

REPORT NO. WA17-060

**NOISE CONTROL FEASIBILITY STUDY
PROPOSED RESIDENTIAL DEVELOPMENT
PART OF LOT 48, CONCESSION 1
264 GOVERNORS ROAD
CITY OF HAMILTON**

SUBMITTED TO:

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1.0 INTRODUCTION

- 1.1** The services of SS Wilson Associates (SSWA) were retained by UrbanSolutions Planning & Land Development Consultants Inc. on behalf of Mr. Donald Newman to prepare a Noise Control Feasibility Study for the proposed residential development located at 264 Governors Road in the City of Hamilton.

The objective of this report is to support an application an amendment to the Official Plan and Rezoning of the land containing the proposed development.

- 1.2** The site is bounded by the following land uses:
- to the north by Governors Road
 - to the south by residential dwellings
 - to the east by St. Bernadette Catholic Elementary School
 - to the west by residential dwellings

The location of the site is shown in Figure 1.

- 1.3** Major features of the development are defined by the Concept Plan drawing prepared by UrbanSolutions, dated November 7, 2017.

Figure 2 illustrates the general layout of the proposed development.

- 1.4** The major surface transportation noise source (current and future) of concern to the development is Governors Road.

It is worth noting that the subject development is in close proximity to a neighbouring Elementary School to the west of the development.

- 1.5** There are no nearby stationary noise sources of concern for the proposed development.

- 1.6** The proposed development is located outside the 25 NEF/NEP contour lines prepared by Transport Canada; therefore, aircraft noise is not considered a problem.

- 1.7** The scope of this report is to define the minimum noise attenuation requirements for the control of outdoor and indoor environmental sound levels.

2.0 SUMMARY AND RECOMMENDATIONS

2.1 SUMMARY

Based on the analysis conducted in this investigation it is concluded that:

1. As advised by the Planning Consultants, the proposed Outdoor Living Areas (OLAs)¹ for the subject development will be located as follows:
 - 3-storey blocks - on the ground floor, facing the internal street along the south side of the townhouse blocks.
 - 2-storey blocks - on the ground floor, along the south side of the townhouse blocks.

Based on the results, the unattenuated daytime sound levels in the OLAs of all of the residential dwellings will not exceed the recommended objective sound level. Therefore, no outdoor noise control measures need be considered for this development.

2. The unattenuated sound levels at the outside walls of all of the dwellings will exceed the recommended objective sound levels. Therefore, indoor noise controls are required for all dwellings along with relevant warning clauses.
3. Although the projected sound levels are predicted to be above the sound level criteria outlined in Section 3, it is feasible to control sound levels within the indoor areas of the proposed development to meet the stated criteria.

2.2 RECOMMENDATIONS

As block/unit numbers have not yet been assigned for this development, for the purpose of this study, numbers have been assigned to the blocks as illustrated in Figure 2.

A summary of the minimum noise attenuation requirements is presented in Table 1. Detailed description is as follows:

1. Air Conditioning

Blocks: 1 and 2 (All Units Inclusive)

¹ At times, it may also be referred to as Outdoor Amenity Areas. The size of an OLA is subject to municipal standards and other project requirements (except when classified as a balcony along with other applicable MOECC rules).

The above noted dwelling units should be equipped with central air conditioning systems with their condensing units to be located in noise insensitive locations. The sound levels of the outdoor condensing units should meet the MOECC's the maximum sound level, L_{AS} of 50 dBA² at the neighbour's closest point(s) of reception, i.e. at their ground-based outdoor areas as well as the closest window on any floor level as outlined in MOECC publication NPC-216 and other levels specified by the municipality. The following warning clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of these properties:

"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 sound level limits of the Municipality and the Ministry of the Environment and Climate Change".

It is also our recommendation that the necessary detailed technical analysis be performed prior to submitting an application for Building Permit to optimize the required air conditioning unit noise rating number/specification in order to meet the Provincial sound level standards at the closest receptors (i.e., a maximum sound level L_{AS} of 50 dBA³ at the neighbour's closest point(s) of reception within their ground-based outdoor areas as well as at the closest window on any floor level) after taking into consideration the specific property design and proposed A/C unit location. Other A/C noise control measures, where required to meet the sound level criteria at the point(s) of reception, should also be identified and shown on the applicable permit drawings/specifications.

The Analysis Section in this study provides additional important details on the application of air conditioners.

2. Provision for Air Conditioning

Blocks: 3, 4, and 5 (All Units Inclusive)

The above noted dwelling units should be equipped with a ducted forced air heating system: furnace/fan, supply air plenum, and duct work. The components are to be appropriately situated and sized to accommodate future installation of central air conditioning systems. The provision for future air conditioning should also include the installation of the necessary rough-in work such as a floor drain for the condensate, appropriate electrical power supply, thermostat control wiring and a capped sleeve in the exterior wall for future refrigeration tubing in an approved location (Installation cost of the air conditioning system is an option to the developer/builder as they see fit).

² Or the lowest hourly ambient Leq due to road traffic projected at the receptor location(s)

³ Or the lowest hourly ambient Leq due to road traffic projected at the receptor location(s)

If the purchaser/occupant does not take the central air conditioning option, the following clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of these properties:

“This dwelling unit has been fitted with provisions, which include a fan forced heating system, suitably sized ducts, plenum, electrical power wiring, thermostatic control wiring, a nearby floor drain, etc. sized to accommodate the future addition of central air conditioning by the occupant at their expense and discretion. 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 sound level limits of the Municipality and the Ministry of the Environment and Climate Change. Future installation of the air conditioning system should meet the Ministry of the Environment and Climate Change criteria in Publication NPC-216 (a maximum sound level L_{AS} of 50 dBA at the neighbour’s closest point(s) of reception, i.e. at their ground-based outdoor areas as well as at the closest window on any floor level) and other applicable levels specified by the municipality.”

3. Warning Clauses *4

For Transportation Noise:

Blocks: 1 to 5 (All Units Inclusive)

The following warning clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of the above noted properties:

“Purchasers/tenants are advised that despite the inclusion of noise control features within this development area and within the dwellings, sound levels from increasing road traffic may continue to be of concern, occasionally interfering with some activities of the dwelling occupants as the sound level exceeds the Municipality’s and the Ministry of the Environment and Climate Change noise criteria.”

For Nearby School:

Blocks: 1 (All Units), and 3 (All Units)

The following warning clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of the above noted properties:

^{*4}Reference should be made to Bulletin No. 91003, Environmental Warnings/Restrictions, Ontario Ministry of Consumer and Commercial Relations.

“Purchasers/tenants are advised that the dwelling unit is in close proximity to an existing elementary school. Sound levels may at times be audible”

4. Building Acoustic Insulation

Blocks: 1 and 2 (All Units Inclusive)

All exterior building components (walls, windows and doors) should meet the minimum Acoustic Insulation Factors (AIF) shown in Tables 3 and 4. All windows should be well fitted and weather-stripped.

It is also the responsibility of the developer/builder responsible for final design and construction of the subject dwellings to ensure that the correct windows, walls and doors acoustic specifications are secured from the Acoustical Engineer prior to planning and construction of the noted dwellings.

Typical Acoustic Insulation Factors (AIF) are shown in Tables 3 and 4. The Detailed Noise Control Study should provide complete and specific tabulations of AIF's for all properties affected.

It is also the responsibility of the developer/builder responsible for final design and construction of the subject dwellings to ensure that the correct windows, walls and doors acoustic specifications are secured from the Acoustical Engineer prior to planning and construction of the noted dwellings.

5. Implementation Procedures

- a) Prior to final approval of this development, a Detailed Noise Control Study, or an upgraded noise study should be required to take into consideration the following:
 - Final lot layout, lot/block numbers, etc.
 - Possible proposed building locations
 - The exact distances to all sources of concern
 - Final locations of the Outdoor Amenity Areas
- b) The necessary Development Agreement(s) should include the details of all the necessary noise control measures and procedures as outlined herein this noise study to the satisfaction of all concerned parties.
- c) Prior submission of the project plans for Building Permit, the Builder's plans, with respect to the units requiring noise control measures as referred to earlier, should be certified by an Acoustical Engineer as being in conformance with the recommendations of the Detailed Noise Control Study as approved and/or amended by the authorities having jurisdiction.
- d) Prior to their final inspection and release for occupancy, these dwellings should be certified by an Acoustical Engineer as being in compliance with the recommendations of the Detailed Noise Control Study.

In view of the fact that municipal implementation procedures of the noise control measures recommended herein may differ, it is the responsibility of the developer/builder responsible for final design and construction of the subject structures/dwellings to ensure that the correct details related to the noise control measures referred in this report, such as building shell component specifications (windows, walls, doors, and others), air conditioning noise control technical requirements, etc. are secured from the Acoustical Engineer prior to planning and construction of the noted buildings.

3.0 SOUND LEVEL CRITERIA

3.1 SURFACE TRANSPORTATION CRITERIA⁵

The surface transportation noise is based on the objective sound levels recommended by the Ministry of the Environment and Climate Change (Ref: MOECC Publication NPC-300 “Environmental Noise Guideline, Noise Assessment Criteria for Stationary Sources and for Land Use Planning, 2013”) and applicable Regional/Municipal sound level standards and procedures for different land uses and spaces.

The following is a summary of the applicable sound level criteria for surface transportation sources for the shown time periods (day=d & night=n):

Sound Level Limits for Outdoor Living Areas (OLAs)

AREA & TIME PERIOD	$L_{Aeq(day)}$ ROAD AND RAIL (dBA)
Designated (Individual or common) Outdoor Living Areas (16 hr day(d), 07:00 - 23:00)	$L_{Aeq(day)}$ 55

Indoor Sound Level Limits

Type of Space	L_{Aeq} (Time Period) (dBA)	
	Road	Rail
Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc. (Time period-day: 16 hr(d), 07:00 - 23:00)	$L_{Aeq(day)}$ 45	$L_{Aeq(day)}$ 40
Living/dining, den areas of residences, hospitals, nursing homes, etc. (except schools or daycare centres) (Time period-night: 8 hr(n), 23:00 - 07:00)	$L_{Aeq(night)}$ 45	$L_{Aeq(night)}$ 40
Sleeping quarters (Time period-day: 16 hr, 07:00 - 23:00)	$L_{Aeq(day)}$ 45	$L_{Aeq(day)}$ 40
Sleeping quarters (Time period-night: 8 hr, 23:00 - 07:00)	$L_{Aeq(night)}$ 40	$L_{Aeq(night)}$ 35

⁵ Road, rail and rolling stock traffic.

**Additional Supplementary (Best Management Practices) Sound Level
Criteria Recommended for Other Uses**

Type of Space	L _{Aeq} (Time Period) (dBA)	
	Road	Rail
General offices, reception areas, retail stores, etc. (Time period-day: 16 hr, 07:00 - 23:00)	L _{Aeq(day)} 50	L _{Aeq(day)} 45
Living/dining areas of residences, hospitals, schools, nursing/retirement homes, daycare centres, theatres, places of worship, libraries, individual or semiprivate offices, conference rooms, reading rooms, etc. (Time period-day: 16 hr, 23:00 - 07:00)	L _{Aeq(day)} 45	L _{Aeq(day)} 40
Sleeping quarters of hotels/motels (Time period-night: 8 hr, 23:00 - 07:00)	L _{Aeq(night)} 45	L _{Aeq(night)} 40
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc. (Time period-night: 8 hr, 23:00 - 07:00)	L _{Aeq(night)} 40	L _{Aeq(night)} 35

The criteria for acceptable outdoor and indoor sound levels are based on “free-field” predicted and/or measured sound levels at the applicable receiver locations, thus the effects of sound reflections and reverberant sound fields are not considered.

If the sound level is less than or equal to the sound level criteria, no control measures will be required.

The outdoor sound levels **may** exceed the outdoor sound level criterion by up to 5 decibels, provided that it can be demonstrated that it is not technically, economically or administratively feasible to achieve the criterion and that the occupants are informed of a potential disturbance due to the excess noise by means of a warning clause or cautionary note to be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease.

Central air conditioning is required when the nighttime sound level at the outside wall of the sleeping quarters or bedrooms is equal to or exceeds L_{Aeq(night)} 8hrs 60 dBA or when the daytime sound level at the outside wall of the Living/Dining/ Recreation space is equal to or exceeds L_{Aeq(day)} 16 hrs 65 dBA.

If the nighttime sound level at the outside wall exceeds L_{Aeq(night)} 50dBA but is less than 60dBA, or if the daytime sound level at the outside wall exceeds 55dBA but is less than L_{Aeq(day)} 65dBA, then forced air heating with provision for future

installation of central air conditioning is required.

Application of Criteria

The following table summarizes the requirements for noise control measures for the various sound level ranges:

SOURCE OF NOISE	DAYTIME SOUND LEVEL $L_{Aeq(day)}$	NIGHTTIME SOUND LEVEL $L_{Aeq(night)}$	AIR COND.	FORCED AIR VENTILATION WITH PROVISION FOR FUTURE AIR COND.	WARNING CLAUSE	ACOUSTIC INSULATION
ROAD	≤ 55	≤ 50	-	-	-	-
	>55 & ≤ 65	>50 & ≤ 60	-	Yes	Yes "Type C"	-
	>65	>60	Yes	-	Yes "Type D"	Yes
RAIL	≤ 55	≤ 50	-	-	-	-
	>55 & ≤ 60	>50 & ≤ 55	-	Yes	Yes "Type C"	-
	>60 & ≤ 65	>55 & ≤ 60	-	Yes	Yes "Type C"	Yes
	>65	>60	Yes	-	Yes "Type D"	Yes

3.2 CRITERIA FOR STATIONARY NOISE SOURCES

The following criteria apply to the impact of Stationary Sources of noise as defined by the MOECC to include industrial and commercial facilities. The criteria apply to the impact of Stationary Sources external to the development on the proposed development or to the impact of any proposed Stationary Sources internal to the development on the development itself.

The criteria used in this study are based on the objective sound levels recommended by the Ministry of the Environment and Climate Change (Ref.: MOECC Publication NPC-300 "Environmental Noise Guideline, Noise Assessment Criteria for Stationary Sources and for Land Use Planning, 2013) and other relevant publications.

For sound from a stationary source, including Quasi-Steady Impulsive Sound but not including other impulsive sound, the predicted and/or measured "predictable worst case" 1-hour equivalent sound levels (L_{Aeq1hr}) of the stationary source(s) at a point of reception is the higher of the applicable exclusion limit value (given in the following tables) or the background sound level for that point of reception. The outdoor sound level limits for stationary sources apply only to daytime and evening (07:00 – 23:00 hours).

**Exclusion⁶ Limit Values of One-Hour Equivalent
Sound Level (L_{Aeq}, dBA) Outdoor Points of Reception**

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	45	55
19:00 – 23:00	50	45	40	55

**Exclusion Limit Values of One-Hour Equivalent Sound Level (L_{Aeq}, dBA)
Plane of Window of Noise Sensitive Spaces**

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	45	60
19:00 – 23:00	50	50	40	60
23:00 – 07:00	45	45	40	55

⁶ or the minimum hourly background (ambient) sound level L_{Aeq}_{1hr}, whichever is higher

4.0 ANALYSIS

4.1 TRANSPORTATION SOURCES OF NOISE

The relevant road and traffic data were obtained from the City of Hamilton and are summarized below:

- **Governors Road**

Current No. of Lanes	2
Future No. of Lanes (Assumed)	2
Posted Speed Limit	50km/hr.
Future Posted Speed Limit (Assumed)	50km/hr.
AADT (Year 2013)	13,240vpd
Future AADT (Year 2031)	20,650vpd
- Annual Growth Rate (Assumed)	2.5%
- Number of Years of Growth (Assumed)	18 years
Total Truck Percentage	3.6%
- Medium Truck Split	2.5%
- Heavy Truck Split	1.1%
Day(16 hrs.)/Night(8 hrs.) Split (Assumed)	90%/10%
Directional Traffic Split (Assumed)	50%/50%
Road Gradient (Assumed)	2%

Appendix A contains the relevant road traffic data used in this study.

4.2 OUTDOOR NOISE ENVIRONMENT

Sound level predictions were carried out based on MOECC's ORNAMENT sound level prediction modeling procedures⁷ (Ontario Road Noise Analysis Method for Environment and Transportation, Technical Document, 1989).

Overall sound levels at the OLAs of the selected representative receptor locations are shown in Table 2. Sample sound level calculations at representative receptor locations are presented in Appendix B.

In consideration of the calculations, it is concluded that for all of the blocks within the development, the unattenuated daytime sound levels in the designated OLAs will not exceed the objective level of L_{Aeq} 55dBA, therefore outdoor noise control measures are not required.

⁷ The MOECC's noise prediction models ORNAMENT and STEAM have a limitation as to the minimum AADT value for 24 hour traffic volume (calculated for the daytime and nighttime hourly volume). When the AADT value is less than 40 vph, there is a neutral mathematical manipulation that can be used as long as the hourly traffic volume is not very low. The manipulation is implemented by multiplying the traffic volume by any reasonable factor (for example a factor of 10) and then by deducting $10 \times \log$ "factor" from the results (in this case, $10 \times \log 10=10$).

4.3 INDOOR NOISE ENVIRONMENT

The criteria for indoor L_{Aeq} sound levels are based on projected L_{Aeq} levels at the outside face of the dwellings with appropriate assumptions for the differences between the outdoor and indoor sound levels. If the outside L_{Aeq} levels do not exceed the recommended objective sound levels, then the indoor L_{Aeq} levels will not be exceeded, assuming standard building construction and operable windows.

Overall daytime sound levels at the building facades are shown in Table 3 and the overall nighttime sound levels at the building facades are shown in Table 4.

In consideration of the estimated sound levels and by comparison to the acceptable indoor sound level criteria (Section 3) the following is concluded:

- The sound levels at the outside walls of the following receptors (within any habitable room on any floor) is predicted to exceed $L_{Aeq(day)}$ 65 and/or $L_{Aeq(night)}$ 60 dBA respectively:

Blocks: 1 and 2 (All Units Inclusive)

Therefore, central air conditioning is required.

- The daytime/nighttime noise environment at the outside walls of the following receptors (within any habitable room on any floor) is predicted to be in the range of $L_{Aeq day}$ 56-65 dBA and/or $L_{Aeq night}$ 51-60 dBA:

Blocks: 3, 4, and 5 (All Units Inclusive)

Forced-air heating system with provision for central air conditioning is therefore required.

Typical Acoustic Insulation Factors (A.I.F.) are summarized in Tables 3 and 4. A summary of the minimum indoor noise requirements is illustrated in Figure 3.

4.4 TYPICAL WINDOW / WALL CONSTRUCTION

As the detailed architectural plans for Building Permit submission are not available at this time, it is not possible to specify the window and wall details to meet the AIF requirements presented in Tables 3 and 4. Further detailed analysis should be undertaken based on the data presented in this Report to take into consideration the final room location, floor area, window type (operable or fixed), window size and orientation, etc. Such analysis is required by the MOECC and the municipality prior to submission for building permits as part of their Certification process.

Wall construction using concrete block, brick veneer, precast concrete panels or acoustically equivalent light frame construction will be adequate to meet the indoor sound level criteria.

It must be pointed out that there are several factors affecting the final glass selection including:

1. Size of window.
2. Room dimensions.
3. Floor level and direction room faces.
4. Fixed or operable glass.
5. The number of building components.
6. Type of wall to be used.
7. Projected sound levels outside the window

For the calculation of type of windows required for each dwelling, a detailed description of each unit is required.

As an example, for a typical unit with daytime outdoor sound level of 65 dBA, the AIF value for the Living Room will be 27 assuming 3 components. If the window to floor ratio is 32%, then the window requirements in terms of glass thickness, mm (air space thickness, mm) glass thickness, mm are any of the following:

Double Glazed: 3mm (13mm) 3mm; 4mm (6mm) 4mm

As an example, for a typical unit with nighttime outdoor sound level of 58 dBA, the AIF value for the bedrooms will be 25 assuming 3 components. If the window to floor ratio is 20%, then the window requirements in terms of glass thickness, mm (air space thickness, mm) glass thickness, mm are any of the following:

Double Glazed: 3mm (13mm) 3mm; 4mm (6mm) 4mm

The above window glazing construction is typical examples only. It is recommended that prior to the submission of the building plans for Building Permit that the detailed architectural drawings of the units requiring noise control measures, as referred to earlier, be examined by the Acoustical Engineer in order to advise the design consultant on the *specific* building components for noise control to suite the actual window construction details.

4.5 CONTROL OF AIR CONDITIONING UNITS NOISE

To control the environmental noise emitted by air conditioning or heat pump units it is essential that the following procedures and specifications be considered to by the parties responsible for the selection, design and installation of the air conditioning systems:

1. Control of air conditioning noise is governed by Provincial and/or municipal standards which specify acceptable sound emission levels for the air conditioning devices and/or acceptable sound levels at the point(s) of reception.

The Ministry of the Environment and Climate Change criteria for control of air conditioning noise is outlined in several technical publications including publications NPC-300 and NPC-216 (a maximum sound level of 50 dBA⁸ at the neighbour's closest point(s) of reception, i.e. at their outdoor areas as well as at the closest window on any floor level). The applicable sound level criteria for new residential development where air conditioning is a mandatory requirement for noise control inside habitable rooms are: 1) a maximum ARI^{*} Sound Rating to suit the site specific installation for the air conditioning device, and 2) hourly L_{Aeq} sound level limits of 50 dBA at the point(s) of reception (or the prevailing hourly L_{Aeq} due to vehicular traffic ambient noise if higher than 50 dBA).

Municipal standards for air conditioning noise may also include specific or maximum Sound Rating numbers (in bels) and/or point-of-reception sound level limits in reference to specific municipal By-Laws and/or standards as applicable.

Therefore, it is essential that the final selection, location, design, and specifications of the air conditioning devices ensure compliance with the applicable sound level criteria prior to making any commitment.

The following are examples of the preferred approach when dealing with the issue of air conditioning noise.

- a) If the A/C condensing unit is to be installed in backyards in urban areas, then units having lower bels rating may be required. The use of units with lower sound rating of 6.8bel or lower may give the builder the flexibility of locating the unit as close as 3 metres from the joint property lines without exceeding the MOECC 50 dBA standard for houses in urban areas.
- b) If the unit is to be located in the front or in the side yard areas (closer to the front and provided that there are no windows to habitable rooms on the side walls), then units having less stringent sound level rating requirements may result in complying with sound criteria.
- c) Through the building permit process of the specific properties, additional calculations should be performed to optimize the unit sound ratings depending on the house model and the installation location.

⁸ Or the lowest hourly ambient Leq due to road traffic projected at the receptor location(s)

^{*} When tested in accordance with ARI Standard 270-84

2. The resulting sound levels due to residential air conditioners at the nearest points-of-reception should not exceed the levels in MOECC Publication NPC-216 (a maximum sound level of 50 dBA⁹ at the neighbour's closest point(s) of reception, i.e. at their outdoor areas as well as at the closest window on any floor level).
3. The siting of the split-system central air conditioning units and other systems should follow good planning principles.
4. Should location of the outdoor air conditioner unit be in the back or side yard areas where noise is likely to interfere with the outdoor and indoor activities of any occupant and/or neighbor, then it is necessary to design and install noise control measures. Noise control measures include any or a combination of the following:
 - a. Distance setback away from the receptor(s).
 - b. Sound barrier wall(s) or ultimately an acoustic enclosure.
 - c. Sealing selected windows, i.e. installation of non-operable windows.
 - d. Deleting selected windows.

It is also our recommendation that the necessary detailed technical analysis be performed prior to submitting an application for Building Permit to optimize the required air conditioning unit Sound Rating number in order to meet the Provincial sound level standards at the closest receptors after taking into consideration the specific property design and proposed A/C unit location. Other A/C noise control measures, where required to meet the sound level criteria at the point(s) of reception, should also be identified and shown on the applicable permit drawings/specifications.

4.6 Important Notes for the Residential Builder Regarding Windows

The results in this report provide information on the calculated Acoustic Insulation Factors (AIF) for windows based on typical assumed window and room dimensions.

To assist the Builder in appreciating the fact of whether the results presented herein require typical commercially available residential type windows, or special type windows, the following table¹⁰ provides reasonably accurate information on whether such window(s) are standard industry window or not:

⁹ Or the lowest hourly ambient Leq due to road traffic projected at the receptor location(s)

¹⁰ Based on a typical commercially available glazing: 3mm inside pane, 16mm inter-pane air space & 3mm exterior pane.

Acoustic Insulation Factor (AIF) in this report	35	34	33	32	31	30	29	28	27	26
Window to room floor area percentage NOT to be exceeded	10%	13%	16%	20%	25%	32%	40%	50%	63%	80%

If the above ratios are exceeded, several options are available to the builder including one or more of: reducing the size of the window, increasing the inter-pane air spacing, the use of thicker glazing, the use of “laminated” glazing (1 or 2 panes), etc.

WORKED EXAMPLE 1:

- AIF shown in this study: 31
- Actual room floor area: 250 sq.ft.
- You selected a window area of: 45 sq.ft
- Your window/floor ratio: (45 divided by 250, then times 100) =18%
- Your result is less than above table value 25%; i.e. standard glazing unit

WORKED EXAMPLE 2:

- AIF shown in this study: 34
- Actual room floor area: 200 sq.ft.
- You selected a window area of: 50 sq.ft
- Your window/floor ratio: (50 divided by 200, then times 100) =25%
- Your result is more than above table value 13%; i.e. Non-standard (special) glazing unit

TABLES

TABLE 1

SUMMARY OF MINIMUM REQUIRED NOISE CONTROL MEASURES

BLOCKS	SOUND BARRIER	CENTRAL AIR CONDITIONING	PROVISION FOR CENTRAL AIR CONDITIONING	WARNING CLAUSE
1 (Units 1 to 8) 2 (Units 1 to 6)	No	Yes	--	Yes
3 (Units 1 to 6) 4 (Units 1 to 5) 5 (Units 1 to 6)	No	No	Yes	Yes

File Number :
Project Name :

OUTDOORS
Table 2

Description : WA17-060

Any Heavy Rail Line ?	No
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Description : 264 Governors Road, Hamilton

Record Number	1	2	3	4	5	6	7	8	9	10	11	12
Consider Record	Y	Y	N	N	N	N	N	N	N	N	N	N
BLOCK/UNIT NUMBER	BLOCK 1 (UNIT 1)	BLOCK 3 (UNIT 6)										
FACE/DIRECTION	SOUTH	NORTH										
LOCATION	Outdoor Living Area	Outdoor Living Area										
Source 1: Governors Rd	Road Traffic		OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			
Leq Outdoors	55.00	52.00										
Partial angle of exposure, degrees	180	180										
Partial exposure adjust., dB												
Additional Adjustment, dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA	55.00	52.00										
Source 2:	Road Traffic		OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			
Leq Daytime												
Partial angle of exposure, degrees	180	180										
Partial exposure adjust., dB												
Additional Adjustment, dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Source 3:	Road Traffic		OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			
Leq Daytime												
Partial angle of exposure, degrees	180	180										
Partial exposure adjust., dB												
Additional Adjustment, dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Source 4:	Road Traffic		OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			OUTDOOR DAYTIME LEVELS			
Leq Daytime												
Partial angle of exposure, degrees	180	180										
Partial exposure adjust., dB												
Additional Adjustment, dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Sub-Tot. 4 Sources Leq, dBA	55.00	52.00										
Aircraft noise NEF/NEP												
Adjust.1												
Adjust.2												
Adjusted NEF/NEP												
<i>Approx. Overall Combined Leq</i>	55	52										
Overall Road and/or Rail and/or Stationary Sources, Leq (dBA)	55	52										
Aircraft Noise Only, NEF												
NOTES	No Sound Barrier Required	No Sound Barrier Required										

N6 Leq-AIF Master-January 2007
 11/9/2017 12:42
 File Number :
 Project Name :
 Description : WA17-060

Proceed

SS WILSON ASSOCIATES

Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS

DAYTIME
Table 3

(Using NRC/MOE Procedures)

Description : 264 Governors Road, Hamilton

Record Number	1	2	3	4	5	6	7	8	9	10	11	12
Consider Record	Y	Y	Y	N	N	N	N	N	N	N	N	N
BLOCK/UNIT NUMBER	BLOCK 1 (UNIT 1)	BLOCK 3 (UNIT 6)	BLOCK 4 (UNIT 2)									
FACE/DIRECTION	NORTH	NORTH	NORTH									
LOCATION	Building Façade	Building Façade	Building Façade									
ROOM CLASSIFICATION	Living /Dining	Living /Dining	Living /Dining									
Adjustm. to Criterion, dBA												
MOE Transportation Sources Daytime												
Leq Indoor Criteria, dBA	45	45	45									
Aircraft Indoor Criteria, NEF	5	5	5									
Source 1: Governors Rd	Road Traffic	DAYTIME LEVELS			DAYTIME LEVELS			DAYTIME LEVELS				
Leq Daytime	65.00	55.00	58.00									
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA	65.00	55.00	58.00									
Angular range of incidence (0,1,2,3)												
Adjusted AIF	27	17	20	24	25	27	-38	-38	-38	-38	-38	-38
Source 2:	Road Traffic	DAYTIME LEVELS			DAYTIME LEVELS			DAYTIME LEVELS				
Leq Daytime												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
Source 3:	Road Traffic	DAYTIME LEVELS			DAYTIME LEVELS			DAYTIME LEVELS				
Leq Daytime												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
Source 4:	Road Traffic	DAYTIME LEVELS			DAYTIME LEVELS			DAYTIME LEVELS				
Leq Daytime												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
Sub-Tot. 4 Sources Leq, dBA	65.00	55.00	58.00									
Aircraft noise NEF/NEP												
Adjust.1												
Adjust.2												
Adjusted NEF/NEP												
<i>Approx. Overall Combined Leq</i>	65	55	58									
Assumed Window/Floor Area %	32.0	32.0	32.0									
Assumed Total # of Components (Road, Rail, and Other Sources)	3	3	3									
Assumed Total # of Components Aircraft ONLY	3	3	3									
AIF of 4 Sources	27	17	20									
Aircraft AIF												
Combined AIF	27	17	20									
Openable or Fixed windows ?	Openable	Openable	Openable									
Regular or Laminated Glass	Regular	Regular	Regular									
Other Adjustment												
Final Adjusted AIF	27	17	20									
Minimum STC (Approx)	28	18	21									
Typical Minimum Double Glazing Alternatives	3 (6)3	3 (6)3	3 (6)3									
NOTES	Mandatory AC	Provision for AC	Provision for AC									

N6 Leq-AIF Master-January 2007
 11/9/2017 12:42
 File Number :
 Project Name :
 Description : WA17-060

Proceed

SS WILSON ASSOCIATES

Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS

(Using NRC/MOE Procedures)

**NIGHT TIME
 Table 4**

Description : 264 Governors Road, Hamilton

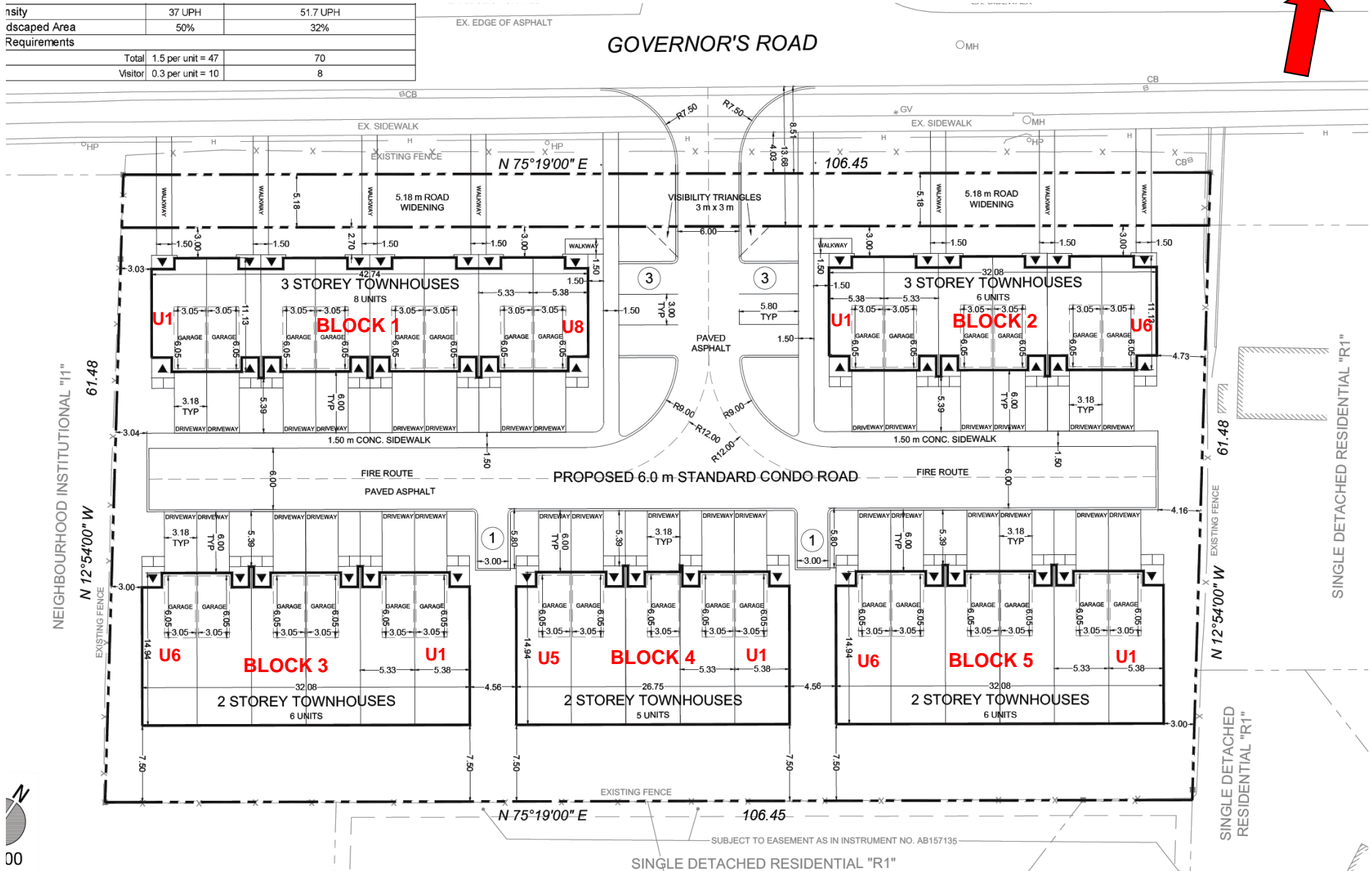
Record Number	1	2	3	4	5	6	7	8	9	10	11	12
Consider Record	Y	Y	Y	N	N	N	N	N	N	N	N	N
BLOCK/UNIT NUMBER	BLOCK 1 (UNIT 1)	BLOCK 3 (UNIT 6)	BLOCK 4 (UNIT 2)									
FACE/DIRECTION	NORTH	NORTH	NORTH									
LOCATION	Building Façade	Building Façade	Building Façade									
ROOM CLASSIFICATION	Bedroom	Bedroom	Bedroom									
Adjustm. to Criterion, dBA												
MOE Transportation Sources Night Leq Indoor Criteria, dBA	40	40	40									
Aircraft Indoor Criteria, NEF												
Source 1: Governors Rd	Road Traffic	NIGHT TIME LEVELS			NIGHT TIME LEVELS			NIGHT TIME LEVELS				
Leq Night Time	58.00	48.00	51.00									
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA	58.00	48.00	51.00									
Angular range of incidence (0,1,2,3)												
Adjusted AIF	25	15	18	-33	-33	-33	-33	-33	-33	-33	-33	-33
Source 2:	Road Traffic	NIGHT TIME LEVELS			NIGHT TIME LEVELS			NIGHT TIME LEVELS				
Leq Night Time												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33
Source 3:	Road Traffic	NIGHT TIME LEVELS			NIGHT TIME LEVELS			NIGHT TIME LEVELS				
Leq Night Time												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33
Source 4:	Road Traffic	NIGHT TIME LEVELS			NIGHT TIME LEVELS			NIGHT TIME LEVELS				
Leq Night Time												
Partial angle of exposure, degrees	180	180	180									
Partial exposure adjust., dB												
Additional Adjustment, dB												
Sub-Total Leq, dBA												
Angular range of incidence (0,1,2,3)												
Adjusted AIF	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33
Sub-Tot. 4 Sources Leq, dBA	58.00	48.00	51.00									
Aircraft noise NEF/NEP												
Adjust.1												
Adjust.2												
Adjusted NEF/NEP												
<i>Approx. Overall Combined Leq</i>	58	48	51									
Assumed Window/Floor Area %	20.0	20.0	20.0									
Assumed Total # of Components (Road, Rail, and Other Sources)	3	3	3									
Assumed Total # of Components Aircraft ONLY	3	3	3									
AIF of 4 Sources	25	15	18									
Aircraft AIF												
Combined AIF	25	15	18									
Openable or Fixed windows ?	Openable	Openable	Openable									
Regular or Laminated Glass	Regular	Regular	Regular									
Other Adjustment												
Final Adjusted AIF	25	15	18									
<i>Minimum STC (Approx)</i>	24	14	17									
Typical Minimum Double Glazing Alternatives	3 (6)3	3 (6)3	3 (6)3									
NOTES	Mandatory AC	Provision for AC	Provision for AC									

FIGURES



**FIGURE 1
KEY PLAN**

nsity	37 UPH	51.7 UPH
dsipated Area	50%	32%
Requirements		
Total	1.5 per unit = 47	70
Visitor	0.3 per unit = 10	8



**FIGURE 2
CONCEPT PLAN**

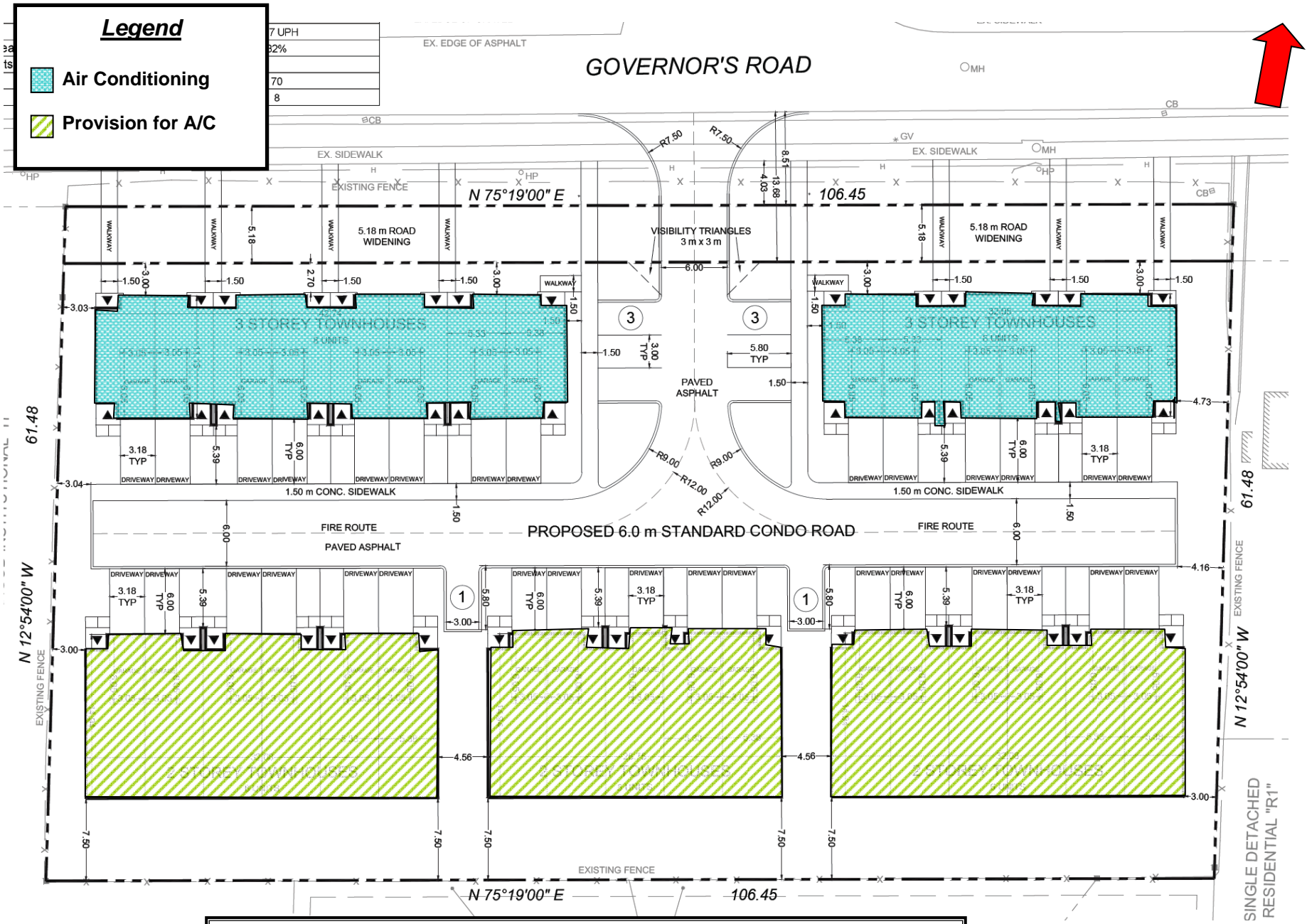


FIGURE 3
SUMMARY OF MINIMUM NOISE ATTENUATION MEASURES

APPENDIX A
ROAD TRAFFIC DATA

Intersection: **Governors Rd**
 Direction: (East/West)

at **Bridlewood/Castlewood**
 (North/South)

Total Vehicles: 7,048
 M.V.E./Year: 4.984
 AWDT Factor: 2.08

Date: Monday
 Sep 30, 2013
 Period: 7 hours

Road Condition: Wet

Weather: Rain

Comments:

TOTAL VEHICLES																	
15 mins. Ending (Pk.Hr.)*	North Bd. on N/S			East Bd. on E/W			South Bd. on N/S			West Bd. on E/W			Total Veh's	Pedestrians			
	L	S	R	L	S	R	L	S	R	L	S	R		N side	E side	S side	W side
	7:15	0	0	6	0	85	2	5	0	1	2	27		4	132	0	1
7:30	1	0	14	0	94	1	15	0	2	5	25	0	157	2	0	1	2
7:45	4	0	15	1	149	3	25	1	5	9	44	4	260	0	0	0	3
8:00	2	1	35	2	174	0	33	2	3	12	53	0	317	2	8	2	0
8:15	10	2	33	0	161	3	52	3	0	12	74	2	352	1	23	8	11
8:30 *	5	2	28	1	187	1	43	1	2	16	50	4	340	8	24	14	7
8:45 *	3	0	18	1	203	1	32	1	2	19	49	2	331	5	2	2	9
9:00 *	3	1	26	0	195	4	23	3	1	27	57	7	347	0	1	6	21
9:15 *	11	5	79	0	126	3	12	12	3	40	76	5	372	8	1	1	40
9:30	9	5	42	4	85	3	12	1	2	10	45	5	223	0	0	1	1
9:45	1	0	5	0	71	0	13	0	0	9	54	3	156	5	4	0	7
10:00	7	4	8	1	74	3	8	2	6	10	41	3	167	0	0	0	0
14:15 *	1	0	10	0	61	2	7	0	1	7	48	2	139	4	0	0	0
14:30 *	0	0	8	1	73	2	15	1	1	5	76	14	196	0	12	2	0
14:45 *	1	8	3	1	66	3	9	2	2	13	78	9	195	18	58	48	19
15:00 *	2	1	8	0	76	1	9	2	0	13	67	10	189	23	14	51	35
15:15	3	2	3	0	61	1	10	2	4	20	77	10	193	2	5	3	3
15:30	0	1	6	3	65	2	9	5	2	42	104	10	249	6	2	2	10
15:45	13	18	44	0	76	3	14	1	0	23	114	8	314	8	3	13	83
16:00	1	2	16	0	76	1	14	1	2	17	92	25	247	3	1	0	10
16:15	5	1	12	1	77	2	10	2	1	12	117	9	249	1	6	0	2
16:30 *	7	1	12	1	58	2	5	0	1	17	125	25	254	1	4	0	5
16:45 *	2	2	12	2	69	2	9	1	2	28	161	19	309	0	5	1	5
17:00 *	4	3	20	2	76	1	5	2	1	20	164	13	311	2	0	0	10
17:15 *	3	1	13	4	61	2	18	2	3	22	169	19	317	2	6	1	2
17:30	6	5	4	0	63	4	7	2	0	14	132	14	251	0	1	0	1
17:45	2	3	9	2	60	1	8	1	3	13	126	14	242	0	0	0	0
18:00	7	1	8	5	53	1	6	1	4	10	132	11	239	0	0	0	0
TOTAL	113	69	497	32	2,675	54	428	51	54	447	2,377	251		101	181	156	286
APPR.		679			2,761			533		3,075			7,048				724

TRUCKS & BUSES														
15 mins. Ending (Pk.Hr.)*	North Bd. on N/S			East Bd. on E/W			South Bd. on N/S			West Bd. on E/W			Total	
	L	S	R	L	S	R	L	S	R	L	S	R		
7:15	0	0	0	0	2	0	0	0	0	0	0	0	2	
7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:45	0	0	0	0	3	0	0	0	0	0	0	0	3	
8:00	0	0	1	1	6	0	1	0	0	1	5	0	15	
8:15	0	0	1	0	4	0	0	0	0	2	9	0	16	
8:30 *	0	0	0	0	2	1	1	0	0	0	5	0	9	
8:45 *	0	0	0	0	4	0	0	0	0	0	5	0	9	
9:00 *	0	0	1	0	5	1	1	0	0	1	1	0	13	
9:15 *	0	0	6	0	9	0	0	2	0	2	3	1	23	
9:30	0	0	1	0	3	0	0	0	0	1	1	0	6	
9:45	0	0	0	0	2	0	0	0	0	0	2	1	5	
10:00	0	0	1	0	3	0	0	0	0	1	2	0	7	
14:15 *	0	0	0	0	2	0	0	0	0	0	1	0	3	
14:30 *	0	0	0	0	8	0	1	0	0	1	2	0	11	
14:45 *	0	0	0	0	4	0	1	0	0	0	2	0	7	
15:00 *	0	0	0	0	3	0	0	0	0	1	8	1	13	
15:15	1	0	0	0	4	0	1	1	0	1	5	1	14	
15:30	0	1	0	0	3	0	0	0	0	4	6	0	14	
15:45	0	1	5	0	2	0	0	0	0	2	7	0	17	
16:00	0	0	3	0	6	0	2	0	0	2	1	1	15	
16:15	0	0	0	0	3	0	0	0	0	0	1	0	4	
16:30 *	0	0	0	0	4	0	0	0	0	0	1	0	5	
16:45 *	0	0	0	0	1	0	0	0	0	0	3	0	4	
17:00 *	0	0	0	0	2	0	0	0	0	0	1	0	3	
17:15 *	0	0	0	0	1	0	0	0	0	0	1	0	2	
17:30	0	0	0	0	1	0	0	0	0	0	1	0	2	
17:45	0	0	0	0	2	0	0	0	0	0	3	0	5	
18:00	0	0	0	0	2	0	0	0	0	0	3	0	5	
TOTAL	1	2	19	1	91	2	10	3	0	23	82	5		
APPR.		22			94			13			110		239	

TRUCKS														
15 mins. Ending (Pk.Hr.)*	North Bd. on N/S			East Bd. on E/W			South Bd. on N/S			West Bd. on E/W			Total	
	L	S	R	L	S	R	L	S	R	L	S	R		
7:15	0	0	0	0	1	0	0	0	0	0	0	0	1	
7:30	0	0	0	0	0	0	0	0	0	0	1	0	1	
7:45	0	0	0	0	1	0	0	0	0	0	0	0	1	
8:00	0	0	0	0	2	0	0	0	0	0	1	0	3	
8:15	0	0	0	0	1	0	0	0	0	1	4	0	6	
8:30 *	0	0	0	0	1	1	0	0	0	0	0	0	2	
8:45 *	0	0	0	0	3	0	0	0	0	0	1	0	4	
9:00 *	0	0	0	0	2	0	0	0	0	0	0	0	2	
9:15 *	0	0	0	0	2	0	0	1	0	0	1	1	5	
9:30	0	0	0	0	3	0	0	0	0	0	1	0	4	
9:45	0	0	0	0	0	0	0	0	0	0	1	0	1	
10:00	0	0	0	0	2	0	0	0	0	0	1	0	3	
14:15 *	0	0	0	0	2	0	0	0	0	0	0	0	2	
14:30 *	0	0	0	0	6	0	1	0	0	0	2	0	9	
14:45 *	0	0	0	0	1	0	0	0	0	0	1	0	2	
15:00 *	0	0	0	0	1	0	0	0	0	0	2	0	3	
15:15	0	0	0	0	1	0	0	1	0	0	2	0	4	
15:30	0	0	0	0	0	0	0	0	0	0	2	0	2	
15:45	0	0	0	0	1	0	0	0	0	0	2	0	3	
16:00	0	0	0	0	1	0	0	0	0	0	1	0	1	
16:15	0	0	0	0	1	0	0	0	0	0	0	0	2	
16:30 *	0	0	0	0	0	0	0	0	0	0	0	0	1	
16:45 *	0	0	0	0	0	0	0	0	0	0	1	0	1	
17:00 *	0	0	0	0	1	0	0	0	0	0	1	0	2	
17:15 *	0	0	0	0	0	0	0	0	0	0	1	0	1	
17:30	0	0	0	0	1	0	0	0	0	0	0	0	1	
17:45	0	0	0	0	1	0	0	0	0	0	2	0	3	
18:00	0	0	0	0	1	0	0	0	0	0	1	0	2	
TOTAL	0	0	0	0	37	1	1	2	0	1	29	1		
APPR.		0			38			3			31		72	

APPENDIX B

SAMPLE SOUND LEVEL CALCULATIONS

Filename: b1u1ola.te Time Period: Day/Night 16/8 hours
Description: Block 1 (U1)-Sound Level at Outdoor Living Area

Road data, segment # 1: Govrnors Rd (day/night)

 Car traffic volume : 17916/1991 veh/TimePeriod *
 Medium truck volume : 465/52 veh/TimePeriod *
 Heavy truck volume : 204/23 veh/TimePeriod *
 Posted speed limit : 50 km/h
 Road gradient : 2 %
 Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 13240
 Percentage of Annual Growth : 2.50
 Number of Years of Growth : 18.00
 Medium Truck % of Total Volume : 2.50
 Heavy Truck % of Total Volume : 1.10
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Govrnors Rd (day/night)

 Angle1 Angle2 : -70.00 deg -40.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 34.00 / 34.00 m
 Receiver height : 1.50 / 7.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Result summary (day)

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	(dBA) !	(dBA)
1.Govrnors Rd	! 1.02 !	54.82 !	54.82
Total		54.82 dBA	

Result summary (night)

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	(dBA) !	(dBA)
1.Govrnors Rd	! 1.03 !	48.32 !	48.32
Total		48.32 dBA	

TOTAL Leq FROM ALL SOURCES (DAY): 54.82
 (NIGHT): 48.32

Filename: **b1u1dn.te** Time Period: **Day/Night 16/8 hours**
 Description: **Block 1 (U1)-Sound Level at Building Facade**

Road data, segment # 1: Govrnors Rd (day/night)

 Car traffic volume : 17916/1991 veh/TimePeriod *
 Medium truck volume : 465/52 veh/TimePeriod *
 Heavy truck volume : 204/23 veh/TimePeriod *
 Posted speed limit : 50 km/h
 Road gradient : 2 %
 Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 13240
 Percentage of Annual Growth : 2.50
 Number of Years of Growth : 18.00
 Medium Truck % of Total Volume : 2.50
 Heavy Truck % of Total Volume : 1.10
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Govrnors Rd (day/night)

 Angle1 Angle2 : -90.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 20.00 / 20.00 m
 Receiver height : 1.50 / 7.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Result summary (day)

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	(dBA) !	(dBA)
1.Govrnors Rd	! 1.02 !	64.91 !	64.91
Total		64.91 dBA	

Result summary (night)

	! source !	Road !	Total
	! height !	Leq !	Leq
	! (m) !	(dBA) !	(dBA)
1.Govrnors Rd	! 1.03 !	58.40 !	58.40
Total		58.40 dBA	

TOTAL Leq FROM ALL SOURCES (DAY): 64.91
 (NIGHT): 58.40