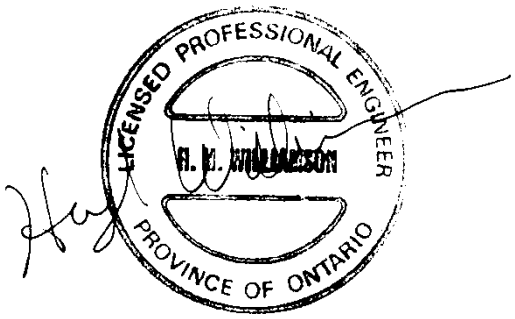
HUGH WILLIAMSON ASSOCIATES INC.
Ottawa, Ontario

TRAFFIC NOISE IMPACT ASSESSMENT FOR THE PROPOSED CHÂTEAU LAURIER ADDITION AT 1 RIDEAU STREET

CITY OF OTTAWA



Prepared for

Momentum - Planning & Communications

Prepared by

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15th January, 2018

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Table of Contents

TRAFFIC NOISE IMPACT ASSESSMENT FOR THE PROPOSED CHÂTEAU LAURIER ADDITION AT 1 RIDEAU STREET, CITY OF OTTAWA

1.0 Introduction

Hugh Williamson Associates Inc. has been retained by Momentum - Planning & Communications to undertake a traffic noise impact assessment in relation to satisfying the City of Ottawa Environmental Noise Control Guidelines (ENCG) for the proposed addition to the Château Laurier Hotel, located at 1 Rideau Street, Part Lots 5 & 6 (South Clare Street), Reg. Plan 186, in the City of Ottawa, Ontario.

This report describes an assessment of noise impacts from road traffic on Murray Street, St. Patrick Street, MacKenzie Avenue and Rideau Street at the interior and outdoor living 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 and Climate Change publication, *NPC-300*[2] by Hugh Williamson Associates Inc.

The proposed addition is located on the northern side of the existing Château Laurier Hotel located at the intersection of Rideau Street and MacKenzie Avenue, as shown in Figure 1 and Figure 2.

This analysis is based on drawings and information received electronically from architects Alliance.

General Description of the Proposed Development

The proposed addition will comprise approximately 171 long term stay style hotel units along with underground parking to serve the hotel. The addition will consist of 8 stories rising to approximately 26.65 m above grade.

Living and sleeping quarters are located on each floor and comprise of one and two bedroom units. HVAC equipment is to be located in the basement of the building.

The development includes an outdoor living area (OLA) in the form of a ground floor courtyard, located on the south side of the addition, between the existing Chateau Laurier Hotel and the proposed addition, as shown in Figure 2.

Site Description

The land surrounding the proposed development consists of commercial, institutional, hotel and residential uses. The site is relatively flat with no significant changes in elevation.

The primary source of environmental noise is vehicular traffic along Murray Street, St. Patrick Street, MacKenzie Avenue and Rideau Street.

2.0 Methodology and Assessment Criteria

This report has been prepared in accordance with the assessment procedures set out in the City of Ottawa *Environmental Noise Control Guidelines*[1]*, ENCG,* and MOECC guidelines.[2]

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 traffic is predicted using STAMSON[3,4], a traffic noise model developed by the MOECC. 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.

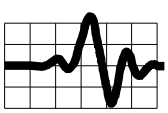
- Noise from future road traffic is predicted using STAMSON at critical points of reception at the proposed development. Locations to be considered include outdoor living areas (OLA) as well as plane of window (POW) locations, where rooms for living or sleeping are provided. Noise levels are predicted as A-weighted equivalent sound levels, L_{EQ}, (i.e. average sound 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 as described below.

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

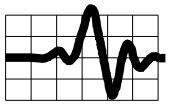
Where building component requirements need to be designed to achieve specific indoor sound levels, restrictions may apply such as the construction assembly and areas of walls, windows, and doors.

The City of Ottawa ENCG requires indoor noise impacts to be calculated based on the construction assembly of the building to ensure compliance to the applicable indoor noise criteria. The MOECC criteria 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, as well as, calculated the indoor noise levels from road traffic at worst case bedroom and living room 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

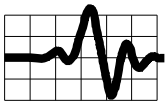
For the evaluation of noise impacts, the critical points of reception, POR 1, POR 2, POR 3, POR 4 and POR 5 were chosen which represent the location of worst case noise impacts at the proposed development. These points of reception are listed in Table 1 and shown on Figures 2 and 3.

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 what mitigation levels are needed to achieve the complying outdoor and indoor sound levels as set out in Appendix 1.

For assessment of indoor sound levels, points of reception, POR 2 and POR 3, were chosen at locations on the building, being the most exposed to noise from Murray Street, St. Patrick Street and MacKenzie Avenue for daytime and nighttime periods of use i.e. living and sleeping locations.

Outdoor sound levels were calculated at these worst case locations, on the sixth floor level of the building. Plane of window locations are used as windows represent the least 'sound proof' building component of the exterior partition.

For the assessment of outdoor living areas (OLA), the location at POR 1 was selected to represent noise impacts at the outdoor living area, as shown in Table 1. The point of reception at the OLA is located in the center of the courtyard, on the ground floor of the building, 1.5 m above grade. It is noted that 1.5 m is used to represent the location of a person's head when sitting.



4.0 Noise Source Modelling and Data

The following road traffic data was used for assessing the traffic noise impacts at each worst case point of reception at 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]

- St. Patrick Street is assessed as a 2-Lane Urban Arterial (2-UAU) with 15,000 AADT, posted speed limit of 50 km/hr.

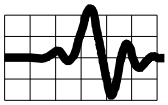
- Murray Street is assessed as a 2-Lane Urban Arterial (2-UAU) with 15,000 AADT, posted speed limit of 50 km/hr.

- Rideau Street is assessed as a 4-Lane Urban Arterial Divided (4-UAD) with 35,000 AADT, posted speed limit of 50 km/hr.

- MacKenzie Avenue is assessed as a 2-Lane Urban Arterial (2-UAU) with 15,000 AADT, posted speed limit of 50 km/hr.

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 Table 1.7, City of Ottawa Environmental Noise Control Guidelines.[1]

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



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 5, using the MOECC STAMSON noise modelling software. The results of predictions are contained in Tables 3 to 5. Samples of the outputs of the STAMSON software are provided in Appendix 2.

The implications of the estimated future noise levels, in relation to the ENCG criteria as set out in Appendix 1, are as follows:

Building Components

As indicated in Table A1.3, where outdoor noise levels exceed various thresholds for living rooms and bedrooms, then building components, walls, windows, etc. must be designed to achieve the indoor sound level criteria set out in Table A1.2.

As shown in Tables 3, the predicted outdoor sound levels indicate that compliance with the Ontario Building Code will be sufficient in achieving acceptable indoor sound levels at POR 2, POR 4 and POR 5. At POR 3, however, building component design is required to achieve acceptable indoor sound levels.

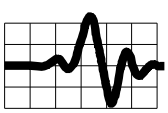
It is recommended that the construction assembly designed to achieve compliance, due to predicted exterior noise levels at POR 3, be applied to all facades of the building.

Indoor sound levels in the sixth floor level suite with exposure to traffic noise from MacKenzie Avenue, Murrary Street and St. Patrick Street have been estimated using standard acoustical procedures, see IBANA-Calculation output in Appendix 2, which take into account window area, wall area, room size, room absorption, as well as, the sound transmission characteristic of the external wall and window construction assembly. Compliance at this location will ensure compliance at other locations in the building i.e. most exposed location.

Refer to Table 6 for predicted indoor sound levels.

- External walls have been modelled as masonry cladding, minimum 89 mm thick, 16 mm air gap, 11 mm OSB sheathing, 2" x 6" stud frame construction with glass fibre cavity insulation, 13 mm drywall interior side. Sound transmission characteristics of these components have been estimated based on National Research Council test data, as shown in Appendix 2. It is noted that the proposed construction will exceed the minimum building component requirements, i.e. perform better. Alternative construction of exterior walls is permissible providing it has a minimum STC rating of 53.

- Windows have been modeled as double glazed thermopane (3 mm glass thickness, 13 mm air gap, 6 mm glass thickness) with sound transmission characteristics based on national Research Council test data as shown in Appendix 2. Alternative window construction is permissible providing it has a minimum STC rating of 31.



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

Outdoor Noise Control Measures and Warning Clauses

As shown in Table 4, future outdoor daytime noise levels at the Outdoor Living Area (OLA) Point of Reception, POR 1, are predicted to be less than 55 dBA. As such noise mitigation measures are not required.

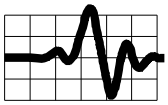
Ventilation Requirements & Warning Clauses for Internal Living Areas

The predicted plane of window noise levels, shown in Table 5, indicate that there is a requirement that all units be fitted with central air-conditioning. It is recommended that the Warning Clause, as noted below, adapted from the ENCG and provincial guidelines, be applied all units.

> *"Purchasers/tenants are advised that sound levels due to increasing road, rail, light, rail, transit way, traffic may occasionally interfere with some indoor activities when doors and windows are open as the outdoor sound levels may exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this dwelling unit has been fitted with central air conditioning 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's noise criteria.*
>
> *To help address the need for sound attenuation this development includes:*
>
> - *Multi-pane glass;*
> - *High sound transmission class walls;*
>
> *To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features".*[*]

This clause should be included in Agreements of Purchase and Sale or Lease Agreements, and incorporated into the relevant Development Agreements which are registered on title of the property.

*The above warning clause is an adaptation of the "Generic" Warning Clause presented in the ENCG and incorporates the more specific wording of the applicable provincial warning clause required for this project. Refer Table 5.



6.0 Conclusions and Recommendations

A detailed traffic noise impact assessment has been conducted for the proposed addition to the Château Laurier Hotel at 1 Rideau Street, in the City of Ottawa, Ontario.

The assessment has been carried out according to City of Ottawa Environmental Noise Control Guidelines taking into account future road traffic noise from Murray Street, St. Patrick Street, MacKenzie Avenue and Rideau Street.

The assessment has led to the following recommendations and conclusions:

6.1 Detailed design of building components, including exterior walls and windows, was required to achieve acceptable indoor sound levels. The proposed construction as noted in Section 5 will comply with City of Ottawa criteria. Alternative construction is acceptable providing the minimum STC ratings specified in Section 5 are achieved.

6.2 Noise impacts at the proposed Outdoor Living Area are predicted to be less than 55 dBA. As such noise mitigation measures are not required.

6.3 Outdoor sound levels exceed various thresholds for ventilation and warning clause requirements. To help address the need for sound attenuation this development includes multi-pane glass; high sound transmission class walls; and central air conditioning.

It is recommended that the Warning Clause, as noted below, adapted from the ENCG and provincial guidelines, be applied all units.

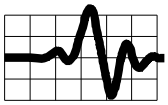
"Purchasers/tenants are advised that sound levels due to increasing road, rail, light, rail, transitway, traffic may occasionally interfere with some indoor activities when doors and windows are open as the outdoor sound levels may exceed the sound level limits of the City and the Ministry of the Environment. To help address the need for sound attenuation this dwelling unit has been fitted with central air conditioning 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's noise criteria.

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

- *Multi-pane glass;*
- *High sound transmission class walls;*

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

This clause should be included in Agreements of Purchase and Sale or Lease Agreements, and incorporated into the relevant Development Agreements which are registered on title of the property.



References

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

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

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

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

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

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

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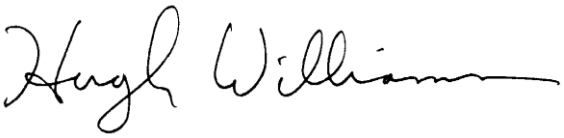

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FIGURES

Contents:

Figure 1: Area Plan showing location of subject property at 1 Rideau Street (Source: geoOttawa)

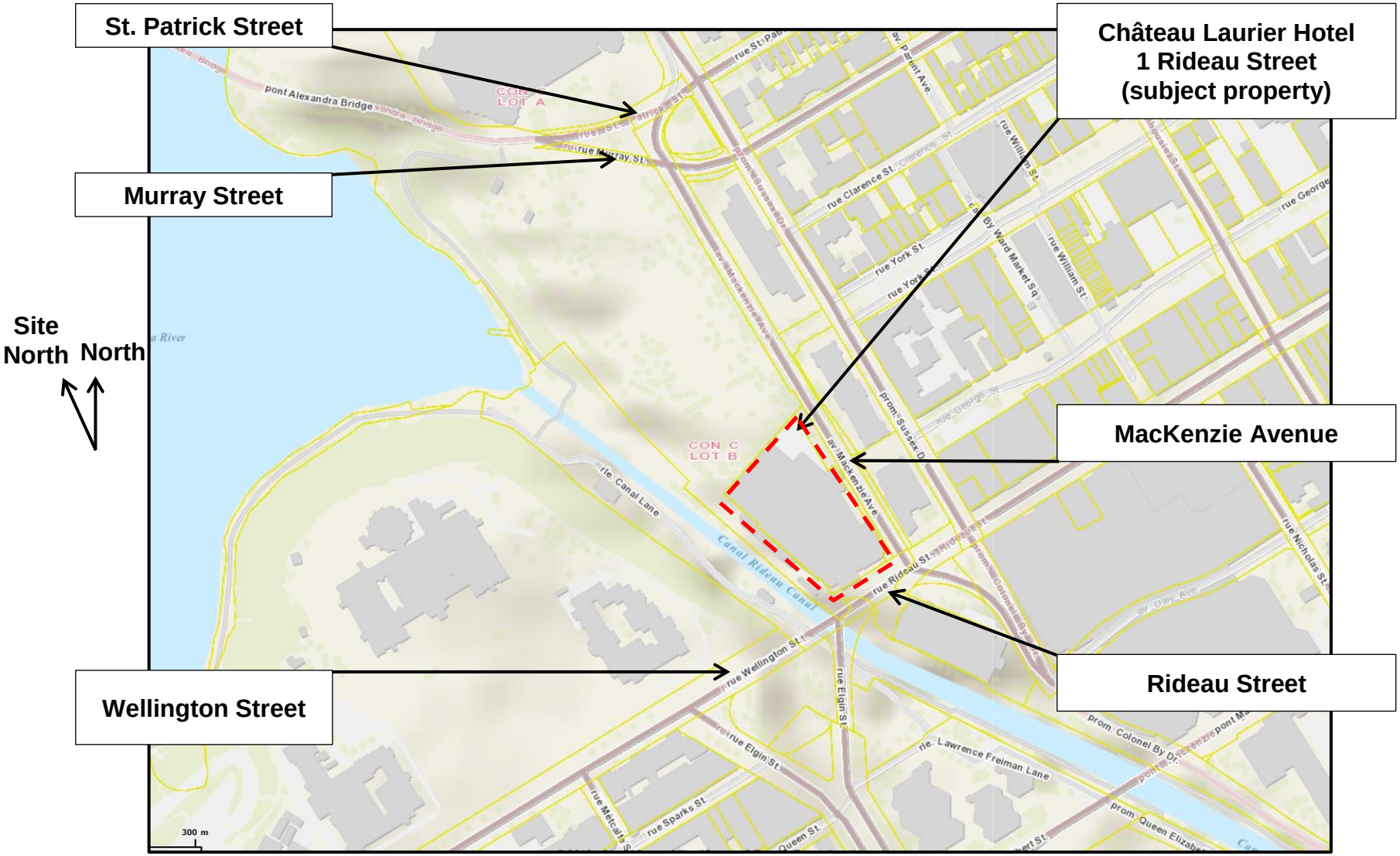


Figure 2: Ground Floor Plan showing Points of Reception (source: architectsAlliance)

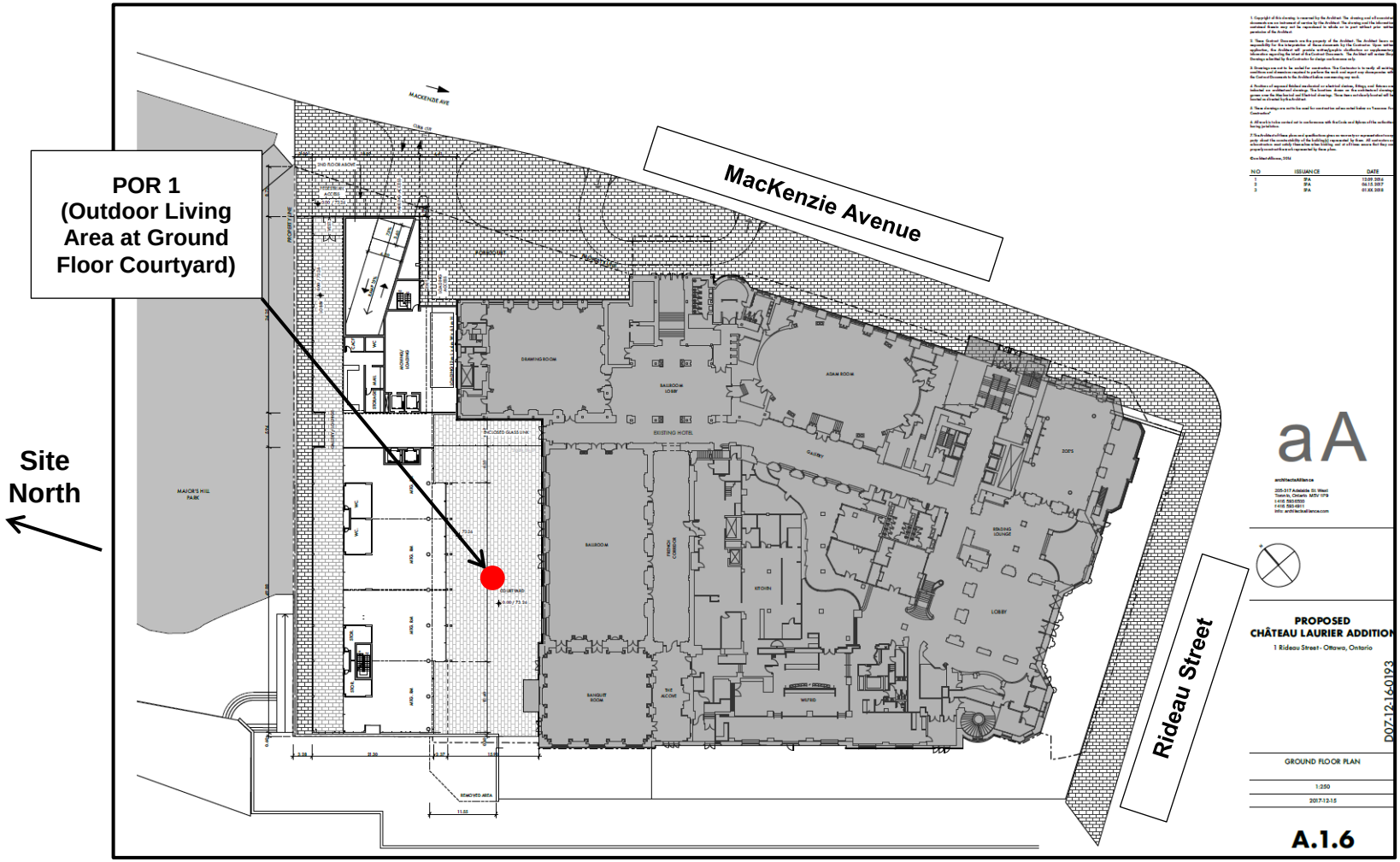


Figure 3: Second to Sixth Floor Level Plan showing Points of Reception (source: architectsAlliance)

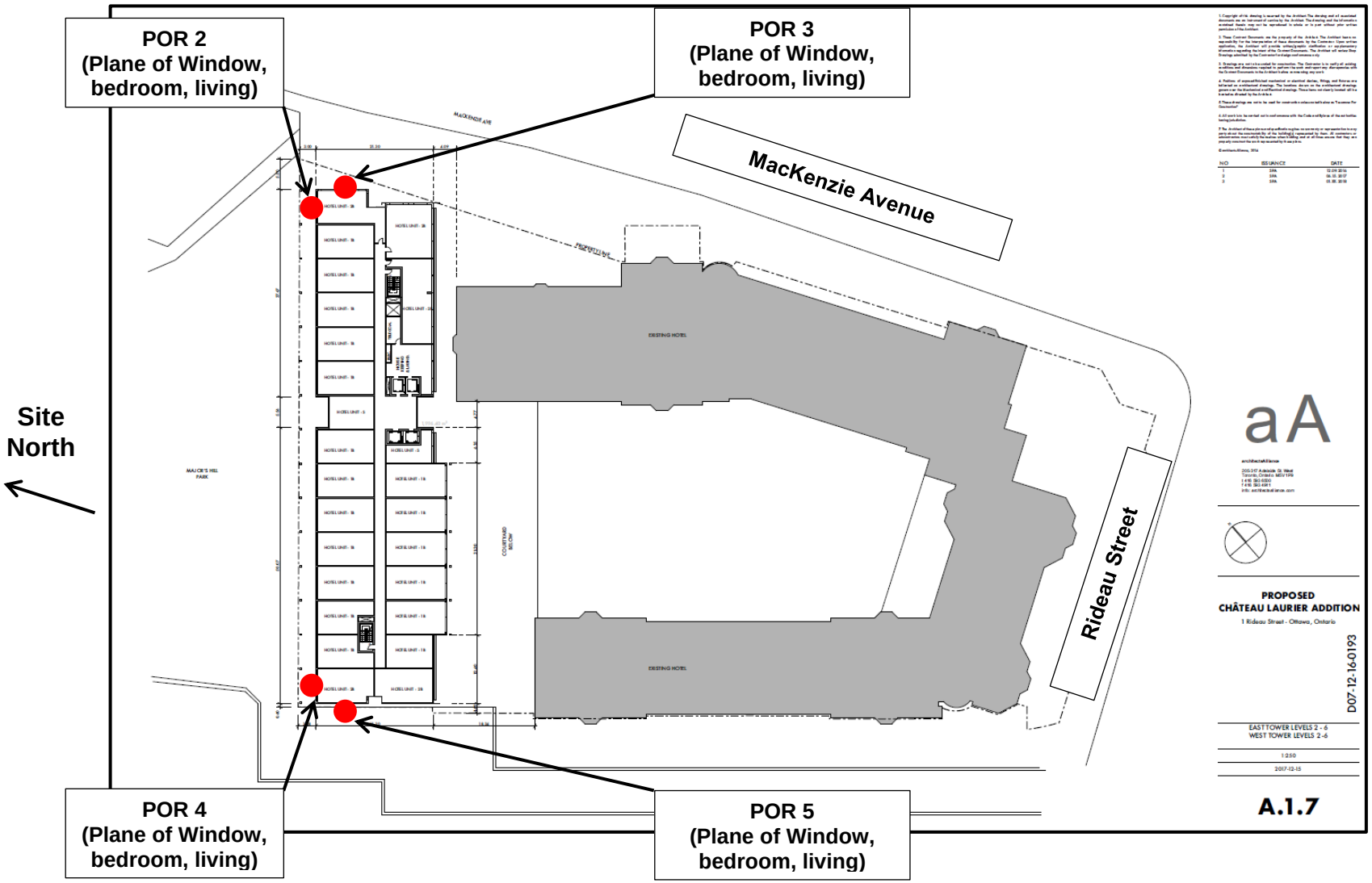


Figure 4: Seventh to Eight Floor Level Plan (source: architectsAlliance)

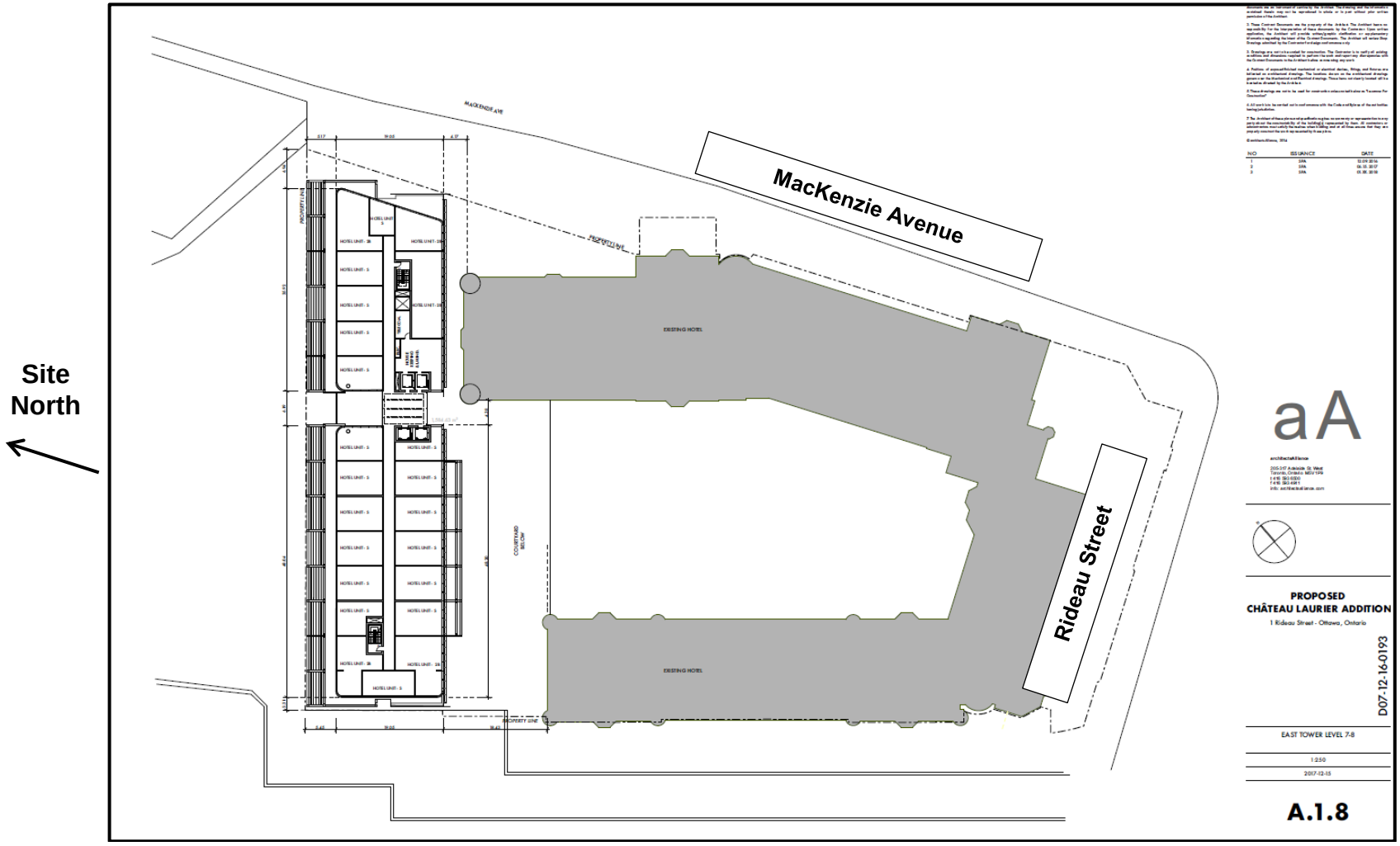
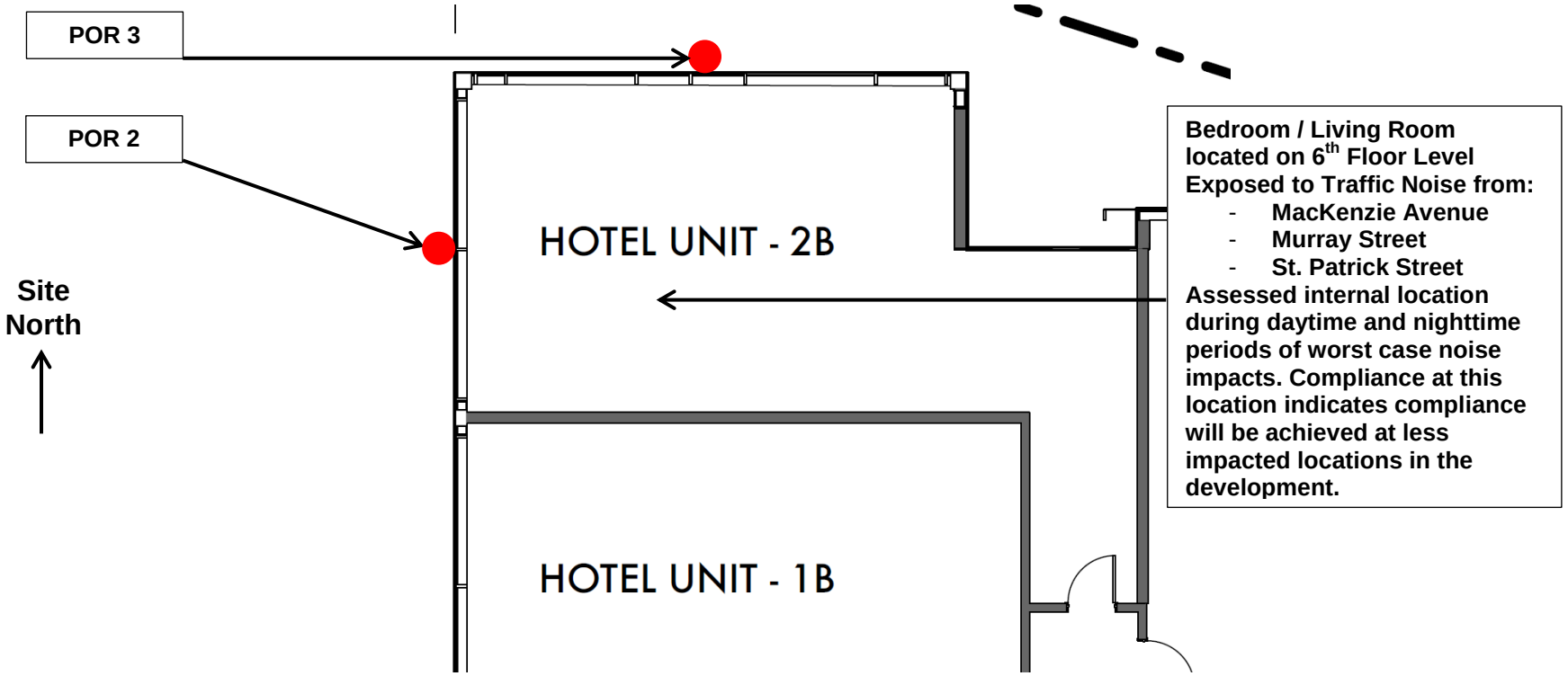


Figure 5: Detailed Plan at POR 2 and POR 3 – 1 Bedroom Unit at Sixth Floor Level - Worst Case (source: architectsAlliance)



POR 2		**POR 3**	
Room Area:	**52 m^2**	**Room Area:**	**52 m^2**
External wall area:	**1.8 m^2**	**External wall area:**	**2.7 m^2**
Window area:	**14.1 m^2**	**Window area:**	**21.1 m^2**

TABLES

Contents:

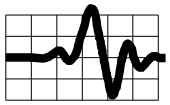


Table 1: Modelled Points of Reception

Symbol	Location	St. Patrick Street			Murray Street			Mackenzie Avenue			Rideau Street		
		Distance (m)	Height (m)	Exposure (deg)	Distance (m)	Height (m)	Exposure (deg)	Distance (m)	Height (m)	Exposure (deg)	Distance (m)	Height (m)	Exposure (deg)
POR 1	Outdoor Living Area (OLA) Ground floor level courtyard with narrow exposure to Rideau Street	-	-	-	-	-	-	-	-	-	118	1.5	60
POR 2	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	312	13.5	180	312	13.5	180	24.5	13.5	90	-	-	-
POR 3	Plane of Window (POW) Sixth floor level window facing MacKenzie Avenue	315	13.5	90	315	13.5	90	16.9	13.5	180	-	-	-
POR 4	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	385.2	13.5	180	385.2	13.5	180	111.5	13.5	90	-	-	-
POR 5	Plane of Window (POW) Sixth floor level window facing Parliament Buildings	388.2	13.5	90	388.2	13.5	90	-	-	-	147.8	13.5	90

*Height measured from street level.

**The proposed outdoor living area at the south side of the addition is in a location fully shielded from noise impacts from St. Patrick Street, Murray Street, and Mackenzie Avenue.

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 7:00-23:00	Split Night 23:00-7:00	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks	Cars	Medium Trucks	Heavy Trucks
			kph			%	%	no.	no.	no.	no.	no.	no.
St. Patrick Street 2-UAU, 2 lane urban arterial) - Future Mature Traffic Volumes from City of Ottawa Guidelines													
	2-UAU	15,000	50	0.92	0.08	7	5	12144	966	690	1056	84	60
Murray Street 2-UAU, 2 lane urban arterial) - Future Mature Traffic Volumes from City of Ottawa Guidelines													
	2-UAU	15,000	50	0.92	0.08	7	5	12144	966	690	1056	84	60
MacKenzie Avenue 2-UAU, 2 lane urban arterial) - Future Mature Traffic Volumes from City of Ottawa Guidelines													
	2-UAU	15,000	50	0.92	0.08	7	5	12144	966	690	1056	84	60
Rideau Street 4-UAD, 4 lane urban arterial divided) - Future Mature Traffic Volumes from City of Ottawa Guidelines													
	4-UAD	35,000	50	0.92	0.08	7	5	28336	2254	1610	2464	196	140

Table 3: Traffic Noise Impacts for Building Component Requirements

Point of Reception	Location	Estimated Future Noise Level* (dBA)		Building Component Requirement
		Day	Night	
POR 2	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	63.78	56.18	Building compliant with Ontario Building Code
POR 3	Plane of Window (POW) Sixth floor level window facing MacKenzie Avenue	68.04	60.45	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria in Table A1.2.**
POR 4	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	58.81	51.22	Building compliant with Ontario Building Code
POR 5	Plane of Window (POW) Sixth floor level window facing Parliament Buildings	59.64	52.05	Building compliant with Ontario Building Code

*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 proposed construction of external walls and windows as specified in Section 5.0 is sufficient to meet indoor sound level criteria, see discussion in Section 5.0 and calculations in Appendix 2.

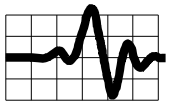


Table 4: Traffic Noise Impacts for Outdoor Living Area (OLA)

Point of Reception	Location	Estimated Future Day Noise Level* (dBA)		Description of Recommended Mitigation
		Unmitigated	Mitigated	
POR 1	Outdoor Living Area (OLA) Ground floor level courtyard with 60 degrees exposure to Rideau Street	48.81	N/A	Not required

* Daytime Noise Impacts, based on Leq 16 h (07:00 – 23:00). Refer Table A1.5.

Table 5: Traffic Noise Impacts for Ventilation and Warning Clause Requirements

Point of Reception (POR)	Location (see Figures 1 to 7)	Sound Levels due to Road Traffic		Ventilation Requirements(1)	Warning Clauses(2)
		Day (dBA)	Night (dBA)		
POR 1	Outdoor Living Area (OLA) Ground floor level courtyard with 60 degrees exposure to Rideau Street	48.81	N/A	-	Not required
POR 2	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	63.78	56.18	Forced air heating with provision for central air-conditioning	Required (Provincial Warning Clause Type C)
POR 3	Plane of Window (POW) Sixth floor level window facing MacKenzie Avenue	68.04	60.45	Central ducted air-conditioning	Required (Provincial Warning Clause Type D)
POR 4	Plane of Window (POW) Sixth floor level window facing Murray Street and St. Patrick Street	58.81	51.22	Forced air heating with provision for central air-conditioning	Required (Provincial Warning Clause Type C
POR 5	Plane of Window (POW) Sixth floor level window facing Parliament Buildings	59.64	52.05	Forced air heating with provision for central air-conditioning	Required (Provincial Warning Clause Type C

*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 6: Predicted Indoor Sound Levels*

Unit / Room (Worst Case)**	Period	Facade 1						Facade 2						Total	City Criterion
		Point of Reception (POR)	Area (m2)	Window (m2)	Wall (m2)	Outdoor Level (dBA)	Indoor Level (dBA)	Point of Reception (POR)	Area (m2)	Window (m2)	Wall (m2)	Outdoor Level (dBA)	Indoor Level (dBA)	Combined Indoor Level (dBA)	(dBA)
Living	Day	POR 2 (Sixth Floor)	52	14.1	1.8	63.8	31	POR 3 (Sixth Floor)	52	21.1	2.7	68.04	37	37.97	45
Bedroom	Night	POR 2 (Sixth Floor)	52	14.1	1.8	56.2	23	POR 3 (Sixth Floor)	52	21.1	2.7	60.45	30	30.79	40

*Prediction Method: IBANA Calculations (Refer to Appendix 2)

**Most exposed location during the daytime and nighttime period.

Appendix 1

City of Ottawa
Noise Criteria and Warning Clauses

For further information refer to:

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

MOECC 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.

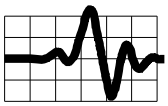


Table A1.3: Summary of Road and Rail Noise* Daytime (07:00 – 23:00) & Nighttime (23:00 – 07:00) Building Component Requirements

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's 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's 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's 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 MoE 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's 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:

```
STAMSON 5.0        SUMMARY REPORT        Date: 11-01-2018
16:21:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por1_d.te            Time Period: 16 hours
```

Description: POR 1 - Outdoor Living Area

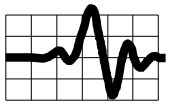
```
Road data, segment # 1: Rideau St
---------------------------------
Car traffic volume  : 28336 veh/TimePeriod
Medium truck volume :  2254 veh/TimePeriod
Heavy truck volume  :  1610 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Rideau St
-------------------------------
Angle1   Angle2           :  30.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1
House density             :     30 %
Surface                   :      1       (Absorptive ground
surface)
Receiver source distance  : 118.00 m
Receiver height           :   1.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :  60.00

Result summary
--------------

                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+---------+---------+---------
 1.Rideau St        !     1.50 !    48.81 !    48.81
--------------------+---------+---------+---------
                      Total                 48.81 dBA


TOTAL Leq FROM ALL SOURCES:       48.81
```

```
STAMSON 5.0        SUMMARY REPORT        Date: 11-01-2018
16:23:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por2_d.te            Time Period: 16 hours

Description: POR 2 - Plane of Window

Road data, segment # 1: st. patrick
----------------------------------
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: st. patrick
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground
surface)
Receiver source distance  : 312.00 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           : 180.00

Road data, segment # 2: murray
------------------------------
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: murray
----------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground
surface)
Receiver source distance  : 312.00 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           : 180.00

Road data, segment # 3: mackenzie
---------------------------------
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 # 3: mackenzie
-------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground
surface)
Receiver source distance  :  24.50 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :  90.00

Result summary
--------------

                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+----------+----------+---------
 1.st. patrick      !     1.50 !    50.57 !    50.57
 2.murray           !     1.50 !    50.57 !    50.57
 3.mackenzie        !     1.50 !    63.34 !    63.34
--------------------+----------+----------+---------
                      Total                  63.78 dBA


TOTAL Leq FROM ALL SOURCES:       63.78
```

```
STAMSON 5.0        SUMMARY REPORT        Date: 11-01-2018
16:24:53
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: por3_d.te            Time Period: 16 hours
```

Description: POR 3 - Plane of Window Day

```
Road data, segment # 1: st. patrick
-----------------------------------
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: st. patrick
---------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground
surface)
Receiver source distance  : 315.00 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :  90.00

Road data, segment # 2: murray
------------------------------
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: murray
----------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground
surface)
Receiver source distance  : 315.00 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           :  90.00

Road data, segment # 3: mackenzie
---------------------------------
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 # 3: mackenzie
-------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      2       (Reflective ground
surface)
Receiver source distance  :  16.90 m
Receiver height           :  13.50 m
Topography                :      1       (Flat/gentle slope; no
barrier)
Reference angle           : 180.00

Result summary
--------------

                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+---------+---------+---------
 1.st. patrick      !     1.50 !    47.51 !    47.51
 2.murray           !     1.50 !    47.51 !    47.51
 3.mackenzie        !     1.50 !    67.96 !    67.96
--------------------+---------+---------+---------
                      Total                 68.04 dBA


TOTAL Leq FROM ALL SOURCES:       68.04
```



IBANA-Calculations - Indoor Noise Estimate from Outdoor Noise Level

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID: POR 2 Daytime
Date:1/11/2018
Outdoor level: NEF 32 or Leq24 64 or Ldn 65 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 52.00 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: G13_WS140(406)_GFB152_OSB11_AIR16_BRI89

Construction Type: 2by6 Wall
Area: 1.80 m²
Test ID: TLA-99-098a
Test Date: 3/3/1999

1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibr
e cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick.

Element 2: GL3_AIR13_GL6

Construction Type: Glazing
Area: 14.10 m²
Test ID: CMHC177.961.5
Test Date: 11/1/1996

Thermopane only

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	48.3
63	45.3
80	37.7
100	30.9
125	32.3
160	30.5
200	32.0
250	34.7
315	27.7
400	26.9
500	22.3
630	20.0
800	17.9
1000	15.1
1250	10.5
1600	7.1
2000	6.9
2500	4.8
3150	0.8
4000	0.9
5000	9.2

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

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	18.1
63	19.1
80	15.2
100	11.8
125	16.2
160	17.1
200	21.1
250	26.1
315	21.1
400	22.1
500	19.1
630	18.1
800	17.1
1000	15.1
1250	11.1
1600	8.1
2000	8.1
2500	6.1
3150	2.0
4000	1.9
5000	9.7

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)
50	15.5
63	16.5
80	22.4
100	26.9
125	22.4
160	23.5
200	21.5
250	17.5
315	23.5
400	23.5
500	27.5
630	29.5
800	32.5
1000	35.5
1250	38.5
1600	40.5
2000	39.5
2500	39.5
3150	41.5
4000	40.5
5000	30.5

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	69.0
63	67.0
80	65.3
100	62.9
125	59.9
160	59.2
200	58.7
250	57.4
315	56.4
400	55.6
500	55.0
630	54.7
800	55.6
1000	55.8
1250	54.2
1600	52.8
2000	51.6
2500	49.5
3150	47.6
4000	46.8
5000	45.3

Single Number Ratings

Outdoor Sound Level:	64	dBA
Indoor Sound Level:	31	dBA
A-wtd Level Reduction:	33	dB
A-wtd Reduction re Standard Source:	31	dB
OITC Rating:	26	dB

Noise Sound Insulation Scenario Calculation Results

Project:
ProjectID: POR 3 Daytime
Date:1/11/2018
Outdoor level: NEF 36 or Leq24 68 or Ldn 69 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 52.00 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: G13_WS140(406)_GFB152_OSB11_AIR16_BRI89

Construction Type: 2by6 Wall
Area: 2.70 m²
Test ID: TLA-99-098a
Test Date: 3/3/1999

1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibr
e cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick.

Element 2: GL3_AIR13_GL6

Construction Type: Glazing
Area: 21.10 m²
Test ID: CMHC177.961.5
Test Date: 11/1/1996

Thermopane only

Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Indoor Sound Level(dB)
50	54.1
63	51.1
80	43.4
100	36.6
125	38.1
160	36.3
200	37.8
250	40.5
315	33.5
400	32.7
500	28.1
630	25.8
800	23.7
1000	20.9
1250	16.3
1600	12.9
2000	12.7
2500	10.6
3150	6.5
4000	6.6
5000	14.9

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

Frequency(Hz)	A-Wtd Sound Level(dBA)
50	23.9
63	24.9
80	20.9
100	17.5
125	22.0
160	22.9
200	26.9
250	31.9
315	26.9
400	27.9
500	24.9
630	23.9
800	22.9
1000	20.9
1250	16.9
1600	13.9
2000	13.9
2500	11.9
3150	7.7
4000	7.6
5000	15.4

Transmission Loss vs. Frequency - Spectrum Values:

Frequency(Hz)	Transmission Loss(dB)
50	15.5
63	16.5
80	22.4
100	26.9
125	22.4
160	23.5
200	21.5
250	17.5
315	23.5
400	23.5
500	27.5
630	29.5
800	32.5
1000	35.5
1250	38.5
1600	40.5
2000	39.5
2500	39.5
3150	41.5
4000	40.5
5000	30.5

Source Sound Level vs. Frequency - Spectrum Values:

Frequency(Hz)	Source Sound Level(dB)
50	73.0
63	71.0
80	69.3
100	66.9
125	63.9
160	63.2
200	62.7
250	61.4
315	60.4
400	59.6
500	59.0
630	58.7
800	59.6
1000	59.8
1250	58.2
1600	56.8
2000	55.6
2500	53.5
3150	51.6
4000	50.8
5000	49.3

Single Number Ratings

Outdoor Sound Level:	68	dBA
Indoor Sound Level:	37	dBA
A-wtd Level Reduction:	31	dB
A-wtd Reduction re Standard Source:	30	dB
OITC Rating:	26	dB

HUGH WILLIAMSON ASSOCIATES INC.
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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. Hugh Williamson Associates was incorporated in 1997 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 Hugh Williamson Associates, 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 20 years of experience as a consultant.

CLIENT LIST:

Hugh Williamson Associates provides consulting services to large and small clients including: National Research Council, National Capital Commission, J. L. Richards & Associates, Barry Padolsky Associates, HOK Urbana Architects, Genivar, Nasittuq Corporation, PWGSC, R. W. Tomlinson, Geo. Tackaberry Construction and Miller Paving.

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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 with many years of experience in the Architectural and Construction industries. With key competencies in measurement, analysis and control of noise and vibration, Michael Wells joined Hugh Williamson Associates in 2012 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 Hugh Williamson Associates, his career includes the founding of Michael Wells Architect in Sydney Australia which specialized in the design of institutional, commercial and residential projects. He is a Director of Architectural Workshops Australia and Vision Blue Pty Ltd. He has more than 10 years of experience as a consultant.

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