



Environmental Noise Feasibility Assessment

3095 Albion Road North

Ottawa, Ontario

REPORT: GWE15-119 – Noise R1

Prepared For:

Akram Farhat
Ahlul-Bayt Centre Ottawa (ABCO)
200 Baribeau Street
Ottawa, Ontario
K1L 7R6

Prepared By:

Michael Lafortune, Environmental Technologist
Joshua Foster, P.Eng., Partner

December 15, 2016

EXECUTIVE SUMMARY

This document describes an environmental noise assessment performed for a proposed place of worship, school and community centre to be located at 3095 Albion Road North in Ottawa, Ontario. The building will rise two-storeys above local grade. The major sources of noise in the area are from the Walkley Yard maintenance and storage facility to the southeast.

The assessment is based on: (i) theoretical noise prediction methods that conform to the Ministry of the Environment and Climate Change (MOECC), City of Ottawa, and Canadian Railway Association requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG) and (iii) architectural drawings received from SJL Architects Incorporated, base mapping information provided by the City of Ottawa and train information verified by the railway authorities.

The results of the stationary noise analysis indicate that noise levels will marginally exceed ENCG stationary noise criteria for a Class 1 area, but fall below criteria for a Class 4 area. We would therefore recommend the new development be considered as a Class 4 area. To designate as a Class 4 area, it is required that the installation of central air conditioning (or similar mechanical system) is incorporated into the design, which will allow building occupants to keep exterior windows and doors closed and maintain a comfortable indoor environment. Upon approval of this development being designated as a Class 4 area, a copy of this report and the notice of approval from the land-use planning authority (City of Ottawa) will be forwarded to the surrounding stationary noise source owners as per the requirements of the ENCG.

The results of the railway traffic noise analysis indicate that noise levels will reach 58 dBA during the daytime period (07:00-23:00) due to transportation sources. The highest noise levels will occur along the proposed south façade of the new institutional building, which is nearest and most exposed to the rail line. A complete set of noise control measures for the development is provided in Section 5.3.

TABLE OF CONTENTS

		PAGE
1.	INTRODUCTION	1
2.	TERMS OF REFERENCE	1
3.	OBJECTIVES	2
4.	METHODOLOGY	2
4.1	Background	2
4.2	Stationary Noise	3
4.2.1	Stationary Noise Criteria	3
4.2.2	Site Inspection	5
4.2.3	FTA Stationary Noise Calculations	5
4.2.4	Noise Monitoring	6
4.3	Railway Traffic Noise	8
4.3.1	Railway Traffic Noise Criteria	8
4.3.2	Railway Traffic Volumes	10
4.3.3	Theoretical Railway Noise Predictions	10
5.	RESULTS AND DISCUSSION	11
5.1	Stationary Noise Levels	11
5.1.1	FTA Stationary Noise Results	11
5.1.2	Noise Monitoring Results	12
5.2	Railway Traffic Noise Levels	14
5.3	Noise Control Measures	15
6.	CONCLUSIONS AND RECOMMENDATIONS	15

FIGURES

APPENDICES:

Appendix A – Stationary Noise Monitoring Results

Appendix B – STAMSON 5.04 Input and Output Data

1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by Ahlul-Bayt Centre Ottawa (ABCO) to undertake an environmental noise feasibility assessment for a proposed place of worship, school and community centre to be located at 3095 Albion Road in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to an environmental noise feasibility assessment. GWE's scope of work involved assessing exterior noise levels generated by stationary and transportation sources associated with the Walkley Yard maintenance and storage facility. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa¹ and Ontario Ministry of the Environment and Climate Change (MOECC)² guidelines, as well as Guidelines for New Development in Proximity to Railway Operations³ and on-site monitoring of ambient noise levels. Noise calculations were based on architectural drawings received from SJL Architects Incorporated, base mapping information provided by the City of Ottawa and train information verified by the railway authorities.

In relation to nearby rail operations, this report is focused on environmental noise. As the proposed building is located more than 75 metres (m) from the "rail line right of way"⁴, vibrations are not expected to be of concern as per the City of Ottawa's Official Plan Section 4.8.7. Safety concerns, such as perimeter fencing as outlined in the railway guidelines⁵, are addressed by others.

2. TERMS OF REFERENCE

The focus of this environmental noise feasibility assessment is a proposed place of worship, school and community centre. The proposed building will comprise a total floor area of 3,325 square meters (m²) and rise two-storeys above local grade. The operations of the school are expected between 08:00 and 15:00. The place of worship will be open daily with activities expected to occur between 07:00 and 23:00. Overnight, the building is expected to be vacant. The development is located near the intersection of Kitchener Avenue and Albion Road North. To the south and east of the development is the Walkley Yard

¹ City of Ottawa Environmental Noise Control Guidelines, January 2016

² Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

³ Dialog and J.E. Coulter Associates Limited, prepared for The Federation of Canadian Municipalities and The Railway Associated of Canada, May 2013

⁴ 75 metres from an existing or proposed light rail transit corridor

⁵ Dialog and J.E. Coulter Associates Limited, prepared for The Federation of Canadian Municipalities and The Railway Associated of Canada, May 2013

maintenance and storage facility. To the west is open space, with commercial and industrial uses to the north.

The major sources of noise in the area are from Walkley Yard and the associated rail lines. Walkley Yard includes maintenance and storage facilities (MSF) for both Canadian National (CN) Rail and OC Transpo. Future operations of the OC Transpo facility have been considered within this assessment and are based on probable expansion options outlined in the Trillium Line Expansion Environmental Assessment (EA), the preferred option shows building locations positioned farther east. All options however, would exhibit similar track alignment and building arrangements compared to existing site conditions. Similar activities are likely to continue with the addition of more buildings added either to the north, east or west of the current MSF. The activities which occur at the OC Transpo facility include cleaning the interior of the vehicles, washing the outside of the vehicles and inspections and replacement of mechanical components. Most of these activities occur indoors. During early morning hours (05:00 to 06:00) and late night hours (00:00 to 01:00), trains are marshalled in and out of the yard past the 3095 Albion site, to and from the Trillium Line. To the north of the site is a commercial development with various businesses, including a lumber yard and trucking equipment facility. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The main goals of this work are to: (i) calculate the future noise levels on the study building produced by local railway traffic, (ii) determine outdoor noise impacts from existing surrounding stationary noise sources, and (iii) ensure that noise levels do not exceed the allowable limits specified by the ENCG as outlined in Section 4.2 and 4.3 of this report.

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.

4.2 Stationary Noise

Stationary sources are defined in the City of Ottawa's ENCG as: "all sources of sound and vibration, whether fixed or mobile, that exist or operate on a premises, property or facility. The combined sound and vibration levels of which are emitted beyond the property boundary of the premises, property or facility, unless the source(s) is (are) due to construction". The significant stationary sources in operation in the study area are an OC Transpo Trillium Line (O-Train) maintenance and storage facility and a Canadian National Railway (CN) rail yard. There is also a commercial / light industrial development to the north.

The assessment of stationary noise was based upon a combination of theoretical and onsite noise measurements. Theoretical calculations were based upon methodology developed by the United States Federal Transit Authority⁶. This method is based on a number of test facilities similar to the OC Transpo and CN rail yards. Appropriate reference sound levels are provided, with procedures of determining impacts at various set back distances from the facility. The full methodology is described in section 4.2.3 and details of the on-site monitoring are outlined in Section 4.2.4.

4.2.1 Stationary Noise Criteria

The equivalent sound energy level, L_{eq} , provides a weighted 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 selected period of time. For stationary sources, the L_{eq} is commonly calculated on an hourly interval, while for roadways, the L_{eq} is calculated on the basis of a 16-hour daytime / 8-hour nighttime split. For impulsive noise, such as shunting of trains, an impulse L_{eq} , noted as L_{ieq} is used.

Noise criteria taken from the ENCG apply to outdoor points of reception (POR) on the property; for daytime operations, it is considered 30 m from a dwelling, and for nighttime operations the plane of window (POW). According to this document, the recommended maximum noise levels in an urban

⁶ FTA, Transit Noise and Vibration Impact Assessment, May 2006
Ahlul-Bayt Centre Ottawa – 3095 Albion Road North
Environmental Noise Feasibility Assessment

environment (Class 1 Area) are the higher of the limits set out in Tables 1 and 2, or the noise produced by transportation sources, whichever is greater⁷. Generally, the site is considered to be in a Class 1 area as it is within the urban boundary and background noise levels are expected to be dominated by transportation and other sources.

The ENCG also allows for the consideration of a Class 4 area for new proposed noise sensitive land uses where central air conditioning will form an integral part of the design. For a development to be considered a Class 4 area, the planning authority must agree to the condition. Once the development has been approved as a Class 4 area, the surrounding source owners will be notified and can then use the Class 4 designation for their approval process with the MOECC. Table 1 summarizes the Class 4 sound level limits for steady and varying sound and Table 2 describes the impulsive sound level limits. Impulsive sound level limits are dependent on the number of impulses observed during any one-hour period.

TABLE 1: ENCG EXCLUSIONARY SOUND LEVEL LIMITS STEADY AND VARYING SOUND

Time of Day	Noise Level Limits (dBA) Class 1		Noise Level Limits (dBA) Class 4	
	Outdoor Point of Reception	Plane of Window	Outdoor Point of Reception	Plane of Window
07:00 – 19:00	50	50	55	60
19:00 – 23:00	50	50	55	60
23:00 – 07:00	N/A	45	N/A	55

⁷ City of Ottawa Environmental Noise Control Guidelines, January 2016
 Ahlul-Bayt Centre Ottawa – 3095 Albion Road North
 Environmental Noise Feasibility Assessment

TABLE 2: ENCG EXCLUSIONARY SOUND LEVEL LIMITS IMPULSIVE SOUND

Time of Day	Number of Impulses in one hour period	Noise Level Limits (dBAI) Class 1		Noise Level Limits (dBAI) Class 4	
		Outdoor Point of Reception	Plane of Window	Outdoor Point of Reception	Plane of Window
07:00 – 19:00	≥9	50	50	55	60
	7 to 8	55	55	60	65
	5 to 6	60	60	65	70
	4	65	65	70	75
	3	70	70	75	80
	2	75	75	80	85
	1	80	80	85	90
23:00 – 07:00	≥9	-	45	-	55
	7 to 8	-	50	-	60
	5 to 6	-	55	-	65
	4	-	60	-	70
	3	-	65	-	75
	2	-	70	-	80
	1	-	75	-	85

4.2.2 Site Inspection

GWE conducted a visit to the site on December 8, 2015, as well as November 8, November 10, November 21, December 1 and December 5, 2016. During the site visits, it was observed that the dominant source of noise was the CN Rail Yard, as well as some noise originating from the OC Transpo facility. Noise originating from the commercial and industrial site to the north was found to be relatively quiet, apart from the occasional in and out movement of trucks. Common sources of noise included the movement of diesel equipment and locomotives, shunting of cars and brake squeal on rail cars, all noises typically associated with a rail yard and storage and maintenance facility.

4.2.3 FTA Stationary Noise Calculations

Stationary noise prediction methods were based on a protocol developed by the United States of America, the Federal Transit Administration (FTA) has produced a document entitled: ‘Transit Noise and Vibration Impact Assessment⁸’. This document provides a general assessment and screening procedures for the computation of stationary noise impacts from rail yards. The general assessment has been based on noise source and land-use information discussed in Sections 4.2.1 and 4.2.2.

⁸ C. E. Hanson; D. A. Towers; and L. D. Meister, Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

The general assessment for stationary noise begins with determining a reference sound exposure level (SEL) at 50 feet from the center of the site. A value of 118 dBA is provided for Yards and Shops similar to that of the OC Transpo and CN facilities at Walkley Yard. A reference SEL of 109 dBA is provided for layover tracks. After reference SEL's have been determined for each defined noise source, an hourly L_{eq} can be calculated based on the train volumes associated with each noise source. It is assumed that both OC Transpo and CN facility sources could have up to 20 train activities per hour. The layover track source considers one diesel locomotive idling for a total of one-hour at the CN facility.

The following equation was used to extrapolate hourly L_{eq} 's at 50 feet to points of reception on the study building. Where a barrier breaks the line of sight between the receiver and the source, an attenuation value of 5 dBA can be applied.

$$L_2=L_1-20\log(R_2/R_1)$$

Where:

L_1 is the calculate L_{EQ} sound level

L_2 is the extrapolated sound level

R_1 is equal to 50 feet

R_2 is the distance from source to point of reception

4.2.4 Noise Monitoring

In addition to theoretical calculations, assessment of stationary noise across the site was also determined 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. Because there was no power at the site, 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 November 8th through to December 5th, 2016. A four-week time frame was selected to capture a statistically relevant set of data, allowing for daily changes in trainyard operations and meteorological conditions. 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 Photograph 1. The Brüel and Kjær (B&K) noise monitoring station is illustrated in Photograph 2 below. The measurement location was selected to represent the east side of the Mosque which is most exposed to the stationary sources. The location also considered security of the equipment.



PHOTOGRAPH 1: VIEW OF MICROPHONE ON STATION LOOKING NORTH



PHOTOGRAPH 2: INTERNAL COMPONENTS OF NOISE MONITORING STATION

4.3 Railway Traffic Noise

4.3.1 Railway Traffic Noise Criteria

For railway 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 railways, 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 noise sensitive buildings.

For rail traffic, the ENCG specifies that the recommended indoor noise limit range (that is relevant to this study) is 40 dBA for places for worship, schools and community centres, as outlined in Table 3 below. Based on GWE's experience, more comfortable indoor noise levels should be targeted toward 37 dBA to control peak noise and deficiencies in building envelope construction.

TABLE 3: INDOOR SOUND LEVEL CRITERIA (ROAD & RAIL)⁹

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

Due to the characteristics of rail noise which occur over short periods (i.e. whistles, brake squealing), and a significant low frequency component produced by the movement of the locomotive along the track, road and rail traffic noise require separate analyses, particularly when assessing indoor sound levels. In order to account for the special character of railway sound, the indoor sound level criteria are more stringent by 5 dB as compared to the road traffic criteria. This difference typically results in requirements for upgraded glazing elements to provide better noise attenuation by the building envelope. Interior noise level criteria include the influence from rail crossings and warning whistle bursts.

Predicted noise levels at the plane of window (POW) and outdoor living area (OLA) 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. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning (or similar systems). Where noise levels exceed 60 dBA daytime and 55 dBA nighttime, building components will require higher levels of sound attenuation.

In addition, the exterior walls are to be built to a minimum of brick veneer or masonry equivalent construction, from the foundation to the rafters when the rail traffic L_{eq} (24-hour), estimated at a location of a nighttime receptor, is greater than 60 dBA, and when the development is within 100 metres of the tracks.

⁹ Adapted from ENCG 2016 – Tables 2.2b and 2.2c
Ahlul-Bayt Centre Ottawa – 3095 Albion Road North
Environmental Noise Feasibility Assessment

4.3.2 Railway Traffic Volumes

The ENCG recommends the use of future rail traffic volumes obtained from the applicable rail authority. In the absence of future rail traffic volumes, the existing data should be increased at an annual rate of 2.5% per year for a minimum of 15 years after the expected construction completion date. Projected daily rail traffic data are based information available from the Trillum Line Extension EA. Table 4 below summarizes the rail traffic volumes considered in the assessment. Within Walkley Yard, the dominant source of transportation noise is the movement of trains from one area to another. As a conservative measure, these train movements were assumed to comprise heavy rail diesel locomotive CN trains with 10 cars, as well as the 4-car O-Train vehicles.

TABLE 4: RAILWAY TRAFFIC DATA

Railway	Train Class	Speed Limit (km/h)	Projected 2030 Rail Train Movements
CN Rail	Diesel (Freight)	40	192/24*
O-Train	Diesel (Passenger)	50	192/24*

*- Daytime and nighttime train movements

4.3.3 Theoretical Railway Noise Predictions

Calculations were performed for receptors in close proximity to the railway with the assistance of the (MOECC) rail and road noise analysis program STAMSON 5.04 which incorporates the calculation model 'Sound from Trains Environment Analysis Method' (STEAM). The impact from railway noise is then compared to the relevant criteria.

The CN railway and O-Train lines were treated as single line sources of noise which use existing building locations as noise barriers. In addition to the railway volumes summarized in Table 4, theoretical noise predictions were also based on the following parameters:

- All trains operating in the area are diesel trains
- One locomotive was modelled per CN train, with an average of 10 cars per train
- 4-Car SRT source used for O-Train line

- CN trains entering the yard are travelling at 40 km/h while OC Transpo trains are travelling at 50 km/h
- As no crossings are near the development, whistles are not used
- Rail lines are not welded

5. RESULTS AND DISCUSSION

5.1 Stationary Noise Levels

5.1.1 FTA Stationary Noise Results

The results of the FTA stationary noise calculations indicate that noise levels will marginally exceed the ENCG criteria for a Class 1 area; but fall, however, below criteria for a Class 4 area which assumes the study building has exterior windows and doors closed. Noise levels at the nearest façade to the Walkley Yard facilities (Receptor 1) are expected to approach 58 dBA as detailed in Table 5. As the playground (Receptor 4) is primarily on the west side of the building and a wood acoustic barrier is proposed along the south property line, the noise levels expected at the playground are expected to be 53 dBA accounting for barrier effects as per Section 4.2.3.

TABLE 5: FTA EXTERIOR NOISE LEVELS DUE TO STATIONARY NOISE

Source	Distance to Receptor (m)	Noise Level (dBA)	ENCG Class 4 Criteria (dBA)	Meets ENCG Class 4 Criteria
OC Transpo Yard	319	56	60	YES
CN Yard	430	53		YES
CN Layover Track	312	47		YES
Total	N/A	58		YES

As the building is being considered as a place of worship, school and community centre where central air conditioning (or similar mechanical system) will be provided as part of the design, we would recommend the development be considered within a Class 4 area which will allow building occupants to keep exterior windows and doors closed and maintain a comfortable indoor environment. Under this consideration, stationary noise sound level criteria can be met. A Warning Clause will be required to be placed on title.

5.1.2 Noise Monitoring Results

Based on the on-site monitoring, the hourly equivalent sound pressure levels (L_{eq}) and hourly equivalent impulsive sound pressure levels (L_{ieq}) for each day are presented alongside the L_{a10} and L_{a95} percentile averages for the 12-hour daytime, 4-hour evening and 8-hour nighttime periods in Appendix A. The daytime period is defined between 07:00 and 19:00, the evening period from 19:00 to 23:00 and the nighttime period from 23:00 to 07:00.

As can be seen from the on-site monitoring results, the maximum 10th percentile sound pressure level L_{a10} was found to be 59 dBA. This indicates that for that one hour period measured, 90% of the sound energy falls below 59 dBA. Furthermore, hourly equivalent sound pressure levels (L_{eq}) were found to fall below the criteria for a Class 4 area of 60 dBA >99% of the time. The L_{eq} is less than 56 dBA 97% of the time. Impulsive sound levels were also found to be below the sound level limits for impulsive noise. Comparison of the logged data for the highest recorded L_{ieq} confirmed the number of events per hour. Table 6 summarizes the overall statistics from the measurement data.

TABLE 6: NOISE MONITORING EXTERIOR NOISE LEVELS DUE TO STATIONARY NOISE

Statistic	1-Hour L_{eq} (Steady)	1-Hour L_{ieq} (Impulsive)
Mean	49	52
Minimum	36	67
Maximum	61	70
Standard Deviation	4	6
% of time > 56 dBA	2.6	17.8
% of time >58 dBA	1.6	9.3
% of time > 60 dBA	0.4	6.3
% of time > 65 dBA	0	4.5

It can therefore be concluded that the assumptions of the theoretical analysis are acceptable, and that the proposed noise control measures will be adequate to ensure ENCG compliance for indoor and outdoor sound levels. A sample of the hourly time history L_{eq} is presented in Charts 1 and 2 below. The highest noise levels occur during the early morning hours when trains marshal past the site. These activities,

however, occur when the proposed building would be unoccupied. At this point the trains have left the MSF and noise would be considered more as a transportation source and less as a stationary source.

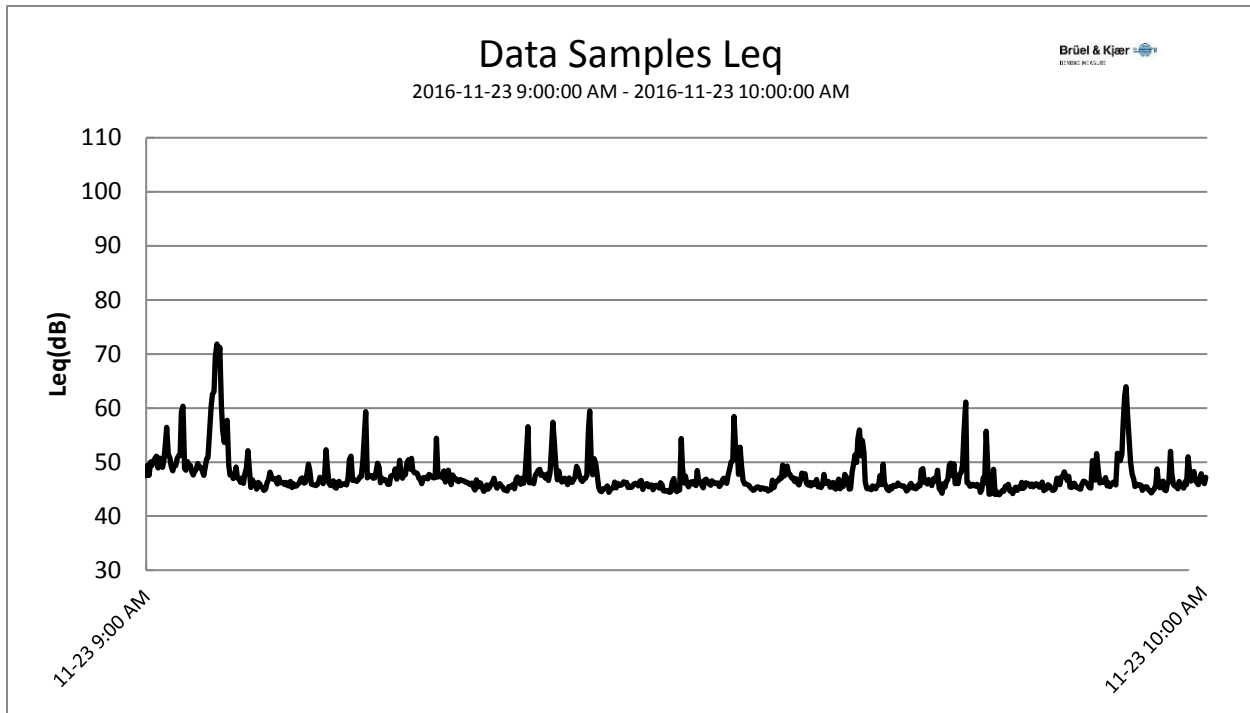


CHART 1: HOURLY TIME HISTORY – TYPICAL SAMPLE AVERAGE RECORDED L_{eq} 52 dBA

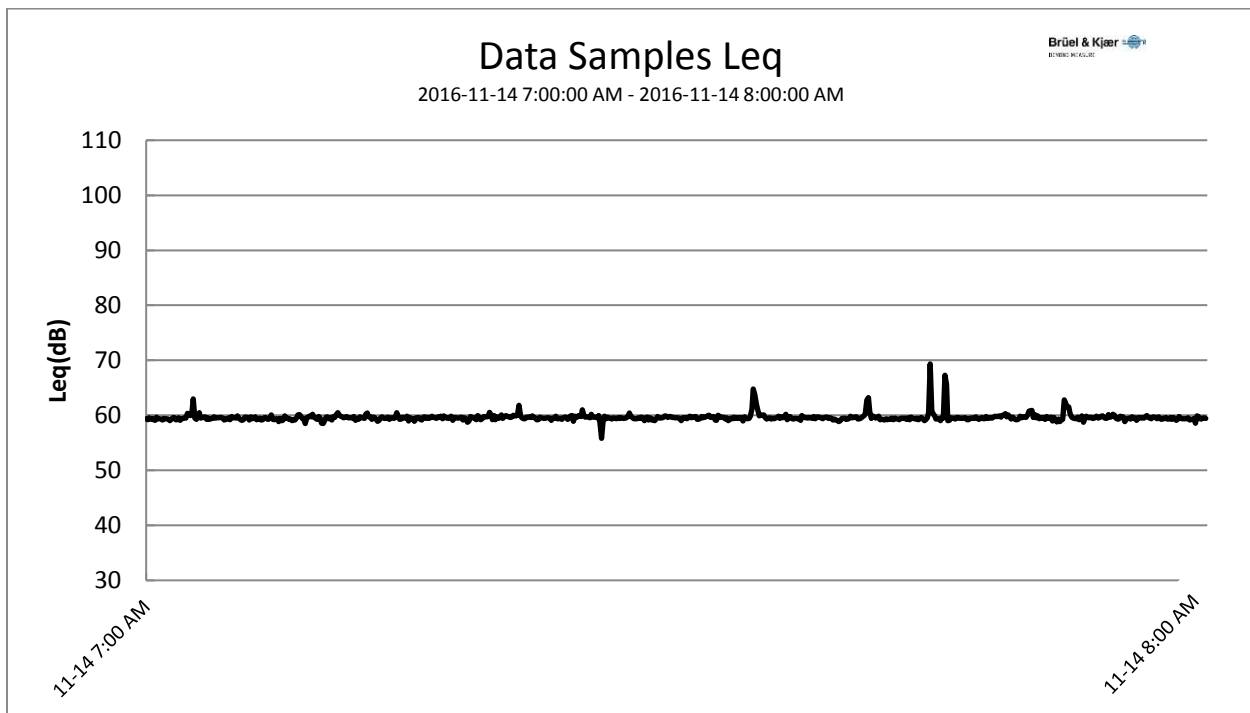


CHART 2: HOURLY TIME HISTORY – TYPICAL SAMPLE OF HIGHER RECORDED L_{eq} 60 dBA

5.2 Railway 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 7 below.

TABLE 7: EXTERIOR NOISE LEVELS DUE TO RAILWAY TRAFFIC

Receptor Number	Plane of Window Receptor Location	Noise Level (dBA)	
		Day	Night
1	POW – 2 nd Floor – East Façade	54	48
2	POW – 2 nd Floor – South Façade	58	52
3	POW – 2 nd Floor – West Façade	54	48
4	OLA – Ground Level – Playground Area	56	49

The results of the current analysis indicate that noise levels will reach 58 dBA during the daytime period (07:00-23:00). The highest noise levels occur along the south façade, which is nearest and most exposed to Walkley Yard.

As noise levels are greater than 55 dBA, the development will incorporate the installation of central air conditioning (or similar mechanical system) as part of compliance for stationary noise, also meeting the ventilation requirements for transportation noise, which will reduce the indoor noise levels to 40 dBA. In addition, a Warning Clause will be required on title, including Purchase, Sale and Lease Agreements.

Noise levels at the playground are expected to approach 56 dBA during the daytime period. According to the ENCG, if this is to be used as an outdoor living area, noise levels should be mitigated to 55 dBA where technically and administratively feasible. Investigation into the application of a 2.2-meter tall (referenced from local grade at the playground area) noise barrier along the southwest property line proved that noise levels can be reduced to 53 dBA, as illustrated in Figure 2. The barrier should be constructed in accordance with the requirements in Part 5 of the ENCG, and have a minimum surface density of 20 kg/m². Table 8 summarizes the results of the barrier investigations at the playground.

TABLE 8: RESULTS OF BARRIER INVESTIGATION

Location	Reference Receptors	Barrier Height (m)	Daytime L_{eq} Noise Levels (dBA)	
			Without Barrier	With Barrier
Playground	4	2.2	56	53

5.3 Noise Control Measures

To control noise impacts on the development, the following noise control measures are recommended:

- (i) Exterior windows around the perimeter of the building should have a minimum STC of 30
- (i) Exterior wall components around the perimeter of the building should have a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data¹⁰
- (ii) The building will be furnished with a heating and cooling system, such as central air conditioning or similar mechanical system, to allow windows to remain closed
- (iii) A 2.2 m tall acoustic barrier will be installed along the south property line
- (iv) The development should be considered as Class 4 Area for stationary noise

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the stationary noise analysis indicate that noise levels will marginally exceed ENCG stationary noise criteria for a Class 1 area, but fall below criteria for a Class 4 area. We would therefore recommend the new development be considered as a Class 4 area. To designate as a Class 4 area, it is required that the installation of central air conditioning (or similar mechanical system) is incorporated into the design, which will allow building occupants to keep exterior windows and doors closed and maintain a comfortable indoor environment. Upgrades to building components, as per Section 5.3, are also recommended. Upon approval of this development being designated as a Class 4 area, a copy of this report and the notice of approval from the land-use planning authority (City of Ottawa) will be forwarded to the surrounding stationary noise source owners as per the requirements of the ENCG.

The results of the railway traffic noise analysis indicate that noise levels will reach 58 dBA during the daytime period (07:00-23:00) due to transportation sources. The highest noise levels occur along the

¹⁰ J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

south façade, which is nearest and most exposed to the rail line. Recommendations for noise control are provided in Section 5.3.

The following Warning Clause¹¹ will also be required on titles, including Purchase, Sale and Lease Agreements:

“Purchasers/tenants are advised that sound levels due to increasing rail traffic, rail yard and industrial activities may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment and Climate Change

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

- *Multi-pane glass (minimum STC 30)*
- *Brick cladding or an acoustic equivalent (minimum STC 45)*
- *an acoustic barrier which is owned and maintained on private property*

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

To help address the need for sound attenuation, this building has been designed with air conditioning (or similar mechanical system). 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 and Climate Change.

Purchasers/tenants are further advised that sound levels due to the adjacent industry and rail yard facilities are required to comply with sound level limits that are protective of indoor areas and are based on the assumption that windows and exterior doors are closed. This building has been supplied with a ventilation / air conditioning system which will allow windows and exterior doors to remain closed.

¹¹ City of Ottawa Environmental Noise Control Guidelines, January 2016
Ahlul-Bayt Centre Ottawa – 3095 Albion Road North
Environmental Noise Feasibility Assessment

Noise levels at the playground are expected to approach 56 dBA during the daytime period. According to the ENCG, if this is to be used as an outdoor living area, noise levels should be mitigated to 55 dBA where technically and administratively feasible. Investigation into the application of a 2.2-metre tall (referenced from local grade at the playground area) noise barrier along the southwest property line proved that noise levels can be reduced to 53 dBA, as illustrated in Figure 2. The barrier should be constructed in accordance with the requirements in Part 5 of the ENCG, and have a minimum surface density of 20 kg/m². Table 8 summarizes the results of the barrier investigations at the playground.

As the development is within 300 metres of a CN Rail line, CN will require an environmental easement and the following Warning Clause to be included in all Agreements of Lease, Purchase, and Sale:

“Canadian National Rail or their assigns or successors in interest have rights-of-way within 300 meters from the land subject hereof. There may be alteration to or expansions of the railway facilities on such rights-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings. The railways will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.”

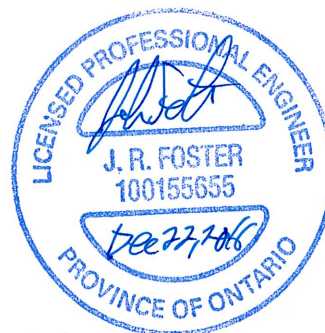
This concludes our assessment and report. If you have any questions or wish to discuss our findings please advise us. In the interim, we thank you for the opportunity to be of service.

Yours truly,

Gradient Wind Engineering Inc.



Michael Lafortune
Environmental Technologist
GWE15-119 – Noise R1



Joshua Foster, P.Eng.
Partner



FIGURE 1:
RECEPTOR AND NOISE SOURCE LOCATIONS

DESCRIPTION

PROJECT 3095 ALBION ROAD NORTH - FEASIBILITY NOISE STUDY

SCALE 1:3000 (APPROX)

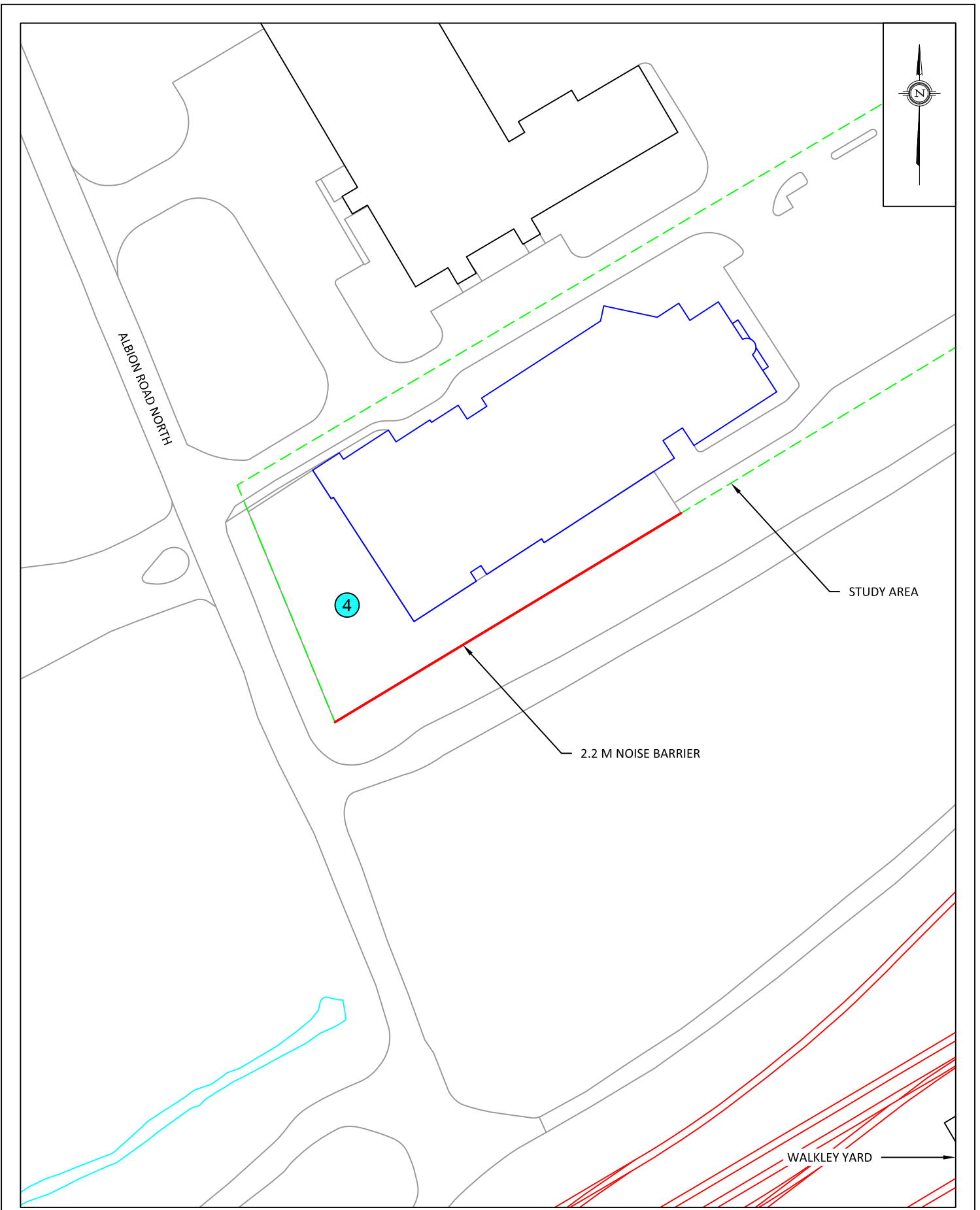
DRAWING NO. GWE15-119-1

DATE DECEMBER 13, 2016

DRAWN BY M.L.

127 Walgreen Road
Ottawa, Ontario
(613) 836 0934





APPENDIX A

STATIONARY NOISE MONITORING RESULTS

	Time	Leq (1H)	Lieq (1H)	Influence	LA10	LA95	Wind Speed	Temperature	Weather
08/11/2016	1:00	-	-	Ambient					
	2:00	-	-	Ambient					
	3:00	-	-	Ambient					
	4:00	-	-	Ambient	-	-			
	5:00	-	-	Ambient					
	6:00	-	-	Ambient					
	7:00	-	-	Ambient					
	8:00	-	-	Ambient					
	9:00	-	-	Ambient					
	10:00	52	55	Ambient					
	11:00	50	52	Ambient					
	12:00	48	50	Ambient	53	45	<31	9.1	Partly Cloudy
	13:00	49	52	Ambient					
	14:00	54	56	Ambient					
	15:00	52	54	Ambient					
	16:00	51	53	Ambient					
	17:00	52	53	Ambient					
	18:00	52	54	Ambient					
	19:00	52	54	Ambient					
	20:00	52	54	Ambient	53	48			
	21:00	51	52	Ambient					
	22:00	51	53	Ambient					
09/11/2016	23:00	49	51	Ambient					
	0:00	48	68	Ambient					
	1:00	46	48	Ambient					
	2:00	46	49	Ambient	49	41			
	3:00	43	44	Ambient					
	4:00	43	44	Ambient					
	5:00	49	52	Ambient					
	6:00	53	55	Ambient					
	7:00	53	55	Ambient					
	8:00	52	57	Ambient					
	9:00	50	52	Ambient					
	10:00	53	57	Ambient					
	11:00	52	56	Ambient					
	12:00	53	57	Ambient	53	43	46	3.9	Partly Cloudy
	13:00	50	53	Ambient					
	14:00	49	53	Ambient					
	15:00	51	55	Ambient					
	16:00	51	53	Ambient					
	17:00	50	52	Ambient					
	18:00	47	48	Ambient					
	19:00	45	46	Ambient					
	20:00	43	46	Ambient	46	38			
21:00	40	41	Ambient						
22:00	-	-	Ambient						
	23:00	-	-	Ambient					
	0:00	-	-	Ambient					
	1:00	-	-	Ambient					
	2:00	-	-	Ambient					
	3:00	-	-	Ambient	-	-			
	4:00	-	-	Ambient					
	5:00	-	-	Ambient					
	6:00	-	-	Ambient					
	7:00	-	-	Ambient					
8:00	52	55	Ambient						
9:00	52	54	Ambient						

10/11/2016	10:00	54	57	Ambient	56	48	54	4.4	Partly Cloudy
	11:00	52	56	Ambient					
	12:00	56	59	Ambient					
	13:00	56	59	Ambient					
	14:00	55	57	Ambient					
	15:00	54	56	Ambient					
	16:00	54	56	Ambient					
	17:00	55	57	Ambient					
	18:00	49	50	Ambient					
	19:00	50	52	Ambient					
11/11/2016	20:00	49	51	Ambient	51	39	72	5.8	Partly Cloudy
	21:00	47	49	Ambient					
	22:00	48	51	Ambient					
	23:00	48	51	Ambient					
	0:00	47	68	Ambient					
	1:00	42	45	Ambient					
	2:00	46	49	Ambient					
	3:00	44	46	Ambient					
	4:00	53	57	Ambient					
	5:00	49	52	Ambient					
	6:00	53	55	Ambient					
	7:00	53	56	Ambient					
	8:00	55	59	Ambient					
	9:00	55	58	Ambient					
	10:00	55	58	Ambient					
	11:00	53	55	Ambient					
	12:00	55	58	Ambient					
	13:00	55	59	Ambient					
	14:00	55	59	Ambient					
	15:00	54	57	Ambient					
	16:00	54	57	Ambient					
	17:00	49	51	Ambient					
18:00	48	50	Ambient						
19:00	49	53	Ambient						
12/11/2016	20:00	44	46	Ambient	43	35	50	1	Partly Cloudy
	21:00	42	44	Ambient					
	22:00	43	45	Ambient					
	23:00	41	45	Ambient					
	0:00	42	68	Ambient					
	1:00	37	38	Ambient					
	2:00	38	39	Ambient					
	3:00	39	40	Ambient					
	4:00	50	52	Ambient					
	5:00	43	46	Ambient					
	6:00	47	52	Ambient					
	7:00	50	55	Ambient					
	8:00	45	49	Ambient					
	9:00	46	49	Ambient					
	10:00	49	52	Ambient					
	11:00	48	51	Ambient					
	12:00	48	51	Ambient					
	13:00	48	50	Ambient					
	14:00	52	55	Ambient					
	15:00	50	54	Ambient					
	16:00	48	50	Ambient					
	17:00	49	50	Ambient					
18:00	50	52	Ambient						
19:00	53	55	Ambient						
20:00	55	58	Ambient						

	21:00	50	52	Ambient	53	48			
	22:00	50	52	Ambient					
13/11/2016	23:00	50	52	Ambient					
	0:00	51	68	Ambient					
	1:00	51	52	Ambient					
	2:00	49	51	Ambient	51	47			
	3:00	49	51	Ambient					
	4:00	50	52	Ambient					
	5:00	51	54	Ambient					
	6:00	50	53	Ambient					
	7:00	52	54	Ambient					
	8:00	51	53	Ambient					
	9:00	47	50	Ambient					
	10:00	47	50	Ambient					
	11:00	49	51	Ambient					
	12:00	52	54	Ambient	52	44	41	7.6	Clear
	13:00	55	57	Ambient					
	14:00	48	51	Ambient					
	15:00	48	51	Ambient					
	16:00	50	52	Ambient					
	17:00	48	49	Ambient					
	18:00	49	50	Ambient					
	19:00	47	48	Ambient					
	20:00	51	53	Ambient	48	44			
21:00	47	48	Ambient						
22:00	46	47	Ambient						
14/11/2016	23:00	46	48	Ambient					
	0:00	43	68	Ambient					
	1:00	43	44	Ambient					
	2:00	42	44	Ambient	59	39			
	3:00	40	42	Ambient					
	4:00	46	49	Ambient					
	5:00	56	59	Ambient					
	6:00	60	61	Trucks					
	7:00	60	61	Trucks					
	8:00	54	55	Ambient					
	9:00	50	53	Ambient					
	10:00	51	54	Ambient					
	11:00	50	53	Ambient					
	12:00	51	54	Ambient	59	44	<31	6.9	Partly Cloudy
	13:00	50	53	Ambient					
	14:00	51	54	Ambient					
	15:00	53	55	Ambient					
	16:00	54	58	Ambient					
	17:00	50	51	Ambient					
	18:00	52	53	Ambient					
	19:00	53	54	Ambient					
	20:00	51	53	Ambient	53	48			
21:00	50	51	Ambient						
22:00	51	52	Ambient						
	23:00	50	51	Ambient					
	0:00	50	68	Ambient					
	1:00	51	52	Ambient					
	2:00	48	49	Ambient	53	47			
	3:00	49	50	Ambient					
	4:00	50	51	Ambient					
	5:00	52	53	Ambient					
	6:00	55	57	Ambient					
7:00	55	56	Ambient						

15/11/2016	8:00	55	60	Ambient	54	43	<31	6.1	Partly Cloudy
	9:00	52	54	Ambient					
	10:00	51	54	Ambient					
	11:00	52	55	Ambient					
	12:00	49	51	Ambient					
	13:00	53	56	Ambient					
	14:00	51	54	Ambient					
	15:00	48	52	Ambient					
	16:00	49	53	Ambient					
	17:00	52	53	Ambient					
	18:00	51	53	Ambient					
	16/11/2016	19:00	48	50					
20:00		47	49	Ambient					
21:00		47	48	Ambient					
22:00		45	47	Ambient					
23:00		47	50	Ambient					
0:00		46	68	Ambient					
1:00		43	44	Ambient					
2:00		41	42	Ambient					
3:00		40	41	Ambient					
4:00		40	41	Ambient					
5:00		48	50	Ambient					
6:00		50	52	Ambient					
17/11/2016	7:00	59	61	Trucks	55	42	<31	4.9	Partly Cloudy
	8:00	53	55	Ambient					
	9:00	52	54	Ambient					
	10:00	54	57	Ambient					
	11:00	53	56	Ambient					
	12:00	49	52	Ambient					
	13:00	52	54	Ambient					
	14:00	49	51	Ambient					
	15:00	52	54	Ambient					
	16:00	54	55	Ambient					
	17:00	54	55	Ambient					
	18:00	53	54	Ambient					
17/11/2016	19:00	52	53	Ambient	50	45	<31	4.9	Partly Cloudy
	20:00	51	53	Ambient					
	21:00	50	51	Ambient					
	22:00	50	51	Ambient					
	23:00	51	52	Ambient					
	0:00	49	68	Ambient					
	1:00	48	49	Ambient					
	2:00	48	49	Ambient					
	3:00	47	48	Ambient					
	4:00	46	47	Ambient					
	5:00	48	49	Ambient					
	6:00	52	54	Ambient					
17/11/2016	7:00	52	54	Ambient	55	42	<31	4.9	Partly Cloudy
	8:00	52	54	Ambient					
	9:00	49	52	Ambient					
	10:00	55	57	Ambient					
	11:00	60	62	Trucks					
	12:00	53	55	Ambient					
	13:00	52	55	Ambient					
	14:00	52	55	Ambient					
	15:00	49	52	Ambient					
	16:00	52	55	Ambient					
	17:00	49	51	Ambient					
	18:00	53	55	Ambient					

	19:00	52	53	Ambient					
	20:00	53	54	Ambient	52	49			
	21:00	51	52	Ambient					
	22:00	50	51	Ambient					
	23:00	50	52	Ambient					
18/11/2016	0:00	50	68	Ambient					
	1:00	49	50	Ambient					
	2:00	48	49	Ambient	52	47			
	3:00	49	50	Ambient					
	4:00	49	50	Ambient					
	5:00	50	51	Ambient					
	6:00	54	56	Ambient					
	7:00	55	57	Ambient					
	8:00	53	54	Ambient					
	9:00	57	59	Ambient					
	10:00	55	57	Ambient					
	11:00	61	63	Trucks					
	12:00	51	53	Ambient	55	47	<31	4.9	Partly Cloudy
	13:00	53	57	Ambient					
	14:00	50	52	Ambient					
	15:00	54	57	Ambient					
	16:00	52	53	Ambient					
	17:00	52	53	Ambient					
	18:00	50	51	Ambient					
		19:00	51	53	Ambient				
	20:00	48	49	Ambient	50	42			
	21:00	48	50	Ambient					
	22:00	44	45	Ambient					
	23:00	45	49	Ambient					
19/11/2016	0:00	45	68	Ambient					
	1:00	44	45	Ambient					
	2:00	44	47	Ambient	46	37			
	3:00	43	43	Ambient					
	4:00	42	43	Ambient					
	5:00	45	48	Ambient					
	6:00	42	45	Ambient					
	7:00	44	47	Ambient					
	8:00	46	49	Ambient					
	9:00	49	53	Ambient					
	10:00	48	52	Ambient					
	11:00	47	52	Ambient					
	12:00	48	51	Ambient	52	40	37	5.9	Fog
	13:00	48	50	Ambient					
	14:00	50	54	Ambient					
	15:00	54	59	Ambient					
	16:00	53	57	Ambient					
	17:00	48	49	Ambient					
	18:00	51	52	Ambient					
		19:00	52	53	Ambient				
	20:00	49	51	Ambient	52	46			
	21:00	48	50	Ambient					
	22:00	49	51	Ambient					
	23:00	48	50	Ambient					
	0:00	48	68	Ambient					
	1:00	49	50	Ambient					
	2:00	48	49	Ambient	49	45			
	3:00	48	49	Ambient					
	4:00	47	49	Ambient					
	5:00	47	48	Ambient					

20/11/2016	6:00	48	50	Ambient					
	7:00	50	53	Ambient					
	8:00	49	51	Ambient					
	9:00	49	52	Ambient					
	10:00	50	52	Ambient					
	11:00	50	52	Ambient					
	12:00	49	51	Ambient	51	45	57	-0.2	Snow
	13:00	49	50	Ambient					
	14:00	50	51	Ambient					
	15:00	48	49	Ambient					
	16:00	48	49	Ambient					
	17:00	48	50	Ambient					
	18:00	47	50	Ambient					
	21/11/2016	19:00	46	47	Ambient				
20:00		46	48	Ambient	48	43			
21:00		46	48	Ambient					
22:00		47	49	Ambient					
23:00		45	48	Ambient					
0:00		60	70	Trucks					
1:00		50	55	Ambient					
2:00		49	53	Ambient	53	42			
3:00		48	52	Ambient					
4:00		50	52	Ambient					
5:00		50	54	Ambient					
6:00		50	53	Ambient					
7:00		53	55	Ambient					
8:00		52	55	Ambient					
9:00	52	55	Ambient						
10:00	53	56	Ambient						
11:00	53	56	Ambient						
12:00	52	56	Ambient	54	46	65	-3.4	Snow	
13:00	53	57	Ambient						
14:00	52	55	Ambient						
15:00	52	55	Ambient						
16:00	52	57	Ambient						
17:00	52	57	Ambient						
18:00	47	50	Ambient						
22/11/2016	19:00	46	49	Ambient					
	20:00	44	46	Ambient	46	40			
	21:00	44	46	Ambient					
	22:00	44	47	Ambient					
	23:00	42	44	Ambient					
	0:00	44	68	Ambient					
	1:00	44	48	Ambient					
	2:00	43	46	Ambient	48	40			
	3:00	43	46	Ambient					
	4:00	46	49	Ambient					
	5:00	49	51	Ambient					
	6:00	55	60	Ambient					
	7:00	54	59	Ambient					
	8:00	55	57	Ambient					
9:00	51	54	Ambient						
10:00	52	55	Ambient						
11:00	54	56	Ambient						
12:00	50	53	Ambient	54	46	56	-2.2	Snow	
13:00	53	56	Ambient						
14:00	52	54	Ambient						
15:00	53	56	Ambient						
16:00	52	54	Ambient						

	17:00	52	54	Ambient					
	18:00	48	50	Ambient					
	19:00	54	57	Ambient					
	20:00	47	50	Ambient				49	44
	21:00	49	51	Ambient					
	22:00	47	48	Ambient					
	23:00	47	49	Ambient					
	0:00	47	68	Ambient					
	1:00	47	54	Ambient					
	2:00	51	55	Ambient				50	43
23/11/2016	3:00	48	49	Ambient	43	-4	Partly Cloudy		
	4:00	46	47	Ambient					
	5:00	47	48	Ambient					
	6:00	50	51	Ambient					
	7:00	50	52	Ambient					
	8:00	53	54	Ambient					
	9:00	52	53	Ambient					
	10:00	55	57	Ambient					
	11:00	53	56	Ambient					
	12:00	53	57	Ambient				53	44
	13:00	53	55	Ambient					
	14:00	51	53	Ambient					
	15:00	53	56	Ambient					
	16:00	55	59	Ambient					
	17:00	51	54	Ambient					
	18:00	46	48	Ambient					
	19:00	44	46	Ambient					
	20:00	45	47	Ambient				45	40
	21:00	46	48	Ambient					
	22:00	42	43	Ambient					
24/11/2016	23:00	43	44	Ambient	35	-2.6	Snow		
	0:00	44	68	Ambient					
	1:00	42	43	Ambient					
	2:00	38	39	Ambient				46	37
	3:00	39	40	Ambient					
	4:00	40	41	Ambient					
	5:00	45	47	Ambient					
	6:00	49	51	Ambient					
	7:00	52	55	Ambient					
	8:00	51	53	Ambient					
	9:00	48	51	Ambient					
	10:00	52	56	Ambient					
	11:00	55	56	Ambient					
	12:00	56	60	Ambient				55	42
	13:00	53	56	Ambient					
	14:00	53	56	Ambient					
	15:00	59	68	Trucks					
	16:00	50	53	Ambient					
	17:00	52	55	Ambient					
	18:00	49	51	Ambient					
19:00	51	54	Ambient						
20:00	45	46	Ambient	46	39				
21:00	44	45	Ambient						
22:00	44	46	Ambient						
	23:00	47	49	Ambient	50	37			
	0:00	45	68	Ambient					
	1:00	52	56	Ambient					
	2:00	57	61	Ambient					
	3:00	60	65	Ambient					

25/11/2016	4:00	43	47	Ambient					
	5:00	47	48	Ambient					
	6:00	49	50	Ambient					
	7:00	54	56	Ambient					
	8:00	51	55	Ambient					
	9:00	51	53	Ambient					
	10:00	52	55	Ambient					
	11:00	51	54	Ambient					
	12:00	46	49	Ambient	52	39	<31	-0.2	Snow & Fog
	13:00	53	56	Ambient					
	14:00	51	54	Ambient					
	15:00	49	52	Ambient					
	16:00	46	48	Ambient					
	17:00	47	48	Ambient					
	18:00	46	48	Ambient					
	19:00	48	50	Ambient					
	20:00	42	44	Ambient	44	38			
	21:00	41	42	Ambient					
22:00	43	45	Ambient						
26/11/2016	23:00	44	47	Ambient					
	0:00	43	68	Ambient					
	1:00	44	47	Ambient					
	2:00	37	38	Ambient	43	35			
	3:00	37	38	Ambient					
	4:00	39	40	Ambient					
	5:00	39	40	Ambient					
	6:00	42	45	Ambient					
	7:00	44	49	Ambient					
	8:00	46	50	Ambient					
	9:00	45	49	Ambient					
	10:00	45	49	Ambient					
	11:00	46	51	Ambient					
	12:00	47	52	Ambient	49	41	<31	0.4	Partly Cloudy
	13:00	49	52	Ambient					
	14:00	48	51	Ambient					
	15:00	54	59	Ambient					
	16:00	48	51	Ambient					
17:00	42	43	Ambient						
18:00	43	45	Ambient						
19:00	44	46	Ambient						
20:00	41	42	Ambient	43	38				
21:00	40	41	Ambient						
22:00	41	42	Ambient						
27/11/2016	23:00	41	42	Ambient					
	0:00	40	68	Ambient					
	1:00	38	39	Ambient					
	2:00	38	39	Ambient	40	34			
	3:00	37	38	Ambient					
	4:00	37	39	Ambient					
	5:00	38	39	Ambient					
	6:00	39	42	Ambient					
	7:00	45	51	Ambient					
	8:00	44	47	Ambient					
	9:00	42	46	Ambient					
	10:00	49	55	Ambient					
	11:00	45	52	Ambient					
	12:00	47	53	Ambient	47	37	30	-2.2	Cloudy
13:00	48	53	Ambient						
14:00	47	51	Ambient						

	15:00	45	49	Ambient			
	16:00	47	49	Ambient			
	17:00	47	48	Ambient			
	18:00	44	46	Ambient			
	19:00	46	48	Ambient			
	20:00	45	46	Ambient	47	42	
	21:00	45	47	Ambient			
	22:00	45	47	Ambient			
	23:00	45	46	Ambient			
28/11/2016	0:00	44	68	Ambient			
	1:00	43	44	Ambient			
	2:00	44	46	Ambient	47	41	
	3:00	45	46	Ambient			
	4:00	48	51	Ambient			
	5:00	45	47	Ambient			
	6:00	47	49	Ambient			
	7:00	50	53	Ambient			
	8:00	49	52	Ambient			
	9:00	55	57	Ambient			
	10:00	52	55	Ambient			
	11:00	52	56	Ambient			
	12:00	53	56	Ambient	54	43	
	13:00	54	58	Ambient			
	14:00	52	56	Ambient			
	15:00	53	56	Ambient			
	16:00	54	57	Ambient			
	17:00	51	53	Ambient			
18:00	47	49	Ambient				
	19:00	51	53	Ambient			
	20:00	52	54	Ambient	53	48	
	21:00	51	53	Ambient			
	22:00	52	56	Ambient			
	23:00	50	53	Ambient			
29/11/2016	0:00	52	68	Ambient			
	1:00	52	54	Ambient			
	2:00	52	55	Ambient	54	49	
	3:00	52	54	Ambient			
	4:00	53	55	Ambient			
	5:00	52	55	Ambient			
	6:00	54	56	Ambient			
	7:00	56	58	Ambient			
	8:00	58	63	Trucks			
	9:00	56	59	Ambient			
	10:00	55	57	Ambient			
	11:00	53	56	Ambient			
	12:00	52	55	Ambient	57	45	
	13:00	53	56	Ambient			
	14:00	52	55	Ambient			
	15:00	51	54	Ambient			
	16:00	51	53	Ambient			
	17:00	50	51	Ambient			
18:00	46	48	Ambient				
	19:00	47	48	Ambient			
	20:00	45	48	Ambient	46	39	
	21:00	41	42	Ambient			
	22:00	42	44	Ambient			
	23:00	41	43	Ambient			
	0:00	44	68	Ambient			
	1:00	42	42	Ambient			

30/11/2016	2:00	38	39	Ambient	44	36	43	3.4	Rain & Fog				
	3:00	38	39	Ambient									
	4:00	48	49	Ambient									
	5:00	43	47	Ambient									
	6:00	45	47	Ambient									
	7:00	52	55	Ambient									
	8:00	52	56	Ambient									
	9:00	50	54	Ambient									
	10:00	56	61	Ambient									
	11:00	51	54	Ambient									
	12:00	54	58	Ambient	55	46							
	13:00	53	58	Ambient									
	14:00	53	55	Ambient									
	15:00	52	54	Ambient									
	16:00	52	54	Ambient									
	17:00	53	55	Ambient									
	18:00	51	54	Ambient									
	19:00	49	52	Ambient									
	20:00	46	48	Ambient	49	43							
	21:00	46	47	Ambient									
	22:00	46	49	Ambient									
	23:00	48	50	Ambient									
	01/12/2016	0:00	51	68	Ambient	53				41	48	5.4	Rain
		1:00	51	53	Ambient								
2:00		46	47	Ambient									
3:00		42	43	Ambient									
4:00		46	49	Ambient									
5:00		52	54	Ambient									
6:00		52	54	Ambient									
7:00		55	58	Ambient									
8:00		53	55	Ambient									
9:00		53	56	Ambient									
10:00		54	58	Ambient									
11:00		55	58	Ambient									
12:00		54	57	Ambient	56	49							
13:00		53	57	Ambient									
14:00		53	55	Ambient									
15:00		53	55	Ambient									
16:00		53	55	Ambient									
17:00		55	56	Ambient									
18:00		53	55	Ambient									
19:00		54	56	Ambient									
20:00		52	54	Ambient	54	49							
21:00		51	53	Ambient									
22:00		51	54	Ambient									
23:00		51	54	Ambient									
02/12/2016	0:00	51	68	Ambient	53	48	44	2.7	Partly Cloudy				
	1:00	51	54	Ambient									
	2:00	51	53	Ambient									
	3:00	51	53	Ambient									
	4:00	51	53	Ambient									
	5:00	51	54	Ambient									
	6:00	54	56	Ambient									
	7:00	56	58	Ambient									
	8:00	53	56	Ambient									
	9:00	53	56	Ambient									
	10:00	53	55	Ambient									
	11:00	52	54	Ambient									
12:00	54	57	Ambient	54	46								

	13:00	53	56	Ambient	57	40	44	2.7	Partly Cloudy
	14:00	53	56	Ambient					
	15:00	51	54	Ambient					
	16:00	49	51	Ambient					
	17:00	49	50	Ambient					
	18:00	49	51	Ambient					
	19:00	50	52	Ambient					
	20:00	47	49	Ambient	48	45			
	21:00	46	47	Ambient					
	22:00	47	48	Ambient					
	23:00	46	47	Ambient					
	03/12/2016	0:00	45	68	Ambient				
1:00		45	46	Ambient					
2:00		44	45	Ambient	46	42			
3:00		44	45	Ambient					
4:00		44	46	Ambient					
5:00		44	45	Ambient					
6:00		46	48	Ambient					
7:00		48	51	Ambient					
8:00		44	47	Ambient					
9:00		45	49	Ambient					
10:00		46	48	Ambient					
11:00		46	48	Ambient					
12:00		47	50	Ambient	48	41			
13:00		46	49	Ambient					
14:00		47	50	Ambient					
15:00		46	49	Ambient					
16:00		44	46	Ambient					
17:00		43	45	Ambient					
18:00		45	48	Ambient					
19:00		44	45	Ambient					
20:00		43	45	Ambient	44	39			
21:00		42	43	Ambient					
22:00		40	41	Ambient					
04/12/2016		23:00	41	44	Ambient			<31	-3.1
	0:00	40	68	Ambient					
	1:00	37	38	Ambient					
	2:00	36	37	Ambient	39	35			
	3:00	38	39	Ambient					
	4:00	38	40	Ambient					
	5:00	37	38	Ambient					
	6:00	43	46	Ambient					
	7:00	45	49	Ambient					
	8:00	45	49	Ambient					
	9:00	44	47	Ambient					
	10:00	47	50	Ambient					
	11:00	39	41	Ambient					
	12:00	39	44	Ambient	47	35			
	13:00	42	46	Ambient					
	14:00	40	44	Ambient					
	15:00	45	52	Ambient					
	16:00	48	51	Ambient					
	17:00	46	48	Ambient					
	18:00	54	55	Ambient					
	19:00	52	54	Ambient					
	20:00	50	52	Ambient	51	48			
	21:00	50	52	Ambient					
	22:00	50	52	Ambient					
23:00	50	52	Ambient						

05/12/2016	0:00	49	68	Ambient	53	48	37	-4.3	Snow
	1:00	50	51	Ambient					
	2:00	51	53	Ambient					
	3:00	50	51	Ambient					
	4:00	53	54	Ambient					
	5:00	55	56	Ambient					
	6:00	52	53	Ambient					
	7:00	54	58	Ambient	55	42			
	8:00	58	59	Trucks					
	9:00	54	56	Ambient					
	10:00	54	57	Ambient					
	11:00	51	54	Ambient					
	12:00	57	66	Ambient					
	13:00	48	51	Ambient					
	14:00	46	48	Ambient					
	15:00	49	52	Ambient					
	16:00	48	50	Ambient					
	17:00	52	55	Ambient					
	18:00	47	48	Ambient					
	19:00	49	51	Ambient	48	41			
	20:00	48	52	Ambient					
	21:00	44	44	Ambient					
	22:00	47	49	Ambient					
23:00	45	46	Ambient						
06/12/2016	0:00	51	69	Ambient	53	38	43	-2.2	Clear
	1:00	46	49	Ambient					
	2:00	44	46	Ambient					
	3:00	61	67	Ambient					
	4:00	56	63	Ambient					
	5:00	49	51	Ambient					
	6:00	53	54	Ambient					
	7:00	59	62	Trucks	55	44			
	8:00	52	53	Ambient					
	9:00	51	54	Ambient					
	10:00	53	55	Ambient					
	11:00	51	54	Ambient					
	12:00	53	56	Ambient					
	13:00	54	59	Ambient					
	14:00	54	56	Ambient					
	15:00	53	56	Ambient					
	16:00	52	54	Ambient					
	17:00	49	51	Ambient					
	18:00	51	53	Ambient					
	19:00	52	55	Ambient	53	49			
	20:00	52	55	Ambient					
	21:00	52	55	Ambient					
	22:00	51	54	Ambient					
23:00	52	54	Ambient						
Maximum		61	70		59	49			
Minimum		36	37		39	34			
Average		49	52		50	43			
Standard Div.		4	6		4	4			
>56 dBA (%)		2.6	17.8						
>58 dBA (%)		1.6	9.3						
>60 dBA (%)		0.4	6.3						
>65 dBA (%)		0	4.5						

APPENDIX B

STAMSON 5.04 - INPUT AND OUTPUT DATA (RAILWAY TRAFFIC NOISE)



STAMSON 5.0 NORMAL REPORT Date: 14-12-2016 10:14:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Rail data, segment # 1: CN (day/night)

```
-----  
Train           ! Trains      ! Speed !# loc !# Cars! Eng  !Cont  
Type           !           ! (km/h) !/Train!/Train! type !weld  
-----+-----+-----+-----+-----+-----+-----  
  1.             ! 192.0/24.0 !  40.0 !   1.0 !  10.0 !Diesel! No
```

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

```
-----  
Angle1   Angle2          : -90.00 deg   -2.00 deg  
Wood depth                :       0     (No woods.)  
No of house rows         :       0 / 0  
Surface                   :       1     (Absorptive ground surface)  
Receiver source distance : 137.00 / 137.00 m  
Receiver height          :   4.50 / 4.50 m  
Topography                :       2     (Flat/gentle slope; with barrier)  
No Whistle  
Barrier angle1            : -90.00 deg   Angle2 : -2.00 deg  
Barrier height            :   0.00 m  
Barrier receiver distance : 10.00 / 10.00 m  
Source elevation          : 84.00 m  
Receiver elevation        : 87.00 m  
Barrier elevation         : 87.00 m  
Reference angle           :   0.00
```

Results segment # 1: CN (day)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.24	91.24
0.50	4.50	3.99	90.99

LOCOMOTIVE (0.00 + 53.26 + 0.00) = 53.26 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-2	0.50	71.92	-14.36	-4.30	0.00	0.00	-0.09	53.16*
-90	-2	0.50	71.92	-14.36	-4.30	0.00	0.00	0.00	53.26

* Bright Zone !

WHEEL (0.00 + 46.39 + 0.00) = 46.39 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-2	0.60	66.26	-15.37	-4.50	0.00	0.00	-0.10	46.29*
-90	-2	0.60	66.26	-15.37	-4.50	0.00	0.00	0.00	46.39

* Bright Zone !

Segment Leq : 54.07 dBA

Total Leq All Segments: 54.07 dBA

Results segment # 1: CN (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.24	91.24
0.50	4.50	3.99	90.99

LOCOMOTIVE (0.00 + 47.23 + 0.00) = 47.23 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-2	0.50	65.90	-14.36	-4.30	0.00	0.00	-0.09	47.14*
-90	-2	0.50	65.90	-14.36	-4.30	0.00	0.00	0.00	47.23

* Bright Zone !

WHEEL (0.00 + 40.37 + 0.00) = 40.37 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-2	0.60	60.24	-15.37	-4.50	0.00	0.00	-0.10	40.27*
-90	-2	0.60	60.24	-15.37	-4.50	0.00	0.00	0.00	40.37

* Bright Zone !

Segment Leq : 48.04 dBA

Total Leq All Segments: 48.04 dBA

RT/Custom data, segment # 1: OC (day/night)

 1 - 4-car SRT:
 Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

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

 Angle1 Angle2 : -68.00 deg 12.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 101.00 / 101.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -68.00 deg Angle2 : 12.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 10.00 / 10.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

Results segment # 1: OC (day)

 Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.81	90.81

RT/Custom (0.00 + 38.68 + 0.00) = 38.68 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	12	0.60	56.02	-13.25	-4.09	0.00	0.00	0.00	38.68*
-68	12	0.60	56.02	-13.25	-4.09	0.00	0.00	0.00	38.68

* Bright Zone !

Segment Leq : 38.68 dBA

Total Leq All Segments: 38.68 dBA

Results segment # 1: OC (night)

 Source height = 0.50 m

Barrier height for grazing incidence

 Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
 -----+-----+-----+-----
 0.50 ! 4.50 ! 3.81 ! 90.81

RT/Custom (0.00 + 32.66 + 0.00) = 32.66 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	12	0.60	50.00	-13.25	-4.09	0.00	0.00	0.00	32.66*
-68	12	0.60	50.00	-13.25	-4.09	0.00	0.00	0.00	32.66

* Bright Zone !

Segment Leq : 32.66 dBA

Total Leq All Segments: 32.66 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 54.19
 (NIGHT) : 48.16



STAMSON 5.0 NORMAL REPORT Date: 14-12-2016 10:15:17
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Rail data, segment # 1: CN (day/night)

Train Type	! Trains !	! Speed !(km/h)	!# loc !/Train!	!# Cars !/Train!	! Eng ! type	!Cont !weld
1.	! 192.0/24.0	! 40.0	! 1.0	! 10.0	!Diesel!	No

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

Angle1	Angle2	: -90.00 deg	90.00 deg
Wood depth	:	0	(No woods.)
No of house rows	:	0 / 0	
Surface	:	1	(Absorptive ground surface)
Receiver source distance	:	132.00 / 132.00 m	
Receiver height	:	4.50 / 4.50 m	
Topography	:	2	(Flat/gentle slope; with barrier)
No Whistle	:		
Barrier angle1	:	-90.00 deg	Angle2 : 90.00 deg
Barrier height	:	0.00 m	
Barrier receiver distance	:	10.00 / 10.00 m	
Source elevation	:	84.00 m	
Receiver elevation	:	87.00 m	
Barrier elevation	:	87.00 m	
Reference angle	:	0.00	

Results segment # 1: CN (day)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.23	91.23
0.50	4.50	3.97	90.97

LOCOMOTIVE (0.00 + 56.64 + 0.00) = 56.64 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.50	71.92	-14.12	-1.17	0.00	0.00	-0.09	56.55*
-90	90	0.50	71.92	-14.12	-1.17	0.00	0.00	0.00	56.64

* Bright Zone !

WHEEL (0.00 + 49.79 + 0.00) = 49.79 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	66.26	-15.11	-1.35	0.00	0.00	-0.10	49.69*
-90	90	0.60	66.26	-15.11	-1.35	0.00	0.00	0.00	49.79

* Bright Zone !

Segment Leq : 57.46 dBA

Total Leq All Segments: 57.46 dBA

Results segment # 1: CN (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.23	91.23
0.50	4.50	3.97	90.97

LOCOMOTIVE (0.00 + 50.62 + 0.00) = 50.62 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.50	65.90	-14.12	-1.17	0.00	0.00	-0.09	50.53*
-90	90	0.50	65.90	-14.12	-1.17	0.00	0.00	0.00	50.62

* Bright Zone !

WHEEL (0.00 + 43.77 + 0.00) = 43.77 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	60.24	-15.11	-1.35	0.00	0.00	-0.10	43.67*
-90	90	0.60	60.24	-15.11	-1.35	0.00	0.00	0.00	43.77

* Bright Zone !

Segment Leq : 51.44 dBA

Total Leq All Segments: 51.44 dBA

RT/Custom data, segment # 1: OCL (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

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

 Angle1 Angle2 : -70.00 deg 20.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 106.00 / 106.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -70.00 deg Angle2 : 20.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 10.00 / 10.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

RT/Custom data, segment # 2: OCR (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

Data for Segment # 2: OCR (day/night)

 Angle1 Angle2 : 11.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 115.00 / 115.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 11.00 deg Angle2 : 90.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 10.00 / 10.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

Results segment # 1: OCL (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.84	90.84

RT/Custom (0.00 + 38.86 + 0.00) = 38.86 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	20	0.60	56.02	-13.59	-3.58	0.00	0.00	0.00	38.86*
-70	20	0.60	56.02	-13.59	-3.58	0.00	0.00	0.00	38.86

* Bright Zone !

Segment Leq : 38.86 dBA

Results segment # 2: OCR (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.89	90.89

RT/Custom (0.00 + 36.71 + 0.00) = 36.71 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	90	0.60	56.02	-14.15	-5.16	0.00	0.00	-0.12	36.59*
11	90	0.60	56.02	-14.15	-5.16	0.00	0.00	0.00	36.71

* Bright Zone !

Segment Leq : 36.71 dBA

Total Leq All Segments: 40.93 dBA

Results segment # 1: OCL (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.84	90.84

RT/Custom (0.00 + 32.84 + 0.00) = 32.84 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	20	0.60	50.00	-13.59	-3.58	0.00	0.00	0.00	32.84*
-70	20	0.60	50.00	-13.59	-3.58	0.00	0.00	0.00	32.84

* Bright Zone !

Segment Leq : 32.84 dBA

Results segment # 2: OCR (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.89	90.89

RT/Custom (0.00 + 30.69 + 0.00) = 30.69 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	90	0.60	50.00	-14.15	-5.16	0.00	0.00	-0.12	30.57*
11	90	0.60	50.00	-14.15	-5.16	0.00	0.00	0.00	30.69

* Bright Zone !

Segment Leq : 30.69 dBA

Total Leq All Segments: 34.91 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.56
(NIGHT): 51.54



STAMSON 5.0 NORMAL REPORT Date: 14-12-2016 10:15:46
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Rail data, segment # 1: CN (day/night)

Train Type	! Trains	! Speed (km/h)	!# loc /Train	!# Cars /Train	! Eng type	!Cont weld
1.	! 192.0/24.0	! 40.0	! 1.0	! 10.0	!Diesel!	No

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

Angle1 Angle2 : -1.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 135.00 / 135.00 m
Receiver height : 4.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
No Whistle
Barrier angle1 : -1.00 deg Angle2 : 90.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 10.00 / 10.00 m
Source elevation : 84.00 m
Receiver elevation : 87.00 m
Barrier elevation : 87.00 m
Reference angle : 0.00

Results segment # 1: CN (day)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.24	91.24
0.50	4.50	3.98	90.98

LOCOMOTIVE (0.00 + 53.54 + 0.00) = 53.54 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.50	71.92	-14.27	-4.11	0.00	0.00	-0.09	53.45*
-1	90	0.50	71.92	-14.27	-4.11	0.00	0.00	0.00	53.54

* Bright Zone !

WHEEL (0.00 + 46.69 + 0.00) = 46.69 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.60	66.26	-15.27	-4.30	0.00	0.00	-0.10	46.59*
-1	90	0.60	66.26	-15.27	-4.30	0.00	0.00	0.00	46.69

* Bright Zone !

Segment Leq : 54.36 dBA

Total Leq All Segments: 54.36 dBA

Results segment # 1: CN (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	4.50	4.24	91.24
0.50	4.50	3.98	90.98

LOCOMOTIVE (0.00 + 47.52 + 0.00) = 47.52 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.50	65.90	-14.27	-4.11	0.00	0.00	-0.09	47.43*
-1	90	0.50	65.90	-14.27	-4.11	0.00	0.00	0.00	47.52

* Bright Zone !

WHEEL (0.00 + 40.67 + 0.00) = 40.67 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.60	60.24	-15.27	-4.30	0.00	0.00	-0.10	40.57*
-1	90	0.60	60.24	-15.27	-4.30	0.00	0.00	0.00	40.67

* Bright Zone !

Segment Leq : 48.34 dBA

Total Leq All Segments: 48.34 dBA

RT/Custom data, segment # 1: OC (day/night)

 1 - 4-car SRT:
 Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

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

 Angle1 Angle2 : -1.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 119.00 / 119.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -1.00 deg Angle2 : 90.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 10.00 / 10.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

Results segment # 1: OC (day)

 Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.91	90.91

RT/Custom (0.00 + 37.33 + 0.00) = 37.33 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.60	56.02	-14.39	-4.30	0.00	0.00	-0.10	37.23*
-1	90	0.60	56.02	-14.39	-4.30	0.00	0.00	0.00	37.33

* Bright Zone !

Segment Leq : 37.33 dBA

Total Leq All Segments: 37.33 dBA

Results segment # 1: OC (night)

 Source height = 0.50 m

Barrier height for grazing incidence

 Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
 -----+-----+-----+-----
 0.50 ! 4.50 ! 3.91 ! 90.91

RT/Custom (0.00 + 31.31 + 0.00) = 31.31 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-1	90	0.60	50.00	-14.39	-4.30	0.00	0.00	-0.10	31.21*
-1	90	0.60	50.00	-14.39	-4.30	0.00	0.00	0.00	31.31

* Bright Zone !

Segment Leq : 31.31 dBA

Total Leq All Segments: 31.31 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.45
 (NIGHT): 48.43

STAMSON 5.0 NORMAL REPORT Date: 14-12-2016 10:19:45
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Rail data, segment # 1: CNL (day/night)

Train Type	! Trains	! Speed ! (km/h)	!# loc !/Train	!# Cars !/Train	! Eng type	!Cont !weld
1.	! 192.0/24.0	! 40.0	! 1.0	! 10.0	! Diesel	! No

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

Angle1	Angle2	: -90.00 deg	-45.00 deg
Wood depth	:	0	(No woods.)
No of house rows	:	0 / 0	
Surface	:	1	(Absorptive ground surface)
Receiver source distance	:	140.00 / 140.00 m	
Receiver height	:	1.50 / 1.50 m	
Topography	:	2	(Flat/gentle slope; with barrier)
No Whistle			
Barrier angle1	:	-90.00 deg	Angle2 : -45.00 deg
Barrier height	:	9.00 m	
Barrier receiver distance	:	10.00 / 10.00 m	
Source elevation	:	84.00 m	
Receiver elevation	:	87.00 m	
Barrier elevation	:	87.00 m	
Reference angle	:	0.00	

Rail data, segment # 2: CNR (day/night)

Train Type	! Trains	! Speed (km/h)	! # loc / Train	! # Cars / Train	! Eng type	! Cont weld
1.	! 192.0/24.0	! 40.0	! 1.0	! 10.0	! Diesel	! No

Data for Segment # 2: CNR (day/night)

Angle1	Angle2	: -45.00 deg	90.00 deg
Wood depth		: 0	(No woods.)
No of house rows		: 0 / 0	
Surface		: 1	(Absorptive ground surface)
Receiver source distance		: 140.00 / 140.00 m	
Receiver height		: 1.50 / 1.50 m	
Topography		: 2	(Flat/gentle slope; with barrier)
No Whistle			
Barrier angle1	Angle2	: -45.00 deg	: 37.00 deg
Barrier height		: 0.00 m	
Barrier receiver distance		: 19.00 / 19.00 m	
Source elevation		: 84.00 m	
Receiver elevation		: 87.00 m	
Barrier elevation		: 87.00 m	
Reference angle		: 0.00	

Results segment # 1: CNL (day)

Barrier height for grazing incidence

Source Height (m)	! Receiver Height (m)	! Barrier Height (m)	! Elevation of Barrier Top (m)
4.00	! 1.50	! 1.46	! 88.46
0.50	! 1.50	! 1.21	! 88.21

LOCOMOTIVE (0.00 + 40.74 + 0.00) = 40.74 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.05	71.92	-10.14	-6.27	0.00	0.00	-14.78	40.74

WHEEL (0.00 + 33.29 + 0.00) = 33.29 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.15	66.26	-11.16	-6.81	0.00	0.00	-15.00	33.29

Segment Leq : 41.46 dBA

Results segment # 2: CNR (day)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.43	88.43
0.50	1.50	0.96	87.96

LOCOMOTIVE (0.00 + 52.90 + 48.88) = 54.35 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.58	71.92	-15.38	-3.65	0.00	0.00	-0.88	52.03*
-45	37	0.58	71.92	-15.38	-3.65	0.00	0.00	0.00	52.90
37	90	0.58	71.92	-15.38	-7.67	0.00	0.00	0.00	48.88

* Bright Zone !

WHEEL (0.00 + 46.48 + 42.24) = 47.87 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.66	66.26	-16.10	-3.67	0.00	0.00	-3.48	43.01*
-45	37	0.66	66.26	-16.10	-3.67	0.00	0.00	0.00	46.48
37	90	0.66	66.26	-16.10	-7.92	0.00	0.00	0.00	42.24

* Bright Zone !

Segment Leq : 55.23 dBA

Total Leq All Segments: 55.41 dBA

Results segment # 1: CNL (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.46	88.46
0.50	1.50	1.21	88.21

LOCOMOTIVE (0.00 + 34.72 + 0.00) = 34.72 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.05	65.90	-10.14	-6.27	0.00	0.00	-14.78	34.72

WHEEL (0.00 + 27.27 + 0.00) = 27.27 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.15	60.24	-11.16	-6.81	0.00	0.00	-15.00	27.27

Segment Leq : 35.44 dBA

Results segment # 2: CNR (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.43	88.43
0.50	1.50	0.96	87.96

LOCOMOTIVE (0.00 + 46.88 + 42.86) = 48.33 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.58	65.90	-15.38	-3.65	0.00	0.00	-0.88	46.01*
-45	37	0.58	65.90	-15.38	-3.65	0.00	0.00	0.00	46.88
37	90	0.58	65.90	-15.38	-7.67	0.00	0.00	0.00	42.86

* Bright Zone !

WHEEL (0.00 + 40.46 + 36.22) = 41.85 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.66	60.24	-16.10	-3.67	0.00	0.00	-3.48	36.98*
-45	37	0.66	60.24	-16.10	-3.67	0.00	0.00	0.00	40.46
37	90	0.66	60.24	-16.10	-7.92	0.00	0.00	0.00	36.22

* Bright Zone !

Segment Leq : 49.21 dBA

Total Leq All Segments: 49.39 dBA

RT/Custom data, segment # 1: OC1 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

Data for Segment # 1: OC1 (day/night)

 Angle1 Angle2 : -69.00 deg -30.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 129.00 / 129.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -69.00 deg Angle2 : -30.00 deg
 Barrier height : 9.00 m
 Barrier receiver distance : 10.00 / 10.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

RT/Custom data, segment # 2: OC2 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

Data for Segment # 2: OC2 (day/night)

 Angle1 Angle2 : -30.00 deg 0.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 129.00 / 129.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -30.00 deg Angle2 : 0.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 19.00 / 19.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

RT/Custom data, segment # 3: OC3 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

Data for Segment # 3: OC3 (day/night)

 Angle1 Angle2 : -15.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 125.00 / 125.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -15.00 deg Angle2 : 38.00 deg
 Barrier height : 0.00 m
 Barrier receiver distance : 19.00 / 19.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

Results segment # 1: OC1 (day)

 Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.96	90.96

RT/Custom (0.00 + 22.69 + 0.00) = 22.69 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-69	-30	0.06	56.02	-9.91	-6.77	0.00	0.00	-16.66	22.69

 Segment Leq : 22.69 dBA

Results segment # 2: OC2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.47	90.47

RT/Custom (0.00 + 33.17 + 0.00) = 33.17 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-30	0	0.60	56.02	-14.95	-7.90	0.00	0.00	0.00	33.17*
-30	0	0.60	56.02	-14.95	-7.90	0.00	0.00	0.00	33.17

* Bright Zone !

Segment Leq : 33.17 dBA

Results segment # 3: OC3 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.44	90.44

RT/Custom (0.00 + 35.83 + 33.44) = 37.81 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-15	38	0.60	56.02	-14.73	-5.46	0.00	0.00	0.00	35.83*
-15	38	0.60	56.02	-14.73	-5.46	0.00	0.00	0.00	35.83
38	90	0.60	56.02	-14.73	-7.85	0.00	0.00	0.00	33.44

* Bright Zone !

Segment Leq : 37.81 dBA

Total Leq All Segments: 39.19 dBA

Results segment # 1: OC1 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.96	90.96

RT/Custom (0.00 + 16.67 + 0.00) = 16.67 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-69	-30	0.06	50.00	-9.91	-6.77	0.00	0.00	-16.66	16.67

Segment Leq : 16.67 dBA

Results segment # 2: OC2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.47	90.47

RT/Custom (0.00 + 27.15 + 0.00) = 27.15 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-30	0	0.60	50.00	-14.95	-7.90	0.00	0.00	0.00	27.15*
-30	0	0.60	50.00	-14.95	-7.90	0.00	0.00	0.00	27.15

* Bright Zone !

Segment Leq : 27.15 dBA



Results segment # 3: OC3 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
-----+-----+-----+-----
0.50 ! 4.50 ! 3.44 ! 90.44

RT/Custom (0.00 + 29.81 + 27.42) = 31.79 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-15	38	0.60	50.00	-14.73	-5.46	0.00	0.00	0.00	29.81*
-15	38	0.60	50.00	-14.73	-5.46	0.00	0.00	0.00	29.81
38	90	0.60	50.00	-14.73	-7.85	0.00	0.00	0.00	27.42

* Bright Zone !

Segment Leq : 31.79 dBA

Total Leq All Segments: 33.17 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 55.51
(NIGHT) : 49.49



STAMSON 5.0 NORMAL REPORT Date: 14-12-2016 10:20:51
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4B.te Time Period: Day/Night 16/8 hours
Description: 2.2 m Barrier

Rail data, segment # 1: CNL (day/night)

```
-----  
Train                    ! Trains                    ! Speed !# loc !# Cars! Eng !Cont  
Type                    !                    ! (km/h) !/Train!/Train! type !weld  
-----+-----+-----+-----+-----+-----+-----  
  1.                    ! 192.0/24.0                    ! 40.0 ! 1.0 ! 10.0 !Diesel! No
```

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

```
-----  
Angle1    Angle2                    : -90.00 deg    -45.00 deg  
Wood depth                    :            0            (No woods.)  
No of house rows                :            0 / 0  
Surface                        :            1            (Absorptive ground surface)  
Receiver source distance        : 140.00 / 140.00 m  
Receiver height                 :    1.50 / 1.50    m  
Topography                     :            2            (Flat/gentle slope; with barrier)  
No Whistle  
Barrier angle1                  : -90.00 deg    Angle2 : -45.00 deg  
Barrier height                  :    9.00 m  
Barrier receiver distance        : 10.00 / 10.00 m  
Source elevation                :    84.00 m  
Receiver elevation               :    87.00 m  
Barrier elevation                :    87.00 m  
Reference angle                 :    0.00
```

Rail data, segment # 2: CNR (day/night)

Train Type	! Trains	! Speed (km/h)	! # loc / Train	! # Cars / Train	! Eng type	! Cont weld
1.	! 192.0/24.0	! 40.0	! 1.0	! 10.0	! Diesel!	No

Data for Segment # 2: CNR (day/night)

Angle1	Angle2	: -45.00 deg	90.00 deg
Wood depth		: 0	(No woods.)
No of house rows		: 0 / 0	
Surface		: 1	(Absorptive ground surface)
Receiver source distance		: 140.00 / 140.00 m	
Receiver height		: 1.50 / 1.50 m	
Topography		: 2	(Flat/gentle slope; with barrier)
No Whistle			
Barrier angle1	Angle2	: -45.00 deg	: 37.00 deg
Barrier height		: 2.20 m	
Barrier receiver distance		: 19.00 / 19.00 m	
Source elevation		: 84.00 m	
Receiver elevation		: 87.00 m	
Barrier elevation		: 87.00 m	
Reference angle		: 0.00	

Results segment # 1: CNL (day)

Barrier height for grazing incidence

Source Height (m)	! Receiver Height (m)	! Barrier Height (m)	! Elevation of Barrier Top (m)
4.00	! 1.50	! 1.46	! 88.46
0.50	! 1.50	! 1.21	! 88.21

LOCOMOTIVE (0.00 + 40.74 + 0.00) = 40.74 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.05	71.92	-10.14	-6.27	0.00	0.00	-14.78	40.74

WHEEL (0.00 + 33.29 + 0.00) = 33.29 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.15	66.26	-11.16	-6.81	0.00	0.00	-15.00	33.29

Segment Leq : 41.46 dBA

Results segment # 2: CNR (day)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.43	88.43
0.50	1.50	0.96	87.96

LOCOMOTIVE (0.00 + 48.42 + 48.88) = 51.66 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.45	71.92	-14.09	-3.59	0.00	0.00	-5.81	48.42
37	90	0.58	71.92	-15.38	-7.67	0.00	0.00	0.00	48.88

WHEEL (0.00 + 40.58 + 42.24) = 44.50 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.56	66.26	-15.11	-3.64	0.00	0.00	-6.93	40.58
37	90	0.66	66.26	-16.10	-7.92	0.00	0.00	0.00	42.24

Segment Leq : 52.42 dBA

Total Leq All Segments: 52.75 dBA

Results segment # 1: CNL (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.46	88.46
0.50	1.50	1.21	88.21

LOCOMOTIVE (0.00 + 34.72 + 0.00) = 34.72 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.05	65.90	-10.14	-6.27	0.00	0.00	-14.78	34.72

WHEEL (0.00 + 27.27 + 0.00) = 27.27 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-45	0.15	60.24	-11.16	-6.81	0.00	0.00	-15.00	27.27

Segment Leq : 35.44 dBA

Results segment # 2: CNR (night)

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
4.00	1.50	1.43	88.43
0.50	1.50	0.96	87.96

LOCOMOTIVE (0.00 + 42.40 + 42.86) = 45.64 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.45	65.90	-14.09	-3.59	0.00	0.00	-5.81	42.40
37	90	0.58	65.90	-15.38	-7.67	0.00	0.00	0.00	42.86

WHEEL (0.00 + 34.56 + 36.22) = 38.48 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	37	0.56	60.24	-15.11	-3.64	0.00	0.00	-6.93	34.56
37	90	0.66	60.24	-16.10	-7.92	0.00	0.00	0.00	36.22

Segment Leq : 46.40 dBA

Total Leq All Segments: 46.73 dBA

RT/Custom data, segment # 1: OC1 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 1: OC1 (day/night)

Angle1 Angle2 : -69.00 deg -30.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 129.00 / 129.00 m
Receiver height : 4.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -69.00 deg Angle2 : -30.00 deg
Barrier height : 9.00 m
Barrier receiver distance : 10.00 / 10.00 m
Source elevation : 84.00 m
Receiver elevation : 87.00 m
Barrier elevation : 87.00 m
Reference angle : 0.00

RT/Custom data, segment # 2: OC2 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
Speed : 50 km/h

Data for Segment # 2: OC2 (day/night)

Angle1 Angle2 : -30.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 129.00 / 129.00 m
Receiver height : 4.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -30.00 deg Angle2 : 0.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 19.00 / 19.00 m
Source elevation : 84.00 m
Receiver elevation : 87.00 m
Barrier elevation : 87.00 m
Reference angle : 0.00

RT/Custom data, segment # 3: OC3 (day/night)

1 - 4-car SRT:

Traffic volume : 192/24 veh/TimePeriod
 Speed : 50 km/h

Data for Segment # 3: OC3 (day/night)

 Angle1 Angle2 : -15.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 125.00 / 125.00 m
 Receiver height : 4.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -15.00 deg Angle2 : 38.00 deg
 Barrier height : 2.20 m
 Barrier receiver distance : 19.00 / 19.00 m
 Source elevation : 84.00 m
 Receiver elevation : 87.00 m
 Barrier elevation : 87.00 m
 Reference angle : 0.00

Results segment # 1: OC1 (day)

 Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.96	90.96

RT/Custom (0.00 + 22.69 + 0.00) = 22.69 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-69	-30	0.06	56.02	-9.91	-6.77	0.00	0.00	-16.66	22.69

 Segment Leq : 22.69 dBA

Results segment # 2: OC2 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.47	90.47

RT/Custom (0.00 + 33.17 + 0.00) = 33.17 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-30	0	0.47	56.02	-13.72	-7.88	0.00	0.00	-1.83	32.60*
-30	0	0.60	56.02	-14.95	-7.90	0.00	0.00	0.00	33.17

* Bright Zone !

Segment Leq : 33.17 dBA

Results segment # 3: OC3 (day)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.44	90.44

RT/Custom (0.00 + 35.83 + 33.44) = 37.81 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-15	38	0.47	56.02	-13.52	-5.43	0.00	0.00	-2.05	35.03*
-15	38	0.60	56.02	-14.73	-5.46	0.00	0.00	0.00	35.83
38	90	0.60	56.02	-14.73	-7.85	0.00	0.00	0.00	33.44

* Bright Zone !

Segment Leq : 37.81 dBA

Total Leq All Segments: 39.19 dBA

Results segment # 1: OC1 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.96	90.96

RT/Custom (0.00 + 16.67 + 0.00) = 16.67 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-69	-30	0.06	50.00	-9.91	-6.77	0.00	0.00	-16.66	16.67

Segment Leq : 16.67 dBA

Results segment # 2: OC2 (night)

Source height = 0.50 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
0.50	4.50	3.47	90.47

RT/Custom (0.00 + 27.15 + 0.00) = 27.15 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-30	0	0.47	50.00	-13.72	-7.88	0.00	0.00	-1.83	26.58*
-30	0	0.60	50.00	-14.95	-7.90	0.00	0.00	0.00	27.15

* Bright Zone !

Segment Leq : 27.15 dBA

Results segment # 3: OC3 (night)

 Source height = 0.50 m

Barrier height for grazing incidence

 Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
 -----+-----+-----+-----
 0.50 ! 4.50 ! 3.44 ! 90.44

RT/Custom (0.00 + 29.81 + 27.42) = 31.79 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-15	38	0.47	50.00	-13.52	-5.43	0.00	0.00	-2.05	29.01*
-15	38	0.60	50.00	-14.73	-5.46	0.00	0.00	0.00	29.81
38	90	0.60	50.00	-14.73	-7.85	0.00	0.00	0.00	27.42

* Bright Zone !

Segment Leq : 31.79 dBA

Total Leq All Segments: 33.17 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 52.94
 (NIGHT) : 46.92