FREEFIELD LTD.
Ottawa, Ontario, Canada

TRAFFIC NOISE IMPACT ASSESSMENT FOR THE PROPOSED RESIDENTIAL DEVELOPMENT AT 161 HINCHEY AVENUE

CITY OF OTTAWA

Prepared for

Fotenn

Prepared by

Freefield Ltd.

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1.0 Introduction

Freefield Ltd. has been retained by Fotenn to undertake a traffic noise impact assessment in relation to satisfying the City of Ottawa Environmental Noise Control Guidelines (ENCG) for the proposed four storey multi-unit residential condominium building to be located at 161 Hinchey Avenue, City of Ottawa, Ontario.

This report describes an assessment of noise impacts from surface transportation including road traffic on Scott Street and the Light Rail Transitway (LRT) at the interior and exterior noise sensitive areas of the proposed development.

This assessment has been carried out in accordance with the City of Ottawa *Environmental Noise Control Guidelines, January 2016* (ENCG)[1] and Ministry of Environment, Conservation and Parks (MECP) publication, *NPC-300*[2] by Freefield Ltd.

This analysis is based on drawings and information received electronically from Fotenn and project1studio.

General Description of the Proposed Development

The site is on the east side of Hinchey Avenue at an approximate distance of 220 m from Scott Street and the LRT located in a southerly direction.

The proposed residential development comprises of one 4-storey multi-unit residential condominium building rising to approximately 13.2 m above grade. The building will comprise of fifteen (15) residential condominiums.

The development includes a common outdoor amenity area (outdoor living area) serving the residents located in the rear yard.

Refer to Figures 1 to 3.

General Description of the Site

Directions in this report refer to site north as shown on Figure 1.

The site and surrounding area are zoned Residential Fourth Density (R4S). A small pocket of Institutional (I1A) and Light Commercial (LC1) zoned land lies in a southerly direction from the site.

The site and surrounding area are relatively flat with no significant changes in elevation. The finished floor level of the entrance level will be approximately 64.03 mASL.

The primary source of environmental noise impacting the site is vehicular traffic on Scott Street which lies in a southerly direction at an approximate distance of 230 m from the site's southern boundary and the LRT which lies in a southerly direction at an approximate distance of 210 m from the site's southern boundary.

Sir John A. Macdonald Parkway and Parkdale Avenue located in a north and east direction respectively are greater than 100 m from the site, hence, noise from these roads are not required to be assessed as per ENCG criteria.

It is noted while Scott Street is located greater than 100 m from the site, as it is in the same direction as the rail corridor the cumulative noise from Scott Street has been included in the assessment.

Refer to Figure 1 showing the location of the site with respect to the surrounding area.

2.0 Methodology and Assessment Criteria

The outdoor and indoor noise criteria, sound level limits, are provided in Appendix 1. These limits are to be met by proposed noise sensitive developments using control measures such as site design, set-backs, noise barriers, acoustical requirements for building components and ventilation requirements. In some circumstances, warning clauses related to noise are required on titles, leases and sale agreements.

The noise assessment methodology is summarised as follows:

- Noise generated by road and rail traffic is predicted using STAMSON[3,4], a traffic noise model developed by the MECP. STAMSON takes into account such factors as distance from the road, height, nature of the intervening buildings and terrain, ground absorption, and noise barriers, if present.

- Noise from future road and rail traffic is predicted using STAMSON at critical points of reception at the proposed development. Locations to be considered include outdoor living areas (OLA) as well as 'plane of window' (POW) locations, where rooms for living or sleeping are provided. Noise levels are predicted as A-weighted equivalent sound levels, L_{EQ}, (i.e. average levels) for various periods such as Day (07:00 to 23:00) and Night (23:00 to 07:00) periods. A-weighting is a frequency correction to sound pressure levels which approximates the response of the human ear and is used extensively for environmental noise assessments. Results are expressed in dBA, A-weighted decibels.

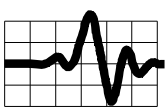
- Based on the predicted sound levels, the specifications for mitigation measures such as noise barriers, building component requirements, ventilation requirements and warning clauses, are determined according to criteria established by the City of Ottawa ENCG and MECP guidelines including NPC-300.

The noise criteria for outdoor living areas and indoor living areas are set out in Tables A1.1 and A1.2, Appendix 1.

Where building component requirements need to be designed to achieve specific indoor sound levels, restrictions apply such as the construction assembly and areas of walls, windows, and doors.

The City of Ottawa ENCG requires indoor noise impacts to be calculated based on the proposed construction assembly of the building to ensure compliance to the applicable indoor noise criteria. The MECP criteria contained in NPC-300 set outdoor noise thresholds to determine the need for building component design. As such, this analysis has compared the predicted exterior noise impacts with the applicable NPC-300 criteria.

Based on the predicted exterior noise levels indoors noise levels have been calculated at worst case living room and bedroom locations for both daytime and nighttime periods. Refer section 5.0 and a summary of the provincial criteria in Table A1.3, Appendix 1.



The ventilation requirements, outdoor noise control measures and warning clause requirements are dependent on predicted outdoor noise levels. Warning clauses, when required, are to be placed on title documents, sale agreements, and lease agreements. Refer ENCG Table A1 Surface Transportation Warning Clauses and the more specific provincial warning clauses taken from NPC-300[2] Section C8 Warning Clauses that are summarised in Appendix 1.

3.0 Points of Reception

For the evaluation of noise impacts, the critical points of reception, POR 1 to POR 2, were chosen at the south and eastern facades of the residential development. The locations represent worst case noise impacts at the proposed development, hence, compliance at these locations will ensure compliance at all other locations on the development.

POR 1 is located at the fourth-floor level plane of window location representing either a living room or a bedroom location with 180 degrees exposure to Scott Street and the LRT.

POR 2 is located at the fourth-floor level plane of window location representing either a living room or a bedroom location with 90 degrees exposure to Scott Street and the LRT.

POR 3 was assessed at the developments outdoor living area, located on the east side of the building in the rear yard.

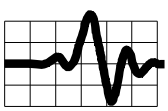
The points of reception are listed in Table 1 and shown in Figures 2 and 3.

Outdoor sound levels are predicted at the critical points of reception. The predicted sound levels at each point of reception are then used to determine the requirements for mitigation needed to achieve the complying indoor sound levels as set out in in Appendix 1.

For assessment of indoor sound levels, points of reception, POR 1 and POR 2 were selected at locations on the building most exposed to noise from Scott Street and the LRT for daytime periods at the worst case living room location and for nighttime periods for the worst-case bedroom location.

Outdoor sound levels were calculated at these worst-case locations, 12 m above grade representing the approximate centre of the windows located on the fourth floor. Plane of window locations are used as windows represent the least 'sound attenuating' building component of the exterior partition.

Refer to Table 1 and Figures 2 and 3.



4.0 Noise Source Modelling and Data

The following road and LRT traffic data was used to assess the traffic noise impacts at each point of reception on the development. The data was taken from the City of Ottawa ENCG which provides ultimate future traffic volume data for various roadways based on roadway class and number of lanes. The traffic data used represents future traffic volumes and correspond to a 'mature state of development', in the City's Official Plan.[1] Traffic for the future LRT was based on 8 trains per hour in each direction i.e. 16 trains per hour in total.

- Scott Street is assessed as a 4 Lane Urban Arterial-Undivided (4-UAD), with 30,000 AADT Volume and a posted speed limit of 50 km/hr, as per City of Ottawa Guidelines. Scott Street is modelled as two two-lane segments, S1 and S2, in this assessment.

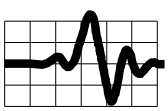
- LRT is assessed as an eastern and western line with 384 AADT and a speed of 80 km/hr. The LRT is modelled as one two-lane segment, S3, in this assessment.

The proportion of traffic type and times used to develop the traffic data for each road segment consists of a 92/8 day/night split with 7% medium trucks and 5% heavy trucks by volume as set out in Appendix B, City of Ottawa Environmental Noise Control Guidelines.[1]

The proportion of traffic used to develop the traffic data for the rail segment was based on a maximum of 8 trains per hour in each direction i.e. 16 trains per hour and based on a 16 hour daytime period and 8 hour nighttime corresponding to the daytime and nighttime periods as per City of Ottawa Environmental Noise Control Guidelines.[1]

The surrounding topography was assessed as a generally flat, reflective surface. The LTR is located in a grade separate corridor at this location approximately 4 m below ground level at Scott Street.

Refer to Table 2: Future Traffic Volumes and Posted Speed Limits.



5.0 Noise Impact Assessment

Based on the future traffic projections, sound levels were predicted at each of the worst-case points of reception, POR 1 to POR 3, using the MECP STAMSON noise modelling software. The results of predictions are contained in Tables 1 to 6. Samples of the outputs of the STAMSON software are provided in Appendix 2.

In the following, the implications of the estimated future noise levels in relation to ENCG and NPC-300 criteria, as set out in Appendix 1, are discussed.

The requirement for building components, ventilation and warning clauses, as noted below, apply to the development.

Building Components

The City of Ottawa ENCG provides indoor sound level criteria for noise sensitive spaces including living, dining, and sleeping areas of residences. This criterion is based on the provincial guideline, NPC-300, and is to be met by the design of building components including the walls, windows and doors of the proposed development.

To assess compliance, POR 1 and POR 2, were selected at locations which represent the worst case noise impact, that is, the part of the building most exposed to road and rail traffic noise, hence, the building components designed for these locations are sufficient to meet the indoor sound level criteria at all locations on the building.

Indoor sound levels in the developments worst case fourth floor living and bedroom areas, with noise coming through facades represented by POR 1 and POR 2, have been estimated using standard acoustical procedures, see IBANA-Calculation output in Appendix 2, which takes into account window areas, wall areas, room sizes and room absorption as well as the sound transmission characteristic of the external walls and windows and the proposed construction assembly of the building.

The proposed construction assembly of the building will consist of the following assemblies:

EXTERIOR WALLS

- Exterior cladding
- Air barrier membrane
- Minimum 11 mm OSB Sheathing or similar
- 38 mm x 140 mm Wood Studs
- 140 mm glass fibre insulation
- polyethylene vapour barrier
- 1 x layer minimum 13 mm gypsum board

WINDOWS AND PATIO DOORS:

- Thermally broken double-glazed vinyl windows or similar.

In order to consider worst case interior noise impacts the following construction assemblies where considered:

- External walls have been modelled as 11 mm OSB, 140 mm wood studs on 406 mm centre with glass fibre cavity insulation, 1 layer of 13 mm gypsum board on interior side with STC 36 rating. Alternative construction is permissible providing it has a minimum STC rating of 36. It is noted the proposed exterior wall assemblies will meet the minimum STC required.

- Windows have been modelled as vinyl frame double pane casement windows 3 mm glass 13 mm air 3 mm glass with STC 31 rating. Alternative construction is permissible providing it has a STC 31 rating or higher.

Sound transmission characteristics used in this analysis are based on National Research Council (NRC) test data, as shown in Appendix 2.

As shown in Table 5 the resulting estimates of indoor sound levels comply with the daytime and nighttime sound level criteria. As such, with the proposed wall and window construction indoor sound levels will meet the indoor sound level criteria set out in Table A1.2.

In addition, as shown Table 3 and Table A1.3 the provincial requirement for building components will be met providing the building complies with the Ontario Building Code.

Outdoor Noise Control Measures

As shown in Table 5, future outdoor daytime noise levels at the Outdoor Living Area (OLA) Point of Reception, POR 3, are below 55 dBA during the daytime period. As such, control measures (barriers) are not required.

Ventilation Requirements & Warning Clauses

The predicted plane of window noise levels, shown in Table 4, indicate that there is not a provincial requirement for ventilation i.e. air conditioning, to ensure that the indoor sound levels are within the City's and the Ministry of Environment, Conservation and Parks noise criteria. Refer table A1.5.

The predicted plane of window noise levels, shown in Table 4, indicate that the Warning Clauses, as noted in Table A1.5 are not required.

6.0 Conclusions and Recommendations

A detailed traffic noise impact assessment has been conducted for the proposed residential development, comprised of one 4-storey multi-unit residential condominium building, to be located at 161 Hinchey Avenue in the City of Ottawa, Ontario.

The assessment has been carried out according to City of Ottawa Environmental Noise Control Guidelines and MECP NPC-300 taking into account future road traffic noise from Scott Street and the LRT rail corridor.

The assessment has led to the following recommendations and conclusions:

6.1 It has been found that City of Ottawa and MECP criteria for surface transportation noise impacts can be met for the proposed development provided that the building components are constructed to comply with the Ontario Building Code. The proposed assembly as noted in this report meets the requirement for building component design. Alternative construction is permissible providing walls have a minimum STC of 36 and windows and patio doors have a minimum STC of 31.

6.2 Future outdoor daytime noise levels at the proposed Outdoor Living Area (OLA) Point of Reception, POR 3, are below 55 dBA. As such, noise mitigation (barriers) are not required.

6.3 Outdoor sound levels are below various thresholds for ventilation and warning clause requirements; hence, ventilation requirements and warning clauses are not required for this development.

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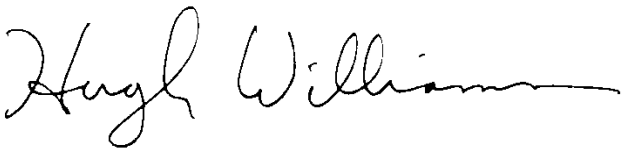


Hugh Williamson, Ph.D., P.Eng.
Member, Canadian Acoustical Society

References

1. City of Ottawa *Environmental Noise Control Guidelines, January 2016*.

2. Ministry of Environment, Conservation and Parks, Publication NPC-300, *Environmental Noise Guideline Stationary and Transportation Sources - Approval and Planning*, August 2013.

3. Ministry of Environment, Conservation and Parks, *Sample Application Package, Basic Comprehensive Certificate of Approval (Air and Noise)*, July 2009.

4. Ministry of Environment, Conservation and Parks, Road Noise Analysis Method for Environment and Transportation (ORNAMENT), 1989.

5. Ministry of Environment, Conservation and Parks, STAMSON Software, Version 5.03, 1996. (Software version of References 5 and 6.)

6. City of Ottawa *"Official Plan - Annex 10*", 2011.

FIGURES

Contents:

Figure 1: Area Plan, Proposed Development at 161 Hinchey Avenue (Source: geoOttawa)

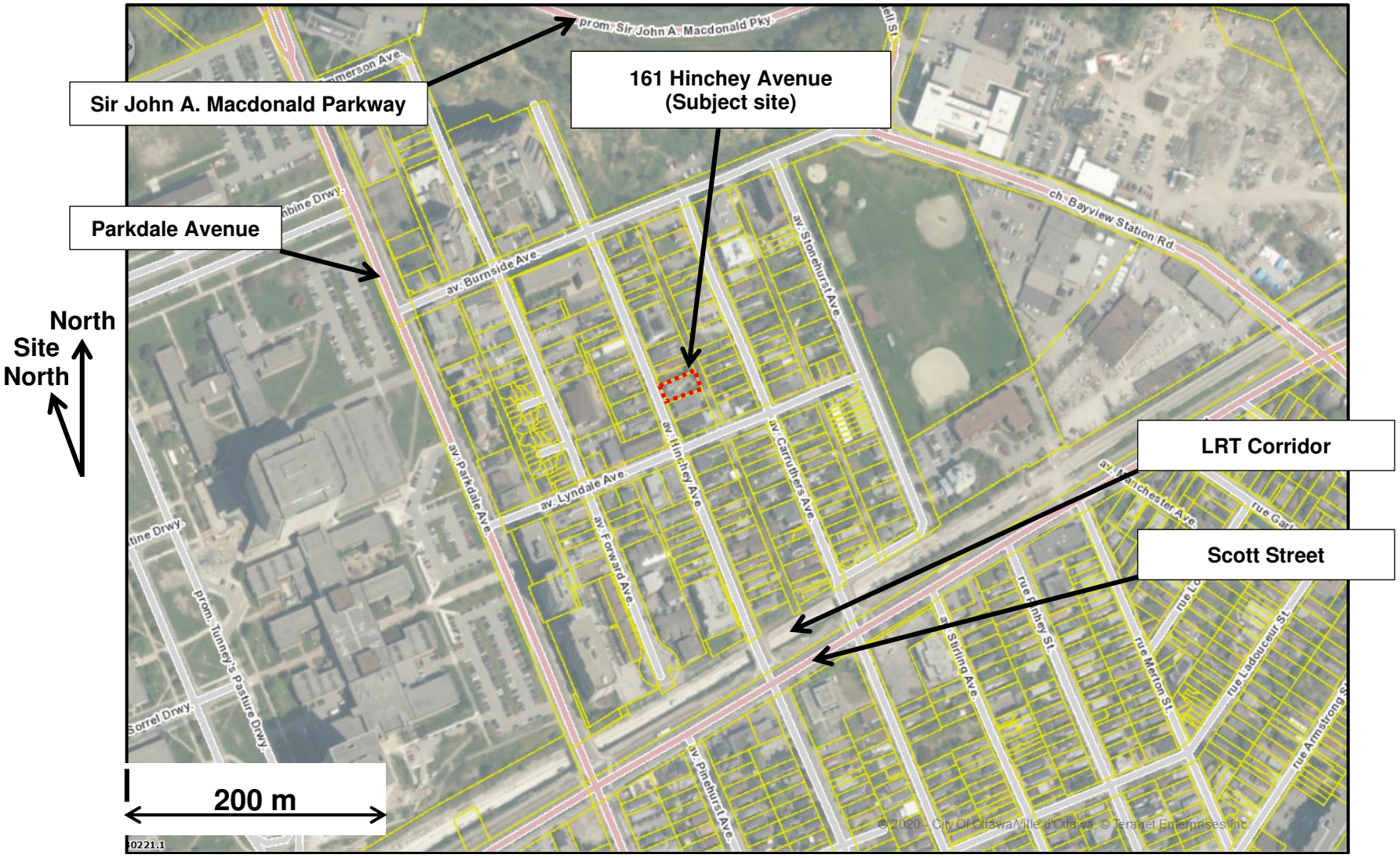


Figure 2: Site Plan showing Points of Reception (Source: Project1 Studio)
Refer Table 1 for distance and angle of exposure to Scott Street and the LRT

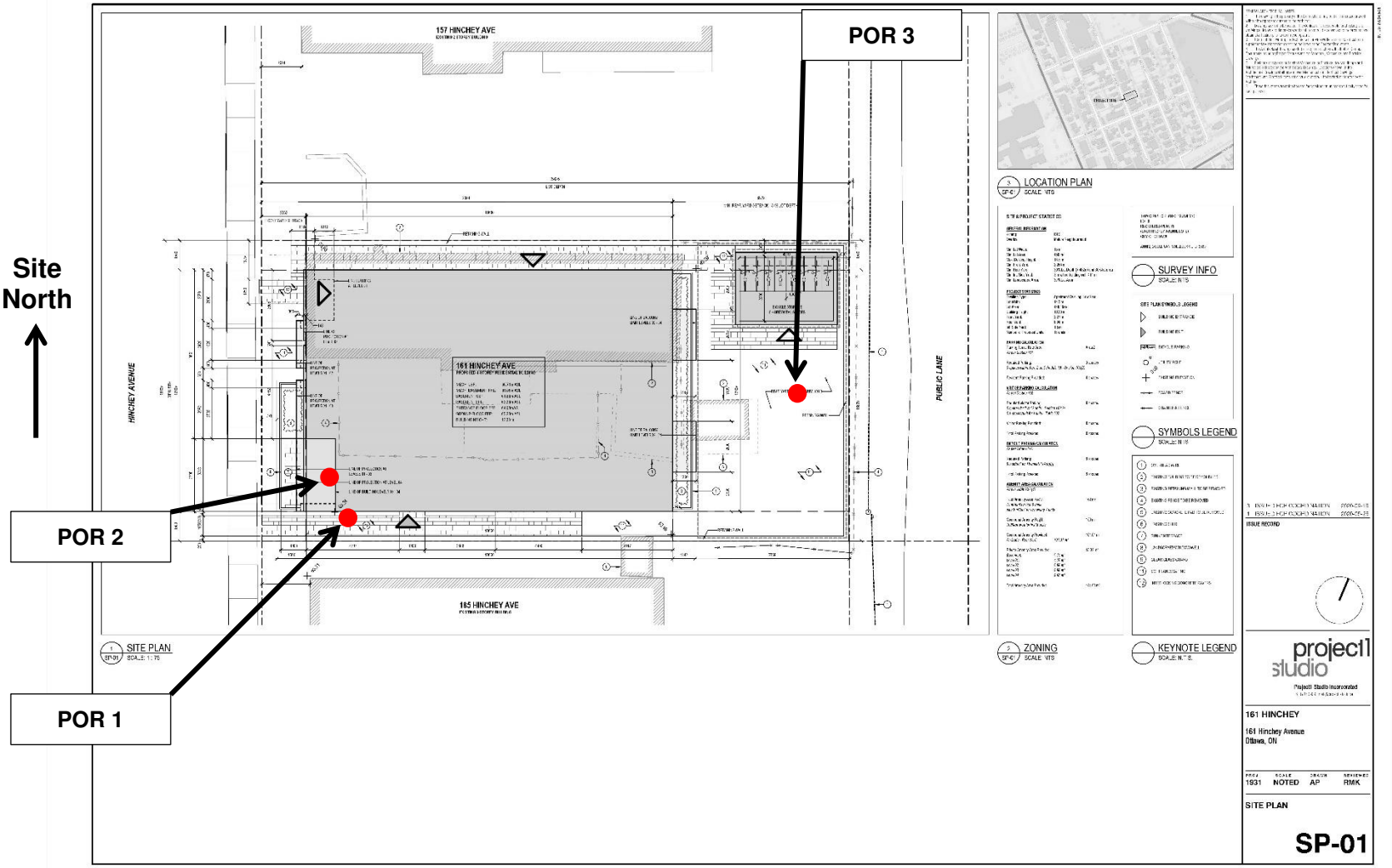
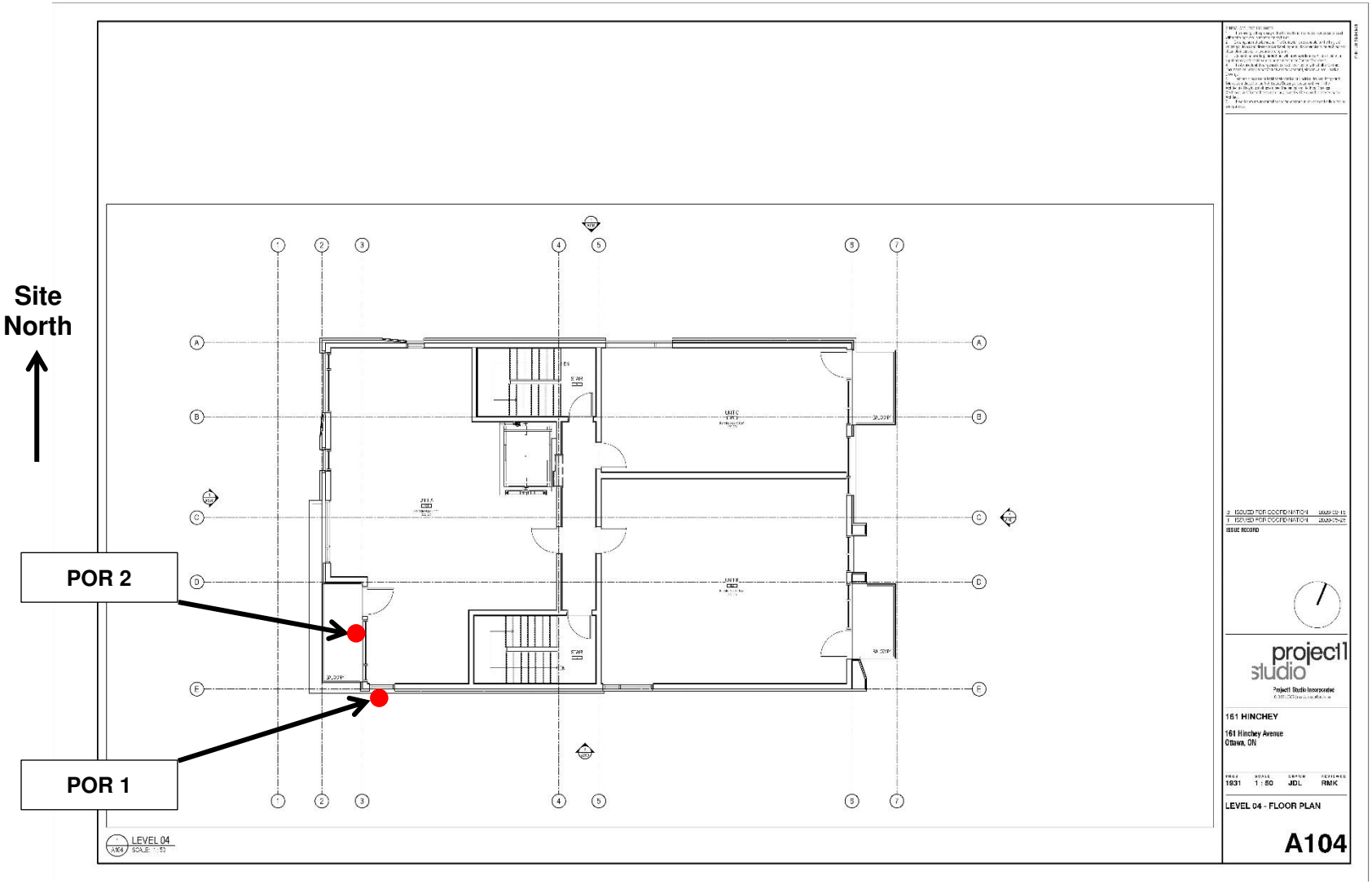


Figure 3: Fourth Floor Level Plan showing Points of Reception at Worst Case Residential Unit



TABLES

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Table 1: Modelled Points of Reception

Symbol	Location	Scott Street			LRT		Height (m)*	Description
		Distance (m)		Angle of exposure (deg.)	Distance (m)	Angle of exposure (deg.)		
		S1	S2		S3			
POR 1	Fourth floor level window – Southern Facade	228.8	233.6	180	208.3	180	12	Plane of window (living or bedroom)
POR 2	Fourth floor level window – Western Facade	230.5	235.3	90	210	90	12	Plane of window (living or bedroom)
POR 3	Outdoor Living Area (located in rear yard)	235	239.8	180	214.5	180	1.5	Outdoor Living Area (Common Amenity Area)

*Height measured from ground

Table 2: Future Traffic Volumes and Posted Speed Limits

Road Segment	Input Data							Day Volumes, 7:00 - 23:00			Night Volumes, 23:00 - 7:00		
	Segment Type	AADT (24 hours)	Posted Speed	Split Day	Split Night 23:00-7:00	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks
			kph	7:00-23:00	7:00	%	%	no.	no.	no.	no.	no.	no.
Scott Street, 4 Lane, Urban Arterial-Undivided (4-UAD), Future Mature Traffic Volumes from City of Ottawa Guidelines*													
East (S1)	4-UAD	15,000	50	0.92	0.08	7	5	12144	966	690	1056	84	60
West (S2)	4-UAD	15,000	50	0.92	0.08	7	5	12144	966	690	1056	84	60
LRT**													
										Trains			Trains
East / West	LRT	384	80	16 hours	8 hours					256			128

*Future Mature State Traffic Data for Scott Street based on 2 - two lane segments each with 15,000 AADT Volume as per City of Ottawa Guidelines. Modelled as S1 and S2.

**Future Mature State Traffic for LRT based on 16 trains per hour. Modelled as one two-lane segment, S3.

Table 3: Traffic Noise Impacts for Building Component Requirements

Point of Reception	Location	Estimated Future Noise Level* (dBA)		Building Component Requirement
		Day (Living Room - 7:00 to 23:00)	**Night** (Bedroom – 23:00 to 07:00)	
POR 1	Fourth floor level living or bedroom window – Southern Facade	50	43.19	Building compliant with Ontario Building Code sufficient to achieve indoor sound level criteria in Table A1.2.
POR 2	Fourth floor level living or bedroom window – Western Facade	46.99	40.18	Building compliant with Ontario Building Code sufficient to achieve indoor sound level criteria in Table A1.2.

*Daytime Noise Impacts based on Leq 16 h (07:00 – 23:00), Nighttime Noise Impacts based on Leq 8 h (23:00 – 07:00). Refer Table A1.3.

** Analysis shows that the proposed construction of external walls and windows is sufficient to meet City of Ottawa ENCG indoor sound level criteria, see discussion in Section 5.0.

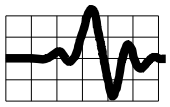


Table 4: Traffic Noise Impacts for Ventilation and Warning Clause Requirements

Point of Reception (POR)	Location (see Figures 1 to 5)	Sound Levels due to Road Traffic*		Ventilation Requirements(1)	Warning Clauses(2)
		Day (dBA)	Night (dBA)		
POR 1	Fourth floor level living or bedroom window – Southern Facade	50	43.19	None Required	Not Required
POR 2	Fourth floor level living or bedroom window – Western Facade	46.99	40.18	None Required	Not Required
POR 3	Outdoor Living Area	50	-	Not applicable	Not required

*Daytime Noise Impacts based on Leq 16 h (07:00 – 23:00), Night Impacts based on Leq 8 h (23:00 – 07:00).

Notes: 1. Ventilation Requirements - Refer Table A1.5, Appendix 1
2. Warning Clause Requirements - Refer Tables A1.5 and A1.6, Appendix 1

Table 5: Predicted Indoor Sound Levels*

Room	Period	Area (m2)	Facade 1 (POR 1)			Facade 2 (POR 2)			Combined Indoor Sound Level (dBA)	City Criterion (dBA)	Complies (Yes/No)
			Window[3] (m2)	Wall[1] (m2)	Indoor Sound Level (dBA)	Window[3] (m2)	Wall[2] (m2)	Indoor Sound Level (dBA)			
Living / Dining Room	Day	10.2	2	5.5	21	11.8	0.3	21	24	45	Yes
Bedroom	Night	10.2	2	5.5	15	11.8	0.3	15	18	40	Yes

*Prediction Method: IBANA Calculations Refer to Appendix 2.

Table 6: Traffic Noise Impacts for Outdoor Living Area (OLA)

Point of Reception	Location	Estimated Future Day Noise Level* (dBA)		Description of Recommendations and Mitigation
		Day	Night	
POR 3	Outdoor Living Area	50	-	None Required

* Daytime Noise Impacts based on Leq 16 h (07:00 – 23:00). Result less than 55 dBA, hence, outdoor noise control measures not required. Refer Table A1.1 and A1.5.

Appendix 1

City of Ottawa Noise Criteria and Warning Clauses

For further information refer to:

City of Ottawa Environmental Noise Control Guidelines[1] (ENCG)

MECP Documents, NPC-300[5, 6, 7]

Table A1.1 Summary of Sound Level Criteria for Outdoor Living Areas* Surface Transportation (Road and Rail)

Time Period	Leq 16 hr (dBA)
16 hr, 07:00 – 23:00	55

*Reference: ENCG[1] Table 2.2a and NPC-300[2], Table C-1.

Table A1.2 Summary of Indoor Sound Level Criteria* Surface Transportation (Road and Rail)

Type of Space	Leq (Time Period (dBA))	
	Roadways, Transitways and LRT	Rail (diesel engines/ locomotives)
General offices, reception areas, retail stores, etc. (Time period: 16 hr., 07:00 – 23:00)	50	45
Living/dining areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual semi-private offices, conference rooms, reading rooms, etc. (Time period: 16 hr., 07:00 – 23:00)	45	40
Sleeping quarters of hotels/motels (Time period: 8 hr., 23:00 – 07:00)	45	40
Sleeping Quarters of residences, hospitals, nursing/retirement homes, etc. (Time period: 8 hr., 23:00 – 07:00)	40	35

*Reference: ENCG[1] Table 2.2b and 2.2c and NPC-300[2], Table C-1 and table C-9.

Table A1.3: Summary of Road and Rail Noise* Daytime (07:00 – 23:00) & Nighttime (23:00 – 07:00) Building Component Requirements

Assessment Location & Time		Outdoor Leq (dBA)	Building Component Requirements
Plane of the Living/Dining Room Windows ♦ Daytime (07:00 – 23:00)	Road	Less than or equal to 65	Building compliant with Ontario Building Code
		Greater than 65	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria in Table A1.2.
	Rail	Less than or equal to 60	Building compliant with Ontario Building Code
		Greater than 60	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria in Table A1.2.
Plane of Bedroom Window ♦ Nighttime (23:00 – 07:00)	Road	Less than or equal to 60	Building compliant with Ontario Building Code
		Greater than 60	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria in Table A1.2.
	Rail	Less than or equal to 55	Building compliant with Ontario Building Code
		Greater than 55	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria in Table A1.2.

*Reference: NPC-300, Section C7.1 Road Noise Control Measures

Table A1.4: Summary of Facade Material Requirement for Rail Noise Only*

Assessment Location	Distance to Railway	Sound Level dBA	Facade Material Requirement
Plane of Bedroom Window ♦ 24 hr.	**Less than 100 m**	**Leq $_{24\ hr}$ less than or equal to 60**	**No additional requirement**
		Leq $_{24\ hr}$ greater than 60	**Brick veneer or acoustically equivalent**
	Greater than 100 m	**Leq $_{24\ hr}$ less than or equal to 60**	**No additional requirement**
		Leq $_{24\ hr}$ greater than 60	**No additional requirement**

*Reference: NPC-300, Section C7.2 Rail Noise Control Measures.

Table A1.5: Summary of Combination of Road and Rail Noise* Day-time (07:00 – 23:00) & Night-time (23:00 – 07:00) Outdoor, Ventilation and Warning Clause Requirements

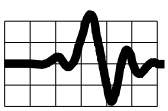
Assessment Location & Time	Outdoor Leq (dBA)	Ventilation Requirements	Outdoor Control Measures	Warning Clauses (see Table A1.6)
Outdoor Living Area (OLA) ♦ Day-time (07:00 – 23:00)	Less than or equal to 55	N/A	None Required	Not Required
	Greater than 55 to less than 60	N/A	Control Measures (barriers) not required but should be considered.	Type A required if resultant Leq exceeds 55 dBA
	Greater than 60	N/A	Control measures (barriers) required to reduce the Leq to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible.	Type B required if resultant Leq exceeds 55 dBA
Plane of the Living/Dining Room Windows ♦ Day-time (07:00 –23:00)	Less than or equal to 55	None Required	N/A	Not Required
	Greater than 55 to less than or equal to 65	Forced air heating with provision for central air-conditioning	N/A	Required Type C
	Greater than 65	Central ducted air-conditioning	N/A	Required Type D
Plane of Bedroom Window ♦ Night-time (23:00 – 07:00)	Less than or equal to 50	None Required	N/A	Not Required
	Greater than 50 to less than or equal to 60	Forced air heating with provision for central ducted air-conditioning	N/A	Required Type C
	Greater than 60	Central ducted air-conditioning	N/A	Required Type D

*Reference: NPC-300, Section C7.1 and C7.2.

Table A1.6: Summary of Provincial Warning Type Clauses (may be used individually or in combination)*

Type	Warning Clause
Type A	"Purchasers/Tenants are advised that sound levels due to increasing (road) (transitway) (rail) (air) traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of Environment, Parks and Conservation noise criteria."
Type B	"Purchasers/Tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing (road) (transitway) (rail) (air) traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of Environment, Parks and Conservation noise criteria."
Type C	"This dwelling unit has been fitted with a forced air heating system and the ducting etc. was sized to accommodate central air-conditioning. Installation of central air-conditioning by the occupant will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment, Parks and Conservation noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with the noise criteria of MECP Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts on and in the immediate vicinity of the subject property."
Type D	"This dwelling unit has been supplied with a central air-conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment, Parks and Conservation noise criteria."
Type E	“Purchasers/tenants are advised that due to the proximity of the adjacent industry (facility) (utility), sound levels from the industry (facility) (utility) may at times be audible.

*Reference: NPC-300[2] Section C8 Warning Clauses. Refer ENCG Table A1 Surface Transportation Warning Clauses for example of applicable “no outdoor amenity area provided” type warning clause.



Appendix 2

Calculation Details and Software Outputs

Contents:

Sample outputs from STAMSON:

STAMSON 5.0 SUMMARY REPORT Date: 07-08-2020 11:35:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por1d.te Time Period: 16 hours
Description: POR_1 Daytime (Plane of Window)

Road data, segment # 1: S1_Scott_W

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: S1_Scott_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 228.80 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: S2_Scott_E

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: S2_Scott_E

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 233.60 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary
---

source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.S1_Scott_W	1.50	46.84	46.84
2.S2_Scott_E	1.50	46.75	46.75
Total			49.81 dBA

RT/Custom data, segment # 1: LRT_E_W
---
1 - Custom (77.7 dBA):
Traffic volume : 256 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: LRT_E_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 208.30 m
Receiver height : 12.00 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.00 m
Reference angle : 0.00

Result summary
---

source height (m)	Gen Leq (dBA)	Total Leq (dBA)
1.LRT_E_W	4.00	36.22	36.22
Total			36.22 dBA

TOTAL Leq FROM ALL SOURCES: 49.99

STAMSON 5.0 SUMMARY REPORT Date: 07-08-2020 11:41:24
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por1n.te Time Period: 8 hours
Description: POR_1 Nighttime (Plane of Window)

Road data, segment # 1: S1_Scott_W

Car traffic volume : 1056 veh/TimePeriod
Medium truck volume : 84 veh/TimePeriod
Heavy truck volume : 60 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: S1_Scott_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 228.80 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: S2_Scott_E

Car traffic volume : 1054 veh/TimePeriod
Medium truck volume : 84 veh/TimePeriod
Heavy truck volume : 60 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: S2_Scott_E

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 233.60 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary
---

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.S1_Scott_W	1.50	39.24	39.24
2.S2_Scott_E	1.50	39.15	39.15
Total			42.21 dBA

RT/Custom data, segment # 1: LRT_E_W
---
1 - Custom (77.7 dBA):
Traffic volume : 128 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: LRT_E_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 208.30 m
Receiver height : 12.00 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.00 m
Reference angle : 0.00

Result summary
---

	source height (m)	Gen Leq (dBA)	Total Leq (dBA)
1.LRT_E_W	4.00	36.22	36.22
Total			36.22 dBA

TOTAL Leq FROM ALL SOURCES: 43.18

STAMSON 5.0 SUMMARY REPORT Date: 07-08-2020 11:39:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por2d.te Time Period: 16 hours
Description: POR_2 Daytime (Plane of Window)

Road data, segment # 1: S1_Scott_W

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: S1_Scott_W

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 228.80 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: S2_Scott_E

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: S2_Scott_E

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 233.60 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary
---

source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.S1_Scott_W 1.50	43.83	43.83
2.S2_Scott_E 1.50	43.74	43.74
Total		46.80 dBA

RT/Custom data, segment # 1: LRT_E_W
---
1 - Custom (77.7 dBA):
Traffic volume : 256 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: LRT_E_W

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 208.30 m
Receiver height : 12.00 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.00 m
Reference angle : 0.00

Result summary
---

source height (m)	Gen Leq (dBA)	Total Leq (dBA)
1.LRT_E_W 4.00	33.21	33.21
Total		33.21 dBA

TOTAL Leq FROM ALL SOURCES: 46.98

STAMSON 5.0 SUMMARY REPORT Date: 07-08-2020 11:42:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por2n.te Time Period: 8 hours
Description: POR_2 Nighttime (Plane of Window)

Road data, segment # 1: S1_Scott_W

Car traffic volume : 1054 veh/TimePeriod
Medium truck volume : 84 veh/TimePeriod
Heavy truck volume : 60 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: S1_Scott_W

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 228.80 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: S2_Scott_E

Car traffic volume : 1056 veh/TimePeriod
Medium truck volume : 84 veh/TimePeriod
Heavy truck volume : 60 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: S2_Scott_E

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 233.60 m
Receiver height : 12.00 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary
---

source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.S1_Scott_W 1.50	36.23	36.23
2.S2_Scott_E 1.50	36.14	36.14
Total		39.20 dBA

RT/Custom data, segment # 1: LRT_E_W
---
1 - Custom (77.7 dBA):
Traffic volume : 128 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: LRT_E_W

Angle1 Angle2 : -90.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 208.30 m
Receiver height : 12.00 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.00 m
Reference angle : 0.00

Result summary
---

source height (m)	Gen Leq (dBA)	Total Leq (dBA)
1.LRT_E_W 4.00	33.21	33.21
Total		33.21 dBA

TOTAL Leq FROM ALL SOURCES: 40.17

STAMSON 5.0 SUMMARY REPORT Date: 07-08-2020 11:39:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por3d.te Time Period: 16 hours
Description: POR_3 Daytime (Outdoor Living Area)

Road data, segment # 1: S1_Scott_W

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: S1_Scott_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 228.80 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: S2_Scott_E

Car traffic volume : 12144 veh/TimePeriod
Medium truck volume : 966 veh/TimePeriod
Heavy truck volume : 690 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: S2_Scott_E

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 233.60 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary
---

source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.S1_Scott_W 1.50	46.84	46.84
2.S2_Scott_E 1.50	46.75	46.75
Total		49.81 dBA

RT/Custom data, segment # 1: LRT_E_W
---
1 - Custom (77.7 dBA):
Traffic volume : 256 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: LRT_E_W

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 7
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 208.30 m
Receiver height : 1.50 m
Topography : 3 (Elevated; no barrier)
Elevation : 4.00 m
Reference angle : 0.00

Result summary
---

source height (m)	Gen Leq (dBA)	Total Leq (dBA)
1.LRT_E_W 4.00	36.22	36.22
Total		36.22 dBA

TOTAL Leq FROM ALL SOURCES: 49.99

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID:
Date:2020-08-07
Outdoor level: NEF 18 or Leq24 50 or Ldn 51 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 10.10 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: OSB11_WS140(406)_GFB152_G13

Construction Type: 2by6 Wall
Area: 5.50 m²
Test ID: TLA-99-033a
Test Date: 1999-01-22

11 mm OSB, 140 mm wood studs on 406 mm centre with glass fibre cavity insulation, 1 of 13 mm gypsum board.

Element 2: GL3_AIR13_GL3

Construction Type: Window
Area: 2.00 m²
Test ID: TLA-99-143a
Test Date: 1999-04-12

Vinyl casement window (seals not taped).

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	35.8
63	35.1
80	33.0
100	32.1
125	31.1
160	27.1
200	19.2
250	19.4
315	12.6
400	12.1
500	7.7
630	5.9
800	3.9
1000	2.6
1250	-1.6
1600	-3.1
2000	-6.2
2500	-8.2
3150	-6.8
4000	-5.6
5000	-8.5

A-Weighted Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	5.6
63	8.9
80	10.5
100	13.0
125	15.0
160	13.7
200	8.3
250	10.8
315	6.0
400	7.3
500	4.5
630	4.0
800	3.1
1000	2.6
1250	-1.0
1600	-2.1
2000	-5.0
2500	-6.9
3150	-5.6
4000	-4.6
5000	-8.0

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)

50	17.9
63	16.6
80	16.9
100	15.5
125	13.5
160	16.7
200	24.2
250	22.7
315	28.4
400	28.2
500	32.0
630	33.5
800	36.4
1000	37.8
1250	40.5
1600	40.6
2000	42.5
2500	42.4
3150	39.0
4000	36.8
5000	38.1

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	55.0
63	53.0
80	51.3
100	48.9
125	45.9
160	45.2
200	44.7
250	43.4
315	42.4
400	41.6
500	41.0
630	40.7
800	41.6
1000	41.8
1250	40.2
1600	38.8
2000	37.6
2500	35.5
3150	33.6
4000	32.8
5000	31.3

Single Number Ratings

Outdoor Sound Level:	50 dBA
Indoor Sound Level:	21 dBA
A-wtd Level Reduction:	29 dB
A-wtd Reduction re Standard Source:	28 dB
OITC Rating:	25 dB

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID:
Date:2020-08-07
Outdoor level: NEF 12 or Leq24 44 or Ldn 45 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 10.10 ft²
Absorbtion: 120% of floor area

Construction Description:

Element 1: OSB11_WS140(406)_GFB152_G13

Construction Type: 2by6 Wall
Area: 5.50 m²
Test ID: TLA-99-033a
Test Date: 1999-01-22

11 mm OSB, 140 mm wood studs on 406 mm centre with glass fibre cavity insulation, 1 of 13 mm gypsum board.

Element 2: GL3_AIR13_GL3

Construction Type: Window
Area: 2.00 m²
Test ID: TLA-99-143a
Test Date: 1999-04-12

Vinyl casement window (seals not taped).

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	29.0
63	28.3
80	26.2
100	25.3
125	24.3
160	20.4
200	12.4
250	12.6
315	5.9
400	5.3
500	0.9
630	-0.9
800	-2.9
1000	-4.1
1250	-8.4
1600	-9.9
2000	-13.0
2500	-15.0
3150	-13.6
4000	-12.4
5000	-15.3

A-Weighted Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	-1.2
63	2.1
80	3.7
100	6.2
125	8.2
160	7.0
200	1.5
250	4.0
315	-0.7
400	0.5
500	-2.3
630	-2.8
800	-3.7
1000	-4.1
1250	-7.8
1600	-8.9
2000	-11.8
2500	-13.7
3150	-12.4
4000	-11.4
5000	-14.8

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)

50	17.9
63	16.6
80	16.9
100	15.5
125	13.5
160	16.7
200	24.2
250	22.7
315	28.4
400	28.2
500	32.0
630	33.5
800	36.4
1000	37.8
1250	40.5
1600	40.6
2000	42.5
2500	42.4
3150	39.0
4000	36.8
5000	38.1

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	49.0
63	47.0
80	45.3
100	42.9
125	39.9
160	39.2
200	38.7
250	37.4
315	36.4
400	35.6
500	35.0
630	34.7
800	35.6
1000	35.8
1250	34.2
1600	32.8
2000	31.6
2500	29.5
3150	27.6
4000	26.8
5000	25.3

Single Number Ratings

Outdoor Sound Level:	44 dBA
Indoor Sound Level:	15 dBA
A-wtd Level Reduction:	29 dB
A-wtd Reduction re Standard Source:	29 dB
OITC Rating:	25 dB

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID:
Date:2020-08-07
Outdoor level: NEF 15 or Leq24 47 or Ldn 48 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 10.10 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: OSB11_WS140(406)_GFB152_G13

Construction Type: 2by6 Wall
Area: 0.30 m²
Test ID: TLA-99-033a
Test Date: 1999-01-22

11 mm OSB, 140 mm wood studs on 406 mm centre with glass fibre cavity insulation, 1 of 13 mm gypsum board.

Element 2: GL3_AIR13_GL3

Construction Type: Window
Area: 11.80 m²
Test ID: TLA-99-143a
Test Date: 1999-04-12

Vinyl casement window (seals not taped).

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	33.3
63	31.8
80	27.7
100	26.2
125	23.7
160	23.2
200	22.9
250	23.8
315	15.0
400	16.3
500	12.0
630	10.0
800	8.2
1000	6.9
1250	2.7
1600	1.2
2000	-2.2
2500	-6.6
3150	-5.3
4000	-1.9
5000	-4.2

A-Weighted Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	3.1
63	5.6
80	5.2
100	7.1
125	7.6
160	9.8
200	12.0
250	15.2
315	8.4
400	11.5
500	8.8
630	8.1
800	7.4
1000	6.9
1250	3.3
1600	2.2
2000	-1.0
2500	-5.3
3150	-4.1
4000	-0.9
5000	-3.7

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)

50	19.5
63	19.0
80	21.3
100	20.5
125	19.9
160	19.7
200	19.5
250	17.3
315	25.2
400	23.0
500	26.7
630	28.5
800	31.1
1000	32.7
1250	35.3
1600	35.3
2000	37.6
2500	39.8
3150	36.5
4000	32.2
5000	32.8

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	52.0
63	50.0
80	48.3
100	45.9
125	42.9
160	42.2
200	41.7
250	40.4
315	39.4
400	38.6
500	38.0
630	37.7
800	38.6
1000	38.8
1250	37.2
1600	35.8
2000	34.6
2500	32.5
3150	30.6
4000	29.8
5000	28.3

Single Number Ratings

Outdoor Sound Level:	47 dBA
Indoor Sound Level:	21 dBA
A-wtd Level Reduction:	26 dB
A-wtd Reduction re Standard Source:	24 dB
OITC Rating:	25 dB

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID:
Date:2020-08-07
Outdoor level: NEF 9 or Leq24 41 or Ldn 42 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 10.10 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: OSB11_WS140(406)_GFB152_G13

Construction Type: 2by6 Wall
Area: 0.30 m²
Test ID: TLA-99-033a
Test Date: 1999-01-22

11 mm OSB, 140 mm wood studs on 406 mm centre with glass fibre cavity insulation, 1 of 13 mm gypsum board.

Element 2: GL3_AIR13_GL3

Construction Type: Window
Area: 11.80 m²
Test ID: TLA-99-143a
Test Date: 1999-04-12

Vinyl casement window (seals not taped).

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	27.3
63	25.8
80	21.7
100	20.2
125	17.7
160	17.2
200	16.9
250	17.8
315	9.0
400	10.3
500	6.0
630	4.0
800	2.2
1000	0.9
1250	-3.3
1600	-4.8
2000	-8.2
2500	-12.6
3150	-11.3
4000	-7.9
5000	-10.2

A-Weighted Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	-2.9
63	-0.4
80	-0.8
100	1.1
125	1.6
160	3.8
200	6.0
250	9.2
315	2.4
400	5.5
500	2.8
630	2.1
800	1.4
1000	0.9
1250	-2.7
1600	-3.8
2000	-7.0
2500	-11.3
3150	-10.1
4000	-6.9
5000	-9.7

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)

50	19.5
63	19.0
80	21.3
100	20.5
125	19.9
160	19.7
200	19.5
250	17.3
315	25.2
400	23.0
500	26.7
630	28.5
800	31.1
1000	32.7
1250	35.3
1600	35.3
2000	37.6
2500	39.8
3150	36.5
4000	32.2
5000	32.8

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	46.0
63	44.0
80	42.3
100	39.9
125	36.9
160	36.2
200	35.7
250	34.4
315	33.4
400	32.6
500	32.0
630	31.7
800	32.6
1000	32.8
1250	31.2
1600	29.8
2000	28.6
2500	26.5
3150	24.6
4000	23.8
5000	22.3

Single Number Ratings

Outdoor Sound Level:	41 dBA
Indoor Sound Level:	15 dBA
A-wtd Level Reduction:	26 dB
A-wtd Reduction re Standard Source:	24 dB
OITC Rating:	25 dB

RESUMÉ: Dr. HUGH WILLIAMSON, P.Eng.

QUALIFICATIONS:

Ph.D. Mechanical Engineering, University of New South Wales, 1972

B.Sc. Mechanical Engineering, (with Distinction), University of Alberta, 1967

Member, Professional Engineers, Ontario

Member, Canadian Acoustical Association

Member, American Society of Heating, Refrigeration and Air-conditioning Engineers

KEY COMPETENCIES:

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.

PROFESSIONAL EXPERIENCE:

Hugh Williamson is a professional engineer with many years of experience in the measurement, analysis and control of noise and vibration. Freefield Ltd. was incorporated in 2017 and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to joining Freefield Ltd. Hugh Williamson founded and directed Hugh Williamson Associates Inc. which specialized in consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. His career included extensive periods in industry as well as university level research and teaching. He is a former Director of the Acoustics and Vibration Unit at the Australian Defence Force Academy. He has published over 50 engineering and scientific papers and has been an invited speaker on noise and vibration at national and international conferences. He has more than 25 years of experience as a consultant.

CLIENT LIST:

Hugh Williamson has provided consulting services to large and small clients including: National Research Council, R. W. Tomlinson, G. Tackaberry & Sons Construction, Miller Paving, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group and Industry Canada.

RESUMÉ: MICHAEL WELLS

QUALIFICATIONS:

Registered Architect of NSW, Registration Number: 8111

B. Architecture (Hons), University of Sydney, 2002

B.Sc. Architecture, University of Sydney, 1999

Member, Canadian Acoustical Association

KEY COMPETENCIES:

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning.
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.
- Design services including sketch design, design development (development / permit applications), contract documents, tendering and contract administration.

PROFESSIONAL EXPERIENCE:

Michael Wells is a professional Architect registered in NSW, Australia, with many years of experience in the measurement, analysis and control of noise and vibration. Michael Wells is a founding Director of Freefield Ltd. which was incorporated in 2017, and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to establishing Freefield Ltd., his career included working for Hugh Williamson Associates Inc. specializing in acoustics, noise and vibration consulting services, and, the founding of Michael Wells Architect in Sydney, Australia, specializing in the design of institutional, commercial and residential projects. He is the former Director of Architectural Workshops Australia and Vision Blue Pty Ltd. He has more than 15 years of experience as a consultant.

CLIENT LIST:

Michael Wells has provided consulting services to large and small clients including: National Research Council, R. W. Tomlinson, G. Tackaberry & Sons Construction, Miller Paving, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group and Industry Canada.