FREEFIELD LTD.
Ottawa, Ontario, Canada

# TRAFFIC NOISE IMPACT ASSESSMENT FOR THE PROPOSED MULTI-UNIT RESIDENTIAL DEVELOPMENT AT 20 MARK AVENUE

## CITY OF OTTAWA

***Prepared for***

**1479151 Ontario Inc.**

***Prepared by***

**Freefield Ltd.**

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# TRAFFIC NOISE IMPACT ASSESSMENT FOR THE PROPOSED MULTI-UNIT RESIDENTIAL DEVELOPMENT AT 20 MARK AVENUE CITY OF OTTAWA

## 1.0 Introduction

Freefield Ltd. has been retained by 1479151 Ontario Inc. to undertake a traffic noise impact assessment in relation to satisfying the City of Ottawa Environmental Noise Control Guidelines (ENCG) for the proposed 3 storey low-rise apartment building to be located at 20 Mark Avenue in the City of Ottawa, Ontario.

This report describes an assessment of noise impacts from road traffic on Rideau Street and Montreal Road at the interior and exterior noise sensitive areas of the proposed development.

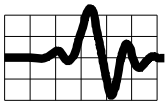
This assessment has been carried out in accordance with the City of Ottawa *Environmental Noise Control Guidelines, January 2016* (ENCG)[1] and Ministry of Environment, Park and Conservation (MOECP) publication, *NPC-300*[2] by Freefield Ltd.

This analysis is based on drawings and information received electronically from Project1 Studio Incorporated.

**General Description of the Site and Proposed Development**

The site is located to the north of Montreal Road with the southern boundary at an approximate distance of 40 m to Montreal Road. North River Road lies approximately 40 m to the west of the western boundary. Further west lies the Rideau River and Rideau Street which Montreal Road transitions to on the western bank of the Rideau River. The site has an approximately frontage of 215 meters on Mark Avenue with an approximate area of 5,660 square meters. The site consists of a series of 6 existing two-storey multi-unit apartment buildings municipally addressed from 30 to 80 Mark Avenue with an existing parking lot at the western end for 22 vehicles. The site of the proposed apartment building (subject application) is on the existing parking lot, as shown on Figure 1. Rideau Street / Montreal Road carry significant volumes of traffic on a 24 hour basis.

The proposed development comprises a three storey low-rise apartment building containing 12 units rising to approximately 9.42 meters above grade. Residential units are located on each level of the building. The development includes an outdoor living area in the form of a landscaped rear yard amenity space located at the rear of the building in the direction of Montreal Road. Refer to Figures 1 to 10.



**Site Description**

The overall site currently comprised of two land use zones with a relatively small area of Residential First Density (R1) zone to the west and a Residential Fourth Density (R4) zone to the east. The majority of the site is zoned R4. As the proposed development is located on the portion of the site currently zoned R1 it is understood that as part of the site plan control application an application to rezone the lands to permit a development consisting of a 3 storey low-rise apartment building is also being submitted.

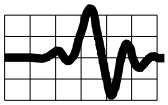
The land surrounding the proposed development consists of predominantly residential land uses (R1 and R4) to the north, east and west.

The land immediately south of the site, fronting Montreal Road, is zoned Traditional Mainstreet (TM) and consists of predominantly commercial uses.

The site is relatively flat with no significant changes in elevation.

The primary source of environmental noise is vehicular traffic on Montreal Road / Rideau Street. As Montreal Road transitions to Rideau Street at the western bank of the Rideau River traffic noise impacts from traffic on Montreal Road and Rideau Street have been assessed as one road segment.

Vanier Parkway lies in an easterly direction at an approximate distance of 290 m from the location of the development. Due to the large distance, greater than 100 m, noise impacts at the proposed development from the Vanier Parkway are not required to be assessed, as per ENCG criteria, and are considered to be insignificant.



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

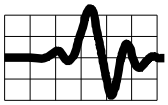
- Noise from future road traffic is predicted using STAMSON at critical points of reception at the proposed development. Locations to be considered include outdoor living areas (OLA) as well as 'plane of window' (POW) locations, where rooms for living or sleeping are provided. Noise levels are predicted as A-weighted equivalent sound levels, $L_{EQ}$, (i.e. average 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 MOECP 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 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 proposed construction assembly of the building to ensure compliance to the applicable indoor noise criteria. The MOECP 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 and POR 4, were chosen which represent the locations of worst case noise impacts at the proposed developments. POR 1 and POR 2 are located at the third floor level at living and dining room locations with 90 degrees exposure and 180 degrees exposure to Montreal Road respectively. POR 3 was assessed at the developments third floor level bedroom location with 180 degrees exposure to Montreal Road. POR 4 was assessed at the developments outdoor living area, located at the rear of the building with 56 degrees exposure to Montreal Road. These points of reception are listed in Table 1 and shown in Figures 2 - 10.

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 was selected at location on the building most exposed to noise from Montreal Road for daytime periods of use i.e. living room. POR 3 were selected at locations on the building most exposed to noise from Montreal Road for nighttime periods of use i.e. bedroom locations.

Outdoor sound levels were calculated at these worst case locations, on the third floor level, located 7.5 m above grade. Plane of window locations are used as windows represent the least 'sound proof' building component of the exterior partition.

Refer to Table 1 and Figures 2 to 10.

# 4.0 Noise Source Modelling and Data

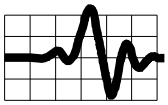
The following road traffic data was used to assess the traffic noise impacts at each point of reception on the development. The data was taken from the City of Ottawa ENCG which provides ultimate future traffic volume data for various roadways based on roadway class and number of lanes. The traffic data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

- Montreal Road is assessed as a 4-Lane Urban Arterial – Undivided (4-UAU) with 30,000 AADT and a 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 Appendix B, City of Ottawa Environmental Noise Control Guidelines.[1]

The surrounding topography was assessed as a generally flat, reflective surface.

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 4, using the MOECP 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.

***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, POR 2 and POR 3 was selected at locations which represent the worst case noise impact, that is, the part of the building most exposed to road 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 third floor level living and dining area, POR 1 and POR 2, and, in the developments worst case third floor level bedroom area, POR 3, 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 facade of the building consists of a combination of brick veneer construction, cement board cladding on stud frame and aluminium frame doubled pane windows. In order to consider cases of worst case interior noise impacts the following construction assemblies where considered:

- External walls have been modelled as either: (as per specified cladding refer building elevations)
    - 1 layer of 13mm gypsum board, 140 mm wood or metal studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick with an STC 53 rating. Alternative construction is permissible providing it has a minimum STC rating of 53.
    - 1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 0.7 mm building paper, 9.5 mm cement stucco with STC 40 rating. Alternative construction is permissible providing it has a minimum STC rating of 40.

- Windows have been modelled as aluminium frame double pane casement windows 3 mm glass 13 mm air 3 mm glass with STC 28 rating. Alternative construction is permissible providing it has a STC 28 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.**

To ensure compliance to provincial MOECP criteria in NPC-300, exterior noise impacts have been compared to the applicable exterior noise thresholds set out in Table A1.3. As shown in Tables 3, the predicted outdoor sound levels indicate that compliance with the Ontario Building Code will be sufficient in meeting the applicable provincial criteria. i.e. predicted noise impacts are less than the provincial criteria of 65 dBA during the day and less than 60 dBA during the night.

***Outdoor Noise Control Measures***

As shown in Table 7, future outdoor daytime noise levels at the Outdoor Living Area (OLA) Point of Reception, POR 4, ***without*** a noise barrier, exceed 60 dBA during the daytime period. As such control measures (barriers) are required to reduce the Leq to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible.

As shown in Table 7, future outdoor daytime noise levels at the Outdoor Living Area (OLA) Point of Reception, POR 4, ***with*** a 2.1 m high noise barrier are below 55 dBA, hence, will comply with the outdoor noise level criteria of 55 dBA. As such, it is recommended a 2.1 m high noise barrier be provided shielding noise impacts to POR 4 in location shown in Figure 10.

Noise barriers are to be solid, having no gaps, and are to have a surface density of no less than 20 kg/$m^2$.

***Ventilation Requirements & Warning Clauses***

The predicted plane of window noise levels, shown in Table 4, indicate that there is a provincial requirement in NPC-300 that all units be fitted with forced air heating with provision for central air-conditioning with would allow installation of central air-conditioning by the occupant so windows and exterior doors can remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment, Park and Conservation's noise criteria.

The development is being constructed with central air conditioning which exceeds the minimum provincial requirement.

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, Parks and Conservation noise criteria.***
>
> ***Measures for sound attenuation include:***
> - ***Provision of central air conditioning****

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 the applicable provincial warning clause required for this project. Refer Table 4.

# 6.0 Conclusions and Recommendations

A detailed traffic noise impact assessment has been conducted for the proposed 3 storey low-rise apartment building to be located at 20 Mark Avenue in the City of Ottawa, Ontario.

The assessment has been carried out according to City of Ottawa Environmental Noise Control Guidelines and MOECP NPC-300 taking into account future road traffic noise from Montreal Road and Rideau Street.

The assessment has led to the following recommendations and conclusions:

6.1 It has been found that City of Ottawa and MOECP criteria for surface transportation noise impacts can be met for the proposed development provided that the building components are constructed as follows:

- External walls consisting of either: (Refer to Figures 7 and 8)
    - 1 layer of 13mm gypsum board, 140 mm wood or metal studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick with an STC 53 rating. Alternative construction is permissible providing it has a minimum STC rating of 53.

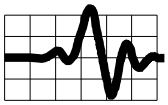
    - 1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 0.7 mm building paper, 9.5 mm cement stucco with STC 40 rating. Alternative construction is permissible providing it has a minimum STC rating of 40.

- Windows consisting of aluminium frame double pane casement windows with 3 mm glass, 13 mm air, 3 mm glass, with STC 28 rating. Alternative construction is permissible providing it has a STC 28 rating or higher.

It is noted the proposed construction, as shown in Figure 7 and 8, will meet or exceed the minimum building component design requirements for this project.

6.2 Future outdoor daytime noise levels at the Outdoor Living Area (OLA) Point of Reception, POR 4, will exceed the outdoor noise level criteria of 55 dBA without mitigation (barriers). As such, it is recommended a 2.1 m high noise barrier be provided, as shown in Figure 10, to shield noise impacts to POR 4. As shown in Table 7, with a 2.1 m high noise barrier, daytime noise levels are below 55 dBA, hence, comply with the outdoor noise level criteria. Noise barriers are to be solid, having no gaps, and are to have a surface density of no less than 20 kg/m2.

6.3 Outdoor sound levels exceed various thresholds for ventilation and warning clause requirements. The development is being constructed with central air conditioning in all dwelling units which will meet the intent of both the ENCG and NPC-300 requirements.



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, Parks and Conservation noise criteria.*

*Measures for sound attenuation include:*

- *Provision of central air conditioning.*

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.

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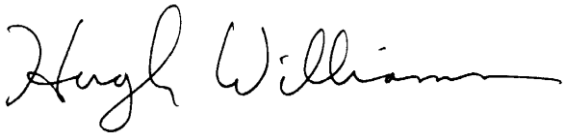


Hugh Williamson, Ph.D., P.Eng.
Member, Canadian Acoustical Society

## References

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

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

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

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

5. Ministry of Environment, Park and Conservation, 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 20 Mark Avenue (Source: geoOttawa)**

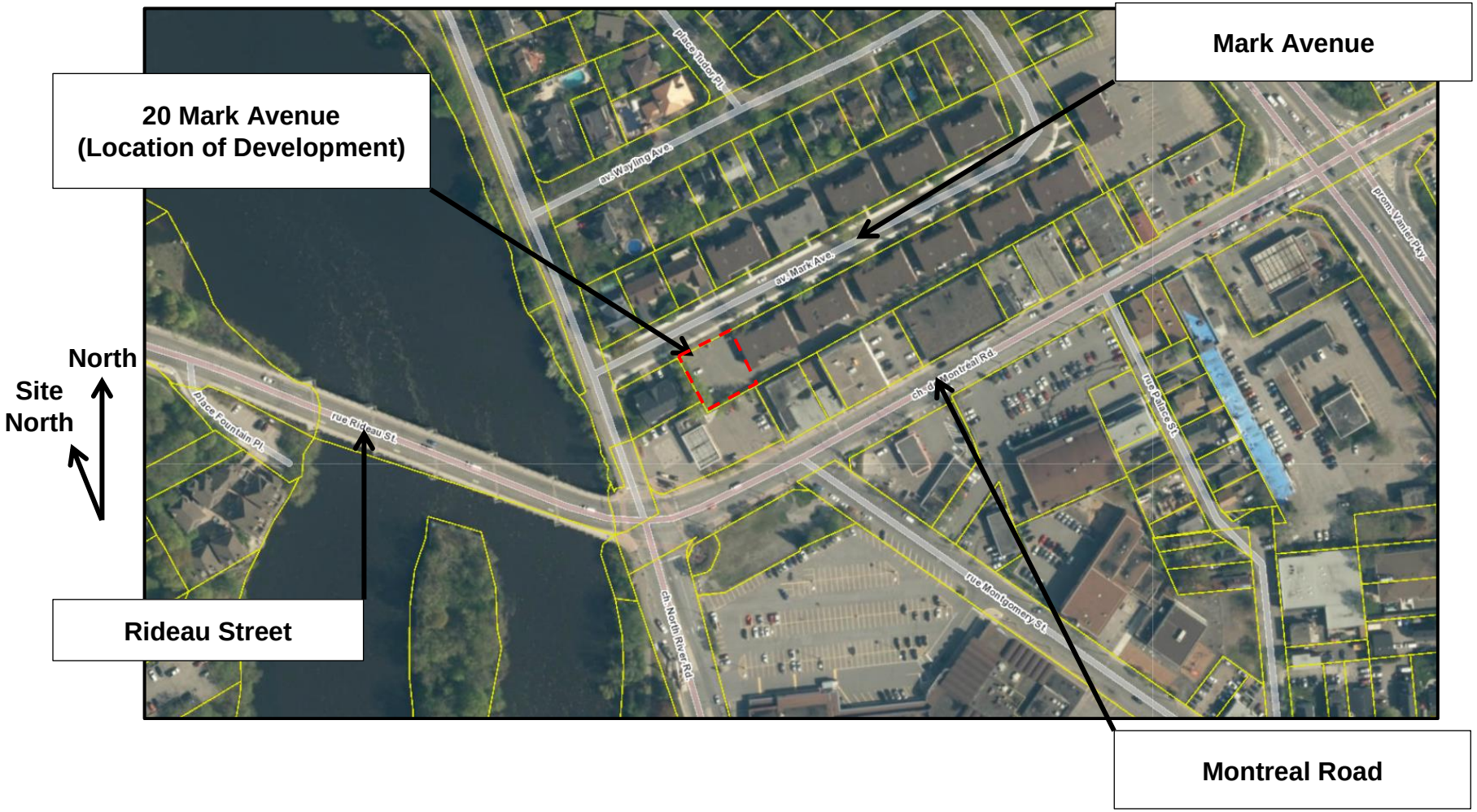


**Figure 2: Detailed Area Plan showing Points of Reception with Distance and Angle of Exposure to Montreal Road (Source: geoOttawa)**

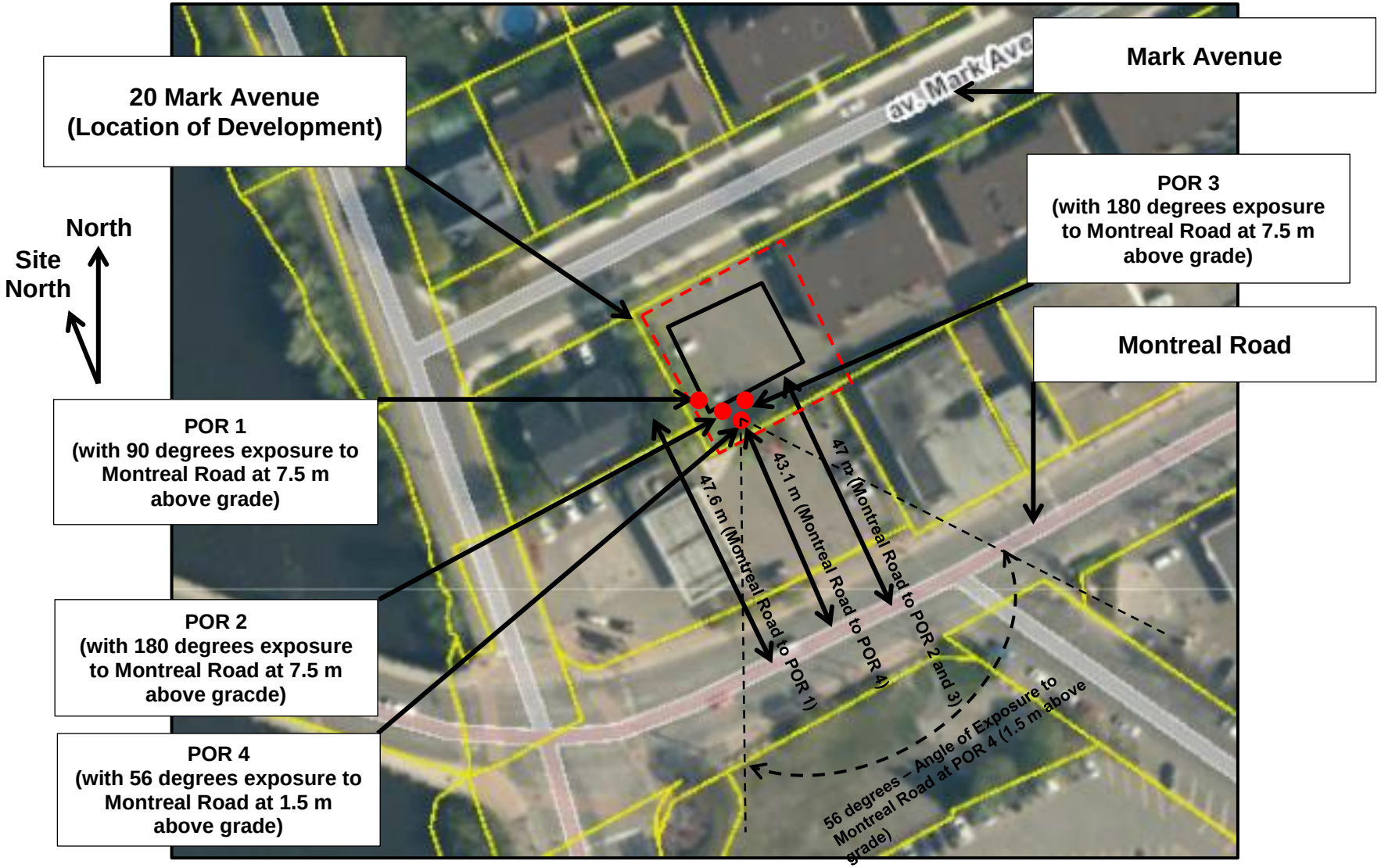


**Figure 3: Site Plan showing Points of Reception (source: Project1 Studio Incorporated)**

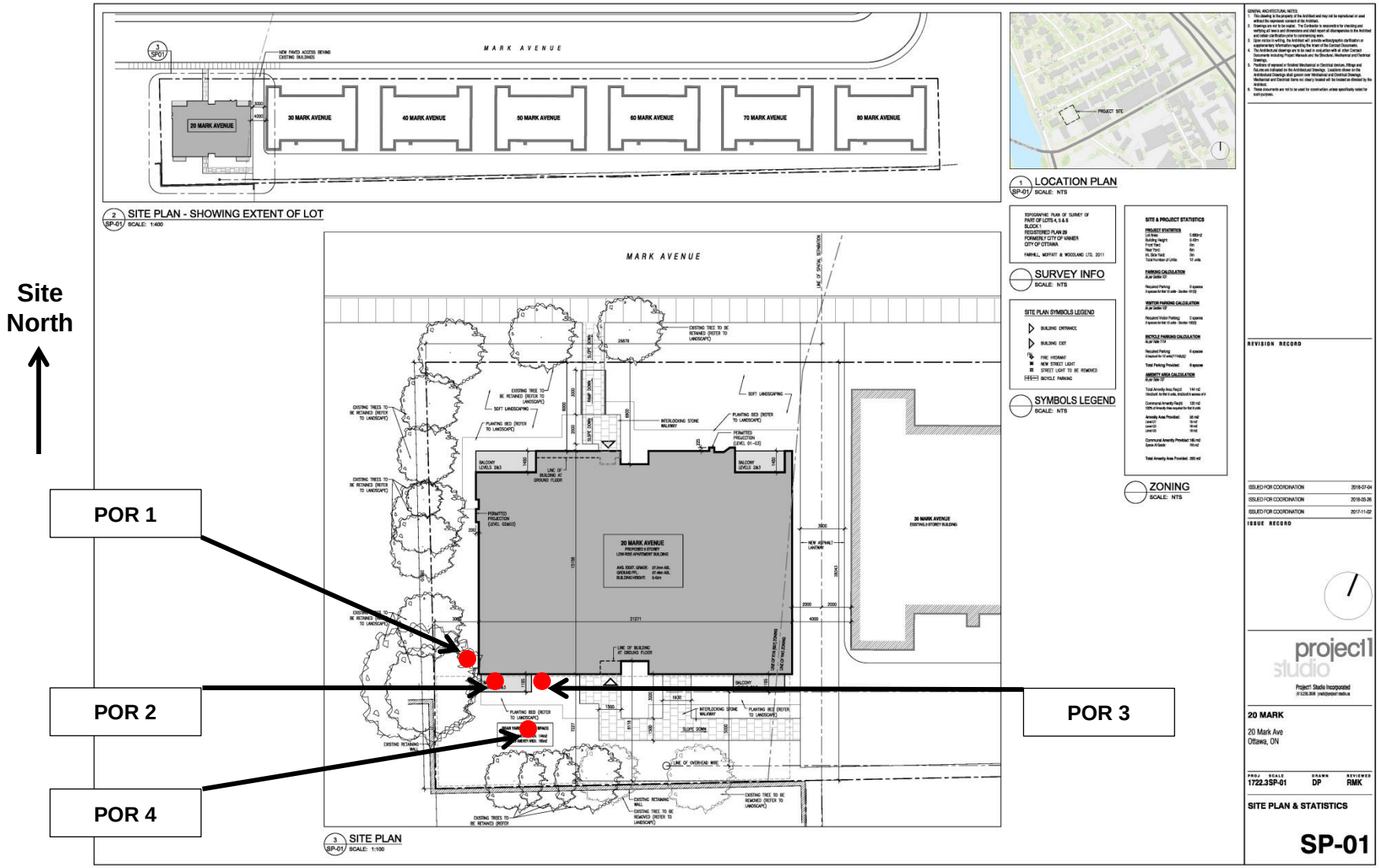


**Figure 4: Ground Floor Plan showing Internal Living Areas and Outdoor Point of Reception (source: Project1 Studio Incorporated)**

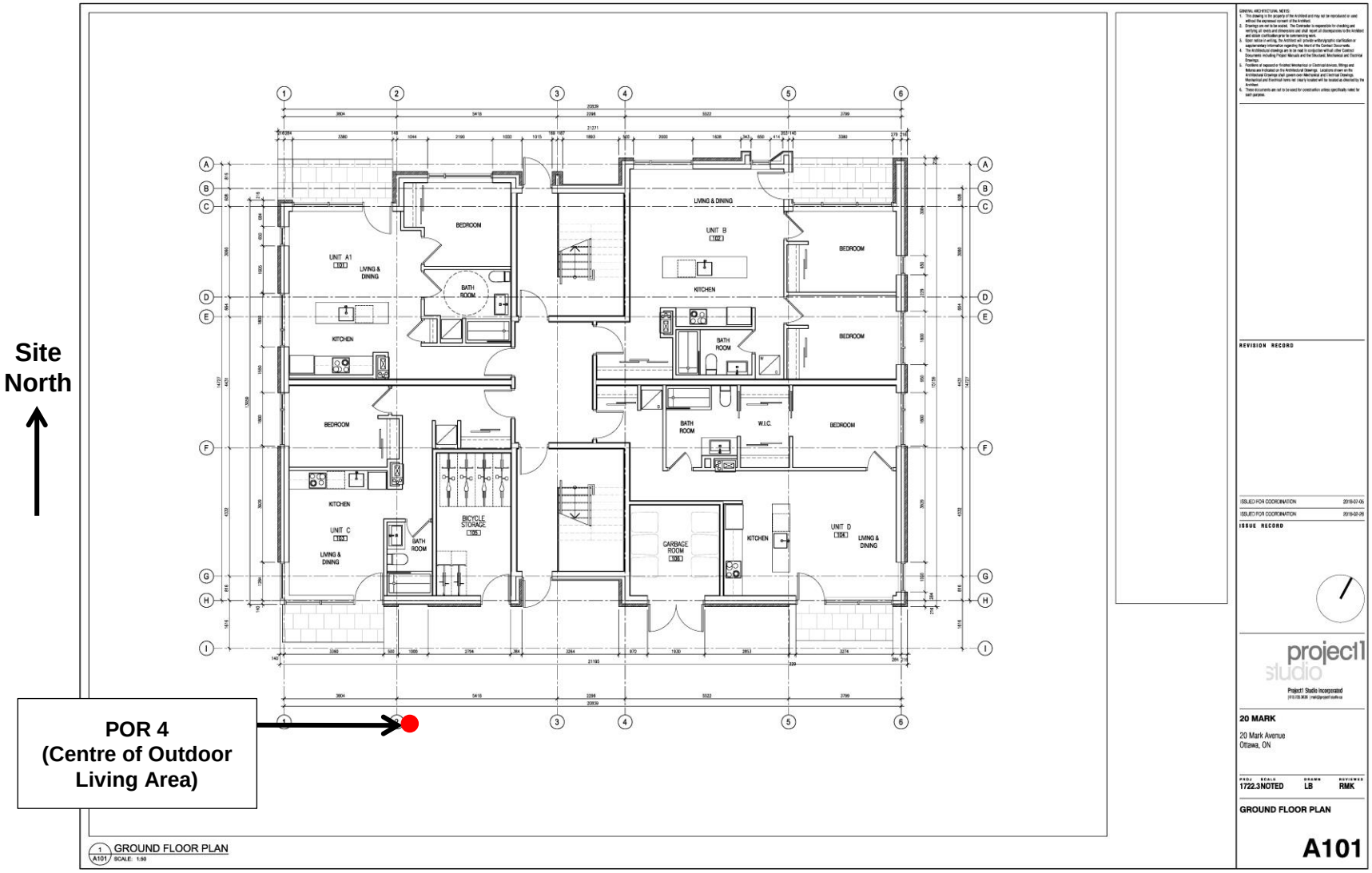


**Figure 5: Second Floor Plan showing Internal Living Areas (source: Project1 Studio Incorporated)**

**Site North**

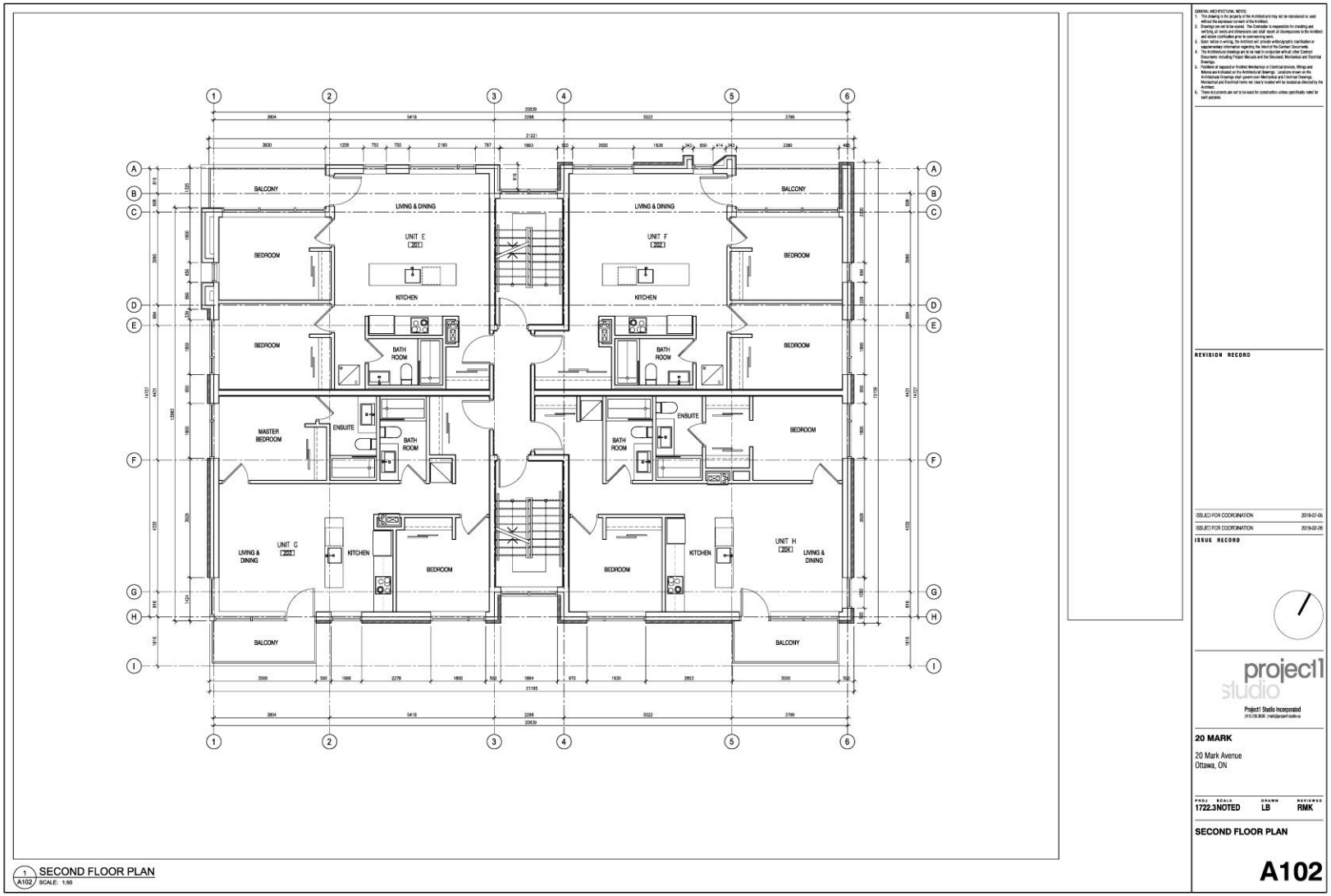


**Figure 6: Third Floor Plan showing Internal Living Areas and Points of Reception (source: Project1 Studio Incorporated)**

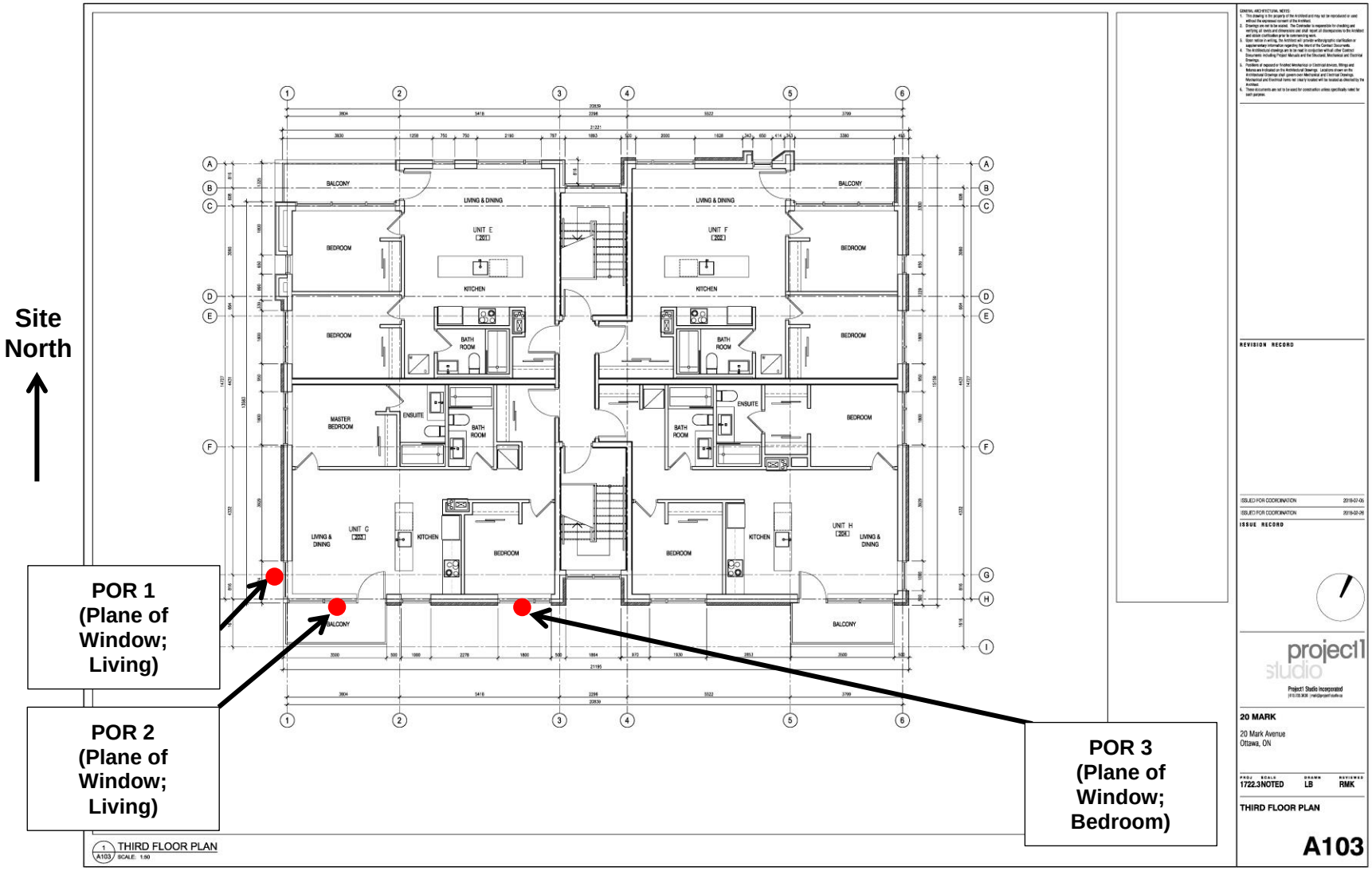


**Figure 7: North and South Elevation showing Points of Reception (source: Project1 Studio Incorporated)**

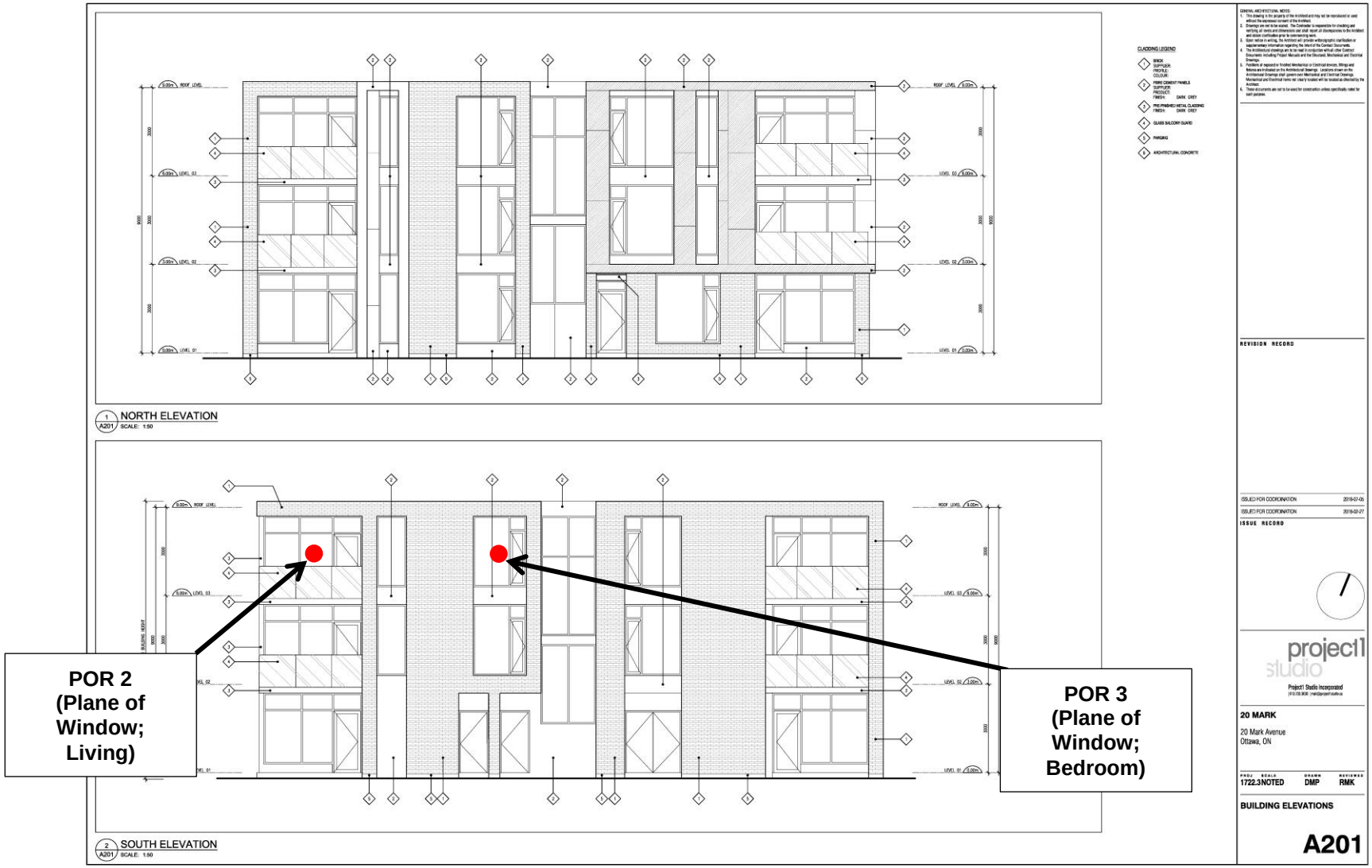


**Figure 8: East and West Elevation showing Points of Reception (source: Project1 Studio Incorporated)**

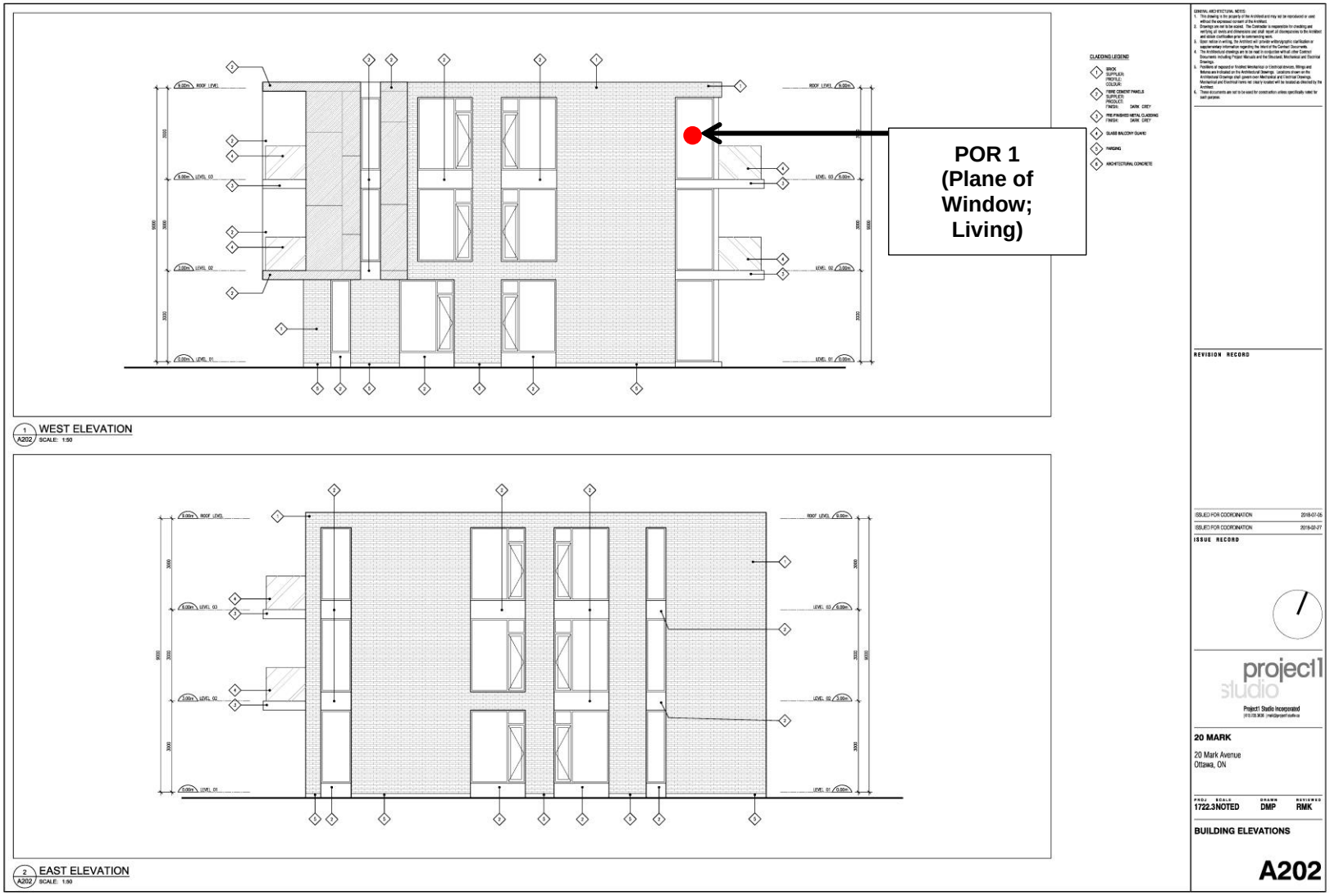


**Figure 9: Detailed Unit Plan for Interior Noise Calculations (source: Project1 Studio Incorporated)**

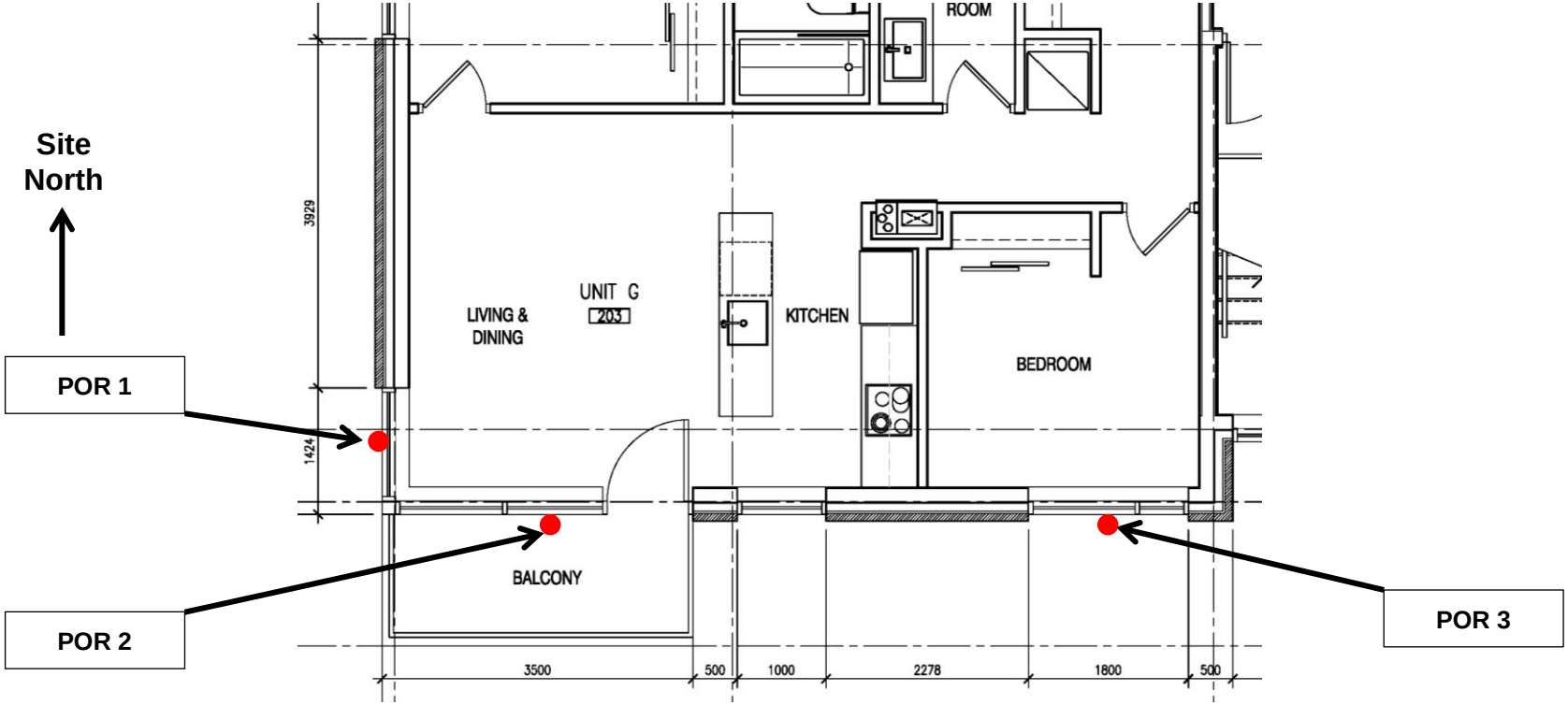
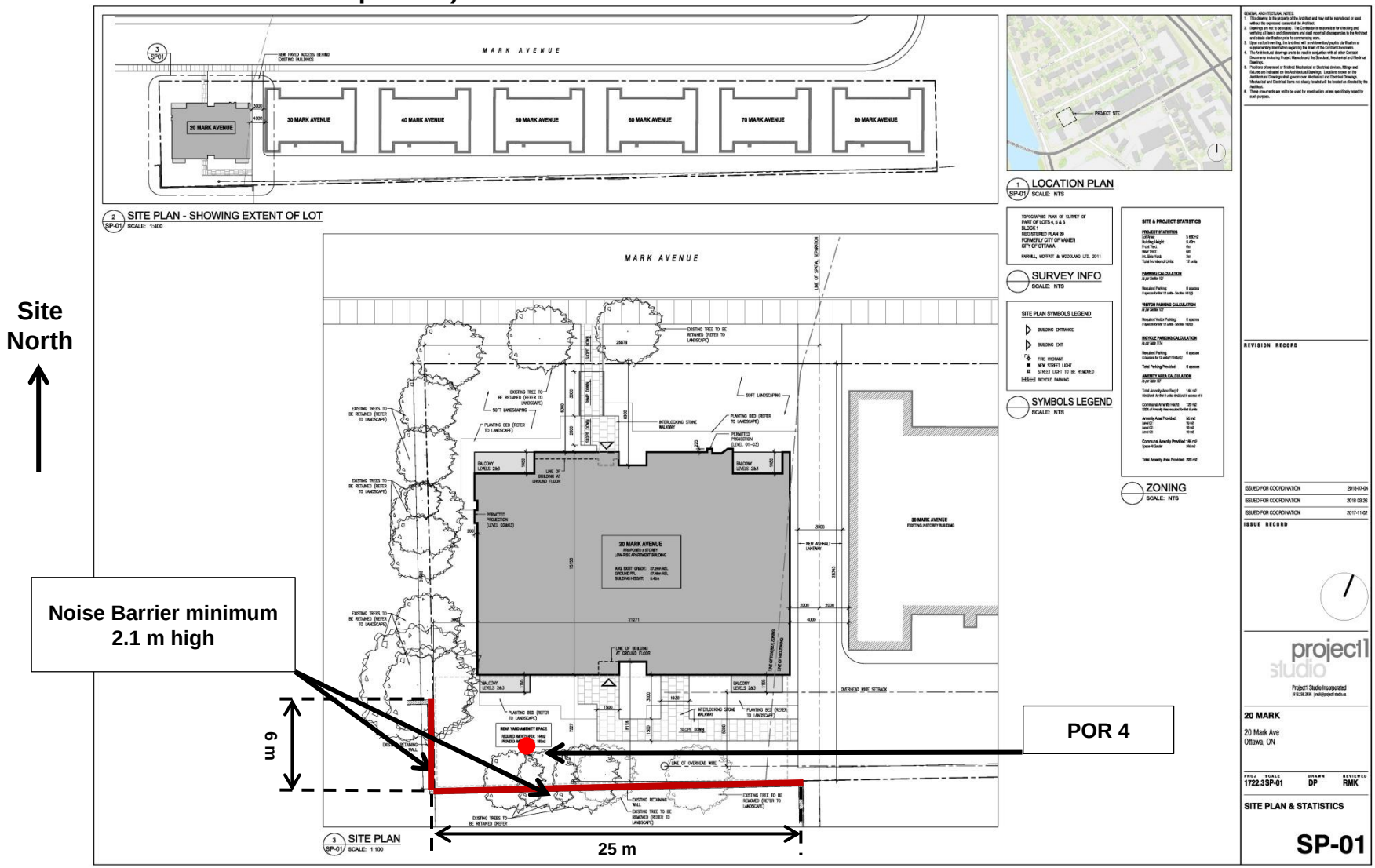


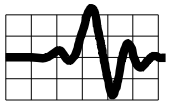
**Figure 10: Site Plan showing Recommended Noise Barrier at POR 4 - Outdoor Living Area (source: Project1 Studio Incorporated)**



# TABLES

**Contents:**





## Table 1: Modelled Points of Reception

| Symbol | Location | Distance to Montreal Road (m) | Angle of exposure (deg.) | Height* (m) | Description |
|---|---|---|---|---|---|
| POR 1 | Third floor level window with 90 degrees exposure to Montreal Road | 47.6 | 90 | 7.5 | Plane of window (living room) |
| POR 2 | Third floor level window with 180 degrees exposure to Montreal Road | 47 | 180 | 7.5 | Plane of window (living room) |
| POR 3 | Third floor level window with 180 degrees exposure to Montreal Road | 47 | 180 | 7.5 | Plane of window (bedroom) |
| POR 4 | Outdoor Living Area located at the rear of the building | 43.7 | 56 | 1.5 | Outdoor Living Area (rear yard) |

*Height measured from street level.

## 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 kph | Split Day 7:00-23:00 | Split Night 23:00-7:00 | Medium Trucks % | Heavy Trucks % | Cars no. | Medium Trucks no. | Heavy Trucks no. | Cars no. | Medium Trucks no. | Heavy Trucks no. |
| | | | | | | | | | | | | | |
| **Montreal Road 4-UAU, 4 Lane Urban Arterial Un-Divided - Future Mature Traffic Volumes from City of Ottawa Guidelines** | | | | | | | | | | | | | |
| East/West | 4-UAU | 30,000 | 50 | 0.92 | 0.08 | 7 | 5 | 24288 | 1932 | 1380 | 2112 | 168 | 120 |

## Table 3: Traffic Noise Impacts for Building Component Requirements

| Point of Reception | Location | Estimated Future Noise Level* (dBA) | | Building Component Requirement |
|---|---|---|---|---|
| | | Day | Night | |
| POR 1 | Third floor level living room window with 90 degrees exposure to Montreal Road Assessed: **Living Room - 7:00 to 23:00 (Day)** | 60.72 | - | Building compliant with Ontario Building Code ** |
| POR 2 | Third floor level living room window with 180 degrees exposure to Montreal Road Assessed: **Living - 7:00 to 23:00 (Day)** | 63.79 | - | Building compliant with Ontario Building Code ** |
| POR 3 | Third floor level bedroom window with 180 degrees exposure to Montreal Road Assessed: **Bedroom – 23:00 to 07:00 (Night)** | - | 56.19 | 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 the proposed construction of external walls and windows or alternative construction complying with the Ontario Building Code 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 7) | Sound Levels due to Road Traffic | | Ventilation Requirements(1) | Warning Clauses(2) |
|---|---|---|---|---|---|
| | | Day (dBA) | Night (dBA) | | |
| POR 1 | Third floor level window with 90 degrees exposure to Montreal Road | 60.72 | - | Forced Air with provision for central ducted air conditioning | Required (Provincial Warning Clause Type C) |
| POR 2 | Third floor level window with 180 degrees exposure to Montreal Road | 63.79 | - | Forced Air with provision for central ducted air conditioning | Required (Provincial Warning Clause Type C) |
| POR 3 | Third floor level window with 180 degrees exposure to Montreal Road | - | 56.19 | Forced Air with provision for central ducted air conditioning | Required (Provincial Warning Clause Type C) |
| POR 4 | Outdoor Living Area located at the rear of the building ***without Noise Barrier*** | 61.84 | - | Not applicable | See results below |
| POR 4 | Outdoor Living Area located at the rear of the building ***with 2.1 m high Noise Barrier*** | 54.69 | - | Not applicable | Not required (Resultant Noise Impact with 2.1 m high barrier less than 55 dBA) |

*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) | | | Facade 3 (POR 3) | | | 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) | Window[3] (m2) | Wall[1] (m2) | Indoor Sound Level (dBA) | | | |
| Living / Dining Room | Day | 24.9 | 3.8 | 8.4 | 29 | 11.4 | 4.4 | 36 | - | - | - | **36.8** | **45** | **Yes** |
| Bedroom | Night | 8.1 | - | - | - | - | - | - | 4.3 | 3.9 | 29 | **29** | **40** | **Yes** |

*Prediction Method: IBANA Calculations Refer to Appendix 2.

Assessed construction assembly:

1. 1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick with STC 53 rating.
2. 1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 0.7 mm building paper, 9.5 mm cement stucco with STC 40 rating.
3. Aluminum casement window (seals not taped) with 3 mm glass, 13 mm air, 3 mm glass with STC 28 rating.

## 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 4 | Outdoor Living Area located at the rear of the building ***without Noise Barrier*** | 61.84 | - | Control measures (barriers) required to reduce the Leq to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible. (See results below) |
| POR 4 | Outdoor Living Area located at the rear of the building ***with 2.1 m high Noise Barrier*** | 54.69 | - | 2.1 m high Noise Barrier (Refer to Figure 10) |

* Daytime Noise Impacts, based on Leq 16 h (07:00 – 23:00). Noise criteria of 55 dBA, see Table A1.1.

# Appendix 1

# City of Ottawa
# Noise Criteria and Warning Clauses

**For further information refer to:**

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

**MOECP 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**<br>♦ 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**<br>♦ 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**<br>♦ 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

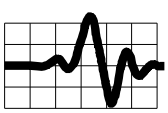
| Assessment Location & Time | Outdoor Leq (dBA) | Ventilation Requirements | Outdoor Control Measures | Warning Clauses (see Table A1.6) |
|---|---|---|---|---|
| **Outdoor Living Area (OLA)**<br>♦ Day-time (07:00 – 23:00) | Less than or equal to 55 | N/A | None Required | Not Required |
| | Greater 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**<br>♦ 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**<br>♦ 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 MOECP 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

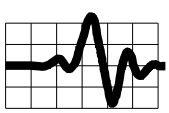
**Contents:**

**Sample outputs from STAMSON:**



**Sample outputs from Ibana:**





```
STAMSON 5.0        SUMMARY REPORT        Date:
21-08-2018 09:31:51
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE
ASSESSMENT

Filename: POR1D.te             Time Period: 16
hours
Description: POR 1 - Plane of Window - Living
Room - Day


Road data, segment # 1: Montreal Rd
----------------------------------
Car traffic volume  : 24288 veh/TimePeriod
Medium truck volume :  1932 veh/TimePeriod
Heavy truck volume  :  1380 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or
concrete)

Data for Segment # 1: Montreal Rd
---------------------------------
Angle1   Angle2          : -90.00 deg   0.00
deg
Wood depth               :      0       (No
woods.)
No of house rows         :      1
House density            :     50 %
Surface                  :      2
(Reflective ground surface)
Receiver source distance  :  47.60 m
Receiver height          :   7.50 m
Topography               :      1
(Flat/gentle slope; no barrier)
Reference angle          :  90.00
```

```
Result summary
--------------

                     !  source  !   Road   !
Total
                     !  height  !   Leq    !
Leq
                     !   (m)    !  (dBA)   !
(dBA)
---------------------+---------+---------+-------
--
 1.Montreal Rd       !     1.50 !    60.72 !
60.72
---------------------+---------+---------+-------
--
                          Total
60.72 dBA
```

**TOTAL Leq FROM ALL SOURCES:  60.72**

```
STAMSON 5.0        SUMMARY REPORT        Date:
21-08-2018 09:34:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE
ASSESSMENT

Filename: POR2D.te             Time Period: 16
hours
Description: POR 2 - Plane of Window - Living
Room - Day


Road data, segment # 1: Montreal Rd
----------------------------------
Car traffic volume  : 24288 veh/TimePeriod
Medium truck volume :  1932 veh/TimePeriod
Heavy truck volume  :  1380 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or
concrete)

Data for Segment # 1: Montreal Rd
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00
deg
Wood depth                :      0       (No
woods.)
No of house rows          :      1
House density             :     50 %
Surface                   :      2
(Reflective ground surface)
Receiver source distance  :  47.00 m
Receiver height           :   7.50 m
Topography                :      1
(Flat/gentle slope; no barrier)
Reference angle           : 180.00
```

```
Result summary
--------------

                     !  source  !   Road   !
Total
                     !  height  !   Leq    !
Leq
                     !    (m)   !  (dBA)   !
(dBA)
---------------------+---------+---------+-------
--
 1.Montreal Rd       !     1.50 !    63.79 !
63.79
---------------------+---------+---------+-------
--
                          Total
63.79 dBA
```

**TOTAL Leq FROM ALL SOURCES:  63.79**

```
STAMSON 5.0        SUMMARY REPORT        Date:
21-08-2018 09:36:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE
ASSESSMENT

Filename: POR3N.te             Time Period: 8
hours
Description: POR 3 - Plane of Window - Bedroom -
Night


Road data, segment # 1: Montreal Rd
----------------------------------
Car traffic volume  :  2112 veh/TimePeriod
Medium truck volume :   168 veh/TimePeriod
Heavy truck volume  :   120 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or
concrete)

Data for Segment # 1: Montreal Rd
---------------------------------
Angle1   Angle2           : -90.00 deg   90.00
deg
Wood depth                :      0       (No
woods.)
No of house rows          :      1
House density             :     50 %
Surface                   :      2
(Reflective ground surface)
Receiver source distance  :  47.00 m
Receiver height           :   7.50 m
Topography                :      1
(Flat/gentle slope; no barrier)
Reference angle           : 180.00
```

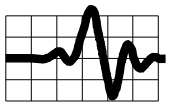
```
Result summary
--------------

                     !  source  !   Road   !
Total
                     !  height  !   Leq    !
Leq
                     !   (m)    !  (dBA)   !
(dBA)
---------------------+---------+---------+-------
--
 1.Montreal Rd       !     1.50 !    56.19 !
56.19
---------------------+---------+---------+-------
--
                          Total
56.19 dBA
```

**TOTAL Leq FROM ALL SOURCES:  56.19**

```
STAMSON 5.0        SUMMARY REPORT        Date:
21-08-2018 09:47:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE
ASSESSMENT

Filename: por4d.te             Time Period: 16
hours
Description: POR 4 - Outdoor Living Area - Day -
No Barrier


Road data, segment # 1: Montreal Rd
----------------------------------
Car traffic volume  : 24288 veh/TimePeriod
Medium truck volume :  1932 veh/TimePeriod
Heavy truck volume  :  1380 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or
concrete)

Data for Segment # 1: Montreal Rd
---------------------------------
Angle1   Angle2           : -26.00 deg   30.00
deg
Wood depth                :      0       (No
woods.)
No of house rows          :      0
Surface                   :      2
(Reflective ground surface)
Receiver source distance  :  43.10 m
Receiver height           :   1.50 m
Topography                :      1
(Flat/gentle slope; no barrier)
Reference angle           :  56.00
```

```
Result summary
--------------

                     !  source  !   Road   !
Total
                     !  height  !   Leq    !
Leq
                     !   (m)    !  (dBA)   !
(dBA)
---------------------+---------+---------+-------
--
 1.Montreal Rd       !     1.50 !    61.84 !
61.84
---------------------+---------+---------+-------
--
                          Total
61.84 dBA

TOTAL Leq FROM ALL SOURCES:       61.84
```

```
STAMSON 5.0        SUMMARY REPORT        Date:
21-08-2018 10:19:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE
ASSESSMENT

Filename: por4dMIT.te          Time Period: 16
hours
Description: POR 4 - Outdoor Living Area - Day -
With Barrier


Road data, segment # 1: Montreal Rd
-----------------------------------
Car traffic volume  : 24288 veh/TimePeriod
Medium truck volume :  1932 veh/TimePeriod
Heavy truck volume  :  1380 veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or
concrete)

Data for Segment # 1: Montreal Rd
---------------------------------
Angle1   Angle2           : -26.00 deg   30.00
deg
Wood depth                :      0       (No
woods.)
No of house rows          :      0
Surface                   :      2
(Reflective ground surface)
Receiver source distance  :  43.10 m
Receiver height           :   1.50 m
Topography                :      2
(Flat/gentle slope; with barrier)
Barrier angle1            : -26.00 deg   Angle2
: 30.00 deg
Barrier height            :   2.10 m
Barrier receiver distance :   3.90 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :  56.00
Result summary
--------------

                     !  source  !   Road   !
Total
                     !  height  !   Leq    !
Leq
                     !   (m)    !  (dBA)   !
(dBA)
---------------------+----------+----------+-----
-----
 1.Montreal Rd       !     1.50 !    54.69 !
54.69
---------------------+----------+----------+-----
-----
                           Total
54.69 dBA

Barrier table for segment # 1: Montreal Rd
------------------------------------------

Barrier ! Elev of !  Road   ! Tot Leq !
Height  ! Barr Top!  dBA    !   dBA   !
--------+---------+---------+---------+
   3.60 !    3.60 !   46.68 !   46.68 !
   4.10 !    4.10 !   44.97 !   44.97 !
   4.60 !    4.60 !   43.58 !   43.58 !
   5.10 !    5.10 !   42.42 !   42.42 !
   5.60 !    5.60 !   41.84 !   41.84 !
   6.10 !    6.10 !   41.84 !   41.84 !
   6.60 !    6.60 !   41.84 !   41.84 !
   7.10 !    7.10 !   41.84 !   41.84 !
   7.60 !    7.60 !   41.84 !   41.84 !
   8.10 !    8.10 !   41.84 !   41.84 !
```



**TOTAL Leq FROM ALL SOURCES: 54.69**

Noise Sound Insulation Scenario Calculation Results

**Project: POR 1**
ProjectID:
Date:8/21/2018
Outdoor level: NEF 29 or Leq24 61 or Ldn 62 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 24.90 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: GL3_AIR13_GL3

Construction Type: Window
Area: 3.80 m²
Test ID: TLA-99-177a
Test Date: 5/31/1999

Aluminum casement window (seals not taped).

Element 2: G13_WS140(406)_GFB152_OSB11_AIR16_BRI89

Construction Type: 2by6 Wall
Area: 8.40 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 fibre cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick.

Sound Level vs. Frequency - Spectrum Values:

| Frequency(Hz) | Indoor Sound Level(dB) |
|---|---|
| 50 | 38.8 |
| 63 | 36.8 |
| 80 | 33.3 |
| 100 | 33.3 |
| 125 | 30.0 |
| 160 | 32.0 |
| 200 | 29.3 |
| 250 | 28.0 |
| 315 | 22.6 |
| 400 | 23.9 |
| 500 | 19.0 |
| 630 | 18.0 |
| 800 | 18.3 |
| 1000 | 19.0 |
| 1250 | 15.2 |
| 1600 | 11.8 |
| 2000 | 7.3 |
| 2500 | 3.7 |
| 3150 | 3.1 |
| 4000 | 2.1 |
| 5000 | -2.6 |

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

| Frequency(Hz) | A-Wtd Sound Level(dBA) |
|---|---|
| 50 | 8.6 |
| 63 | 10.6 |
| 80 | 10.8 |
| 100 | 14.2 |
| 125 | 13.9 |
| 160 | 18.6 |
| 200 | 18.4 |
| 250 | 19.4 |
| 315 | 16.0 |
| 400 | 19.1 |
| 500 | 15.8 |
| 630 | 16.1 |
| 800 | 17.5 |
| 1000 | 19.0 |
| 1250 | 15.8 |
| 1600 | 12.8 |
| 2000 | 8.5 |
| 2500 | 5.0 |
| 3150 | 4.3 |
| 4000 | 3.1 |
| 5000 | -2.1 |

Transmission Loss vs. Frequency - Spectrum Values:

| Frequency(Hz) | Transmission Loss(dB) |
|---|---|
| 50 | 24.1 |
| 63 | 24.1 |
| 80 | 25.9 |
| 100 | 23.5 |
| 125 | 23.8 |
| 160 | 21.1 |
| 200 | 23.2 |
| 250 | 23.3 |
| 315 | 27.6 |
| 400 | 25.6 |
| 500 | 29.9 |
| 630 | 30.5 |
| 800 | 31.2 |
| 1000 | 30.6 |
| 1250 | 32.9 |
| 1600 | 34.9 |
| 2000 | 38.2 |
| 2500 | 39.7 |
| 3150 | 38.3 |
| 4000 | 38.3 |
| 5000 | 41.4 |

Source Sound Level vs. Frequency - Spectrum Values:

| Frequency(Hz) | Source Sound Level(dB) |
|---|---|
| 50 | 66.0 |
| 63 | 64.0 |
| 80 | 62.3 |
| 100 | 59.9 |
| 125 | 56.9 |
| 160 | 56.2 |
| 200 | 55.7 |
| 250 | 54.4 |
| 315 | 53.4 |
| 400 | 52.6 |
| 500 | 52.0 |
| 630 | 51.7 |
| 800 | 52.6 |
| 1000 | 52.8 |
| 1250 | 51.2 |
| 1600 | 49.8 |
| 2000 | 48.6 |
| 2500 | 46.5 |
| 3150 | 44.6 |
| 4000 | 43.8 |
| 5000 | 42.3 |

Single Number Ratings

| | | |
|---|---|---|
| Outdoor Sound Level: | 61 | dBA |
| Indoor Sound Level: | 29 | dBA |
| A-wtd Level Reduction: | 32 | dB |
| A-wtd Reduction re Standard Source: | 31 | dB |
| OITC Rating: | 28 | dB |

Noise Sound Insulation Scenario Calculation Results

**Project: POR 2**
ProjectID:
Date:8/21/2018
Outdoor level: NEF 32 or Leq24 64 or Ldn 65 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 24.90 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: GL3_AIR13_GL3

Construction Type: Window
Area: 11.40 m²
Test ID: TLA-99-177a
Test Date: 5/31/1999

Aluminum casement window (seals not taped).

Element 2: G13_WS140(406)_GFB152_OSB11_BPAP0.7_STUC9.5

Construction Type: 2by6 Wall
Area: 4.40 m²
Test ID: TLA-99-091a
Test Date: 2/24/1999

1 of 13mm gypsum board, 140 mm wood studs on 406 mm centres with glass fibre cavity insulation, 11 mm OSB, 0.7 mm building paper, 9.5 mm cement stucco.

Sound Level vs. Frequency - Spectrum Values:

| Frequency(Hz) | Indoor Sound Level(dB) |
|---|---|
| 50 | 46.8 |
| 63 | 45.1 |
| 80 | 41.4 |
| 100 | 41.0 |
| 125 | 39.5 |
| 160 | 40.0 |
| 200 | 37.1 |
| 250 | 35.7 |
| 315 | 30.3 |
| 400 | 31.6 |
| 500 | 26.8 |
| 630 | 25.8 |
| 800 | 26.0 |
| 1000 | 26.8 |
| 1250 | 23.0 |
| 1600 | 19.5 |
| 2000 | 15.1 |
| 2500 | 11.4 |
| 3150 | 10.9 |
| 4000 | 9.9 |
| 5000 | 5.2 |

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

| Frequency(Hz) | A-Wtd Sound Level(dBA) |
|---|---|
| 50 | 16.6 |
| 63 | 18.9 |
| 80 | 18.9 |
| 100 | 21.9 |
| 125 | 23.4 |
| 160 | 26.6 |
| 200 | 26.2 |
| 250 | 27.1 |
| 315 | 23.7 |
| 400 | 26.8 |
| 500 | 23.6 |
| 630 | 23.9 |
| 800 | 25.2 |
| 1000 | 26.8 |
| 1250 | 23.6 |
| 1600 | 20.5 |
| 2000 | 16.3 |
| 2500 | 12.7 |
| 3150 | 12.1 |
| 4000 | 10.9 |
| 5000 | 5.7 |

Transmission Loss vs. Frequency - Spectrum Values:

| Frequency(Hz) | Transmission Loss(dB) |
|---|---|
| 50 | 20.2 |
| 63 | 19.9 |
| 80 | 21.8 |
| 100 | 19.9 |
| 125 | 18.4 |
| 160 | 17.2 |
| 200 | 19.6 |
| 250 | 19.7 |
| 315 | 24.0 |
| 400 | 22.0 |
| 500 | 26.2 |
| 630 | 26.9 |
| 800 | 27.6 |
| 1000 | 27.0 |
| 1250 | 29.2 |
| 1600 | 31.3 |
| 2000 | 34.5 |
| 2500 | 36.0 |
| 3150 | 34.6 |
| 4000 | 34.6 |
| 5000 | 37.7 |

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: | 36 | dBA |
| A-wtd Level Reduction: | 28 | dB |
| A-wtd Reduction re Standard Source: | 27 | dB |
| OITC Rating: | 24 | dB |

Noise Sound Insulation Scenario Calculation Results

**Project: POR 3**
ProjectID:
Date:8/21/2018
Outdoor level: NEF 24 or Leq24 56 or Ldn 57 dBA

Source Spectrum details:

100% ISO 717 Road Traffic
Corrections:

Receiving room:

Floor Area: 8.10 ft²
Absorbtion: 100% of floor area

Construction Description:

Element 1: GL3_AIR13_GL3

Construction Type: Window
Area: 4.30 m²
Test ID: TLA-99-177a
Test Date: 5/31/1999

Aluminum casement window (seals not taped).

Element 2: G13_WS140(406)_GFB152_OSB11_AIR16_BRI89

Construction Type: 2by6 Wall
Area: 3.90 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 fibre cavity insulation, 11 mm OSB, 16 mm airspace, 89 mm brick.

Sound Level vs. Frequency - Spectrum Values:

| Frequency(Hz) | Indoor Sound Level(dB) |
|---|---|
| 50 | 39.0 |
| 63 | 36.8 |
| 80 | 33.0 |
| 100 | 32.6 |
| 125 | 29.8 |
| 160 | 32.4 |
| 200 | 29.7 |
| 250 | 28.3 |
| 315 | 23.0 |
| 400 | 24.3 |
| 500 | 19.4 |
| 630 | 18.4 |
| 800 | 18.7 |
| 1000 | 19.4 |
| 1250 | 15.6 |
| 1600 | 12.2 |
| 2000 | 7.7 |
| 2500 | 4.1 |
| 3150 | 3.5 |
| 4000 | 2.6 |
| 5000 | -2.2 |

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

| Frequency(Hz) | A-Wtd Sound Level(dBA) |
|---|---|
| 50 | 8.8 |
| 63 | 10.6 |
| 80 | 10.5 |
| 100 | 13.5 |
| 125 | 13.7 |
| 160 | 19.0 |
| 200 | 18.8 |
| 250 | 19.7 |
| 315 | 16.4 |
| 400 | 19.5 |
| 500 | 16.2 |
| 630 | 16.5 |
| 800 | 17.9 |
| 1000 | 19.4 |
| 1250 | 16.2 |
| 1600 | 13.2 |
| 2000 | 8.9 |
| 2500 | 5.4 |
| 3150 | 4.7 |
| 4000 | 3.6 |
| 5000 | -1.7 |

Transmission Loss vs. Frequency - Spectrum Values:

| Frequency(Hz) | Transmission Loss(dB) |
|---|---|
| 50 | 22.1 |
| 63 | 22.2 |
| 80 | 24.3 |
| 100 | 22.4 |
| 125 | 22.1 |
| 160 | 18.8 |
| 200 | 21.0 |
| 250 | 21.1 |
| 315 | 25.4 |
| 400 | 23.3 |
| 500 | 27.6 |
| 630 | 28.3 |
| 800 | 28.9 |
| 1000 | 28.4 |
| 1250 | 30.6 |
| 1600 | 32.6 |
| 2000 | 35.9 |
| 2500 | 37.4 |
| 3150 | 36.0 |
| 4000 | 36.0 |
| 5000 | 39.1 |

Source Sound Level vs. Frequency - Spectrum Values:

| Frequency(Hz) | Source Sound Level(dB) |
|---|---|
| 50 | 61.0 |
| 63 | 59.0 |
| 80 | 57.3 |
| 100 | 54.9 |
| 125 | 51.9 |
| 160 | 51.2 |
| 200 | 50.7 |
| 250 | 49.4 |
| 315 | 48.4 |
| 400 | 47.6 |
| 500 | 47.0 |
| 630 | 46.7 |
| 800 | 47.6 |
| 1000 | 47.8 |
| 1250 | 46.2 |
| 1600 | 44.8 |
| 2000 | 43.6 |
| 2500 | 41.5 |
| 3150 | 39.6 |
| 4000 | 38.8 |
| 5000 | 37.3 |

Single Number Ratings

| | | |
|---|---|---|
| Outdoor Sound Level: | 56 | dBA |
| Indoor Sound Level: | 29 | dBA |
| A-wtd Level Reduction: | 27 | dB |
| A-wtd Reduction re Standard Source: | 26 | dB |
| OITC Rating: | 26 | 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.