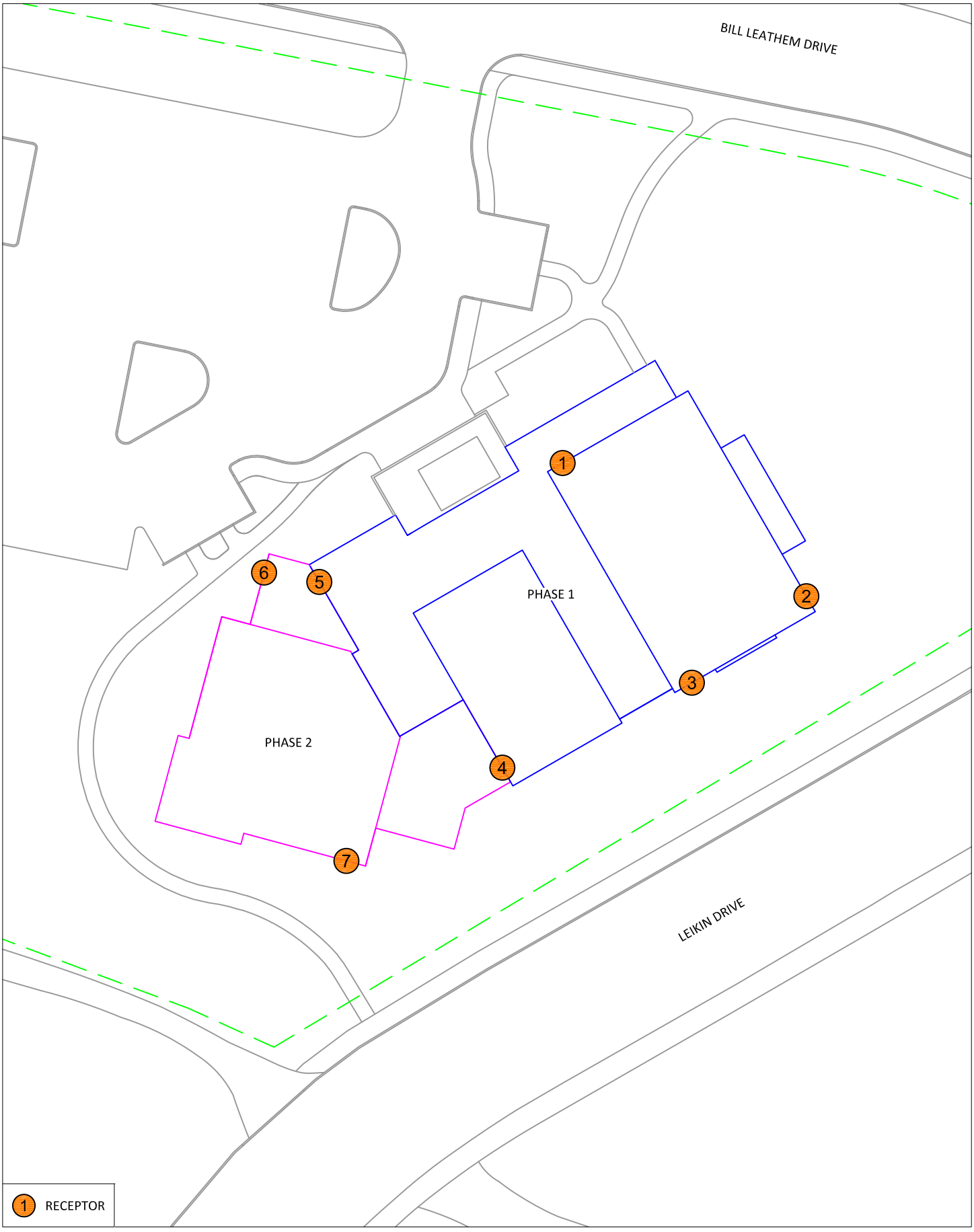
127 Walgreen Road
Ottawa, Ontario
Canada K0A 1L0

(613) 836 0934
www.gradientwind.com

PROJECT	SALVATION ARMY CHURCH - TRANSPORTATION NOISE STUDY
SCALE	1:4000 (APPROX.)
DRAWING NO.	GWE15-009-1
DATE	JULY 18, 2017
DRAWN BY	M.L

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



127 Walgreen Road
Ottawa, Ontario
Canada K0A 1L0

(613) 836 0934
www.gradientwind.com

PROJECT	SALVATION ARMY CHURCH - TRANSPORTATION NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE15-009-2
DATE	JULY 18, 2017
DRAWN BY	M.L
DESCRIPTION	FIGURE 2: RECEPTOR LOCATIONS

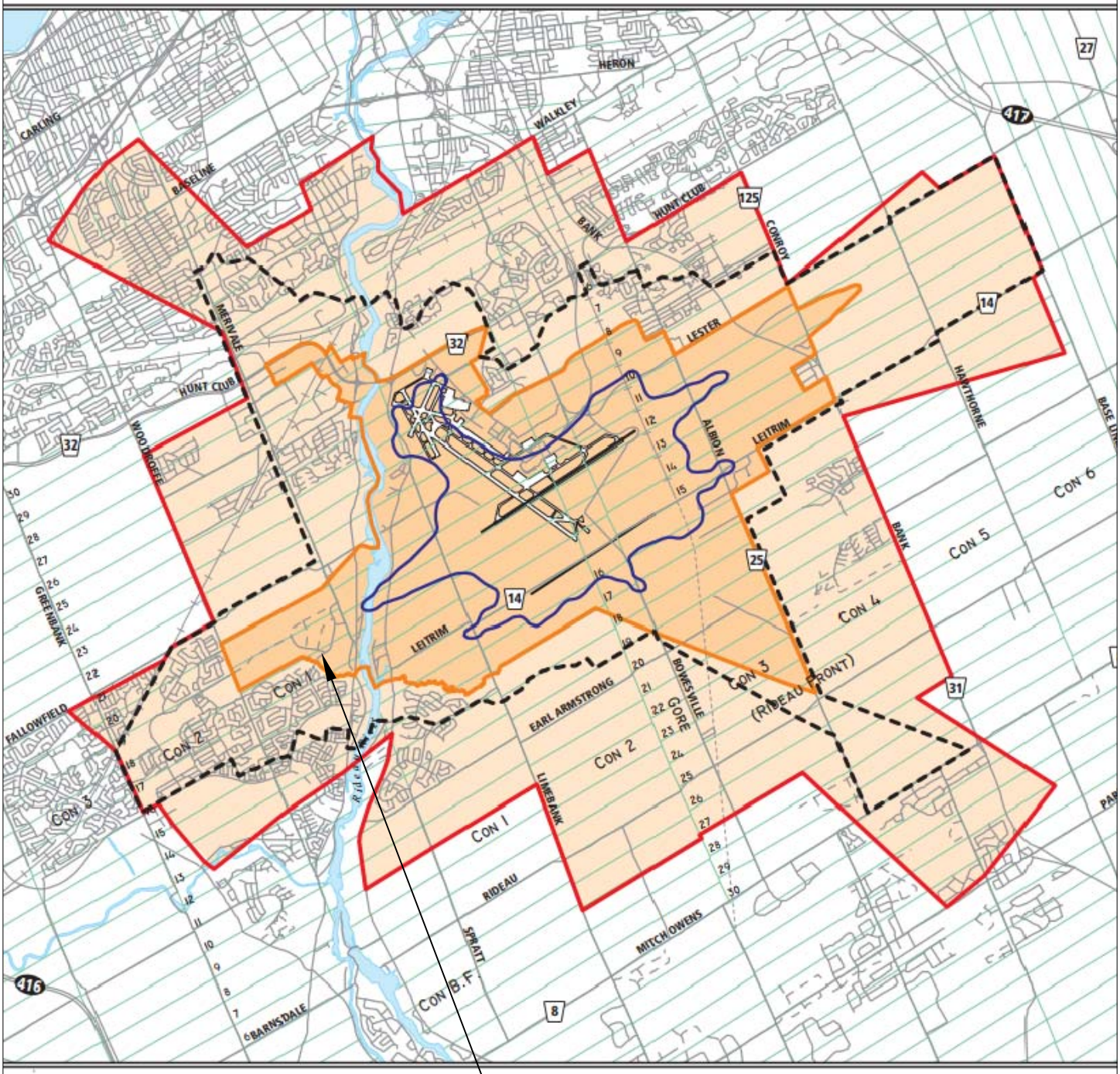


FIGURE REPRODUCED FROM THE CITY OF OTTAWA OFFICIAL PLAN - ANNEX 10 (LAND USE CONSTRAINTS DUE TO AIRCRAFT NOISE) PREPARED IN SEPTEMBER 2011

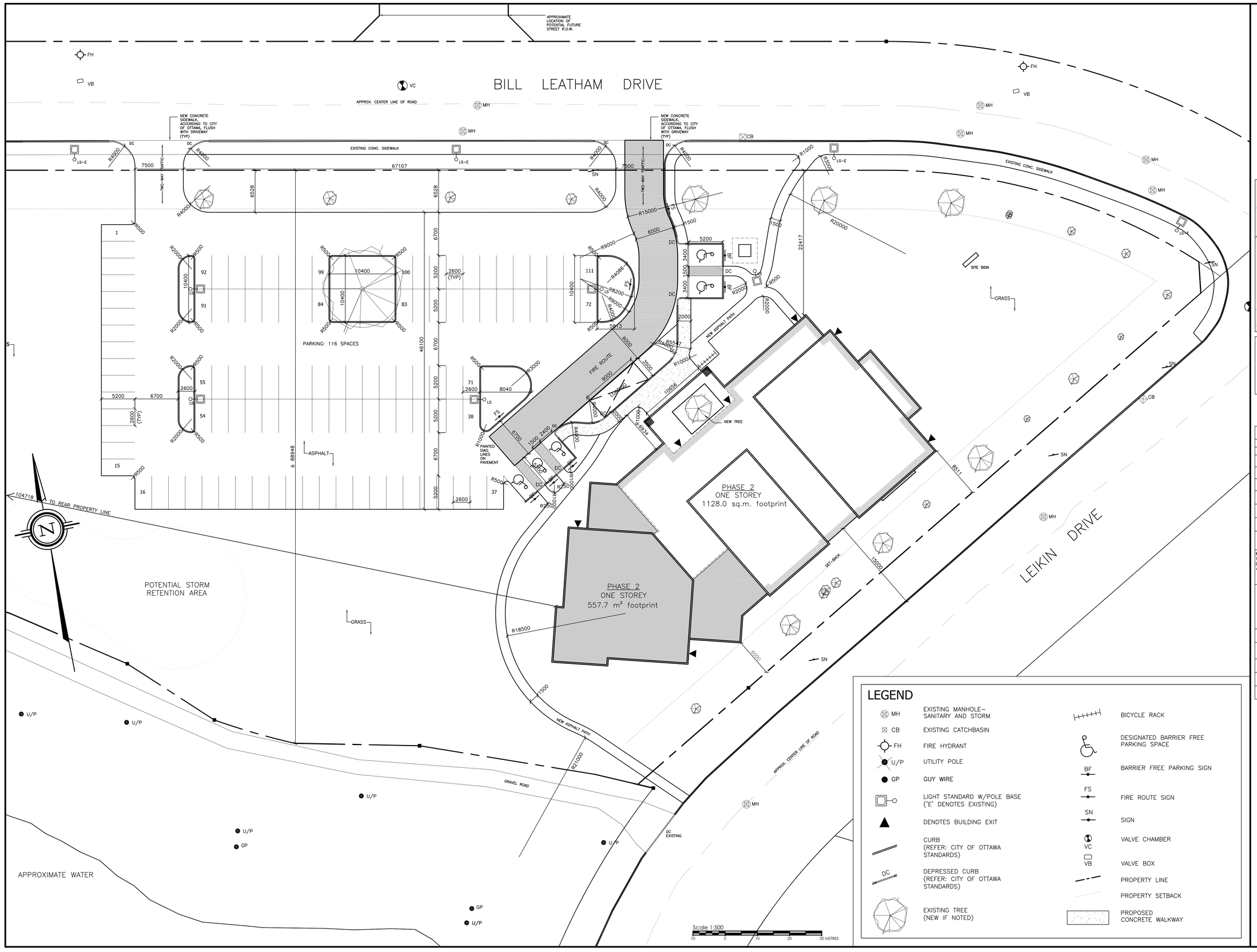
127 Walgreen Road
Ottawa, Ontario
Canada K0A 1L0

(613) 836 0934
www.gradientwind.com

PROJECT: SALVATION ARMY CHURCH - TRANSPORTATION NOISE STUDY		DESCRIPTION: FIGURE 3: DEVELOPMENT LOCATION IN REFERENCE TO THE OTTAWA AIRPORT OPERATING INFLUENCE ZONE
SCALE: NTS	DRAWING NO.: GWE15-009-3	
DATE: JULY 18, 2017	DRAWN BY: M.L	

APPENDIX A

Architectural Drawings and Assemblies



NO.	REVISION	DATE
1	ISSUED FOR SITE PLAN APPLICATION	

KEY PLAN

Property Information:

Legal Description:
PART OF LOTS 17 & 18
Concession 1 (Rideau Front)
(Geographic Township of Nepean)
City of Ottawa

GENERAL NOTES:
1. ALL WALKWAYS TO BE ASPHALT PAVING UNLESS NOTED OTHERWISE.
2. ALL NEW PARKING AREAS TO BE ASPHALT UNLESS NOTED OTHERWISE.
3. REFER TO LEGAL SURVEY FOR SITE SPECIFIC LEGAL INFORMATION.
4. REFER TO CIVIL FOR COMPLETE GRADE INFORMATION.

BUILDING AREA (FOOTPRINT): 1696.2 m²
LOT AREA: 19578 m²
ZONE: IL9 – LIGHT INDUSTRIAL

MECHANISM		REQUIRED	PROVIDED
MINIMUM LOT AREA		3000 m²	1672.2 m²
MINIMUM LOT WIDTH		50 m	± 89.2 m
MINIMUM FRONT YARD SETBACK		6 m	6 m
MINIMUM CORNER SIDE YARD SETBACK		6 m	22.4 m
MINIMUM REAR YARD SETBACK		6 m	104.7 m
MAXIMUM LOT COVERAGE		60 %	8.66 %
MAXIMUM BUILDING HEIGHT		22 m	10.5 m
MAXIMUM FLOOR SPACE INDEX		2	0.087
MAX. WIDTH LANDSCAPE AREA (AROUND PARKING LOT)		NO MIN.	N.A.
MIN. WIDTH OF LANDSCAPE AREA	ABUTTING A STREET	3 m	6.5 m
	OTHER CASES:	NO MIN.	N.A.
MIN. # PARKING SPACES	PLACE OF ASSEMBLY, WORSHIP	10/100m² GFA OF ASSEMBLY AREA: MULTI-PURPOSE: 114.8 FELLOWSHIP: 167.9 GYM: 373.7 WORSHIP: 370.3 SUM: 1026.7 m² CARS REQ. 103	116
VEHICLE PARKING SPACE SIZE PROVISIONS		2.6m x 5.2m	2.6 m x 5.2 m
MIN AISLE WIDTH		6.7 m	6.7 m
MIN. # BICYCLE PARKING SPACES		1 PER 1500 m² GFA	6
BICYCLE PARKING SPACE SIZE PROVISIONS		0.6m x 1.8m	0.6 m x 1.8 m
LOADING SPACE		1: 3.5m x 9m	1

LEGEND

- MH — EXISTING MANHOLE– SANITARY AND STORM
- CB — EXISTING CATCHBASIN
- FH — FIRE HYDRANT
- U/P — UTILITY POLE
- GP — GUY WIRE
- LIGHT STANDARD W/POLE BASE ('E' DENOTES EXISTING)
- DENOTES BUILDING EXIT
- CURB (REFER: CITY OF OTTAWA STANDARDS)
- DC — DEPRESSED CURB (REFER: CITY OF OTTAWA STANDARDS)
- EXISTING TREE (NEW IF NOTED)
- BICYCLE RACK
- DESIGNATED BARRIER FREE PARKING SPACE
- BF — BARRIER FREE PARKING SIGN
- FS — FIRE ROUTE SIGN
- SN — SIGN
- VC — VALVE CHAMBER
- VB — VALVE BOX
- PROPERTY LINE
- PROPERTY SETBACK
- PROPOSED CONCRETE WALKWAY

CONSTRUCTION

Vandenberg & Wildeboer
A·R·C·H·I·T·E·C·T·S
www.vwarchitects.ca Telephone: 613.287.0164 Facsimile: 613.271.8609 mail@vwarchitects.ca
• THE OLD STONE LODGE • 160 PLAMONDON WAY • OTTAWA, (GLOUCESTER) • ONTARIO • K2E 8E9 •

PROJECT TITLE
SALVATION ARMY
BARRHAVEN, NAPEAN

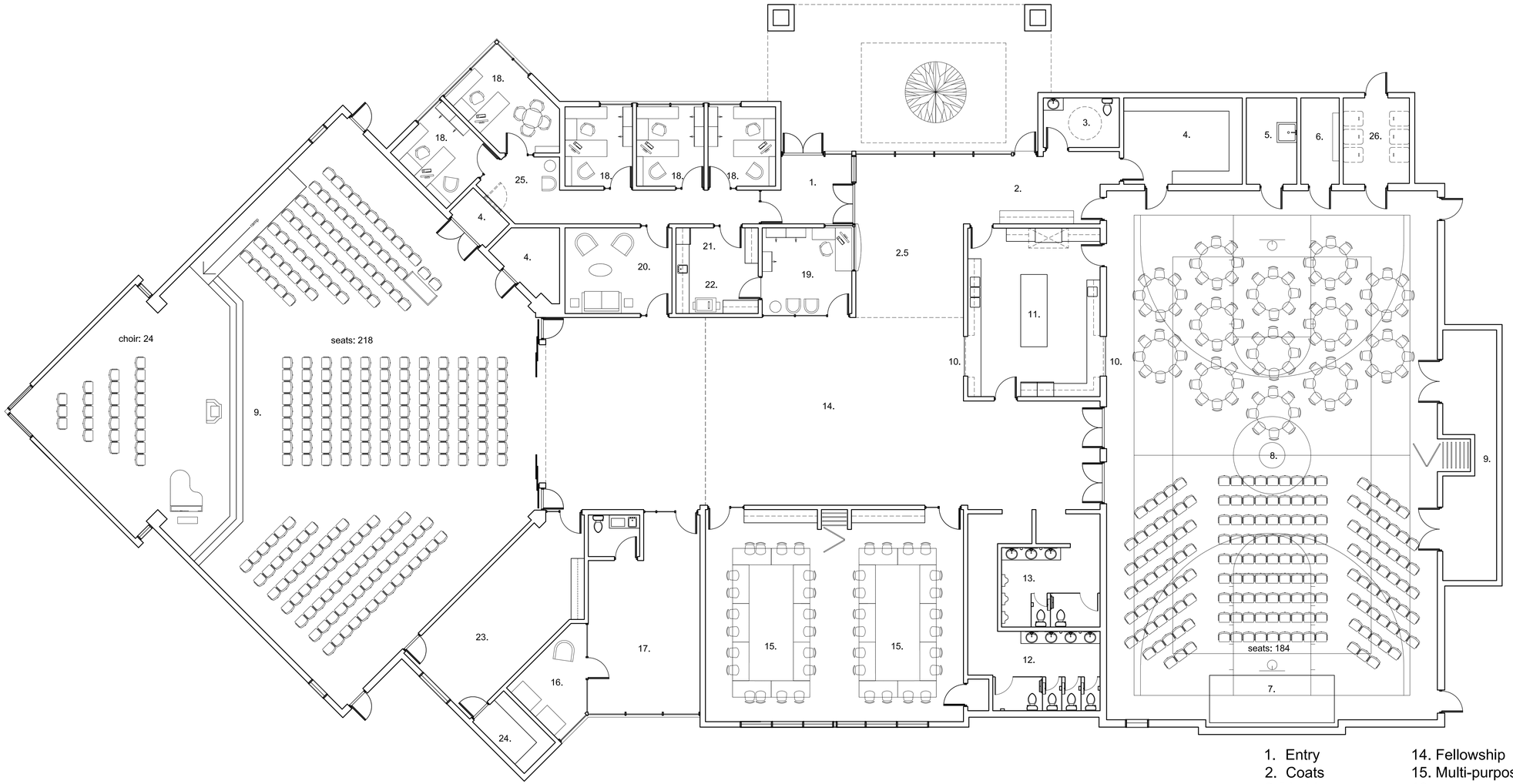
DRAWING TITLE
PHASE 2: SITE PLAN

DESIGNED BY: RALPH VANDENBERG
DRAWN BY: LV
START DATE: 2015
SCALE: 1:500
PROJECT NO. 1502

DRAWING No. A100

PLOT DATE: March 29, 2016

NO.	REVISION	DATE
1	ISSUED FOR SITE PLAN APPLICATION	



1. Entry
2. Coats
2.5 Lobby
3. Universal w/c
4. Storage
5. Janitorial
6. Electrical
7. Platform
8. Worship & Gymnasium
9. Sanctuary
10. Pass Thru
11. Kitchen
12. Women's
13. Men's
14. Fellowship
15. Multi-purpose
16.
17.
18. Office
18.5 Work Station
19. Reception
20. Waiting, Prayer & Meeting Room
21. Kitchenette
22. Work Room
23. Music
24. Music Storage
25. Waiting
26. Recycling/ Refuse

0 2 4 8 16'

AREA: 18139.7 sq. ft.
1685.2 sq. m.

CONSTRUCTION

Vandenberg & Wildeboer
A·R·C·H·I·T·E·C·T·S
www.vwarchitects.ca Telephone: 613.287.0144 Facsimile: 613.271.8609 mail@vwarchitects.ca
• THE OLD STONE LODGE • 160 PLAMONDON WAY • OTTAWA, ONTARIO • CANADA • K2E 8E9 •

PROJECT TITLE
SALVATION ARMY
BARRHAVEN, NAPEAN

DRAWING TITLE
PHASE 2: PLAN

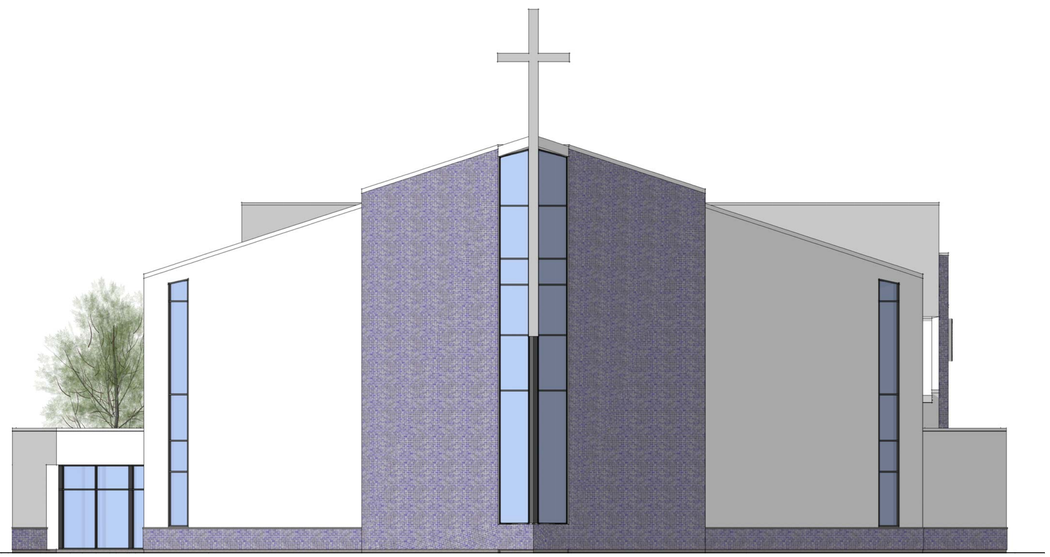
DESIGNED BY: RALPH VANDENBERG
DRAWN BY: LV
START DATE: 2015
SCALE: 1:100
PROJECT NO. 1502

DRAWING No. A101

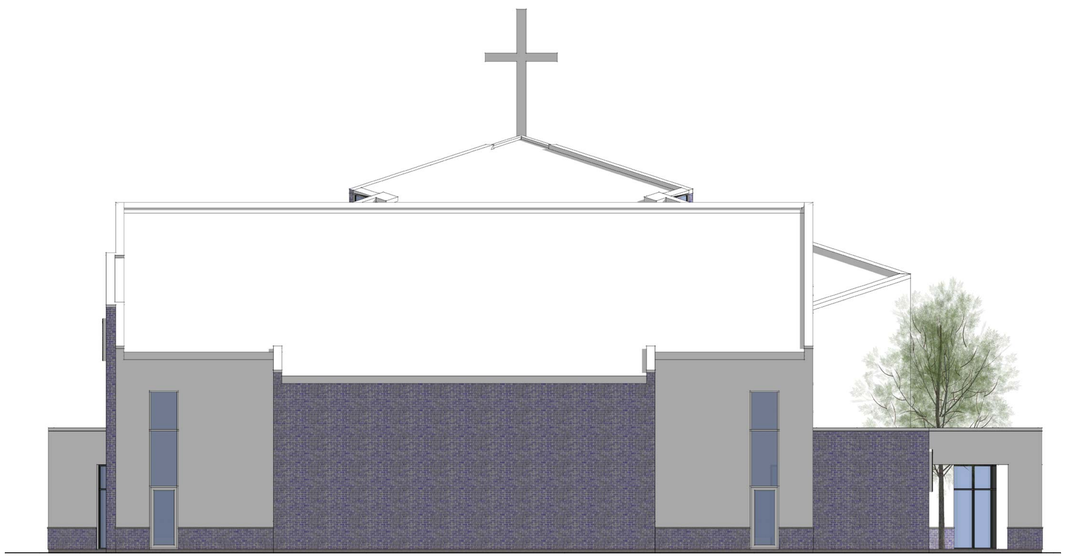
PLOT DATE: March 29, 2016

NORTH

SOUTH



WEST



EAST

NO.	REVISION	DATE
1	ISSUED FOR SITE PLAN APPLICATION	

CONSTRUCTION

Vandenberg & Wildeboer
A·R·C·H·I·T·E·C·T·S
www.vwarchitects.ca Telephone: 613.287.0144 Facsimile: 613.271.8609 mail@vwarchitects.ca
•THE OLD STONE LODGE • 160 FLAMBOROUGH WAY • OTTAWA (KANATA) • ONTARIO • K2K 3H9•

PROJECT TITLE

SALVATION ARMY BARRHAVEN
NAPEAN

DRAWING TITLE

PHASE 2: ELEVATIONS

DESIGNED BY: RALPH VANDENBERG
DRAWN BY: LV
START DATE: 2015
SCALE: 1:100
PROJECT NO. 1502

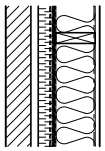
DRAWING No. A102

PLOT DATE: March 29, 2016

TYPICAL CONSTRUCTION ASSEMBLIES
SALVATION ARMY - BARRHAVEN
APRIL 05, 2016

EXTERIOR WALLS:

EX1



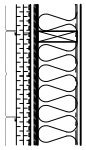
MASONRY VENEER/WOOD STUD
1 HR FRR PER SB-2 TABLES 2.3.4.A & C

- MASONRY VENEER (SEE ELEVS.)
- AIR SPACE (W/MORTAR CONTROL)
- 50 XPS INSULATION (RSI 1.8 c.i.)
- SHEATHING MEMBRANE (AIR BARRIER-VAPOUR PERMEABLE)
- WOOD SHEATHING (SEE STRUCT.)
- 140 WOOD STUD @ 400 O.C.
- BATT INSULATION (RSI 3.88)
- SHEET POLY VAPOUR BARRIER
- 16 TYPE X GYPSUM BOARD (FRR)

MIN. RSI 2.3+1.8 ci

(ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
WOOD FRAMED/NON-RESIDENTIAL)

EX2



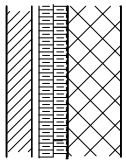
METAL SIDING/WOOD STUD
1 HR FRR PER SB-2 TABLES 2.3.4.A & C

- 38 PREFIN. METAL SIDING
- 25 XPS INSUL. ON HORIZ. Z-BAR (RSI .9 c.i.)
- 25 XPS INSUL. ON VERT. Z-BAR (RSI .9 c.i.)
- SHEATHING MEMBRANE (AIR BARRIER-VAPOUR PERMEABLE)
- 13 EXT. GYPSUM SHEATHING (STC)
- WOOD SHEATHING (REFER TO STRUCT.)
- 140 WOOD STUD @ 400 O.C.
- BATT INSULATION (RSI 3.88)
- SHEET POLY VAPOUR BARRIER
- 16 TYPE X GYPSUM BOARD (FRR)

MIN. RSI 2.3+1.8 ci

(ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
WOOD FRAMED/(NON-RESIDENTIAL)

EX3



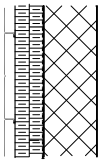
METAL SIDING - CONCRETE BLOCK

- 90 BRICK VENEER
- AIR SPACE
- 50 SEMI-RIGID INSUL. (RSI 1.48 c.i.) ON HORIZ. Z-GIRTS
- 50 XPS INSULATION (RSI 1.48 c.i.) ON VERT. Z-GIRTS
- LIQUID OR MEMBRANE MOISTURE BARRIER (AIR/VAPOUR BARRIER)
- 190 REINFORCED CMU (SEE STRUCT.)

MIN. RSI 2.7ci

ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
(WALL/MASS/NON-RESIDENTIAL)

EX4



METAL SIDING - CONCRETE BLOCK

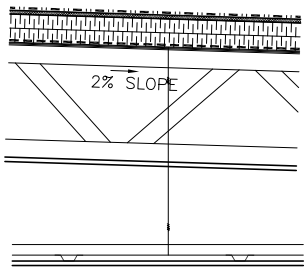
- 38 PREFIN. METAL SIDING
- HORIZ. Z-BAR METAL FURRING
- 50 SEMI-RIGID INSUL. (RSI 1.48 c.i.) ON HORIZ. Z-GIRTS
- 50 XPS INSULATION (RSI 1.48 c.i.) ON VERT. Z-GIRTS
- LIQUID OR MEMBRANE MOISTURE BARRIER (AIR/VAPOUR BARRIER)
- 190 REINFORCED CMU (SEE STRUCT.)

MIN. RSI 2.7ci

ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
(WALL/MASS/NON-RESIDENTIAL)

ROOFS:

R1



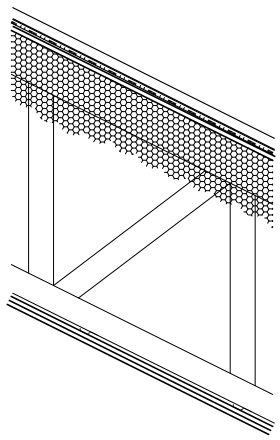
LOW SLOPE - WOOD
1 HR FRR PER SB-2 TABLES 2.3.4.A & C

- 2 PLY MOD. BIT MEMBRANE ROOFING
- PROTECTION BOARD UNDERLAY
- ROOF INSULATION BD (MIN. RSI 5.3 AGED)
- VAPOUR RETARDER
- WOOD ROOF SHEATHING (SEE STRUCT)
- 2% SLOPED STRUCTURE (SEE STRUCT)
- 16 TYPE X GYPSUM BOARD (FRR)
- SUSPENDED CEILING (ACOUSTIC TILE OR GYPSUM BOARD - SEE REFLECTED CEILING)

MIN. RSI 5.3 ci

ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
(ROOFS/INSUL ABOVE DECK/NON-RESIDENTIAL)

R2



SLOPING FLAT ROOF - WOOD
1 HR FRR PER SB-2 TABLES 2.3.4.A & C

- PRE-FINISHED METAL ROOFING
- SYNTHETIC FELT SHEET UNDERLAYMENT
- SELF-ADHERED RUBBERIZED MEMBRANE (EAVE PROTECTION, VALLEYS, PENETRATIONS)
- WOOD ROOF SHEATHING (SEE STRUCT)
- SLOPED ROOF TRUSSES (SEE STRUCT)
- TYPE 2 SPRAY FOAM POLYURETHANE INSULATION (MIN. RSI 8.6 AGED)
- RESILIENT CHANNEL @ 400 O.C. (STC)
- 16 TYPE X GYPSUM BOARD (FRR & STC)
- 16 TYPE X GYPSUM BOARD (FRR)

MIN. RSI 8.6

(ENERGY EFFICIENCY per SB-10,
DIVISION 2, TABLE 5.5-6,
(ROOFS/OTHER/NON-RESIDENTIAL)

APPENDIX B

STAMSON 5.04 - INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bill (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Bill (day/night)
--------------------------------------
Angle1   Angle2           : -90.00 deg   49.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  43.00 / 43.00  m
Receiver height           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 63.33 + 0.00) = 63.33 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     49   0.00  69.03   0.00  -4.57  -1.12   0.00   0.00   0.00
63.33
-------------------------------------------------------------------------
--

Segment Leq : 63.33 dBA

Total Leq All Segments: 63.33 dBA


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

Source height = 1.50 m

ROAD (0.00 + 55.73 + 0.00) = 55.73 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     49   0.00  61.43   0.00  -4.57  -1.12   0.00   0.00   0.00
55.73
-------------------------------------------------------------------------
--

Segment Leq : 55.73 dBA

Total Leq All Segments: 55.73 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 63.33
                           (NIGHT): 55.73
```

```
STAMSON 5.0        NORMAL REPORT        Date: 28-06-2017 10:08:48
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: BillL (day/night)
-----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: BillL (day/night)
---------------------------------------
Angle1   Angle2           : -41.00 deg   30.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  52.00 / 52.00  m
Receiver height           :   3.20 / 3.20   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -41.00 deg   Angle2 : -12.00 deg
Barrier height            :   6.00 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: BillR (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: BillR (day/night)
---------------------------------------
Angle1   Angle2           : -15.00 deg   24.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  58.00 / 58.00  m
Receiver height           :   3.20 / 3.20   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: Leikin (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Leikin (day/night)
----------------------------------------
Angle1   Angle2           : -81.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  23.00 / 23.00  m
Receiver height           :   3.20 / 3.20   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: BillL (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 !        3.20 !        3.04 !         3.04

ROAD (0.00 + 37.51 + 53.93) = 54.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -41    -12   0.25  69.03   0.00  -6.74  -8.06   0.00   0.00 -16.71
37.51
-------------------------------------------------------------------------------
--
   -12     30   0.61  69.03   0.00  -8.69  -6.41   0.00   0.00   0.00
53.93
-------------------------------------------------------------------------------
--

Segment Leq : 54.02 dBA
```

Results segment # 2: BillR (day)

Source height = 1.50 m

ROAD (0.00 + 56.51 + 0.00) = 56.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-15	24	0.00	69.03	0.00	-5.87	-6.64	0.00	0.00	0.00	56.51

Segment Leq : 56.51 dBA

Results segment # 3: Leikin (day)

Source height = 1.50 m

ROAD (0.00 + 63.70 + 0.00) = 63.70 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-81	0	0.00	69.03	0.00	-1.86	-3.47	0.00	0.00	0.00	63.70

Segment Leq : 63.70 dBA

Total Leq All Segments: 64.83 dBA

```
Results segment # 1: BillL (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 !        3.20 !        3.04 !         3.04

ROAD (0.00 + 29.91 + 46.33) = 46.42 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -41    -12   0.25  61.43   0.00  -6.74  -8.06   0.00   0.00 -16.71
29.91
-------------------------------------------------------------------------------
--
   -12     30   0.61  61.43   0.00  -8.69  -6.41   0.00   0.00   0.00
46.33
-------------------------------------------------------------------------------
--

Segment Leq : 46.42 dBA


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

Source height = 1.50 m

ROAD (0.00 + 48.91 + 0.00) = 48.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -15     24   0.00  61.43   0.00  -5.87  -6.64   0.00   0.00   0.00
48.91
-------------------------------------------------------------------------------
--

Segment Leq : 48.91 dBA
```

```
Results segment # 3: Leikin (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.10 + 0.00) = 56.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -81      0   0.00  61.43   0.00  -1.86  -3.47   0.00   0.00   0.00
56.10
-------------------------------------------------------------------------
--

Segment Leq : 56.10 dBA

Total Leq All Segments: 57.23 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 64.83
                           (NIGHT): 57.23
```

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bill (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Bill (day/night)
--------------------------------------
Angle1   Angle2           :   0.00 deg   66.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  72.00 / 72.00  m
Receiver height           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: LeikinL (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinL (day/night)
-----------------------------------------
Angle1   Angle2           : -83.00 deg   69.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  21.00 / 21.00  m
Receiver height           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Road data, segment # 3: LeikinR (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinR (day/night)
------------------------------------------
Angle1   Angle2           : -90.00 deg   -79.00 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           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Bill (day)
--------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.86 + 0.00) = 57.86 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     66   0.00  69.03   0.00  -6.81  -4.36   0.00   0.00   0.00
57.86
-------------------------------------------------------------------------
--

Segment Leq : 57.86 dBA


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

Source height = 1.50 m

ROAD (0.00 + 66.83 + 0.00) = 66.83 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83     69   0.00  69.03   0.00  -1.46  -0.73   0.00   0.00   0.00
66.83
-------------------------------------------------------------------------
--

Segment Leq : 66.83 dBA
```

```
Results segment # 3: LeikinR (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.89 + 0.00) = 56.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -79   0.00  69.03   0.00   0.00 -12.14   0.00   0.00   0.00
56.89
-------------------------------------------------------------------------
--

Segment Leq : 56.89 dBA

Total Leq All Segments: 67.72 dBA


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

Source height = 1.50 m

ROAD (0.00 + 50.26 + 0.00) = 50.26 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     66   0.00  61.43   0.00  -6.81  -4.36   0.00   0.00   0.00
50.26
-------------------------------------------------------------------------
--

Segment Leq : 50.26 dBA


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

Source height = 1.50 m

ROAD (0.00 + 59.23 + 0.00) = 59.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -83     69   0.00  61.43   0.00  -1.46  -0.73   0.00   0.00   0.00
59.23
-------------------------------------------------------------------------
--
```

```
Segment Leq : 59.23 dBA


Results segment # 3: LeikinR (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.29 + 0.00) = 49.29 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -79   0.00  61.43   0.00   0.00 -12.14   0.00   0.00   0.00
49.29
-------------------------------------------------------------------------
--

Segment Leq : 49.29 dBA

Total Leq All Segments: 60.12 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 67.72
                           (NIGHT): 60.12
```

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bill (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Bill (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   -41.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  74.00 / 74.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -84.00 deg   Angle2 : -41.00 deg
Barrier height            :   4.20 m
Barrier receiver distance :   1.00 / 1.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: LeikinL (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinL (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   56.00 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           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: LeikinR (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinR (day/night)
-----------------------------------------
Angle1   Angle2           :  88.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Bill (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 !        1.50 !        1.50 !         1.50

ROAD (47.32 + 39.92 + 0.00) = 48.05 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -84   0.00  69.03   0.00  -6.93 -14.77   0.00   0.00   0.00
47.32
-------------------------------------------------------------------------------
--
   -84    -41   0.00  69.03   0.00  -6.93  -6.22   0.00   0.00 -15.96
39.92
-------------------------------------------------------------------------------
--

Segment Leq : 48.05 dBA


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

Source height = 1.50 m

ROAD (0.00 + 61.92 + 0.00) = 61.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     56   0.00  69.03   0.00  -2.04  -5.07   0.00   0.00   0.00
61.92
-------------------------------------------------------------------------------
--

Segment Leq : 61.92 dBA
```

```
Results segment # 3: LeikinR (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.48 + 0.00) = 49.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    88     90   0.00  69.03   0.00   0.00 -19.54   0.00   0.00   0.00
49.48
-------------------------------------------------------------------------
--

Segment Leq : 49.48 dBA

Total Leq All Segments: 62.33 dBA


Results segment # 1: Bill (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 !        1.50 !        1.50 !         1.50

ROAD (39.73 + 32.32 + 0.00) = 40.45 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -84   0.00  61.43   0.00  -6.93 -14.77   0.00   0.00   0.00
39.73
-------------------------------------------------------------------------
--
   -84    -41   0.00  61.43   0.00  -6.93  -6.22   0.00   0.00 -15.96
32.32
-------------------------------------------------------------------------
--

Segment Leq : 40.45 dBA
```

```
Results segment # 2: LeikinL (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.32 + 0.00) = 54.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     56   0.00  61.43   0.00  -2.04  -5.07   0.00   0.00   0.00
54.32
-------------------------------------------------------------------------
--

Segment Leq : 54.32 dBA


Results segment # 3: LeikinR (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 41.89 + 0.00) = 41.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    88     90   0.00  61.43   0.00   0.00 -19.54   0.00   0.00   0.00
41.89
-------------------------------------------------------------------------
--

Segment Leq : 41.89 dBA

Total Leq All Segments: 54.73 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 62.33
                           (NIGHT): 54.73
```

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bill (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Bill (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   -41.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  60.00 / 60.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: LeikinL (day/night)
------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinL (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   31.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  49.00 / 49.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :   0.00 deg   Angle2 : 6.00 deg
Barrier height            :   4.20 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 # 3: LeikinR (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinR (day/night)
-----------------------------------------
Angle1   Angle2           :  63.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  26.00 / 26.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Bill (day)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.36 + 0.00) = 57.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -41   0.00  69.03   0.00  -6.02  -5.65   0.00   0.00   0.00
57.36
-------------------------------------------------------------------------
--

Segment Leq : 57.36 dBA
```

```
Results segment # 2: LeikinL (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 34.20 + 55.31) = 55.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0      6   0.00  69.03   0.00  -5.14 -14.77   0.00   0.00 -14.92
34.20
-------------------------------------------------------------------------------
--
     6     31   0.00  69.03   0.00  -5.14  -8.57   0.00   0.00   0.00
55.31
-------------------------------------------------------------------------------
--

Segment Leq : 55.35 dBA


Results segment # 3: LeikinR (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.40 + 0.00) = 58.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    63     90   0.00  69.03   0.00  -2.39  -8.24   0.00   0.00   0.00
58.40
-------------------------------------------------------------------------------
--

Segment Leq : 58.40 dBA

Total Leq All Segments: 61.98 dBA
```

```
Results segment # 1: Bill (night)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.76 + 0.00) = 49.76 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -41   0.00  61.43   0.00  -6.02  -5.65   0.00   0.00   0.00
49.76
-------------------------------------------------------------------------
--

Segment Leq : 49.76 dBA


Results segment # 2: LeikinL (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 26.60 + 47.71) = 47.75 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0      6   0.00  61.43   0.00  -5.14 -14.77   0.00   0.00 -14.92
26.60
-------------------------------------------------------------------------
--
     6     31   0.00  61.43   0.00  -5.14  -8.57   0.00   0.00   0.00
47.71
-------------------------------------------------------------------------
--

Segment Leq : 47.75 dBA
```

```
Results segment # 3: LeikinR (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.80 + 0.00) = 50.80 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    63     90   0.00  61.43   0.00  -2.39  -8.24   0.00   0.00   0.00
50.80
-------------------------------------------------------------------------
--

Segment Leq : 50.80 dBA

Total Leq All Segments: 54.38 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 61.98
                           (NIGHT): 54.38
```

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bill (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: Bill (day/night)
---------------------------------------
Angle1   Angle2           : -90.00 deg   4.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  60.00 / 60.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

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

Source height = 1.50 m

ROAD (0.00 + 60.19 + 0.00) = 60.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      4   0.00  69.03   0.00  -6.02  -2.82   0.00   0.00   0.00
60.19
-------------------------------------------------------------------------
--

Segment Leq : 60.19 dBA

Total Leq All Segments: 60.19 dBA


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

Source height = 1.50 m

ROAD (0.00 + 52.59 + 0.00) = 52.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      4   0.00  61.43   0.00  -6.02  -2.82   0.00   0.00   0.00
52.59
-------------------------------------------------------------------------
--

Segment Leq : 52.59 dBA

Total Leq All Segments: 52.59 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 60.19
                           (NIGHT): 52.59
```

```
STAMSON 5.0        NORMAL REPORT        Date: 01-04-2016 10:20:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: LeikinL (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinL (day/night)
-----------------------------------------
Angle1   Angle2           : -44.00 deg   37.00 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           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: LeikinR (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    veh/TimePeriod  *
Posted speed limit  :    60 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):  12000
    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: LeikinR (day/night)
-----------------------------------------
Angle1   Angle2           :  68.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   7.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: LeikinL (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.52 + 0.00) = 63.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -44     37   0.00  69.03   0.00  -2.04  -3.47   0.00   0.00   0.00
63.52
-------------------------------------------------------------------------
--

Segment Leq : 63.52 dBA
```

```
Results segment # 2: LeikinR (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.90 + 0.00) = 59.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    68     90   0.00  69.03   0.00   0.00  -9.13   0.00   0.00   0.00
59.90
-------------------------------------------------------------------------
--

Segment Leq : 59.90 dBA

Total Leq All Segments: 65.09 dBA


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

Source height = 1.50 m

ROAD (0.00 + 55.92 + 0.00) = 55.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -44     37   0.00  61.43   0.00  -2.04  -3.47   0.00   0.00   0.00
55.92
-------------------------------------------------------------------------
--

Segment Leq : 55.92 dBA
```

```
Results segment # 2: LeikinR (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.30 + 0.00) = 52.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    68     90   0.00  61.43   0.00   0.00  -9.13   0.00   0.00   0.00
52.30
-------------------------------------------------------------------------
--

Segment Leq : 52.30 dBA

Total Leq All Segments: 57.49 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 65.09
                           (NIGHT): 57.49
```

APPENDIX C

Detailed STC Calculations

WORSHIP / GYM REQUIRED STC

Outdoor Sound Level	=	**68**	**dBA**
Source Geometry Correction:	=	**0**	**dBA**
Correction For Surface Reflection:	=	**3**	**dBA**
Target Indoor Noise Level:	=	**38.2**	**dBA**
Required Noise Reduction:	=	**32.8**	**dBA**

COMPONENT: Wall			STC Is:	**48**	
Noise Spectrum Type	**D**		Correction:	**7**	**dBA**
Component Category	**d**				
Room Floor Area:	**360**	**m²**			
Component Area:	**691**	**m²**	Correction:		
Component / Floor (%):	**192**	**%**			
Room Absorption Category:	**intermidiate**			**6**	**dBA**
Noise Reduction If Only This Component Transmits Sound Energy:				**35**	**dBA**
Component Transmits	**58**	% Of Sound	**Required Noise Reduction:**	**32.8**	**dBA**

COMPONENT: Window			Required Noise Reduction Is:	**32.8**	**dBA**
Percentage Of Sound Energy Transmitted:				**42**	**%**
Room Floor Area:	**360**	**m²**	Correction:	**4**	
Component Area:	**50**	**m²**			
Component / Floor (%):	**14**	**%**			
Room Absorption Category:	**intermidiate**		Correction:	**-6**	**dBA**
Noise Spectrum	**D**				
Component Category	**c**		Correction:	**4**	**dBA**
			Required STC Is:	**35**	

MULTI-PURPOSE ROOM REQUIRED STC

Outdoor Sound Level	=	**63**	**dBA**
Source Geometry Correction:	=	**0**	**dBA**
Correction For Surface Reflection:	=	**3**	**dBA**
Target Indoor Noise Level:	=	**34**	**dBA**
Required Noise Reduction:	=	**32**	**dBA**

COMPONENT: Wall				
		STC Is:	**48**	
Noise Spectrum Type	**D**	Correction:		
Component Category	**d**		**7**	**dBA**
Room Floor Area:	**114** m^2			
Component Area:	**77.25** m^2	Correction:		
Component / Floor (%):	**68** %			
Room Absorption Category:	**intermidiate**		**1**	**dBA**
Noise Reduction If Only This Component Transmits Sound Energy:			**40**	**dBA**
Component Transmits	**17** % Of Sound	**Required Noise Reduction:**	**32**	**dBA**

COMPONENT: Window				
		Required Noise Reduction Is:	**32**	**dBA**
Percentage Of Sound Energy Transmitted:			**83**	**%**
Room Floor Area:	**114** m^2	Correction:	**1**	
Component Area:	**41** m^2			
Component / Floor (%):	**36** %			
Room Absorption Category:	**intermidiate**	Correction:	**-1**	**dBA**
Noise Spectrum	**D**			
Component Category	**c**	Correction:	**4**	**dBA**
		Required STC Is:	**35**	

SANCTUARY REQUIRED STC

Outdoor Sound Level	=	**65**	**dBA**
Source Geometry Correction:	=	**0**	**dBA**
Correction For Surface Reflection:	=	**3**	**dBA**
Target Indoor Noise Level:	=	**34**	**dBA**
Required Noise Reduction:	=	**34**	**dBA**

COMPONENT: Wall			STC Is:	**48**	
Noise Spectrum Type	**D**		Correction:		
Component Category	**d**			**7**	**dBA**
Room Floor Area:	**441**	**m²**			
Component Area:	**454.5**	**m²**	Correction:		
Component / Floor (%):	**103**	**%**			
Room Absorption Category:	**intermidiate**			**3**	**dBA**
Noise Reduction If Only This Component Transmits Sound Energy:				**38**	**dBA**
Component Transmits	**41**	% Of Sound	**Required Noise Reduction:**	**34**	**dBA**

COMPONENT: Window			Required Noise Reduction Is:	**34**	**dBA**
Percentage Of Sound Energy Transmitted:				**59**	**%**
Room Floor Area:	**441**	**m²**	Correction:	**2**	
Component Area:	**60**	**m²**			
Component / Floor (%):	**14**	**%**			
Room Absorption Category:	**intermidiate**		Correction:	**-6**	**dBA**
Noise Spectrum	**D**				
Component Category	**c**		Correction:	**4**	**dBA**
			Required STC Is:	**35**	

APPENDIX D

INSUL and IBANA-Calc Calculations

Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Multi-Purpose

Date:7/18/2017 **ProjectID:** GWE15-009

Outdoor level: NEF 35 or Leq24 67 or Ldn 68 dBA

Source Spectrum details:

100% Standard CMHC Source

Corrections:

Receiving room:

Floor Area: 120 m²
Absorbtion: 80% of floor area

Construction Description:

Element 1: EX2

Construction Type: Custom Wall
Area: 5.00 m²
Test ID: EX2
Test Date: 4/4/2016

Element 2: GL3_AIR13_GL6

Construction Type: Window
Area: 30.00 m²
Test ID: CMHC177.961.13
Test Date: 11/1/1996

Wood casement

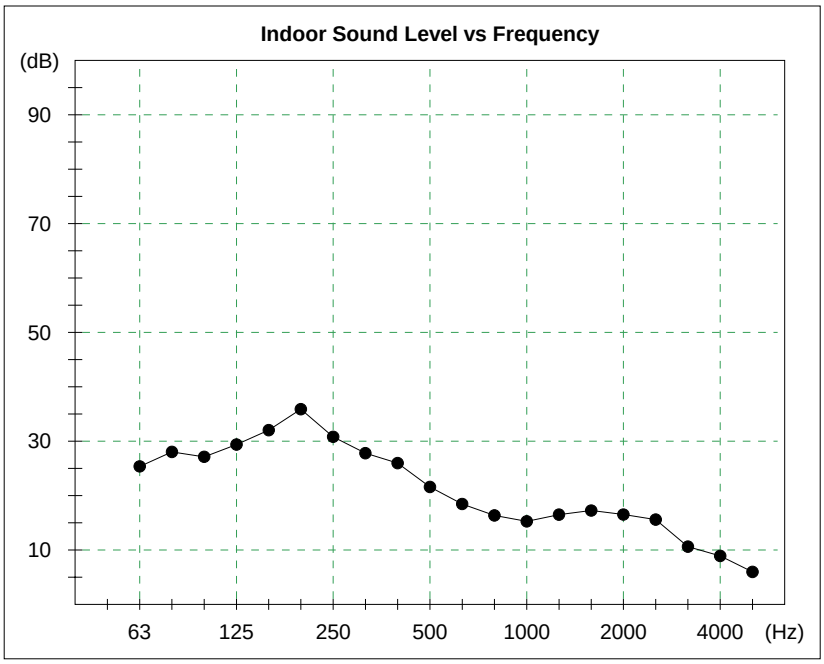
Element 3: R2

Construction Type: Custom Roof-ceiling
Area: 120.00 m²
Test ID: InsulR2
Test Date: 9/23/2016

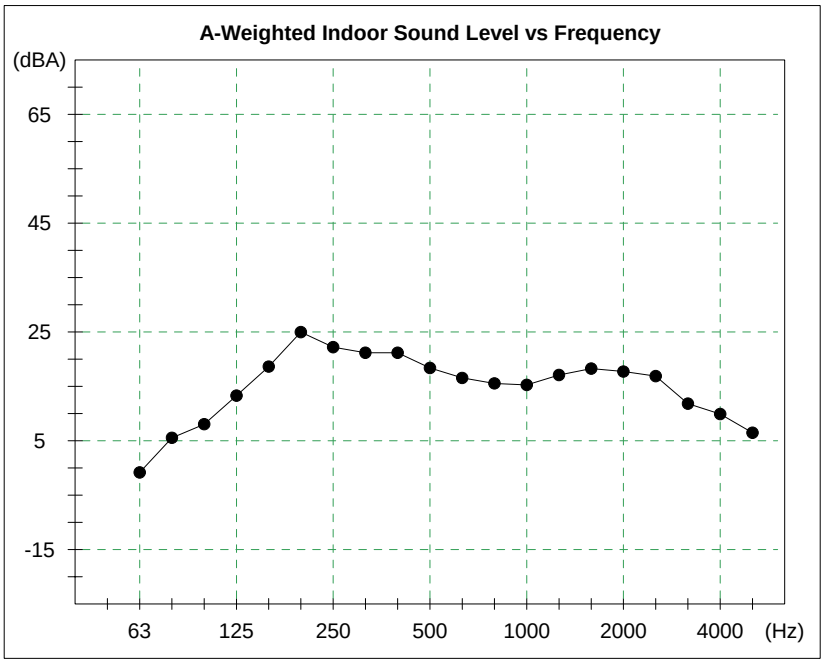
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Multi-Purpose

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	Sound Level (dB)
50	N/A
63	25.4
80	28.0
100	27.1
125	29.4
160	32.0
200	35.9
250	30.8
315	27.8
400	26.0
500	21.6
630	18.4
800	16.3
1000	15.3
1250	16.5
1600	17.3
2000	16.5
2500	15.6
3150	10.6
4000	8.9
5000	6.0

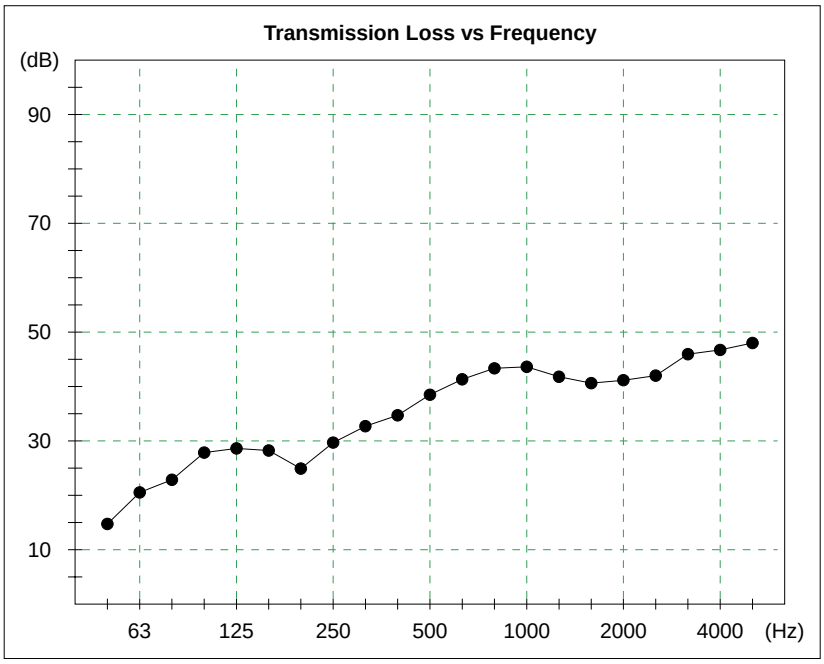


Frequency (Hz)	Sound Level (dBA)
50	N/A
63	-0.8
80	5.5
100	8.0
125	13.3
160	18.6
200	25.0
250	22.2
315	21.2
400	21.2
500	18.4
630	16.5
800	15.5
1000	15.3
1250	17.1
1600	18.3
2000	17.7
2500	16.9
3150	11.8
4000	9.9
5000	6.5

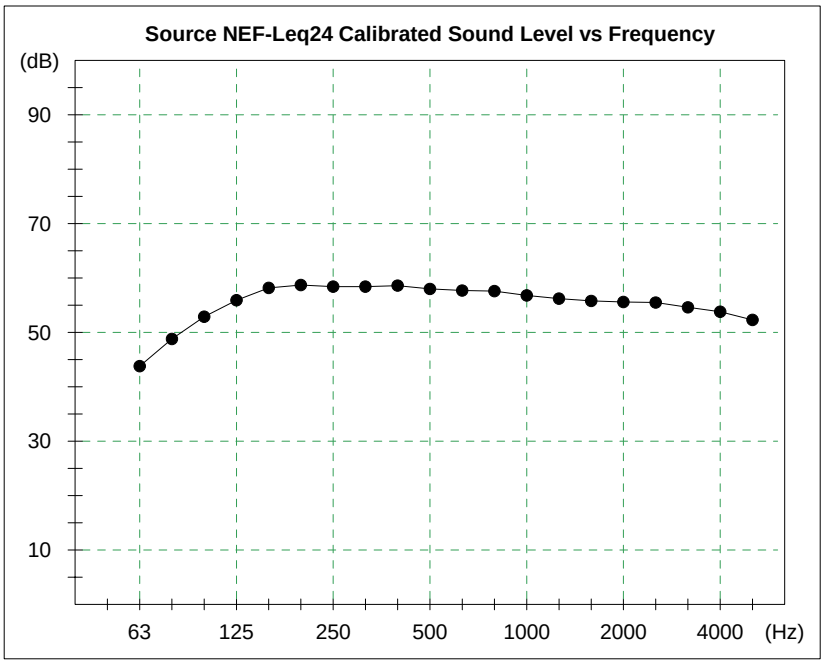
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Multi-Purpose

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	TL (dB)
50	15
63	21
80	23
100	28
125	29
160	28
200	25
250	30
315	33
400	35
500	38
630	41
800	43
1000	44
1250	42
1600	41
2000	41
2500	42
3150	46
4000	47
5000	48



Frequency (Hz)	Sound Level (dB)
50	N/A
63	43.8
80	48.8
100	52.9
125	55.9
160	58.2
200	58.7
250	58.4
315	58.4
400	58.6
500	58.0
630	57.7
800	57.6
1000	56.8
1250	56.2
1600	55.8
2000	55.6
2500	55.5
3150	54.6
4000	53.8
5000	52.3

Single Number Ratings:

Outdoor Sound Level:	67 dBA
Indoor Sound Level:	31 dBA
A-wtd Level Reduction:	36 dB
A-wtd Reduction re Standard Source:	32 dB
OITC Rating:	34 dB

Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Sancturary

Date:7/18/2017 **ProjectID:** GWE15-009

Outdoor level: NEF 35 or Leq24 67 or Ldn 68 dBA

Source Spectrum details:

100% Standard CMHC Source

Corrections:

Receiving room:

Floor Area: 441 m²
Absorbtion: 80% of floor area

Construction Description:

Element 1: EX2

Construction Type: Custom Wall
Area: 394.00 m²
Test ID: EX2
Test Date: 4/4/2016

Element 2: GL3_AIR13_GL6

Construction Type: Window
Area: 60.00 m²
Test ID: CMHC177.961.13
Test Date: 11/1/1996

Wood casement

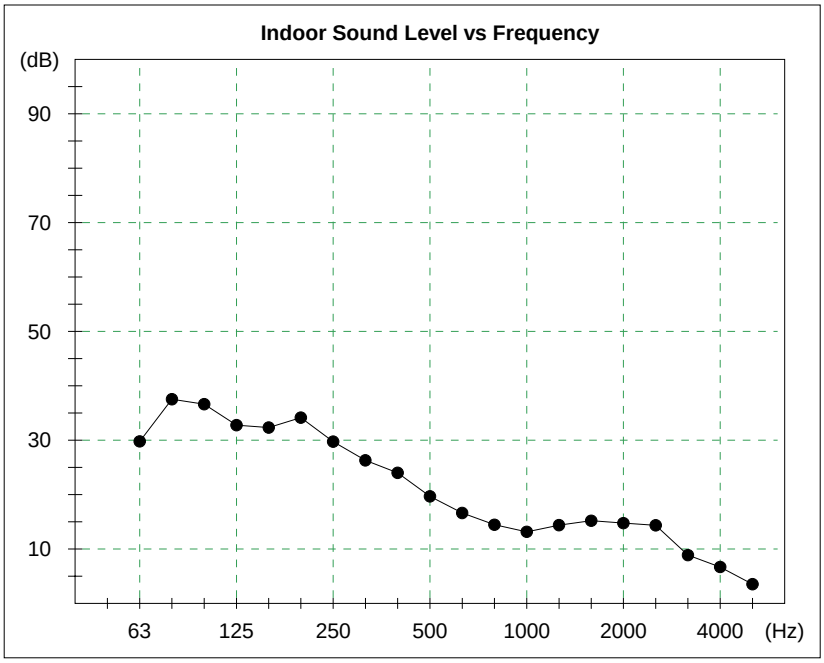
Element 3: R2

Construction Type: Custom Roof-ceiling
Area: 441.00 m²
Test ID: InsulR2
Test Date: 9/23/2016

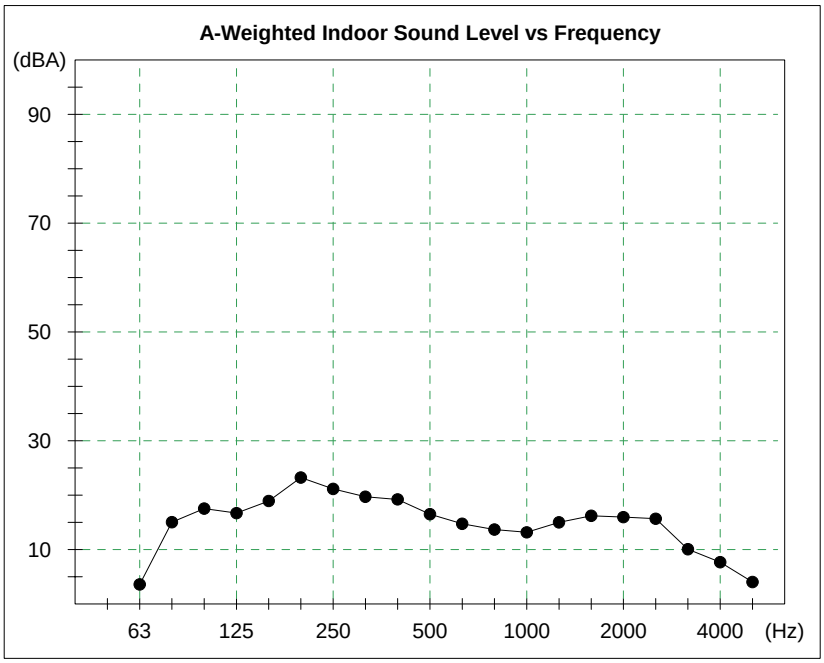
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Sancturary

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	Sound Level (dB)
50	N/A
63	29.8
80	37.5
100	36.6
125	32.8
160	32.3
200	34.1
250	29.7
315	26.3
400	24.0
500	19.7
630	16.6
800	14.5
1000	13.2
1250	14.4
1600	15.2
2000	14.7
2500	14.4
3150	8.9
4000	6.7
5000	3.5

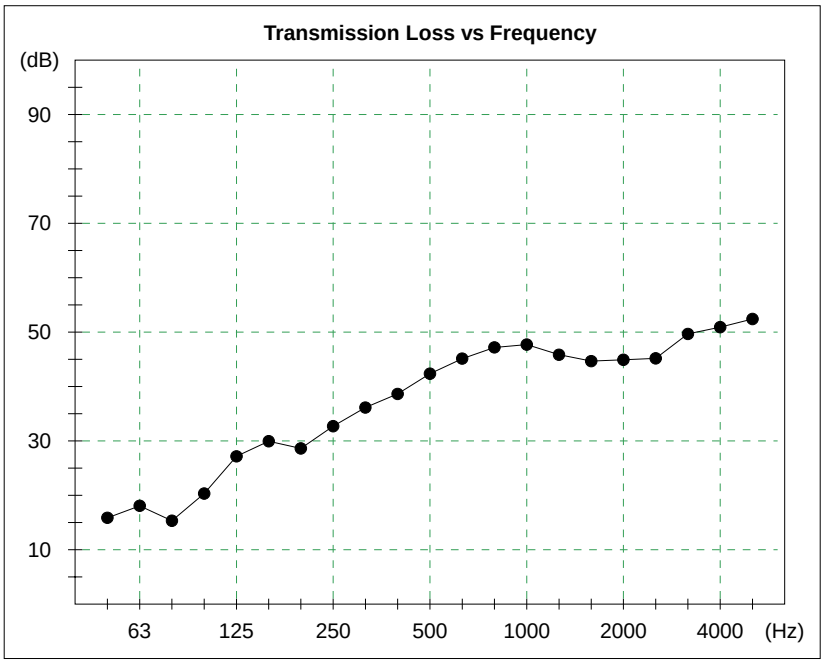


Frequency (Hz)	Sound Level (dBA)
50	N/A
63	3.6
80	15.0
100	17.5
125	16.7
160	18.9
200	23.2
250	21.1
315	19.7
400	19.2
500	16.5
630	14.7
800	13.7
1000	13.2
1250	15.0
1600	16.2
2000	15.9
2500	15.7
3150	10.1
4000	7.7
5000	4.0

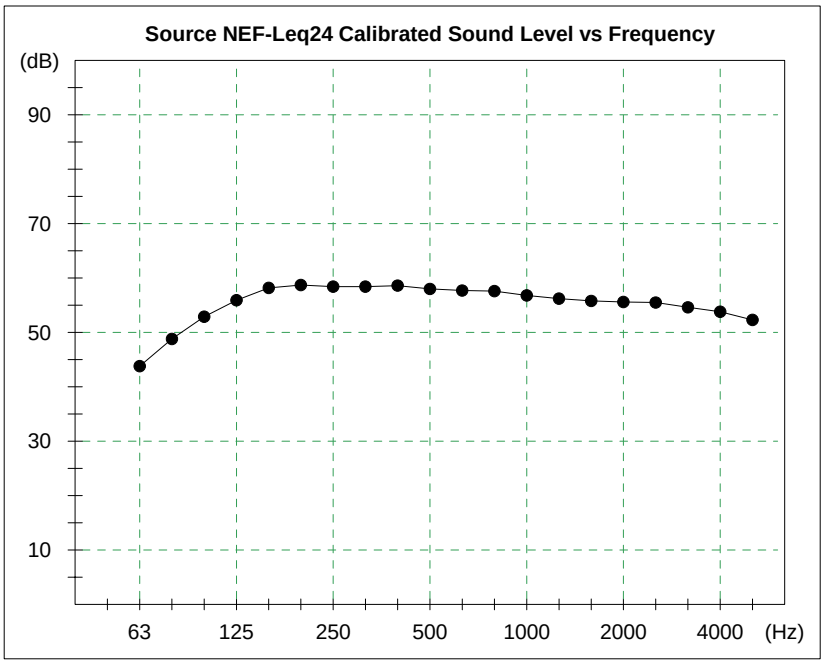
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Sancturary

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	TL (dB)
50	16
63	18
80	15
100	20
125	27
160	30
200	29
250	33
315	36
400	39
500	42
630	45
800	47
1000	48
1250	46
1600	45
2000	45
2500	45
3150	50
4000	51
5000	52



Frequency (Hz)	Sound Level (dB)
50	N/A
63	43.8
80	48.8
100	52.9
125	55.9
160	58.2
200	58.7
250	58.4
315	58.4
400	58.6
500	58.0
630	57.7
800	57.6
1000	56.8
1250	56.2
1600	55.8
2000	55.6
2500	55.5
3150	54.6
4000	53.8
5000	52.3

Single Number Ratings:

Outdoor Sound Level:	67 dBA
Indoor Sound Level:	30 dBA
A-wtd Level Reduction:	37 dB
A-wtd Reduction re Standard Source:	31 dB
OITC Rating:	32 dB

Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Worship and Gym

Date:7/18/2017 **ProjectID:** GWE15-009

Outdoor level: NEF 35 or Leq24 67 or Ldn 68 dBA

Source Spectrum details:

100% Standard CMHC Source

Corrections:

Receiving room:

Floor Area: 360 m²
Absorbtion: 90% of floor area

Construction Description:

Element 1: EX2

Construction Type: Custom Wall
Area: 691.00 m²
Test ID: EX2
Test Date: 4/4/2016

Element 2: R2

Construction Type: Custom Roof-ceiling
Area: 360.00 m²
Test ID: InsulR2
Test Date: 9/23/2016

Element 3: GL6_AIR9_GL8

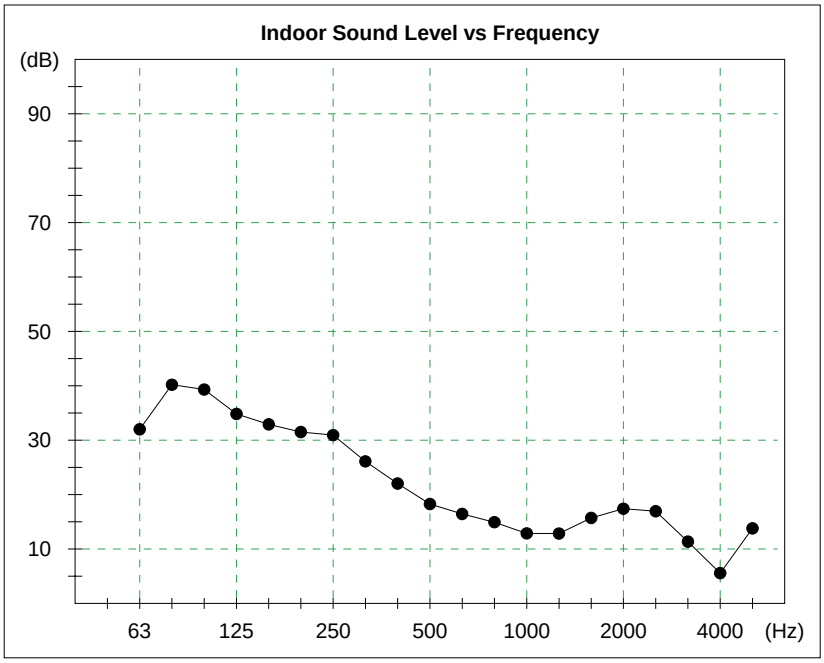
Construction Type: Glazing
Area: 50.00 m²
Test ID: CMHC177.961.6
Test Date: 11/1/1996

Thermopane only

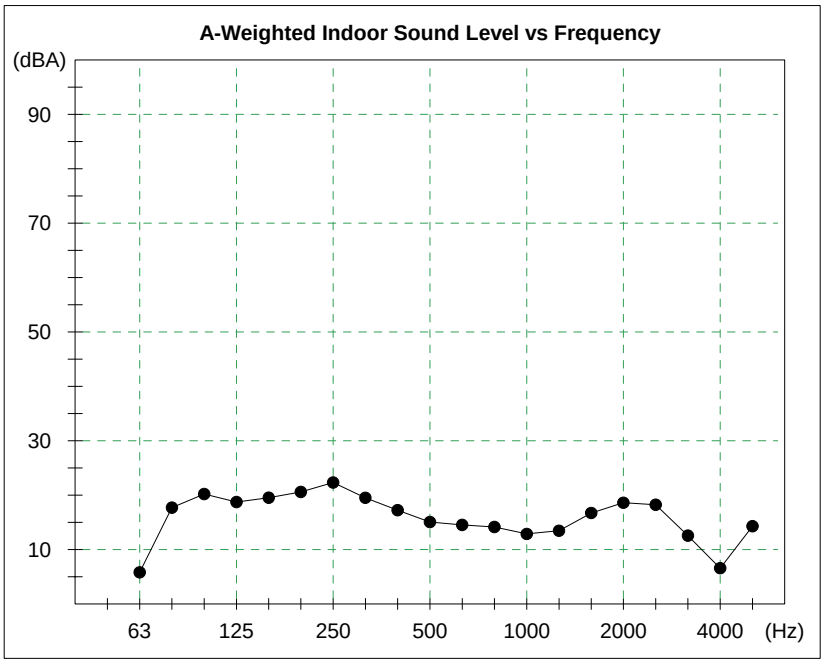
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Worship and Gym

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	Sound Level (dB)
50	N/A
63	32.0
80	40.2
100	39.3
125	34.8
160	32.9
200	31.5
250	30.9
315	26.1
400	22.0
500	18.3
630	16.4
800	14.9
1000	12.9
1250	12.9
1600	15.7
2000	17.4
2500	16.9
3150	11.3
4000	5.6
5000	13.8



Frequency (Hz)	Sound Level (dBA)
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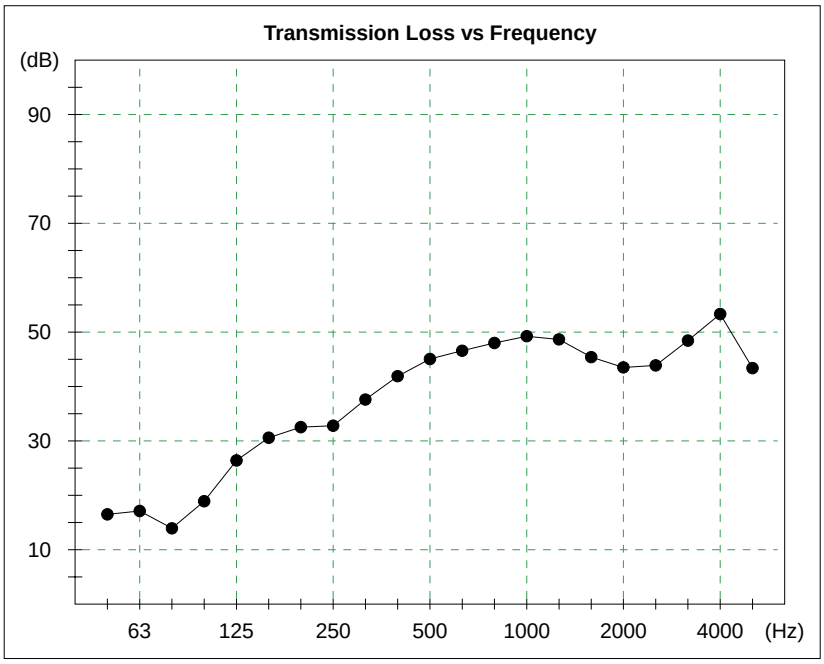
63	5.8
80	17.7
100	20.2
125	18.7
160	19.5
200	20.6
250	22.3
315	19.5
400	17.2
500	15.1
630	14.5
800	14.1
1000	12.9
1250	13.5
1600	16.7
2000	18.6
2500	18.2
3150	12.5
4000	6.6
5000	14.3

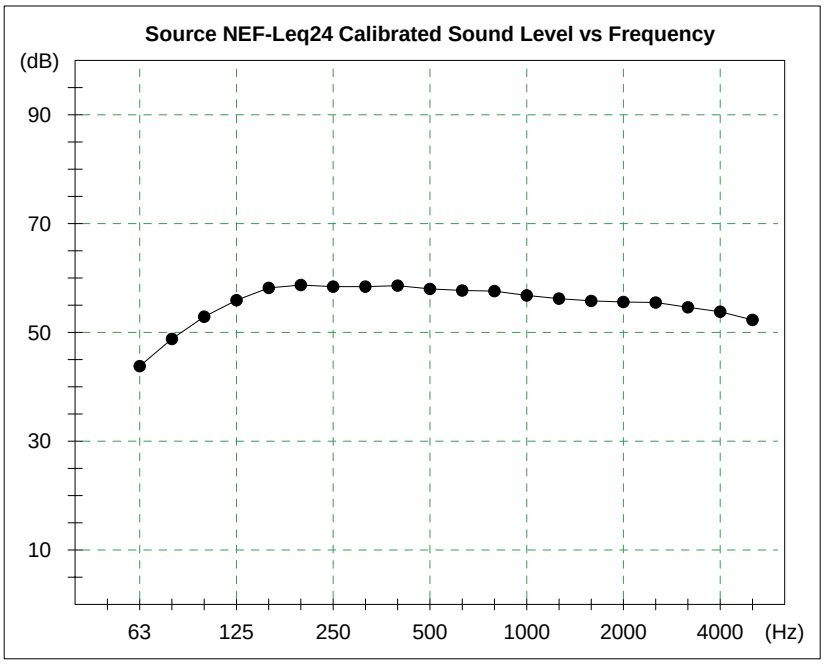
Aircraft Noise Sound Insulation - Scenario Calculation Results

Project: Salvation Army - Worship and Gym

Date:7/18/2017 **ProjectID:** GWE15-009



Frequency (Hz)	TL (dB)
50	17
63	17
80	14
100	19
125	26
160	31
200	33
250	33
315	38
400	42
500	45
630	47
800	48
1000	49
1250	49
1600	45
2000	44
2500	44
3150	48
4000	53
5000	43



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800	57.6
1000	56.8
1250	56.2
1600	55.8
2000	55.6
2500	55.5
3150	54.6
4000	53.8
5000	52.3

Single Number Ratings:

Outdoor Sound Level:	67 dBA
Indoor Sound Level:	31 dBA
A-wtd Level Reduction:	36 dB
A-wtd Reduction re Standard Source:	30 dB
OITC Rating:	31 dB

APPENDIX E

Ottawa International Airport Authority Correspondence

Michael Lafortune

From: Stecky-Efantis, Alexander <alexander.stecky-efantis@yow.ca>
Sent: October-04-16 3:24 PM
To: Beth Henderson; Kealey, Krista
Cc: Joshua Foster
Subject: RE: Barrhaven Salvation Army proposal

Hi Beth,

Thank you for coming to the airport last week to meet with us regarding the development proposal and for your follow-up call.

As requested, I would like to provide some additional information on the limited operations on runway 07/25 this August. There were three weeks when the runway was open; however, taxiway bravo, which is one of the ways to access runway 07/25 was restricted to certain size aircraft due to construction. During this time from August 6th to the end of the month, aircraft movement on runway 07/25 were limited. There were also two days (August 9th and 10th) where the runway was closed for pest control. Finally, the runway was also closed on August 31st and September 2nd for rubber removal maintenance.

Please let me know if you have any questions or require additional information.

Regards,
Alex

Alexander Stecky-Efantis
Manager, Airport Planning and Municipal Affairs
Ottawa International Airport Authority
Gestionnaire, Planification aéroportuaire et affaires municipales
Administration de l'aéroport international d'Ottawa

Tel. / Tél. : 613-248-2000x1909
Fax / Téléc. : 613-248-2021

From: Beth Henderson [mailto:bethhenderson@bell.net]
Sent: September-28-16 3:57 PM
To: Stecky-Efantis, Alexander; Kealey, Krista

Cc: Jeff_Barrett@can.salvationarmy.org; James_Mercer@can.salvationarmy.org; 'Joshua Foster'; Miguel Tremblay; Michaela_Jones@can.salvationarmy.org
Subject: Barrhaven Salvation Army proposal

Good afternoon Krista and Alex

Thank you for taking the time to meet with us today to discuss the Salvation Army Church's proposal at 102 Bill Leathem Drive. I believe the exchange of information and ideas was constructive and beneficial as we move forward in the development application process.

Through this email I will request that Joshua Foster contact Alex to obtain the dates that the main east west runway was not active or significantly below the normal usage due to the resurfacing during the on site monitoring that was conducted by Gradient engineering on the proposed site.
Also it would be great if you could send the proposed 2043 contour mapping that was discussed.

As discussed I will contact the city planner on this file and ensure that the airport authority is circulated on the next submission.

Thank you again for your time and consideration and we look forward to discussing the application with you or answering any of your questions that may arise upon review of the second submission.

Sincerely,
Beth Henderson