

**NOISE IMPACT ASSESSMENT
FOR
SITE PLAN APPROVAL**

**406 – 408 BANK STREET
OTTAWA
prepared for
BRIAN CLARK ARCHITECT**

Draft sent 1 March, 2013; final sent 19 March, 2013

1.0 Background

A new residential development is proposed for the property at 406 to 408 Bank Street. It will consist of a 6-storey multiunit building containing commercial units on the ground floor and residential units on the upper floors. Figure 1 shows the location of this development.

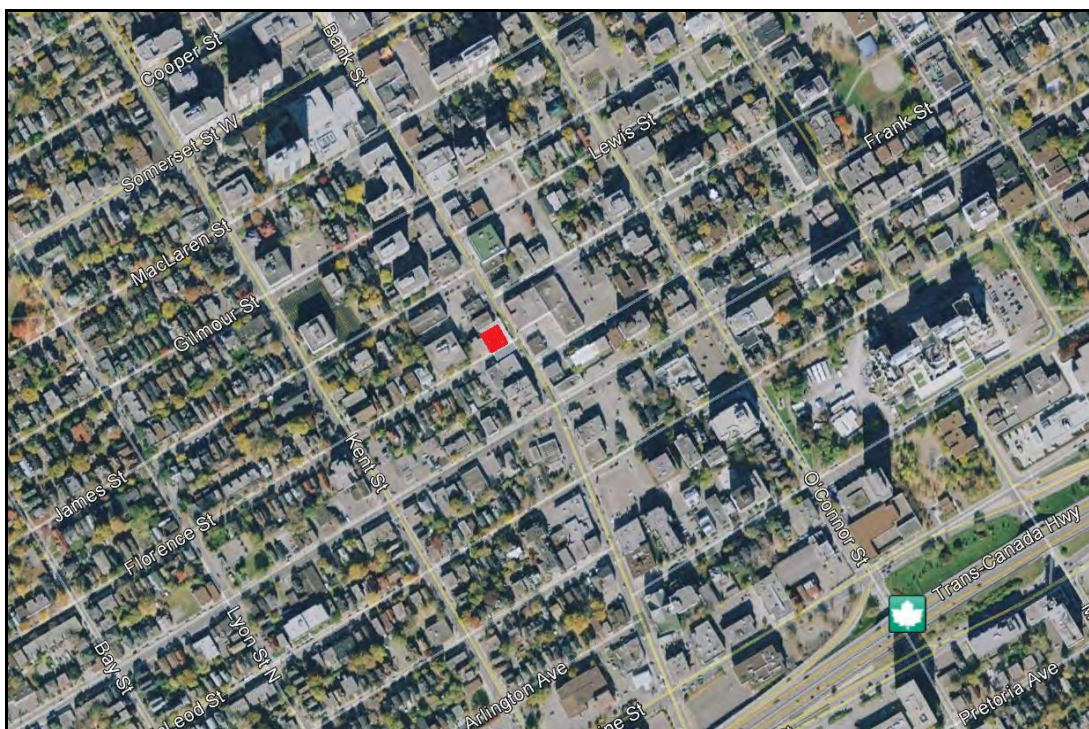


FIGURE 1: SITE LOCATION

Noise sources to be included in an assessment of noise impact for new developments are defined in the City of Ottawa Environmental Noise Control Guidelines (ENCG). They include roads, highways, rail lines, transitways, aircraft and stationary (industrial) installations. The noise assessment process for each of these possible sources is prescribed in the ENCG, including the proximity of the source to the development within which the source is to be considered. In addition, any stationary noise sources located on the proposed development must be identified. The noise study must then define control measures to ensure their noise levels within the 70m influence area (in this case, from 35m to 105m from the centre of the site) will be within the levels prescribed by the ENCG.

This site is located on Bank Street, at the northeast corner with Florence Street. Bank Street is defined in Ottawa's Transportation Master Plan as a two-lane Urban Arterial road. Florence Street is a local access street. The Transportation Master Plan shows no change in these classifications over the life of the Plan. Gladstone Avenue is classified as a two-lane Major Collector, and is located within 100 metres of the site to the south. The Queensway (Highway 417) is located less than 500 metres to the south of the site. The ENCG require that noise from these roadways as well as from Bank Street be taken into account in assessing noise impact on the site, because of their classification and proximity. O'Connor Street and Kent Street are also classified as two-lane Urban Arterial roads, but both are more than 100 metres from the site, so need not be included as noise sources. The site is not within the Ottawa Airport NEF/NEP 25 contour or the Rockcliffe Airport noise zone, so aircraft are not a noise source. There are no rail lines or proposed light rail transit lines, and no OC Transpo Transitway routes or stations within 500 metres of the site.

The neighbourhood is commercial with single family homes to the south of Florence and some low-to medium-rise multiunit residential at scattered locations. No industrial or heavy commercial sites are within 500 metres of the location.

Stationary noise sources on the site, typically a diesel emergency generator, HVAC fluid coolers, air makeup fan and commercial facilities' air supply and exhaust fans, have not been identified at this time. Prior to building permit stage, the locations and sizings of any such units will be identified and their noise levels reduced by enclosures as necessary to comply with the ENCG requirements for such installations.

Noise impacts must be evaluated for Outdoor Living Areas and the planes of all exposed bedroom windows and living/dining room windows in residential units. City of Ottawa ENCG define the remedial noise attenuation actions that must be included in the building design for the bedroom and living/dining room impact locations. Remedial actions include Notices on Title as well as structural requirements, and are listed in Appendix A.

Outdoor Living Areas for multi-unit buildings can be private or common use areas designated for recreational use by the unit occupiers. These areas can be at ground level or in some other location, such as a rooftop patio or terrace, but usually do not include open balconies on individual units, unless the balcony depth is 4 metres or more (ENCG Appendix B: Glossary and Definitions). There is a "community amenity area" on the roof and a terrace which is on two sides of the building at the 5th floor (Figure 2). Although the terrace is only 2 metres deep, it provides an outdoor living/recreational area for the units on the 5th floor. These locations are considered to be Outdoor Living Areas. **Therefore, Outdoor Living Area requirements apply to both these locations.**

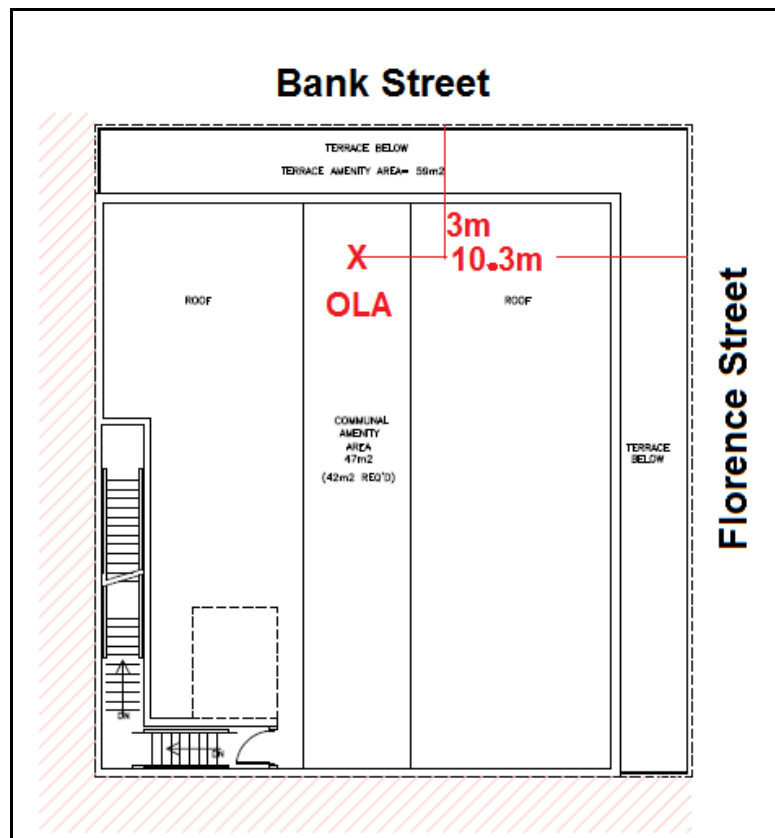


FIGURE 2: LOCATIONS OF OUTDOOR LIVING AREAS ON ROOF AND 5th FLOOR TERRACE

1.1 Identification of Road Traffic Noise Sources

The roads to be considered as noise sources have been identified above. Figures 3, 4 and 5 show the exposure of each of the Bank Street and Florence Street façades to these roadways. For both façades, calculations of noise level were done separately for floors 1 to 4, floor 5, floor 6 and the roof top. Given the location of the site, all noise propagation was taken to be over ground that was non-absorptive, i.e. hard acoustically-reflective surfaces. This results in noise levels from the same source at all building heights along a vertical line (at the same distance from the source) being the same, except if there are different blockage effects along the propagation line.

Noise was calculated using the computer program STAMSON. It was calculated at representative locations on each floor on each façade, usually representing the highest noise level for that floor on that façade. The assumption of reflective ground surfaces implies the same noise level at floors 1 to 4, but the 5th and 6th floors are recessed by 2 metres from the façade at ground level by the terrace on the Bank and the Florence sides. Therefore, calculation locations were defined for floors 1 to 4 together on the Bank (east) and Florence (south) façades, and calculation locations on each of the façades for 5th and 6th floor locations and on the roof were separately defined. The 5th floor locations were separately defined from the 6th floor locations because, although they are both recessed by the same distance, the 5th floor has a guard wall at the outer edge of the terrace, which acts as a noise barrier for the terrace and that floor. The roof location is also calculated separately

in order to locate the representative calculation location where noise levels would be highest, but where people would also tend to be located.

In Figure 3, the exposure of the south (Florence Street) façade to Gladstone Street is shown for the representative locations on that south facade. The dense two-storey housing along Florence and the buildings along the north side of Gladstone constitute a noise barrier for the south façade of the site against noise from Gladstone. The perpendicular distance from Gladstone to floors 1 to 4 on the south façade is about 92 metres, and the two exposure angles to Gladstone (measured relative to this perpendicular) are -21 and $+75$ degrees. Floors 5 and 6 are 2 metres farther from Gladstone (along the perpendicular) and the rooftop OLA is 10.3 metres farther from Gladstone.



FIGURE 3: EXPOSURE OF SOUTH FAÇADE TO NOISE FROM GLADSTONE AVENUE

The exposure angles are defined either by the existence of tall blocking buildings or by the distance from the site going beyond the 100 metre limits.

Figure 4 shows the distance and exposure angles from the Queensway for the south façade calculation point. Again, the exposure angles are defined by blockage and distance from the site. No calculation of noise levels from the Queensway at the lower 4 floors on the south façade was made, since the shielding of the lower floors by buildings along the intervening streets would reduce noise levels considerably. However, the noise levels from the Queensway were calculated for the 5th and 6th floor locations and the rooftop because these locations are generally at or above most of the intervening buildings. The perpendicular distance to the Queensway is 477 metres, and the exposure angles are -32 and $+29.5$ degrees.

Noise from Bank Street on the south (Florence Street) façade was calculated at two locations on the south facade. The maximum noise level on that façade will be at the corner of Bank and Florence.

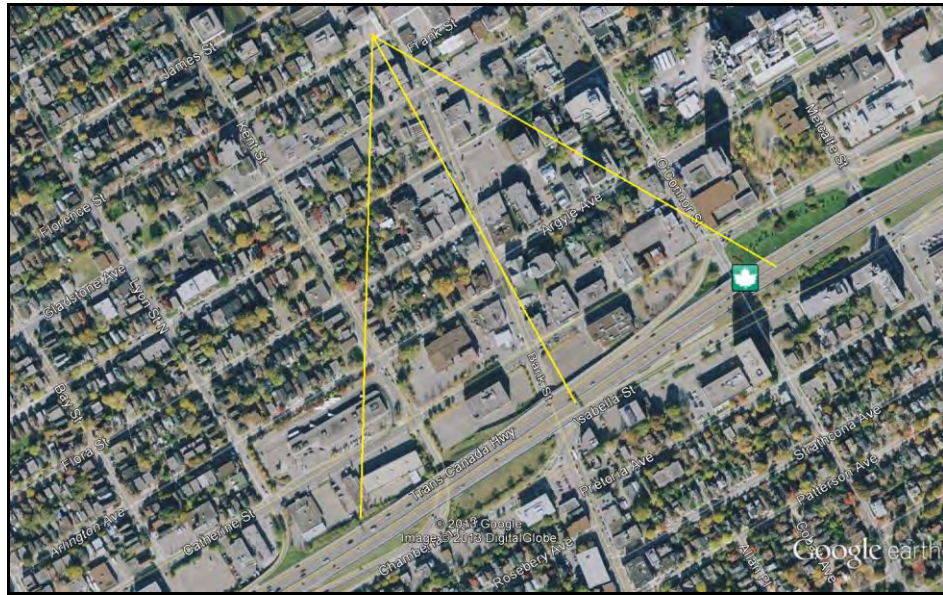


FIGURE 4: EXPOSURE OF SOUTH FAÇADE TO NOISE FROM QUEENSWAY

The noise levels at each of the floor locations here will be half the noise level on the same floor on the east (Bank Street) façade, since the south façade has only half the exposure of the east façade to Bank Street. However, farther west along Florence Street, there is considerable additional shielding from Bank Street noise of the lower floors (1 to 4) on that south façade by buildings on the west side of Bank Street south of Florence. Figure 5 illustrates this situation for a calculation location at the westerly end of the site. Note that the higher floors (5 and 6 and the roof OLA) are not shielded by these buildings on Bank Street, so the noise levels there will still be half the noise level from Bank calculated on the east façade.



FIGURE 5: EXPOSURE TO BANK STREET OF SOUTH FAÇADE AT WESTERLY END OF SITE

Finally, the noise levels on the east (Bank Street) façade are calculated with full exposure (± 90 degrees) to Bank Street, for all floor locations.

2.0 Road Traffic Source Noise Levels

The ENCG define the traffic volumes that must be used in assessing noise according to the future mature state of development of the relevant roads. The ENCG also define the traffic split between cars, medium trucks and heavy trucks on the arterial, and the day/night split of the total traffic volume.

The road classifications and related traffic data shown in the Table 1 below apply to the roadways considered as noise sources in this study. The classifications originate in the City’s Transportation Master Plan; the traffic data is obtained from the City’s Environmental Noise Control Guidelines Part 1: New Land Use Planning for each road class:

**TABLE 1
ROAD DEFINITIONS AND RELATED TRAFFIC DATA**

Row Width (m)	Implied Roadway Class	AADT Vehicles/ Day	Posted Speed Km/Hr	Day/Night Split %	Medium Trucks %	Heavy Trucks % ¹
NA ²	Freeway, Queensway, 6 lanes	18,333 per lane	100	92/8	7	5
20-30	2-Lane Urban Arterial (2-UAU) Bank Street	15,000	50-80	92/8	7	5
20-30	2-Lane Major Collector (2-UMCU) Gladstone Avenue	12,000	40-60	92/8	7	5

¹ The MOE Vehicle Classification definitions should be used to estimate automobiles, medium trucks and heavy trucks.

² The number of lanes is determined by the future mature state of the roadway.

As shown, the Guidelines also specify the range of traffic speeds that should be used for noise assessment. It was assumed that the current posted speed on Bank Street and Gladstone Avenue near this location is 50kph. The posted speed of 100kph on the Queensway was also used.

For multi-lane roads that are close to the receiver locations, it is advisable to divide the total traffic volume into each of the lanes or at a minimum, into the two directions on the road. It was assumed in this study that the AADT volume is equally divided between the two directions on Bank Street, with the traffic located along the mid-line of each lane in each direction. The traffic on Gladstone and the Queensway was represented as a single lane carrying the whole traffic along the roadway centreline.

The following Table 2 shows the traffic volumes from Table 1 divided into directions as described above, also divided between day and night volumes and also divided into automobiles, medium

trucks and heavy trucks according to the given percentages in Table 1.

**TABLE 2
TRAFFIC VOLUME PARAMETERS**

Bank Street: AADT = 15,000; two directions; 7500 per direction

	<i>Daytime (0700 to 2259)</i>	<i>Night time (2300 to 0659)</i>	<i>TOTALS</i>
Automobiles (per direction):	6,072	528	6,600
Medium Trucks (per direction):	483	42	525
Heavy Trucks (per direction):	345	30	<u>375</u>
			7,500
Total Automobiles (x2 dir.):	12,144	1,056	13,200
Total Medium Trucks (x2 dir.):	966	84	1,050
Total Heavy Trucks (x2 dir.):	690	60	<u>750</u>
			15,000

Gladstone Avenue: AADT = 15,000; single lane

	<i>Daytime (0700 to 2259)</i>	<i>Night time (2300 to 0659)</i>	<i>TOTALS</i>
Automobiles (per direction):	9,715	845	10,560
Medium Trucks (per direction):	773	67	840
Heavy Trucks (per direction):	552	48	<u>600</u>
			12,000

Queensway: AADT = 109,998; single lane

	<i>Daytime (0700 to 2259)</i>	<i>Night time (2300 to 0659)</i>	<i>TOTALS</i>
Automobiles (per direction):	89,054	7744	96,798
Medium Trucks (per direction):	7084	616	7,700
Heavy Trucks (per direction):	5060	440	<u>5,500</u>
			109,998

With this data, and the geometric relationships of the exposed facades of the building to the three roadways as described above, noise from traffic was modelled at the representative receptor locations on the building using the computer program STAMSON 5, which is the model accepted by the City of Ottawa.

Note that only the day time noise levels were calculated in this study. If all factors concerning the traffic mix, distances and speed limits are unchanged between day and night, and only the percentage of traffic during the two periods and the averaging number of hours in each period change, then the night time noise is directly related to the day time noise by a multiplying factor (or

a decibel adjustment, which is the logarithm of the multiplying factor). The multiplying factor is the night time percentage divided by the day time percentage, multiplied by the daytime averaging hours and divided by the night time averaging hours, as:

$$\begin{aligned} \text{Multiplying Factor} &= \text{Night percentage} / \text{Day percentage} \times \text{Day hours} / \text{Night hours} \\ &= 8\% / 92\% \times 16 \text{ hours} / 8 \text{ hours} \\ &= 16 / 92 \end{aligned}$$

The correction in decibels to the day time noise to obtain the night time noise is therefore:

$$\text{Decibel correction} = 10\text{Log}[16/92] = -7.6\text{dB}$$

3.0 Noise at Receptor Locations

Under the City's guidelines, Outdoor Living Areas (OLAs), the plane of bedroom windows and the plane of living/dining room windows are the receptor locations on a building where noise levels must be determined.

Figures 6 and 7 show the locations of the noise receptors on the building elevations, indicated by a > with the floor numbers also indicated. Figure 8 shows the locations in plan view with a V and <. Recall that since there is no ground absorption of noise, the calculated noise levels at these receptor locations apply at all heights on the buildings on the facades where the locations are marked in plan view. These heights are indicated as vertical lines on the elevations.

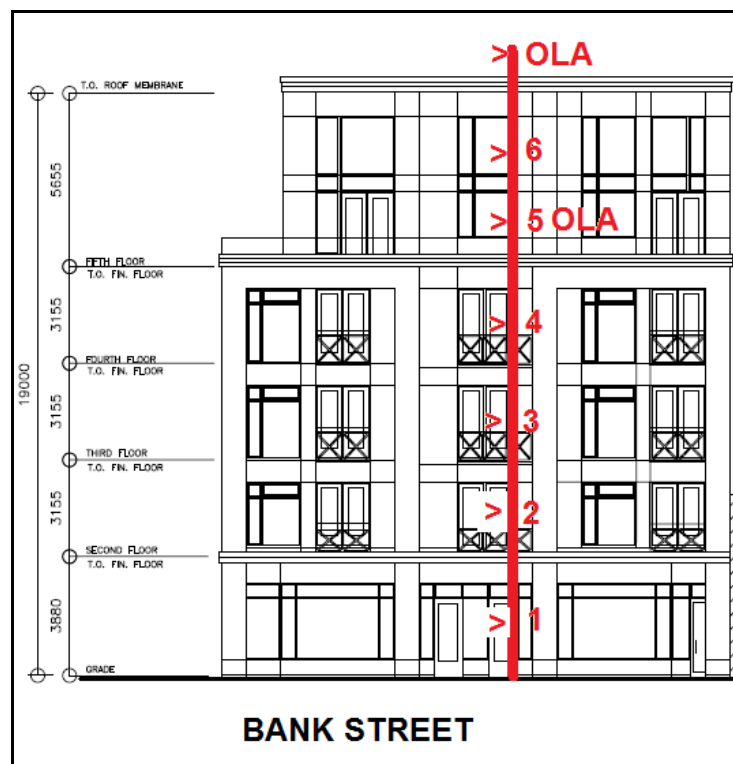


FIGURE 6: BANK STREET ELEVATION SHOWING NOISE CALCULATION LOCATIONS

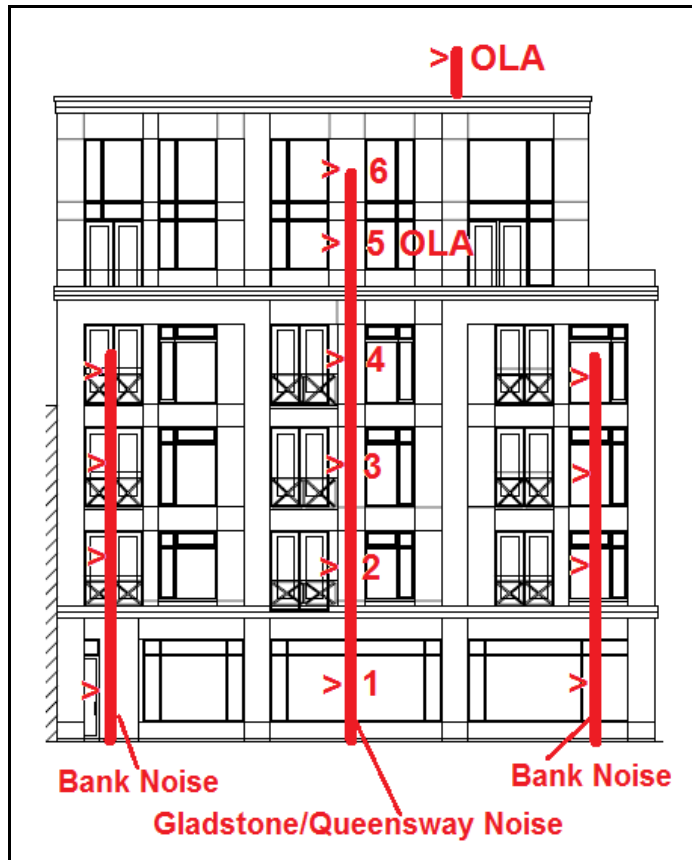


FIGURE 7: FLORENCE AVENUE ELEVATION SHOWING NOISE CALCULATION LOCATIONS

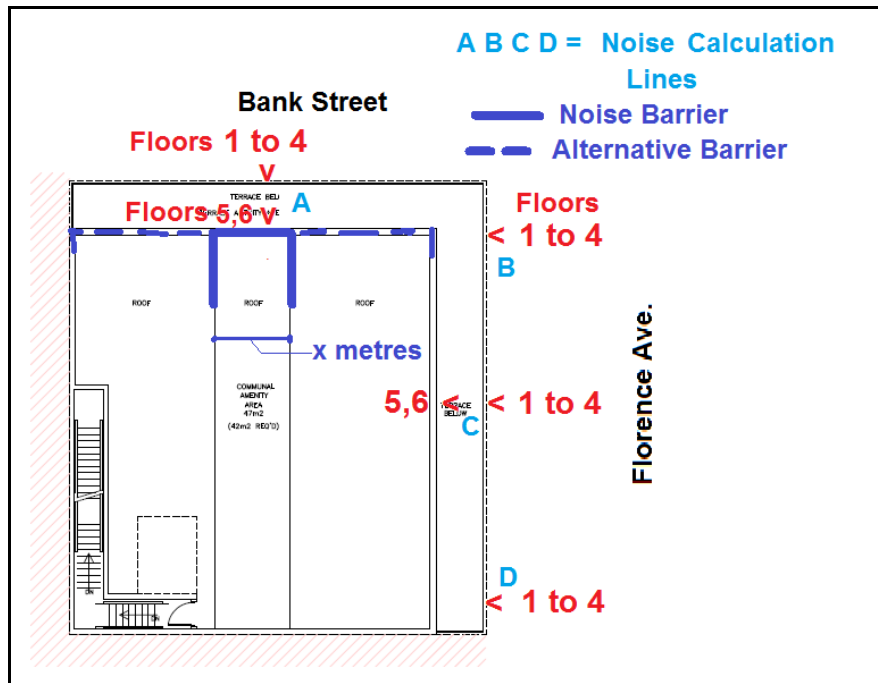


FIGURE 8: PLAN VIEW OF RECEPTOR LOCATIONS

The receptor locations on the Bank Street façade (Line A) have been chosen to represent the least amount of shielding and therefore the highest noise levels that would be experienced on that façade. The centre line of receptors on the Florence Avenue façade (Line C) include the noise levels from Gladstone and the Queensway on that façade; the other two lines of receptors (Lines B and D) represent the noise levels from Bank Street on floors 1 to 4 at those locations. Noise levels at locations on floors 1 to 4 between these lines are interpolated between them.

4.0 STAMSON Calculation Results

Appendix B contains the output data from the STAMSON calculations for day time noise levels at these locations. Table 3 summarizes the STAMSON results of the noise level calculations at the locations, the applicable ENCG standard and the actions required under the City's Guidelines for all residential units adjoining that façade. Note that the actions required depend on whether a Living Room (LR) or Bedroom(s) (BR) are adjacent to the exterior wall. Notice on Title refers to the Warning Clause that must be registered on the Title of the units.

The ENCG also specify a maximum interior noise level due to road traffic for commercial/retail units. This limit is $Leq16hr = 50\text{dBA}$, so for any commercial unit on the ground floor of this building where the façade noise level is greater than 50dBA (daytime), confirmation will be required that its façade (usually glass windows) will provide sufficient attenuation to achieve the indoor level of 50dBA.

The noise level in the Outdoor Living Area on the roof was calculated in STAMSON taking account of its location away from the roof edge. In this case, the roof edge acts as a noise barrier against road traffic noise below. Using a representation of the edge of the roof as a noise barrier of zero height with its base elevated to the roof top level, and the receptor location in the OLA at 1.5 metres above this roof top elevation, the barrier effect of the roof edge was included to reduce the road traffic noise impact.

Table 3 gives the details of the noise calculations. The first column indicates the locations where the noise was calculated by STAMSON. The second column shows where these calculated values apply. Note that there are two locations (calculation lines B and D on the building) where the noise from Bank Street on Floors 1 to 4 on the south (Florence Avenue) façade was calculated. Line B is closest to Bank Street while Line D is at the westerly end of the building. Noise levels at locations on Floors 1 to 4 between these two lines are to be interpolated between these noise levels. The noise level on the bottom 4 floors at Line C was also calculated for the Gladstone Street traffic source alone. This is also shown in Table 3, where the noise level (46.4dBA) is considerably lower than the noise from Bank Street. Because of the greater blockage of Queensway traffic noise by houses and buildings between the lower 4 floors and the Queensway, the Queensway noise source will produce even less noise on these lower 4 floors than Gladstone Avenue traffic. Therefore, Bank Street traffic is essentially the only noise that needs to be considered along the lower 4 floors on the Florence Avenue façade.

Floor 5 has the terrace Outdoor Living Areas on the Bank and Florence facades. Table 3 shows noise levels on the walls and windows of Floor 5 without any barrier installed on the terraces, and with a noise barrier installed. (Note that on both the Bank Street façade and the Florence Avenue facade the noise level on the 5th floor is between the noise level on the 4th floor and the noise level

on the 6th floor. This is because the terrace on the 5th floor acts as a noise barrier against Bank Street noise, and the 5th floor receptor point is within the “shadow zone” of this barrier effect; the noise there is attenuated accordingly.) There will be a guard wall along the edge of the terraces, which if properly constructed, can act as a noise barrier as well. It would need to be built of a material which has a surface density of 20 kilograms/square metre, would have to contact the terrace floor surface and have no gaps or openings to meet the capabilities of a noise barrier. Without the barrier, the noise on both the east and south terraces would exceed the criterion for an Outdoor Living Area, so reduction of the noise is necessary. A guard wall 1.7 metres high and built as described above would provide sufficient attenuation to permit use as an Outdoor Living Area, although noise levels would remain high enough to require a Type B notice on title of all units having access to the terraces. Note also that the guard wall acting as a noise barrier would reduce the noise on the windows and walls of the 5th floor to the point where special design would not be necessary (OBC standards would be sufficient) and central air conditioning would not be required on that floor.

The 6th floor has no terrace on Bank or Florence, so no protection against noise by a guard wall acting as a noise barrier is possible. Table 3 shows that both the south and east façades of the 6th floor will require special design to achieve criteria indoor noise levels, and must have central air conditioning. These units would also require a Type D notice on title.

The north façade is exposed to half of Bank Street (north of the site) and has no terraces. It is, however, shielded on the lower first two floors by the neighbouring 2-storey building. Accordingly, noise levels on this façade, from the 3rd to the 6th floor, will be 3dBA less than the noise levels on the lower 4 floors on the east façade.

The rooftop OLA requires noise protection to reduce noise to levels acceptable for an OLA. Table 3 shows that a 2 metre high barrier is required to reduce noise to less than $Leq16hr = 60dBA$, in accordance with the City’s ENCG. However, the calculation showed that no barrier would be effective against the noise from the Queensway, and that a 2 metre high barrier would provide less than 1dBA reduction in noise from Gladstone. The effect of the 2 metre barrier in reducing noise to acceptable levels is entirely due to its attenuation of Bank Street traffic noise. Accordingly, it needs only to be located at the Bank Street edge of the OLA, and extend perpendicular to this edge along the edges parallel to Florence (north and south boundaries of the OLA) for 9 metres distance on each side. Total length of this barrier is then 18 metres plus x metres (x is the width of the OLA). Alternatively, a 2 metre-high barrier could be installed along the Bank Street edge of the roof, with a stabilizing return at each end. See Figure 8 for the location and extent of the rooftop OLA noise barrier.

The OLA will be exposed to noise from any rooftop-mounted air handling equipment that may eventually be decided upon. The need for and design of any noise protection will be determined once the specifics of such equipment, in terms of their noise levels and locations, have been defined.

5.0 Stationary Source Noise Impacts on Neighbouring Residences

The influence area of this building as a stationary source begins at the property line of the site since the closest nearby buildings are immediately adjacent to the site. Any stationary noise sources on

the roof of this building will need to be attenuated to ensure that its noise, propagating into the influence area in the surrounding community, will be less than $Leq1hr = 45\text{dBA}$ during the night, less than $Leq1hr = 47\text{dBA}$ during the evening and less than $Leq1hr = 50\text{dBA}$ during the day. The noise levels of these sources will be attenuated using sound reduction techniques and methods, such as enclosures, once the equipment has been selected and its acoustic properties defined.

Note that the requirement to attenuate the noise sources on the roof to the above levels as stationary sources will ensure that the noise levels from this equipment will be lower than the noise levels required to meet the criterion for the rooftop Outdoor Living Area.

6.0 Conclusions and Recommendations

Table 3 provides the conclusions of this noise study in detail, and is summarized as follows:

- (1) Except for the 5th floor, the entire Bank Street façade will require special design of the exterior envelope in order to ensure that interior noise levels meet the ENCG criteria. In addition, central air conditioning must be installed in units along this façade. A Type D notice on title of each unit is also required. If a guard wall less than 1.7 meters high is installed along the terrace on the 5th floor, these conditions will also apply to the units on the 5th floor.
- (2) The south façade of the building (Florence Avenue) has a mixed requirement for envelope design. According to Table 3, the 6th floor and most of the lower 4 floors require special design for the envelope, installed central air conditioning and a Type D notice on title. The 5th floor, however, even without a noise barrier installed as the guard wall, is just below the criteria level for these conditions to be imposed. Therefore, while it is not necessary by the ENCG to impose the more exacting conditions on the 5th floor units, it may be economically sensible to do so.
- (3) If the 5th floor terraces on the east and south facades are to be considered as Outdoor Living Areas for the adjacent units, the guard wall must be at least 1.7 metres high in order to meet the ENCG criteria for OLAs. Similarly, the amenity area on the roof requires a 2 metre high barrier, in either location shown in Figure 8, to comply with the noise requirements of the ENCG. In all OLAs identified, the noise level will still be in excess of 55dBA, so a Type B notice on title of all units having access to these OLAs is required.
- (4) Any air-handling equipment that is to be installed on the roof will require attenuation measures to ensure noise levels from these installations do not exceed the ENCG levels for stationary sources at the property line. This should also ensure that the noise level inside the rooftop OLA will not exceed the ENCG requirements for noise in an OLA.



Neil M. Standen, P.Eng.

**TABLE 3
ROAD TRAFFIC NOISE LEVELS AND REQUIRED ACTIONS AT RECEPTOR LOCATIONS**

RECEPTOR	REPRESENTING	NOISE LEVEL		OTTAWA ENCG CRITERION		ACTION **	NOTICE ON TITLE
		DAY *	NIGHT *	DAY *	NIGHT *		
A: floors 1 - 4 (Bank Noise)	Bank St (east) facade						
	Second to 4th floor inclusive (residential)	72.2	64.6	> 65	> 60	Central A/C Special Design Sp Des < 50	Type D
	Ground floor (commercial)	72.2	n/a	> 50	n/a		n/a
A: floor 5 (Bank Noise)	Bank St (east) facade						
	Fifth floor Wall & Windows (No Barrier)	66.9	59.3	> 65	> 50, < 60	L/R: Cent A/C; Sp Des BR: Allow for A/C, OBC 1.7m Noise Barrier Allow for A/C, OBC	Type D
	Fifth floor terrace (OLA) with Barrier	59.7	n/a	> 55, < 60	n/a		Type C
	Fifth floor Wall & Windows (With Barrier)	59.7	52.1	> 55, < 65	> 50, < 60		Type B
A: floor 6 (Bank Noise)	Bank St (east) facade	70.7	63.1	> 65	> 60	Central A/C Special Design	Type D
B: floors 1 - 4 (Bank Noise)	Florence Ave (south) facade						
	Second to 4th floor inclusive (residential)	69.2	61.6	> 65	> 60	Central A/C Special Design Sp Des < 50	Type D
	Ground floor (commercial)	69.2	n/a	> 50	n/a		n/a
C: floors 1 - 4 (Gladstone Noise)	Florence Ave (south) facade						
	Second to 4th floor inclusive (residential)	46.4	38.8	< 55	< 50	OBC none	none
	Ground floor (commercial)	46.4	n/a	< 50	n/a		n/a
D: floors 1 - 4 (Bank Noise)	Florence Ave (south) facade						
	Second to 4th floor inclusive (residential)	60.0	52.4	> 55, < 65	> 50, < 60	Allow for A/C, OBC Sp Des < 50	Type C
	Ground floor (commercial)	60.0	n/a	> 50	n/a		n/a
C: floor 5 (All Roads)	Florence Ave (south) facade						
	Fifth floor Wall & Windows (No Barrier)	64.7	57.1	> 55, < 65	> 50, < 60	Allow for A/C, OBC 1.7m Noise Barrier Allow for A/C, OBC	Type C
	Fifth floor terrace (OLA) with Barrier	59.9	n/a	> 55, < 60	n/a		Type B
	Fifth floor Wall & Windows (With Barrier)	59.9	52.3	> 55, < 65	> 50, < 60		Type C
C: floor 6 (All Roads)	Florence Ave (south) facade	68.0	60.4	> 65	> 60	Central A/C Special Design	Type D
Roof OLA (All Roads)	Roof Amenity Area	58.4	n/a	> 55, < 60	n/a	2m Noise Barrier east (Bank St) side	Type B
North Facade	Floors 3 to 6	69.2	61.6	> 65	> 60	Central A/C Special Design	Type D

* DAY = Leq16hrs from 0700hrs to 2259hrs; Night = Leq 8hrs from 2300hrs to 0659hrs
 LR = Living/Dining Room; BR = Bedroom
 ** Allow for A/C = Provide central heating with ducting sized to accommodate central air conditioning in unit
 Central A/C (Cent A/C) = Provide central air conditioning in unit
 OBC = Design and build to meet Ontario Building Code requirements for acoustical insulation
 Special Design (Sp Des) = Design and build external envelope to achieve indoor noise criteria:
 [Living/Dining rooms Leq 16hr = 45dBA; Bedrooms Leq 8hr = 40dBA]

APPENDIX A
CITY OF OTTAWA NOISE CONTROL CRITERIA FOR NEW RESIDENTIAL DEVELOPMENTS

**Table 1.10 - Combination Of Road And Rail Noise, Day-Time (0700 - 2300) and Night-Time (2300 – 0700)
Outdoor, Ventilation And Warning Clause Requirements**

Assessment Location	L _{eq} (8 or 16 hrs as noted) (dBA)	Ventilation Requirements	Outdoor Control Measures	Warning ¹ Clause
Outdoor Living Area (OLA)	Leq _{16 hr} Less than or equal to 55 dBA	N/A	None required	Not required
	Leq _{16 hr} Greater than 55 dBA to less than or equal to 60 dBA	N/A	Control measures (barriers) may not be required but should be considered	Required if resultant L _{eq} exceeds 55 dBA Type A
	Leq _{16 hr} Greater than 60 dBA	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	Required if resultant L _{eq} exceeds 55 dBA Type B
Plane of Living Room Window	Leq _{16 hr} Less than or equal to 55 dBA	None required	N/A	Not required
	Leq _{16 hr} Greater than 55 dBA to less than or equal to 65 dBA	Forced air heating with provision for central air conditioning	N/A	Required Type C
	Leq _{16 hr} Greater than 65 dBA	Central air conditioning	N/A	Required Type D
Plane of Bedroom Window	Leq _{8 hr} Greater than 50 dBA to less than or equal to 60 dBA	Forced air heating with provision for central air conditioning	N/A	Required Type C
	Leq _{8 hr} Greater than 60 dBA	Central air conditioning ²	N/A	Required Type D

(Reference MOE Tables 1 and 2 LU-131: Requirements, Procedures and Implementation)

Table 1.8 - Road And Rail Noise, Day-Time (0700 - 2300) and Night-Time (2300 – 0700) Building Component Requirements

Assessment Location		Sound Level (time as noted)	Building Component Requirements
Plane of Living Room Window	Road	Leq _{16 hr} Less than or equal to 65 dBA	Building compliant with the Ontario Building Code
		Leq _{16 hr} Greater than 65 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	Rail	N/A	N/A
Plane of Bedroom Window	Road	Leq _{8 hr} Less than or equal to 60 dBA	Building compliant with the Ontario Building Code
		Leq _{8 hr} Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	Rail	N/A	N/A

(Reference: MOE Tables 3 and 4 in Publication LU-131: Requirements, Procedures and Implementation)

Table 1.6 - Indoor Sound Level Criteria Surface Transportation

(Reference MOE Table 2 and Table A-1 in Publication LU-131 and its Annex)

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 or 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

Table 1.13 - Warning Types Clauses

Type	Warning Clause ¹
Type A	"Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the 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 traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the 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 the Environment's noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both 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 the Environment's noise criteria."
Type E	"Purchasers/tenants are advised that due to the proximity of the adjacent industry facility (car wash), sound levels from the industry facility (car wash) may at times be audible"

¹These warnings are standard clauses from the MOE and are subject to change at the discretion of the City, Airport Authority, CN or other applicable agencies, as required.

APPENDIX B
STAMSON OUTPUT DATA

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 16:40:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bank5e.te Time Period: 16 hours
Description: Bank Street noise 5th floor east facade

Road data, segment # 1: bank north

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: bank north

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 : 15.00 m
Receiver height : 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 0.00 m
Elevation : 13.35 m
Barrier receiver distance : 2.00 m
Source elevation : 0.00 m
Receiver elevation : 13.35 m
Barrier elevation : 13.35 m
Reference angle : 0.00

Road data, segment # 2: bank south

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: bank south

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 : 15.00 m
 Receiver height : 1.50 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 0.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

```

-----
! source ! Road ! Total
! height ! Leq ! Leq
! (m) ! (dBA) ! (dBA)
-----+-----+-----+-----
1.bank north ! 1.50 ! 60.14 ! 60.14
2.bank south ! 1.50 ! 60.14 ! 60.14
-----+-----+-----+-----
Total 63.15 dBA
  
```

Barrier table for segment # 1: bank north

```

-----+-----+-----+-----+
Barrier ! Elev of ! Road ! Tot Leq !
Height ! Barr Top! dBA ! dBA !
-----+-----+-----+-----+
0.50 ! 13.85 ! 58.29 ! 58.29 !
0.60 ! 13.95 ! 57.82 ! 57.82 !
0.70 ! 14.05 ! 57.34 ! 57.34 !
0.80 ! 14.15 ! 56.86 ! 56.86 !
0.90 ! 14.25 ! 56.39 ! 56.39 !
1.00 ! 14.35 ! 55.92 ! 55.92 !
1.10 ! 14.45 ! 55.47 ! 55.47 !
1.20 ! 14.55 ! 55.02 ! 55.02 !
1.30 ! 14.65 ! 54.59 ! 54.59 !
1.40 ! 14.75 ! 54.18 ! 54.18 !
1.50 ! 14.85 ! 53.78 ! 53.78 !
1.60 ! 14.95 ! 53.39 ! 53.39 !
1.70 ! 15.05 ! 53.01 ! 53.01 !
1.80 ! 15.15 ! 52.65 ! 52.65 !
  
```

1.90 !	15.25 !	52.30 !	52.30 !
2.00 !	15.35 !	51.96 !	51.96 !
2.10 !	15.45 !	51.63 !	51.63 !
2.20 !	15.55 !	51.32 !	51.32 !
2.30 !	15.65 !	51.01 !	51.01 !
2.40 !	15.75 !	50.72 !	50.72 !

Barrier table for segment # 2: bank south

Barrier !	Elev of !	Road !	Tot Leq !
Height !	Barr Top!	dBa !	dBa !

-----+-----+-----+-----+

0.50 !	13.85 !	58.29 !	58.29 !
0.60 !	13.95 !	57.82 !	57.82 !
0.70 !	14.05 !	57.34 !	57.34 !
0.80 !	14.15 !	56.86 !	56.86 !
0.90 !	14.25 !	56.39 !	56.39 !
1.00 !	14.35 !	55.92 !	55.92 !
1.10 !	14.45 !	55.47 !	55.47 !
1.20 !	14.55 !	55.02 !	55.02 !
1.30 !	14.65 !	54.59 !	54.59 !
1.40 !	14.75 !	54.18 !	54.18 !
1.50 !	14.85 !	53.78 !	53.78 !
1.60 !	14.95 !	53.39 !	53.39 !
1.70 !	15.05 !	53.01 !	53.01 !
1.80 !	15.15 !	52.65 !	52.65 !
1.90 !	15.25 !	52.30 !	52.30 !
2.00 !	15.35 !	51.96 !	51.96 !
2.10 !	15.45 !	51.63 !	51.63 !
2.20 !	15.55 !	51.32 !	51.32 !
2.30 !	15.65 !	51.01 !	51.01 !
2.40 !	15.75 !	50.72 !	50.72 !

STAMSON 5.0 SUMMARY REPORT Date: 26-02-2013 02:22:48
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bankqw5s.te Time Period: 16 hours
 Description: Queensway noise 5th floor south facade

Road data, segment # 1: queensway

 Car traffic volume : 89054 veh/TimePeriod
 Medium truck volume : 7084 veh/TimePeriod
 Heavy truck volume : 5060 veh/TimePeriod
 Posted speed limit : 100 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: queensway

 Angle1 Angle2 : -32.00 deg 30.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 5
 House density : 20 %
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 477.00 m
 Receiver height : 1.50 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -32.00 deg Angle2 : 30.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 5.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

	! source !	Road !	Total !
	! height !	Leq !	Leq !
	! (m) !	! (dBA) !	! (dBA) !
1.queensway	! 1.50 !	56.70 !	56.70 *
Total		56.70 dBA	

* Bright Zone !

Barrier table for segment # 1: queensway

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
0.50	13.85	56.70	56.70
0.60	13.95	56.70	56.70
0.70	14.05	56.70	56.70
0.80	14.15	56.70	56.70
0.90	14.25	56.70	56.70
1.00	14.35	56.70	56.70
1.10	14.45	56.70	56.70
1.20	14.55	56.70	56.70
1.30	14.65	56.70	56.70
1.40	14.75	56.70	56.70
1.50	14.85	56.70	56.70
1.60	14.95	56.70	56.70
1.70	15.05	56.70	56.70
1.80	15.15	56.70	56.70
1.90	15.25	56.50	56.50
2.00	15.35	55.70	55.70
2.10	15.45	54.87	54.87
2.20	15.55	54.05	54.05
2.30	15.65	53.25	53.25
2.40	15.75	52.49	52.49

STAMSON 5.0 SUMMARY REPORT Date: 26-02-2013 02:28:58
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bank5s.te Time Period: 16 hours
 Description: Gladstone noise 5th floor south facade

Road data, segment # 1: gladstone

 Car traffic volume : 9715 veh/TimePeriod
 Medium truck volume : 773 veh/TimePeriod
 Heavy truck volume : 552 veh/TimePeriod
 Posted speed limit : 50 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: gladstone

 Angle1 Angle2 : -21.00 deg 75.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 2
 House density : 95 %
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 94.60 m
 Receiver height : 1.50 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -21.00 deg Angle2 : 75.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 0.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

	! source !	Road !	Total !
	! height !	Leq !	Leq !
	! (m) !	! (dBA) !	! (dBA) !
1.gladstone	! 1.50 !	46.34 !	46.34 *
Total		46.34 dBA	

* Bright Zone !

Barrier table for segment # 1: gladstone

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
0.50	13.85	46.34	46.34
0.60	13.95	46.34	46.34
0.70	14.05	46.34	46.34
0.80	14.15	46.34	46.34
0.90	14.25	46.34	46.34
1.00	14.35	46.34	46.34
1.10	14.45	46.34	46.34
1.20	14.55	46.34	46.34
1.30	14.65	46.34	46.34
1.40	14.75	46.34	46.34
1.50	14.85	46.34	46.34
1.60	14.95	46.34	46.34
1.70	15.05	46.34	46.34
1.80	15.15	46.34	46.34
1.90	15.25	46.34	46.34
2.00	15.35	46.34	46.34
2.10	15.45	46.34	46.34
2.20	15.55	46.21	46.21
2.30	15.65	45.56	45.56
2.40	15.75	44.95	44.95

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 13:49:09
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bank6e.te Time Period: 16 hours
Description: Bank Street noise 6th floor east facade

Road data, segment # 1: bank north

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: bank north

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 : 15.00 m
Receiver height : 4.70 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 0.00 m
Elevation : 13.35 m
Barrier receiver distance : 2.00 m
Source elevation : 0.00 m
Receiver elevation : 13.35 m
Barrier elevation : 13.35 m
Reference angle : 0.00

Road data, segment # 2: bank south

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: bank south

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 : 15.00 m
 Receiver height : 4.70 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 0.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

```

-----
                ! source ! Road ! Total
                ! height ! Leq ! Leq
                ! (m) ! (dBA) ! (dBA)
-----+-----+-----+-----
1.bank north   ! 1.50 ! 65.47 ! 65.47 *
2.bank south   ! 1.50 ! 65.47 ! 65.47 *
-----+-----+-----+-----
                Total           68.48 dBA
  
```

* Bright Zone !

Barrier table for segment # 1: bank north

```

-----
Barrier ! Elev of ! Road ! Tot Leq !
Height ! Barr Top! dBA ! dBA !
-----+-----+-----+-----
1.50 ! 14.85 ! 65.47 ! 65.47 !
2.00 ! 15.35 ! 65.47 ! 65.47 !
2.50 ! 15.85 ! 60.47 ! 60.47 !
3.00 ! 16.35 ! 59.70 ! 59.70 !
3.50 ! 16.85 ! 57.84 ! 57.84 !
4.00 ! 17.35 ! 55.71 ! 55.71 !
4.50 ! 17.85 ! 53.73 ! 53.73 !
5.00 ! 18.35 ! 51.99 ! 51.99 !
5.50 ! 18.85 ! 50.48 ! 50.48 !
6.00 ! 19.35 ! 49.47 ! 49.47 !
  
```

Barrier table for segment # 2: bank south

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
1.50	14.85	65.47	65.47
2.00	15.35	65.47	65.47
2.50	15.85	60.47	60.47
3.00	16.35	59.70	59.70
3.50	16.85	57.84	57.84
4.00	17.35	55.71	55.71
4.50	17.85	53.73	53.73
5.00	18.35	51.99	51.99
5.50	18.85	50.48	50.48
6.00	19.35	49.47	49.47

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 16:30:44
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bankqw6s.te Time Period: 16 hours
 Description: Queensway noise 6th floor south facade

Road data, segment # 1: queensway

Car traffic volume : 89054 veh/TimePeriod
 Medium truck volume : 7084 veh/TimePeriod
 Heavy truck volume : 5060 veh/TimePeriod
 Posted speed limit : 100 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: queensway

Angle1 Angle2 : -32.00 deg 30.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 5
 House density : 20 %
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 477.00 m
 Receiver height : 4.70 m

Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -32.00 deg Angle2 : 30.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 5.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	! (dBA) !	! (dBA)
1.queensway	1.50	56.70	56.70 *
Total		56.70	dBA

* Bright Zone !

Barrier table for segment # 1: queensway

Barrier !	Elev of !	Road !	Tot Leq !
Height !	Barr Top!	dBA !	dBA !
1.50 !	14.85 !	56.70 !	56.70 !
2.00 !	15.35 !	56.70 !	56.70 !
2.50 !	15.85 !	56.70 !	56.70 !
3.00 !	16.35 !	56.70 !	56.70 !
3.50 !	16.85 !	56.70 !	56.70 !
4.00 !	17.35 !	56.70 !	56.70 !
4.50 !	17.85 !	56.70 !	56.70 !
5.00 !	18.35 !	56.70 !	56.70 !
5.50 !	18.85 !	53.14 !	53.14 !
6.00 !	19.35 !	49.80 !	49.80 !

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 12:03:50
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bank6s.te Time Period: 16 hours
 Description: Gladstone noise 6th floor south facade

Road data, segment # 1: gladstone

 Car traffic volume : 9715 veh/TimePeriod
 Medium truck volume : 773 veh/TimePeriod
 Heavy truck volume : 552 veh/TimePeriod
 Posted speed limit : 50 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: gladstone

 Angle1 Angle2 : -21.00 deg 75.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 2
 House density : 95 %
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 94.60 m
 Receiver height : 4.70 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -21.00 deg Angle2 : 75.00 deg
 Barrier height : 0.00 m
 Elevation : 13.35 m
 Barrier receiver distance : 2.00 m
 Source elevation : 0.00 m
 Receiver elevation : 13.35 m
 Barrier elevation : 13.35 m
 Reference angle : 0.00

Result summary

	! source !	Road !	Total !
	! height !	Leq !	Leq !
	! (m) !	! (dBA) !	! (dBA) !
1.gladstone	!	1.50 !	46.34 ! 46.34 *
Total			46.34 dBA

* Bright Zone !

Barrier table for segment # 1: gladstone

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
1.50	14.85	46.34	46.34
2.00	15.35	46.34	46.34
2.50	15.85	46.34	46.34
3.00	16.35	46.34	46.34
3.50	16.85	46.34	46.34
4.00	17.35	46.34	46.34
4.50	17.85	46.34	46.34
5.00	18.35	46.34	46.34
5.50	18.85	45.13	45.13
6.00	19.35	42.46	42.46

.....

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 12:12:57
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bankgrde.te Time Period: 16 hours
 Description: Bank Street noise 1st to 4th floor east facade

Road data, segment # 1: bank north

Car traffic volume : 6072 veh/TimePeriod
 Medium truck volume : 483 veh/TimePeriod
 Heavy truck volume : 345 veh/TimePeriod
 Posted speed limit : 50 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: bank north

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 : 15.00 m
 Receiver height : 1.94 m

Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Road data, segment # 2: bank south

Car traffic volume : 6072 veh/TimePeriod
 Medium truck volume : 483 veh/TimePeriod
 Heavy truck volume : 345 veh/TimePeriod
 Posted speed limit : 50 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: bank south

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 : 15.00 m
 Receiver height : 1.94 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Result summary

	! source !	Road !	Total !
	! height !	Leq !	Leq !
	! (m) !	! (dBA) !	! (dBA) !
1.bank north	! 1.50 !	65.47 !	65.47
2.bank south	! 1.50 !	65.47 !	65.47
Total			68.48 dBA

STAMSON 5.0 SUMMARY REPORT Date: 25-02-2013 11:51:36
 MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bankgld1.te Time Period: 16 hours
 Description: Gladstone noise 1st to 4th floor south facade

Road data, segment # 1: gladstone

 Car traffic volume : 9715 veh/TimePeriod
 Medium truck volume : 773 veh/TimePeriod
 Heavy truck volume : 552 veh/TimePeriod
 Posted speed limit : 50 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: gladstone

 Angle1 Angle2 : -21.00 deg 75.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 2
 House density : 95 %
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 92.60 m
 Receiver height : 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Result summary

	! source !	Road !	Total
	! height !	! Leq !	! Leq
	! (m) !	! (dBA) !	! (dBA)
1.gladstone	! 1.50 !	! 46.41 !	! 46.41
Total			46.41 dBA

STAMSON 5.0 SUMMARY REPORT Date: 27-02-2013 12:41:27
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bank14sw.te Time Period: 16 hours
Description: Bank street noise 1st to 4th floor southwest

Road data, segment # 1: bank north

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: bank north

Angle1 Angle2 : 0.00 deg 42.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 27.86 m
Receiver height : 1.94 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: bank south

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: bank south

Angle1 Angle2 : 0.00 deg 42.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 23.98 m
Receiver height : 1.94 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Result summary

	! source !	Road	! Total	
	! height !	! Leq	! Leq	
	! (m)	! (dBA)	! (dBA)	
1.bank north	!	1.50 !	56.46 !	56.46
2.bank south	!	1.50 !	57.11 !	57.11
	Total		59.81 dBA	

.....

STAMSON 5.0 SUMMARY REPORT Date: 01-03-2013 12:30:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: roofola.te Time Period: 16 hours
Description: Gladstone noise in rooftop OLA

Road data, segment # 1: gladstone

Car traffic volume : 9715 veh/TimePeriod
Medium truck volume : 773 veh/TimePeriod
Heavy truck volume : 552 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: gladstone

Angle1 Angle2 : -21.00 deg 75.00 deg
Wood depth : 0 (No woods.)
No of house rows : 2
House density : 95 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 102.88 m
Receiver height : 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -21.00 deg Angle2 : 75.00 deg
Barrier height : 0.00 m
Elevation : 19.00 m
Barrier receiver distance : 10.30 m

Source elevation : 0.00 m
 Receiver elevation : 19.00 m
 Barrier elevation : 19.00 m
 Reference angle : 0.00

Result summary

```

! source ! Road ! Total
! height ! Leq ! Leq
! (m) ! (dBA) ! (dBA)
-----+-----+-----+-----
1.gladstone ! 1.50 ! 46.09 ! 46.09
-----+-----+-----+-----
Total 46.09 dBA
  
```

Barrier table for segment # 1: gladstone

```

Barrier ! Elev of ! Road ! Tot Leq !
Height ! Barr Top! dBA ! dBA !
-----+-----+-----+-----+
0.50 ! 19.50 ! 46.09 ! 46.09 !
0.60 ! 19.60 ! 46.09 ! 46.09 !
0.70 ! 19.70 ! 46.09 ! 46.09 !
0.80 ! 19.80 ! 46.09 ! 46.09 !
0.90 ! 19.90 ! 46.09 ! 46.09 !
1.00 ! 20.00 ! 46.09 ! 46.09 !
1.10 ! 20.10 ! 46.09 ! 46.09 !
1.20 ! 20.20 ! 46.09 ! 46.09 !
1.30 ! 20.30 ! 46.09 ! 46.09 !
1.40 ! 20.40 ! 46.09 ! 46.09 !
1.50 ! 20.50 ! 46.09 ! 46.09 !
1.60 ! 20.60 ! 46.09 ! 46.09 !
1.70 ! 20.70 ! 45.98 ! 45.98 !
1.80 ! 20.80 ! 45.67 ! 45.67 !
1.90 ! 20.90 ! 45.36 ! 45.36 !
2.00 ! 21.00 ! 45.05 ! 45.05 !
2.10 ! 21.10 ! 44.76 ! 44.76 !
2.20 ! 21.20 ! 44.47 ! 44.47 !
2.30 ! 21.30 ! 44.18 ! 44.18 !
2.40 ! 21.40 ! 43.90 ! 43.90 !
  
```

STAMSON 5.0 SUMMARY REPORT Date: 19-03-2013 12:38:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: olabank.te Time Period: 16 hours
Description: Noise from Bank street at rooftop OLA

Road data, segment # 1: bank north

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: bank north

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 : 16.70 m
Receiver height : 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 0.00 m
Elevation : 19.00 m
Barrier receiver distance : 3.00 m
Source elevation : 0.00 m
Receiver elevation : 19.00 m
Barrier elevation : 19.00 m
Reference angle : 0.00

Road data, segment # 2: bank south

Car traffic volume : 6072 veh/TimePeriod
Medium truck volume : 483 veh/TimePeriod
Heavy truck volume : 345 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: bank south

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 : 15.00 m
 Receiver height : 1.50 m
 Topography : 4 (Elevated; with barrier)
 Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
 Barrier height : 0.00 m
 Elevation : 19.00 m
 Barrier receiver distance : 3.00 m
 Source elevation : 0.00 m
 Receiver elevation : 19.00 m
 Barrier elevation : 19.00 m
 Reference angle : 0.00

Result summary

```

-----
! source ! Road ! Total
! height ! Leq ! Leq
! (m) ! (dBA) ! (dBA)
-----+-----+-----+-----
1.bank north ! 1.50 ! 55.24 ! 55.24
2.bank south ! 1.50 ! 55.00 ! 55.00
-----+-----+-----+-----
Total 58.13 dBA
  
```

Barrier table for segment # 1: bank north

```

-----+-----+-----+-----+
Barrier ! Elev of ! Road ! Tot Leq !
Height ! Barr Top! dBA ! dBA !
-----+-----+-----+-----+
0.50 ! 19.50 ! 53.70 ! 53.70 !
0.60 ! 19.60 ! 53.41 ! 53.41 !
0.70 ! 19.70 ! 53.12 ! 53.12 !
0.80 ! 19.80 ! 52.84 ! 52.84 !
0.90 ! 19.90 ! 52.56 ! 52.56 !
1.00 ! 20.00 ! 52.29 ! 52.29 !
1.10 ! 20.10 ! 52.02 ! 52.02 !
1.20 ! 20.20 ! 51.76 ! 51.76 !
1.30 ! 20.30 ! 51.51 ! 51.51 !
1.40 ! 20.40 ! 51.25 ! 51.25 !
1.50 ! 20.50 ! 51.01 ! 51.01 !
1.60 ! 20.60 ! 50.76 ! 50.76 !
1.70 ! 20.70 ! 50.52 ! 50.52 !
1.80 ! 20.80 ! 50.29 ! 50.29 !
  
```

1.90 !	20.90 !	50.06 !	50.06 !
2.00 !	21.00 !	49.83 !	49.83 !
2.10 !	21.10 !	49.61 !	49.61 !
2.20 !	21.20 !	49.52 !	49.52 !
2.30 !	21.30 !	49.35 !	49.35 !
2.40 !	21.40 !	49.19 !	49.19 !
2.50 !	21.50 !	49.03 !	49.03 !
2.60 !	21.60 !	48.89 !	48.89 !
2.70 !	21.70 !	48.75 !	48.75 !
2.80 !	21.80 !	48.62 !	48.62 !
2.90 !	21.90 !	48.50 !	48.50 !
3.00 !	22.00 !	48.38 !	48.38 !
3.10 !	22.10 !	48.27 !	48.27 !
3.20 !	22.20 !	48.16 !	48.16 !
3.30 !	22.30 !	48.06 !	48.06 !
3.40 !	22.40 !	47.97 !	47.97 !

Barrier table for segment # 2: bank south

Barrier !	Elev of !	Road !	Tot Leq !
Height !	Barr Top!	dBa !	dBa !
-----+	-----+	-----+	-----+
0.50 !	19.50 !	53.59 !	53.59 !
0.60 !	19.60 !	53.32 !	53.32 !
0.70 !	19.70 !	53.06 !	53.06 !
0.80 !	19.80 !	52.79 !	52.79 !
0.90 !	19.90 !	52.54 !	52.54 !
1.00 !	20.00 !	52.29 !	52.29 !
1.10 !	20.10 !	52.04 !	52.04 !
1.20 !	20.20 !	51.79 !	51.79 !
1.30 !	20.30 !	51.55 !	51.55 !
1.40 !	20.40 !	51.31 !	51.31 !
1.50 !	20.50 !	51.08 !	51.08 !
1.60 !	20.60 !	50.85 !	50.85 !
1.70 !	20.70 !	50.62 !	50.62 !
1.80 !	20.80 !	50.40 !	50.40 !
1.90 !	20.90 !	50.18 !	50.18 !
2.00 !	21.00 !	50.08 !	50.08 !
2.10 !	21.10 !	49.90 !	49.90 !
2.20 !	21.20 !	49.73 !	49.73 !
2.30 !	21.30 !	49.58 !	49.58 !
2.40 !	21.40 !	49.43 !	49.43 !
2.50 !	21.50 !	49.29 !	49.29 !
2.60 !	21.60 !	49.16 !	49.16 !
2.70 !	21.70 !	49.03 !	49.03 !
2.80 !	21.80 !	48.91 !	48.91 !
2.90 !	21.90 !	48.80 !	48.80 !

3.00 ! 22.00 ! 48.69 ! 48.69 !
3.10 ! 22.10 ! 48.59 ! 48.59 !
3.20 ! 22.20 ! 48.49 ! 48.49 !
3.30 ! 22.30 ! 48.40 ! 48.40 !
3.40 ! 22.40 ! 48.31 ! 48.31 !

STAMSON 5.0 SUMMARY REPORT Date: 01-03-2013 12:35:59
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: olaqwy.te Time Period: 16 hours
Description: Queensway noise in rooftop OLA

Road data, segment # 1: queensway

Car traffic volume : 89054 veh/TimePeriod
Medium truck volume : 7084 veh/TimePeriod
Heavy truck volume : 5060 veh/TimePeriod
Posted speed limit : 100 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: queensway

Angle1 Angle2 : -32.00 deg 30.00 deg
Wood depth : 0 (No woods.)
No of house rows : 5
House density : 20 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 487.00 m
Receiver height : 1.50 m
Topography : 4 (Elevated; with barrier)
Barrier angle1 : -32.00 deg Angle2 : 30.00 deg
Barrier height : 0.00 m
Elevation : 19.00 m
Barrier receiver distance : 10.30 m
Source elevation : 5.00 m
Receiver elevation : 19.00 m
Barrier elevation : 19.00 m
Reference angle : 0.00

Result summary

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	! (dBA) !	! (dBA)
1.queensway	!	1.50 !	56.61 ! 56.61 *
	Total		56.61 dBA

* Bright Zone !

Barrier table for segment # 1: queensway

Barrier !	Elev of !	Road !	Tot Leq !
Height !	Barr Top!	dBA !	dBA !
0.50 !	19.50 !	56.61 !	56.61 !
0.60 !	19.60 !	56.61 !	56.61 !
0.70 !	19.70 !	56.61 !	56.61 !
0.80 !	19.80 !	56.61 !	56.61 !
0.90 !	19.90 !	56.61 !	56.61 !
1.00 !	20.00 !	56.61 !	56.61 !
1.10 !	20.10 !	56.61 !	56.61 !
1.20 !	20.20 !	56.61 !	56.61 !
1.30 !	20.30 !	56.61 !	56.61 !
1.40 !	20.40 !	56.61 !	56.61 !
1.50 !	20.50 !	56.61 !	56.61 !
1.60 !	20.60 !	56.61 !	56.61 !
1.70 !	20.70 !	56.61 !	56.61 !
1.80 !	20.80 !	56.61 !	56.61 !
1.90 !	20.90 !	56.61 !	56.61 !
2.00 !	21.00 !	56.61 !	56.61 !
2.10 !	21.10 !	56.61 !	56.61 !
2.20 !	21.20 !	56.33 !	56.33 !
2.30 !	21.30 !	55.98 !	55.98 !
2.40 !	21.40 !	55.61 !	55.61 !