KOIKAS ACOUSTICS PTY LTD
CONSULTANTS IN NOISE & VIBRATION
ABN 12 058 524 771
Commercial 1 (Unit 27)
637 - 645 Forest Road
BEXLEY NSW 2207
Ph: (02) 9587 9702
Fax: (02) 9587 5337
E-mail: Office@KoikasAcoustics.com

ACOUSTIC ASSESSMENT

RAIL NOISE & VIBRATION NOISE IMPACT

BOARDING HOUSE OPERATIONAL NOISE IMPACT

NO. 73-75 WALDRON ROAD, CHESTER HILL

Date: Thursday, 23 August 2018
File Reference: 3281R20180822jtnk73-75WaldronRdChesterHillV4

DOCUMENT CONTROL	
Project Title	Acoustic Assessment Rail Noise & Vibration Noise Impact Boarding House Operational Noise Impact No. 73-75 Waldron Road, Chester Hill
Our Project Number	3281
Our File Reference	3281R20180822jtnk73-75WaldronRdChesterHillV4
File Link	Z:\ACOUSTICS\ACOUSTICS 18\REPORT\Rail Noise & Vibration\3281R20180822jtnk73-75WaldronRdChesterHillV4.docx
Issue Date	Thursday, 23 August 2018
Revision	V1 20/12/2017
	V2 20/12/2017
	V3 22/08/2018
	V4 23/08/2018
Prepared By	James Tsevrementzis
Approved By	Nick Koikas 
Prepared for	Eminent Constructions Pty Ltd Email: greg@eminentconstructions.com.au
Care of	Attention: Denis Antipas Email: denisantipas@gmail.com

ACOUSTIC ASSESSMENT

NO. 73-75 WALDRON ROAD, CHESTER HILL

CONTENTS

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was commissioned by Eminent Constructions to undertake an acoustic assessment for the proposed residential boarding house studios at No. 73-75 Waldron Road, Chester Hill.

This assessment considers the following:

- The rail noise and vibration impacts to the proposed development from the railway corridor (T3 Bankstown Line), and

- The noise impact of the use of the premises by occupants of the proposed boarding house to the surrounding premises.

The assessment was undertaken in accordance with the assessment procedures and noise criteria of:

- City of Canterbury DCP 2012;
- ***NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008*** and ***State Environmental Planning Policy (Infrastructure) 2007***;
- The ***Environmental Protection Authority***'s (now called ***Office of Environmental & Heritage***) ***Noise Policy for Industry (NPI)***;
- ***Protection of the Environmental Operations (POEO) Act 1997***, and
- other relevant Australian Standards.

The aim of this assessment is to ascertain the type and extent of noise mitigation measures required to achieve the nominated noise criteria.

2.0 SITE DESCRIPTION

2.1 SITE ADDRESS

The proposed site is located at No. 73-75 Waldron Road, Chester Hill.

2.2 DESCRIPTION OF ASSESSMENT SITE

The proposed new residential boarding house studios consists of:

- Ground Floor Level: 27 car parking spaces, 1 laundry, 1 common room, 1 caretaker residence.
- First Floor Level: 17 boarding rooms.
- Second Floor Level: 17 boarding rooms.
- Third Floor Level: 17 boarding rooms.

There will be total of 51 boarding rooms, 1 laundry, 1 common room, 1 caretaker residence and 27 car parking spaces.

2.3 AMBIENT NOISE PROFILE OF THE SITE

The ambient noise profile of the area is dominated by rail and road traffic noise.

2.4 SURROUNDING PREMISES

The assessment site is surrounded by:

- Railway corridor (T3 Bankstown Line) to the south;
- Residential dwellings in all directions, and
- Commercial premises to the east.

An aerial photograph showing the assessment site, surrounding premises and monitoring location are attached as **Appendix A** to this report.

2.5 BOARDING HOUSE OPERATIONAL NOISE SOURCES

Assuming that the boarding house is at its full capacity, i.e there are 45 tenancies that have balconies with each of the occupants having one visitor, a total of 90 people would occupy the subject premise. It is assumed as a worst-case scenario that people could occupy the outdoor balcony area with 50 % of people talking, i.e. **45 people talking at the same time**.

There are no mechanical plant or outdoor AC condenser units proposed for the development.

If any of the assumptions made in this assessment are incorrect, there will likely be a need for further calculation to determine the noise impact from the boarding house to surrounding residential premises.

2.6 ARCHITECTURAL DRAWINGS PROVIDED

This acoustic assessment was based on architectural drawings provided by Antonio and Hyde Pty Ltd. The drawing references are detailed below:

Drawing title	Drawing No.	Revision	Date
TITLE PAGE	DA0001	A	4-01-18
SITE AND BUILDING CALCULATIONS	DA0002	A	4-01-18
PROPOSED SITE/ROOF AND ANALYSIS PLAN	DA0100	A	4-01-18
PROPOSED GROUND FLOOR LEVEL	DA1101	A	4-01-18
PROPOSED FIRST FLOOR LEVEL	DA1102	A	4-01-18
PROPOSED SECOND FLOOR LEVEL	DA1103	A	4-01-18
PROPOSED THIRD FLOOR LEVEL	DA1104	A	4-01-18
PROPOSED ELEVATIONS	DA2100	A	4-01-18
PROPOSED SECTIONS	DA3001	A	4-01-18

3.0 NOISE/VIBRATION CRITERIA

3.1 NSW GOVERNMENT DEPARTMENT OF PLANNING

Rail traffic noise assessment is required to be carried out to satisfy the indoor noise criteria stated in ***State Environmental Planning Policy (Infrastructure) 2007.*** The relevant Clauses of ***State Environmental Planning Policy (Infrastructure) 2007*** are provided below:

Clauses 87:

- *Development for any of the following purposes that is on land that is in or immediately adjacent to a rail corridor and the consent authority considers development is likely to be adversely affected by rail noise or vibration:*
  - *Building for residential use*
  - *A place of public worship*
  - *A hospital*
  - *An educational establishment or childcare centre*

**For Clauses 87 (Rail) and 102 (Road):*

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*

- in any bedroom in the building :	***35****dB(A) at any time 10pm-7am*
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway):	***40*** *dB(A) at any time.*

The note to Table 3.1 in Section 3.6.1 *Airborne Noise* in the ***NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008*** states that the airborne noise is calculated as:

LAeq (9hrs)	*night time*	*10pm - 7am, and*
LAeq (15hrs)	*daytime*	*7am - 10pm.*

The assessment procedures outlined in ***Australian Standard 3671-1989 Traffic noise intrusion building siting and construction*** have been used to determine the traffic noise levels that will affect the proposed development. These traffic noise levels will determine the type and extent of building materials required to adequately reduce road/rail traffic noise intrusion to residents.

In addition, Clause 102 (2) states the following:

(2) Before determining a development application for development to which this clause applies,

the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

The Guidelines issued include that by the *NSW Government Department of Planning*, document entitled – *Development Near Rail Corridors and Busy Roads – Interim Guidelines:*

Section 3.6.1 Airborne Noise states in addition to the general indoor noise criteria the following:
If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.

This implies that mechanical or natural ventilation would not be warranted unless the criterion is exceed by more than 10 dB with windows and doors open.

3.2 RAIL VIBRATION CRITERION

The rail vibration criteria as stated in the ***NSW Government Department of Planning Development Near Rail Corridors and Busy Roads - Interim Guidelines December 2008*** states:

Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in ***Assessing Vibration: a technical guideline (DECC 2006)***. Table 2.4 of ***Assessing Vibration: a technical guideline (DECC 2006)*** outlines the relevant rail noise vibration criterion.

Table 2.4 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$) [DECC 2006]

Location	DAYTIME		NIGHT-TIME	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas	0.10	0.20	0.10	0.20
Residences	**0.20**	**0.40**	**0.13**	**0.26**
Offices, schools, educational institutions, places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

3.3 PROTECTION OF THE ENVIRONMENTAL OPERATIONS (POEO) ACT 1997

In the definitions of the POEO Act, "offensive noise" means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

3.4 EPA'S NOISE POLICY FOR INDUSTRY (NPI)

In summary, the following steps and notes applying for the EPA's Noise Policy for Industry (NPI):

- determine the magnitude and nature of all relevant noise sources;
- measure the existing background and ambient noise levels;
- determine the Project Noise Trigger Level (PNTL). The PNTL is a level that, if exceeded, would indicate a potential noise impact on the community, and so, 'trigger' a management response – noise treatment. Assessing a proposal to the NPI requires consideration of the defined Project Noise Trigger Levels, the reasonableness and feasibility of noise treatment options, and any residual noise impacts (exceeding noise levels after all reasonable and feasible noise controls have been applied). As with the INP, the Project Noise Trigger Level is maintained as the lower of the intrusive and amenity noise goals, however, it is only referred to as a $L_{Aeq\ 15\ minutes}$. This means that the amenity noise levels are adjusted from $L_{Aeq\ Period}$ to $L_{Aeq\ 15\ minutes}$. The policy assumes the $L_{Aeq\ 15\ minutes}$ is equal to the $L_{Aeq\ Period}$ + 3dB. An alternate adjustment may be used provided significant evidence is provided as justification.
- Project intrusiveness noise level/limit is maintained as background + 5dB. It is noted that any excursions (breaches) of noise above the intrusiveness level during the daytime would not have the same negative impact as would be the case during the evening and night periods, where more noise-sensitive activities are typically occurring.
- The Minimum RBL's have changed slightly. They are now 35dB(A) daytime, and 30dB(A) evening and night.
- Furthermore, unless reasonably justified, the intrusive noise trigger level for the evening will not be greater than for daytime, and the night-time intrusive noise level will not be greater than for evening.

Table 2.2: Amenity noise levels.

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
(see Table 2.3 to determine which residential receiver category applies)			**Recommended amenity noise level**
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Hospital ward internal external	 All All	 Noisiest 1-hour Noisiest 1-hour	 35 50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB(A) to recommended noise amenity area

- Some exceptions can apply when deriving the project amenity noise level, such as:
  - Assessment in areas of high traffic.
  - For proposed development in major industrial clusters.
  - Where the resultant project amenity noise level is 10dB or lower than the existing industrial noise.
  - Where cumulative industrial noise is not an issue as there are no other industrial premises in the area.
- The trigger point for conducting a detailed maximum noise level assessment is where night-time industrial noise at a residential location exceeds:
  - $L_{Aeq,\ 15\ mins}$ 40dB(A) or the RBL + 5dB, whichever is greater, and/or
  - L_{AFmax} 52dB(A) or the RBL + 15dB, whichever is greater.

A detailed maximum noise level assessment is to cover the maximum noise level, the extent to which this exceeds the background noise level, and the number of occurrences during the night-time period.

3.5 BACKGROUND NOISE

The mechanical plant noise impact assessment was based on an unattended ambient noise survey at a representative site. The background noise level was determined over consecutive 15 minute intervals for a period of one week.

From this data of $L_{A90,15\ minutes}$ noise levels, the 10th percentile lowest background noise levels were determined for each of the days.

The *rating background level* was then determined by calculating the median value of the daily background noise levels during each of the three specific time periods, i.e. daytime, evening and night-time.

The rating background level result was used to determine the noise criteria applicable for the surrounding residential properties in accordance with the Environmental Protection Authority's (EPA) ***Noise Policy for Industry*** (NPI) assessment procedures.

The background noise level $L_{A90,\ 15\ minutes}$ is normally determined in the absence of extraneous noise such as traffic, wind, rain, conversation, birds chirping, insect noise and unnatural increases in noise from distant sources due to local air movement. The EPA defines such sources as *incidental noise* which can cause the masking of offensive noise from a specific source. Where traffic or other incidental noise cannot be excluded, then it is considered that these noise sources are part of the background noise.

Generally, when the ***EPA's NPI*** is complied with, offensive noise is unlikely to occur. In some cases, when the amenity criterion is lower, this does not mean that it is a more stringent criterion compared to the intrusive noise criterion.

4.0 NOISE & VIBRATION SURVEY

4.1 NOISE MONITORING PROCEDURES

All noise methodologies and equipment used comply with the following Australian Standards:

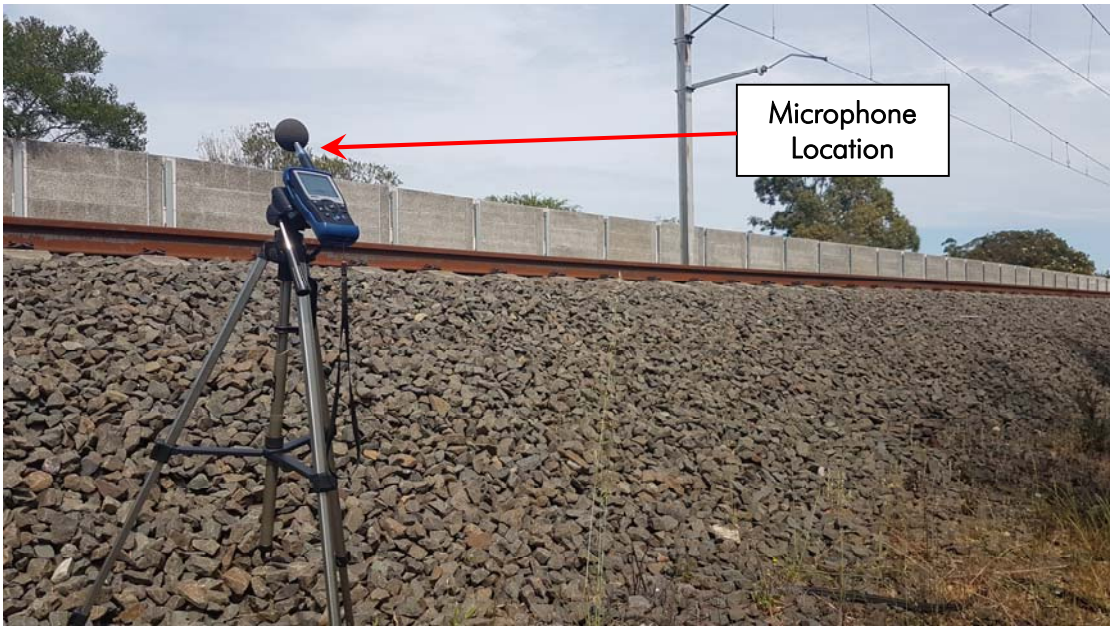
- *AS1259.2-1990 "Acoustics - Sound Level Meters - Integrating - Averaging", and*
- *ISO 1996-2007 "Acoustics – Description, measurement and assessment of environmental noise" Part 2: Determination of environmental noise levels*

4.2 ATTENDED NOISE & VIBRATION SURVEYS

4.2.1 Site Location of Unattended Noise Monitoring

Noise monitoring were undertaken approximately 2 meters from the rail corridor and vibration monitoring was conducted approximately 28 meters from the rail corridor, representative locations to quantify the typical noise and vibration levels to the subject premise. The microphone was placed in free field conditions with unimpeded acoustic views, approximately 1.5 meters above the rail corridor. The geo-phone, a tri-axial transducer was placed on the concrete ground in the rear yard of No. 75 Waldron Road, Chester Hill approximately 9 meters from the subject site boundary where the nearest proposed building facade would be constructed.

An aerial photograph attached as **Appendix A** to this report shows the approximate monitoring location of the noise and vibration instrumentation.



4.2.2 Noise & Vibration Survey Period, Date and Duration

The attended noise and vibration surveys were undertaken by Koikas Acoustics on Tuesday 3rd October 2017.

4.2.3 Meteorological Conditions Pertaining During the Attended Noise & Vibration Survey

Meteorological conditions over the monitoring period did not influence the noise and vibration survey results.

4.3 SURVEY INSTRUMENTATION

The attended vibration survey for this site utilises one Vibrock V901 (S/N 1678) vibration logger and the attended noise monitoring survey with a NTi XL2 precision spectrum analyser S/N A2A-02545-D1.

The sound/vibration monitoring instruments were calibrated with a field calibrator that currently carries NATA certification.

5.0 NOISE/VIBRATION SURVEY RESULTS

5.1 ATTENDED NOISE AND VIBRATION SURVEYS

The measured rail traffic noise levels obtained from the attended noise survey are as follow for the daytime and night time:

Table 1. Rail Traffic Noise Levels [dB]

FREQUENCY [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Total
Cumulative Rail Traffic Noise Levels Daytime [$L_{Aeq,\ 15\ hours}$]	39	49	54	60	59	62	61	57	49	**67**
Cumulative Rail Traffic Noise Levels Night-time [$L_{Aeq,\ 9\ hours}$]	35	45	50	56	56	58	57	54	45	**64**

The calculated whole-body VDV are summarised below against the criterion levels:

Period	Calculated/Measured	Criterion Values	Complied?
Daytime	0.284 $m/s^{1.75}$	0.4 $m/s^{1.75}$	YES
Night-time	0.199 $m/s^{1.75}$	0.26 $m/s^{1.75}$	YES

The daytime and night-time VDV levels are such that there is a low probability for adverse comment. These dose values were determined at the proposed nearest external building façade having approximately 28 metres of separation between the rail corridor and the proposed habitable space. No vibration controls are required for this development.

5.2 UNATTENDED NOISE SURVEY CONDUCTED BY ACOUSTIC DIRECTIONS

The measured background noise levels were obtained from the unattended noise survey undertaken by Acoustic Directions for the development at No. 77-79 Waldron Road (adjacent to the subject site). An extract from the acoustic report (Report Ref: 170905 DA Acoustic Report v1.3) is provided below.

3.1. Background Noise

Unattended automatic logging of background noise levels was conducted on site from 25th May 2017 to 1st June 2017 to quantify the existing background noise levels on site. The location of the logger is shown in Figure 1.

Noise data was acquired using an NTI-Audio XL2 with a Class 1 measurement microphone set to log data of each 15-minute interval. Calibration checks were done prior and after the logging to ensure the validity of data.

Background noise levels are presented as Rating Background Levels (RBL), which were calculated according to the procedure described in the NSW EPA Industrial Noise Policy. RBLs are commonly described for three time periods, which are day, evening and night. These periods are defined as follow:

a) Day – 7:00 am - 6:00 pm Monday to Saturday and 8:00 am - 6:00 pm for Sundays and Public Holidays.

b) Evening – 6:00 pm to 10:00 pm everyday

c) Night – remaining periods

Table 1 below shows the RBL for each period calculated from the site data,

Location	Time Period	Rating Background Level (RBL)
On site at 77-79 Waldron Road, Chester Hill	Day	50 dBA
	Evening	46 dBA
	Night	34 dBA

Table 1. Existing background noise levels at 77-79 Waldron Road, Chester Hill.

6.0 NOMINATED NOISE CRITERIA

6.1 RAIL TRAFFIC NOISE

A summary of the project specific rail traffic noise criteria used in this assessment is given below. The noise levels below refer to internal noise levels.

Space	Night Time	Daytime
Bedrooms	35 dB $L_{Aeq, 9hrs}$	40 dB $L_{Aeq, 15hrs}$
Living Areas & Lounge/Dining	40 dB $L_{Aeq, 9hrs}$	40 dB $L_{Aeq, 15hrs}$

6.2 OPERATIONAL NOISE

The project noise trigger levels are dependent on the background noise levels of the subject site. The calculated project noise trigger levels that are to be achieved to surrounding residential receivers from operation of the boarding house is shown in Table 2 below.

Table 2. Summary of Noise Survey Results and the Calculated Operational Noise Criteria [dB]

PERIOD	Existing Background Noise Levels $L_{A90, Period}$	Intrusive Noise Criteria $L_{A90} + 5$ $L_{Aeq,15mins}$	Amenity Criteria $L_{Aeq, Period}$	Corrected Amenity Criteria $L_{Aeq, Period} + 3$ $L_{Aeq,15mins}$	Project Noise Trigger Level $L_{Aeq,15mins}$
Daytime (0700 to 1800 hours)	50[1]	**55**	60	**63**	**55 Intrusive**
Evening (1800 to 2200 hours)	46[1]	**51**	50	**53**	**51 Intrusive**
Night time (2200 to 0700 hours)	34[1]	**39**	45	**43**	**39 Intrusive**

1. *Measured noise levels pertaining to the development were obtained from the unattended noise survey previously conducted by Acoustic Directions for the development at No. 77-79 Waldron Road (adjacent to the subject site).*

Based on the reported rated background levels, nighttime background levels are very low, and a consequence, balconies cannot be used during this period. The evening background noise level has been referenced in setting the appropriate noise criterion. Therefore the project noise trigger levels adopted for this assessment is:

$L_{Aeq, 15\ min} \leq$ 51 dB for surrounding residential premises (1800 to 2200 hours).

7.0 SOURCE SOUND POWER

7.1 RAIL TRAFFIC NOISE

The sound power levels for the traffic noise along T3 Bankstown Line were derived based on the measured $L_{Aeq,15hours}$ and $L_{Aeq,9hours}$ noise levels, and are presented in Table 3 below for both daytime and night-time period.

Table 3. Derived Sound Power Levels of Traffic [dB/m]

Noise Source	Noise Metric	Octave Band Frequency [Hz]									
		31.5	63	125	250	500	1k	2k	4k	8k	**Total**
T3 Bankstown Line	$L_{WAeq,\ 15\ hours\ (Day)}$	48	58	63	69	68	71	70	66	60	**76.2**
	$L_{WAeq,\ 9\ hours\ (Night)}$	44	54	59	65	65	67	66	63	56	**72.5**

1. *Measured noise levels used to derive the Wickham Street traffic level were obtained from the attended noise survey shown in Section 5.1 of this report.*

7.2 OPERATIONAL NOISE

The following noise sources were considered in this assessment:

- 45 x people talking with a raised vocal effort (located on the respective balcony area).

All the sound sources have been quantified by previous measurements taken by Koikas Acoustics for other similar projects. A summary of these sound power levels are provided in Table 4 below.

Table 4: Sound Power Levels

Noise Source Description	Noise Metric	Sound Power Levels [dB]									
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*Total*
Raised Speech (per person)	L_{Aweq}	-	44	53	61	71	71	66	61	50	**75**

8.0 COMPUTER MODELLING OF NOISE SOURCES

8.1 CADNA/A NOISE MODEL

Noise level predictions were calculated using CADNA/A, a software package developed by DataKustik. Cadna (A) incorporates a computer aided drafting (CAD) program which utilises the height of the ground, the position of buildings and other structures to run through a set of algorithms that calculate at user defined grid points and user input receiver locations the overall sound pressure level and frequency dependant noise level spectrum. It then interpolates the calculated noise levels at each of the grid points to produce noise level contours. The noise level calculations take into account the propagation of sound from a sound source as a function of its distance, the shielding effects of barriers and buildings, the attenuation and reflection off the ground and buildings. Receiver locations were assigned in the computer model at representative positions to ascertain the predicted noise level at these locations resulting from the relevant noise sources in each scenario. The calculated noise levels at these locations were then compared against the nominated noise criteria to demonstrate whether the proposed development complies with the required noise goals.

Noise level contours were produced where necessary to illustrate the propagation of sound from the noise sources to the most noise affected residential receivers and are attached in **Appendix B**.

8.2 CALCULATED NOISE LEVEL CONTOUR RESULTS

SCENARIO 1 Traffic Noise Impact

Indoor Noise Criterion

Bedroom $L_{Aeq,\ 9hrs}$ ≤ 35 dB

Other $L_{Aeq,\ 15hrs}$ ≤ 40 dB

Maximum $L_{Aeq,\ Period}$ traffic noise levels to the subject premise were calculated to be:

61 dB for the daytime and

57 dB for the night-time,

A maximum noise reduction required to meet the indoor design sound level is:

21 dB is required during the daytime and

22 dB during the night-time.

Noise levels to less exposed facades require a lesser noise reduction. These levels were calculated utilising the spectral noise survey results and the Cadna/A noise model at different positions along the periphery of the building. Additional calculations were then undertaken to calculate the resultant indoor intrusion noise levels in octave bands as required by AS3671-1987 Traffic noise intrusion building siting and construction.

Scenario 2 Operational Noise Impact

Indoor Noise Criterion

$L_{Aeq, 15mins}$ 51 dB to surrounding neighbouring premises (1800 to 2200 hours)

The following noise sources were considered in this assessment:

- 45 x people talking with a raised vocal effort (located on the respective balcony area).

Noise levels resulting from the operation of the boarding house were determined to the surrounding residential properties. The calculated external noise levels at most noise-exposed residential receiver location of the residential premises are presented below in Table 5.

Table 5. Operational Noise Levels at the Surrounding Premises [dB]

Receivers		Calculated External Noise Levels $L_{Aeq,15min}$	Project Noise Trigger Level $L_{Aeq,15min}$	Exceeding
Scenario 2 Evening (1800-2200)	R1	41	51	-
	R2	51		-
	R3	51		-
	R4	51		-
	R5	41		-

Refer to **Appendix B** for all receiver locations.

The noise impact from the boarding house (balcony areas) was found to comply during the daytime and evening periods without any noise mitigation measures or restrictions.

A Management Plan (Dated: February 2018) for the boarding house has been created outlining the guidelines and restrictions. The following section relating to night-time rules has been extracted from the Management Plan.

Noise in the common areas and within the rooms must be kept to a minimum after 11pm. Occupants creating excessive noise after this time may be required by management to vacate the premises.

The common outdoor open space area shall be closed between 11.00pm and 6.00am except with the approval of management and for the purposes of gaining access to/from the rooms.

Also, the common room doors and windows will at all times be closed between 11.00pm and 6.00am except with the approval of management.

Compliance will also be achieved during the night-time period provided the night-time rules outlined in the Management Plan (Dated: February 2018) are extended from 10 pm to 7 pm on Monday to Saturday and 10 pm to 8 am on Sundays and Public holidays as per the EPA's assessment periods.

9.0 RECOMMENDATIONS

9.1 SELECTION OF BUILDING MATERIALS

The noise attenuation required of each building component to achieve the required rail traffic noise reduction was calculated for the proposed residential development.

It is noted, that alternative building materials for the external walls, ceiling/roof, window and door systems can be used provided they can achieve the same or better low-frequency transmission loss levels as shown in our calculations attached in ***Appendix C****.*

9.1.1 Ceiling / Roof System

Table 6 provides recommendations for the construction of the new ceiling/roof.

Table 6. Ceiling / Roof Construction Requirements	
Construction	**Applicable Area**
Light Weight Roof System: • 0.42 mm metal deck roof followed by; • minimum 150 mm cavity with a layer of 75 mm thick 11 kg/m^3 insulation batts fitted tightly between the ceiling joists, and • two layer of 13 mm thick plasterboard screw fixed to the underside of the ceiling joists.	All roof areas.

9.1.2 External Walls

External walls recommended as shown in Table 7.

Table 7. Wall Construction Requirements	
Construction	**Applicable Area**
The proposed double brick wall system with: • A layer of 110 mm brick on each side (no brick ties between two leaves); • 50 mm wall cavity with R2 insulation batts in cavity, and • 13 mm cement render on one side. Alternatively a 150mm thick concrete wall will be satisfactory.	All external walls

9.1.3 WINDOWS/GLAZED DOORS

Table 8 provides minimum recommendations for the glazed window and door systems. Representative detail calculations are provided in **Appendix C**.

Table 8. Glazing recommendation		
Room	**Glazing Recommendation (See Notes)**	**Typical Rw / STC**
All windows and doors	6.38 mm laminated	33
Disclaimer	**Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing that is predicted to achieve satisfactory acoustic performance. No consideration has been given to other factors such as safety, thermal or energy efficiency that may render the recommended glazing as non-compliant with other standards or guidelines. It is therefore, the responsibility of the client to ensure all glazed windows and sliding doors installed on-site meet all building design requirements.**	
Notes	1. All glazing systems should be built into a solid frame. 2. Window frames should be tightly fitted to the external wall minimising any air gaps. Where large air gaps (typically >20mm) are present, timber packing material and an appropriate acrylic sealant such as Knauf Bindex (or approved equivalent) should be used. For smaller air gaps <10mm an appropriate acrylic type sealant such as Knauf Bindex (or approved equivalent) should be used. 3. All open-able windows and glazed door systems should be air tight when closed. 4. Q-lon type seals or the equivalent must be fitted along the perimeter of all glazing systems to minimise air gaps. If the windows/doors are not designed to be air-tight when closed, the total noise attenuation performance of the walls and ceiling-roof system will be reduced. 5. Recommended glass systems above have been calculated based on current architectural drawings as established within this report. 6. Typical Rw / STC values have been included for reference only. Under no circumstances should windows or glass doors be ordered off the included Rw / STC value. Our calculations and recommendations for glass systems are based on a more detailed 1/1 octave band analysis of noise transmission.	

Where alternate glass types / thicknesses are proposed to those recommended by Koikas Acoustics within the above Table 8, these may be used in the building provided that the glass provider/manufacturer can demonstrate the installed system can achieve or exceed the following Sound Transmission Loss (STL) values shown in Table 9, corresponding to the glazed systems in Table 8.

Table 9. Typical Sound Transmission Loss (STL) Of Recommended Glass Systems								
		1/1 octave STL [dB]						
System description	**Frequency [Hz]**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
6.38mm laminated		17	25	27	31	34	31	36	39

9.2 MECHANICAL VENTILATION

People occupying habitable spaces that are affected by road noise intrusion may require that they keep windows/doors closed in order to achieve the indoor design sound levels recommended. Therefore, in order to meet the Codes and recommendations of relevant Australian Standards it will be necessary to provide additional ventilation to these particular spaces. Additional ventilation is to be compliant with relevant provisions of the BCA.

The following is considered regarding mechanical or natural ventilation:

- When windows and doors open, a 10 dB noise reduction is generally through the façade.
- In accordance with Section 3.6.1 of the *NSW Government Department of Planning*, document titled – *Development Near Rail Corridors and Busy Roads – Interim Guidelines,* ***if internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.***

Based on the above, mechanical ventilation would be warranted if the external noise level is more than 20 dB above the indoor design noise level. Based on the calculated external rail noise levels illustrated in **Appendix B** and the noise intrusion calculations in **Appendix C**, all habitable spaces of Rooms 209, 210, 211, 212, 213, 214, 215, 309, 310, 311, 312, 313, 314 and 315 will require mechanical ventilation.

It is noted, indoor road noise contributions via the mechanical ventilation plant should be at least 10 dB lower than the recommended indoor sound level of traffic noise intrusion. This will ensure that the combined road noise intrusion and mechanical plant noise does not exceed the indoor noise criterion.

There are two (2) options that are acoustically viable to satisfy the additional ventilation requirement:

OPTION 1: Mechanical ventilation

A small air supply fan unit with a minimum 4 metres length of acoustically lined to the inner side of the duct with 50 mm thick insulation. See details attached in **Appendix D**.

OPTION 2: Fresh air supply to air conditioning

Connecting a fresh air supply to the air handling unit of the nominated air conditioning system. May not be applicable for all types of air conditioning systems. Please contact AC supplier to verify.

Consultation with a mechanical services consultant is recommended to ensure that any adopted air supply approach is compliant with BCA and applicable Australian design standards. Alternative designs could be considered provided that noise intrusion is minimised and the internal noise levels do not exceed the nominated sound criteria levels.

10.0 SUMMARY AND CONCLUSION

Koikas Acoustics Pty Ltd was requested by Eminent Constructions to conduct a rail noise and vibration assessment for the proposed residential boarding house studios at No. 73-75 Waldron Road, Chester Hill. The acoustic assessment includes the following:

Rail Traffic Noise and Vibration Assessment

- An attended noise and vibration surveys were conducted by Koikas Acoustics. The survey results were used to determine the noise impact to the proposed residential dwellings of the subject development.

- The measured resultant rail traffic noise and vibration results was used to calculate the type and extent of building materials required to achieve satisfactory indoor noise attenuation through the external building envelope and achieve the required indoor noise criteria levels.

- Rail traffic noise has been assessed to clause 87 of the ***State Environmental Planning Policy (Infrastructure) 2007*** and relevant Australian standards.

- A rail vibration survey was also conducted to determine the vibration impact to the proposed development. Vibration levels were found to comply with vibration dose criteria.

- Mechanical ventilation system is only required to the habitable spaces of Rooms 209, 210, 211, 212, 213, 214, 215, 309, 310, 311, 312, 313, 314 and 315. Refer to **Section 9.2**, **Appendix C** and **Appendix D** for details.

Boarding House Noise Impact Assessment

- Unattended noise survey results were obtained from the previous acoustic report undertaken by Acoustic Directions for the development at No. 77-79 Waldron Road (adjacent to subject site).

- The noise impact from the boarding house (balcony areas) was found to comply during the daytime and evening periods without any noise mitigation measures or restrictions.

- Compliance will also be achieved during the night-time period provided the night-time rules outlined in the Management Plan (Dated: February 2018) are extended from 10 pm to 7 pm on Monday to Saturday and 10 pm to 8 am on Sundays and Public holidays as per the EPA's assessment periods.

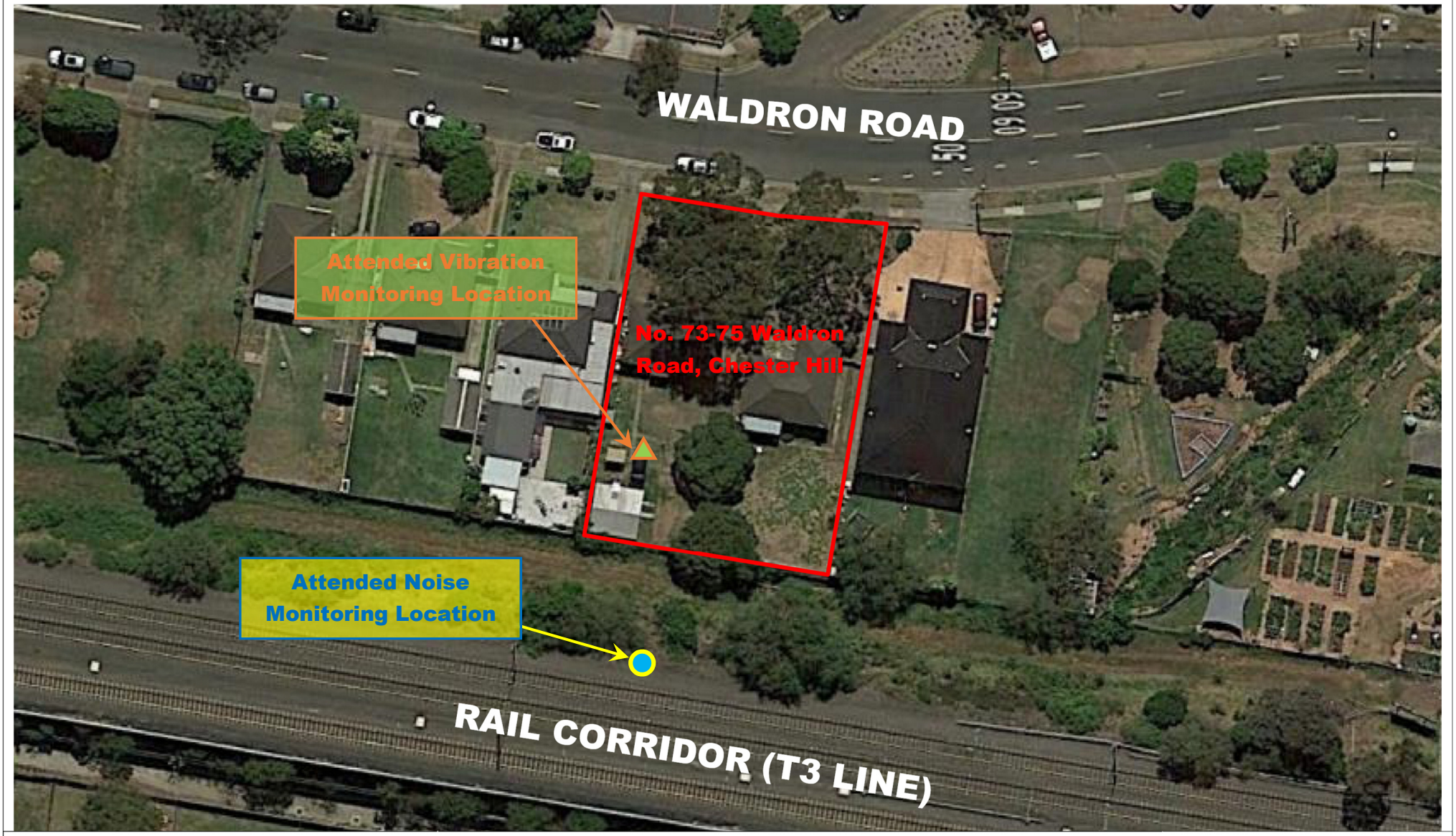
Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing (provided in **Appendix C**) that will achieve the desired acoustic performance indoors. No consideration has been given to other factors such as safety, thermal or energy efficiency that may render the recommended glazing as non-compliant. It is the responsibility of the client to ensure all glazed windows and bi-fold doors installed on-site meet all building design requirements.

Based on the acoustic recommendations provided in this report are implemented in the building design, and construction, Koikas Acoustics certifies that the proposed residential boarding room studios at No. 73-75 Waldron Road, Chester Hill will satisfy the nominated rail traffic noise and rail vibration criteria. Koikas Acoustics supports this development.

APPENDIX A

APPENDIX A

APPENDIX A



AERIAL VIEW

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill

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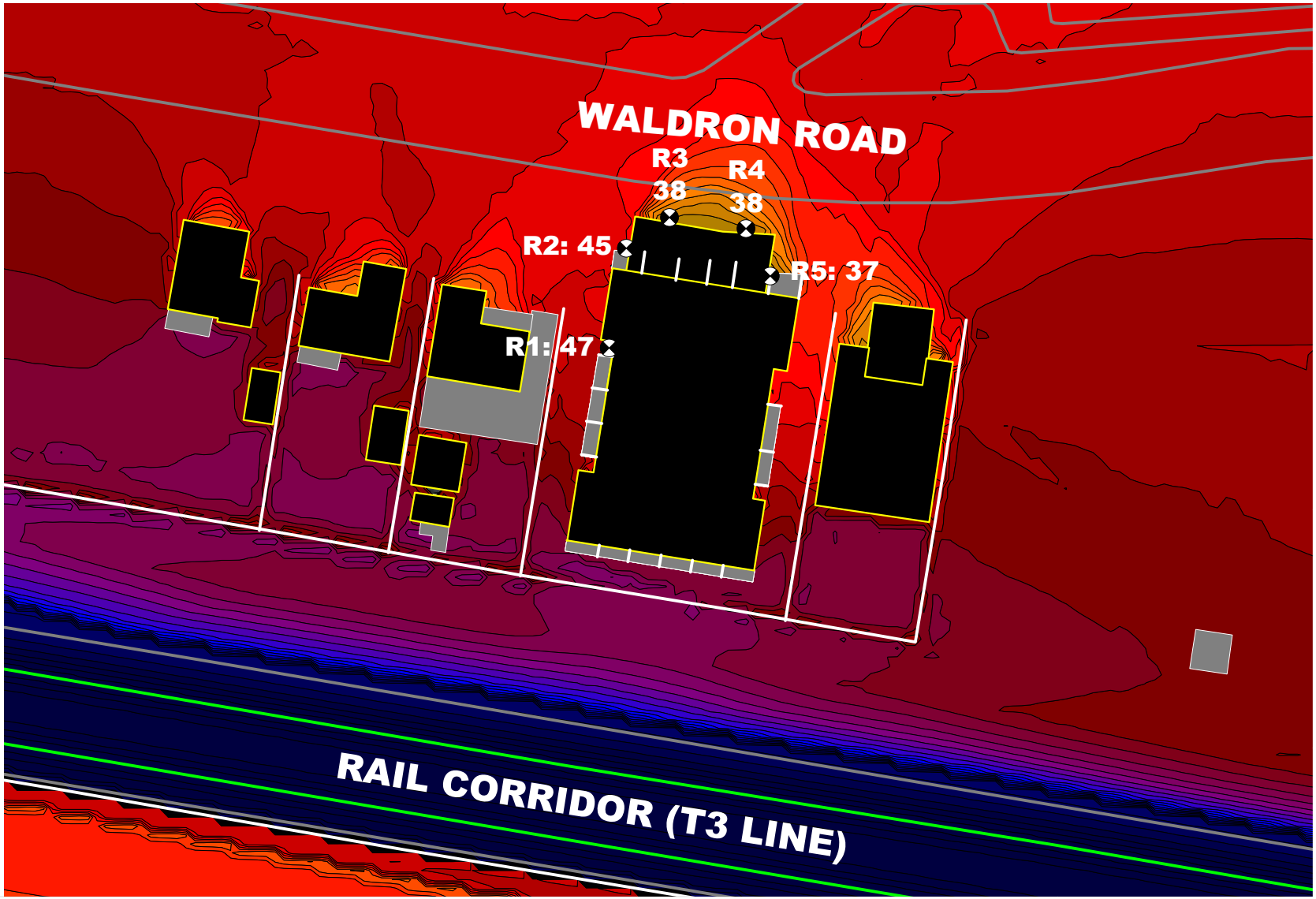
APPENDIX B

APPENDIX B

APPENDIX B



Scenario 1
(Ground Floor)
**** NOISE SOURCES ****

~ Rail Traffic Noise from Railway Corridor (T3 Line)

Note:

- LAeq,daytime noise level contours shown and receiver points are at a height of 1.5 m above the ground.

- Night-time noise levels are approximately 3 dB lower.

- The maximum reading at the subject building is 47 dB.

PRINT DATE: 07/12/17

Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 0.0 dB
> 10.0 dB
> 20.0 dB
> 30.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB

KOIKAS ACOUSTICS PTY LTD
CONSULTANTS IN NOISE & VIBRATION
A.B.N 12 058 524 771 Commercial 1 (Unit 27), 637 - 645 Forest Road, Bexley 2207
E- mail Nick@KoikasAcoustics.com F (02) 9587 5337 P (02) 9587 9702

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill
ASSESSED TO: State Environmental Planing Policy
LIMITING CRITERIA: 35 dB(A) - Bedroom (2200-0700)
40 dB(A) - Other (0700-2200)

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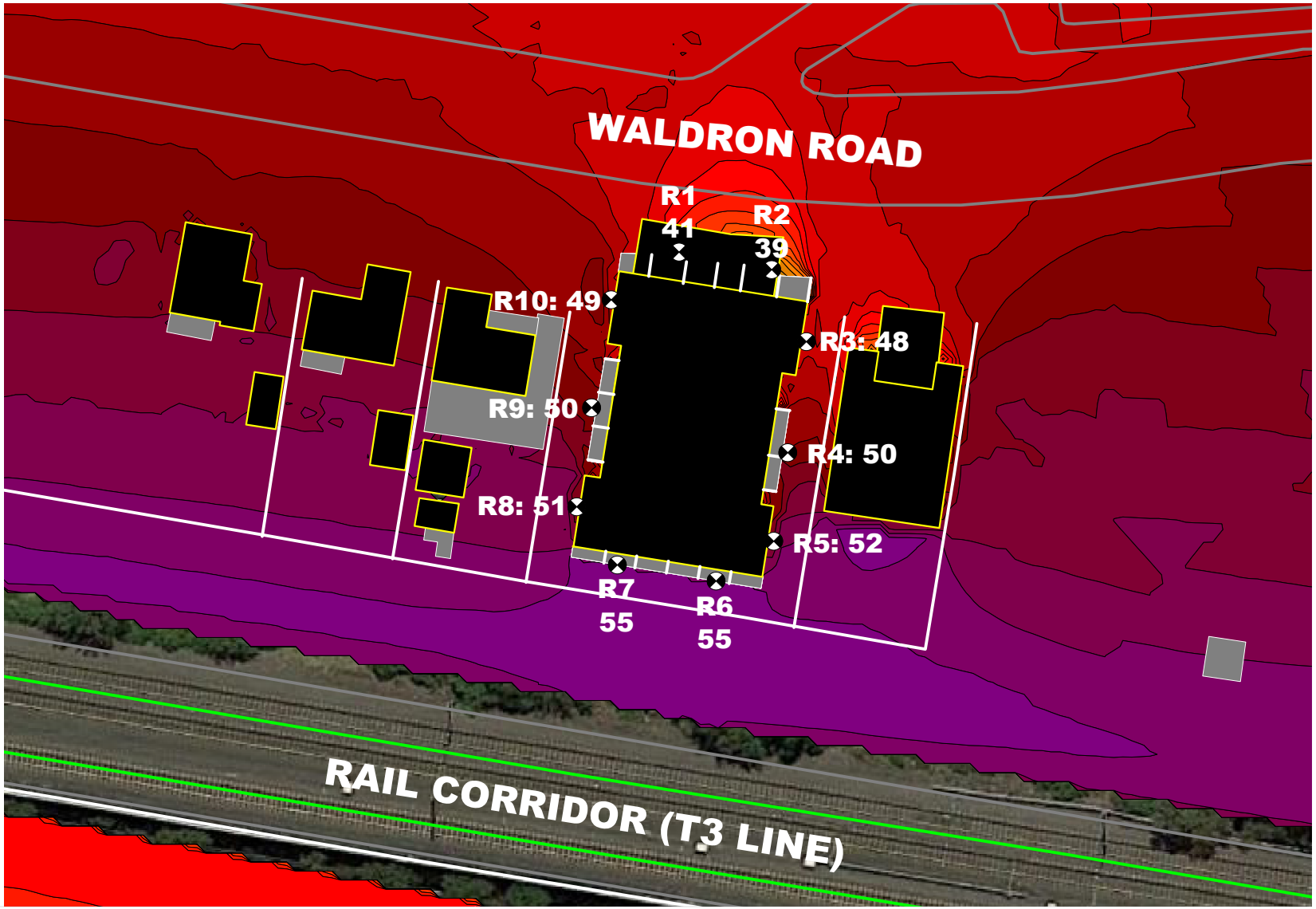

Scenario 1
(First Floor)
**** NOISE SOURCES ****

~ Rail Traffic Noise from Railway Corridor (T3 Line)

Note:

- LAeq,daytime noise level contours shown and receiver points are at a height of 1.5 m above the first floor.

- Night-time noise levels are approximately 3 dB lower.

- The maximum reading at the subject building is 55 dB.

PRINT DATE: 07/12/17

Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 0.0 dB
> 10.0 dB
> 20.0 dB
> 30.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB

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E- mail Nick@KoikasAcoustics.com F (02) 9587 5337 P (02) 9587 9702

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill
ASSESSED TO: State Environmental Planing Policy
LIMITING CRITERIA: 35 dB(A) - Bedroom (2200-0700)
40 dB(A) - Other (0700-2200)

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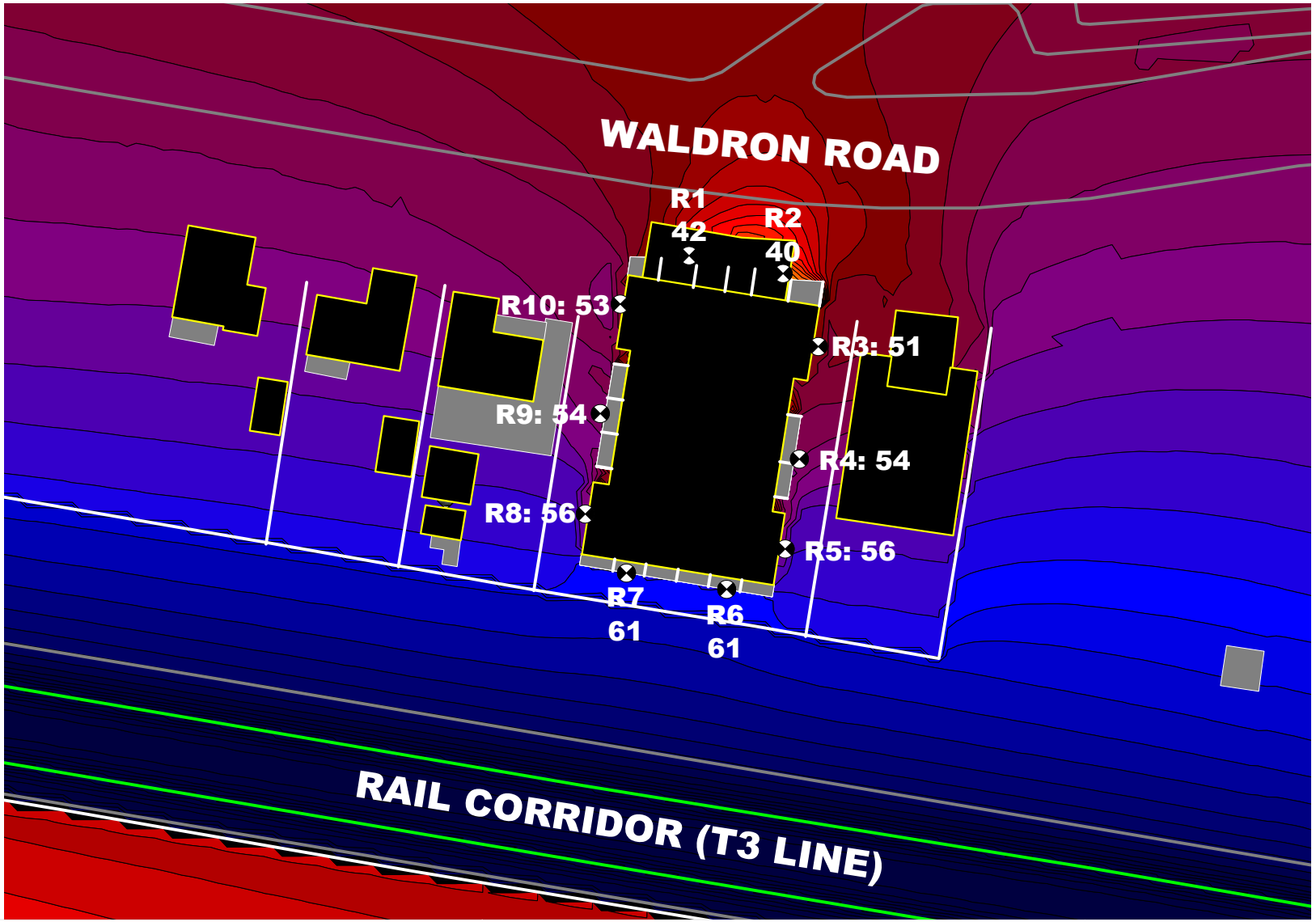

Scenario 1
(Second Floor)
**** NOISE SOURCES ****

~ Rail Traffic Noise from Railway Corridor (T3 Line)

Note:

- LAeq,daytime noise level contours shown and receiver points are at a height of 1.5 m above the second floor.

- Night-time noise levels are approximately 3 dB lower.

- The maximum reading at the subject building is 61 dB.

PRINT DATE: 07/12/17

Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 0.0 dB
> 10.0 dB
> 20.0 dB
> 30.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB

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A.B.N 12 058 524 771 Commercial 1 (Unit 27), 637 - 645 Forest Road, Bexley 2207
E- mail Nick@KoikasAcoustics.com F (02) 9587 5337 P (02) 9587 9702

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill
ASSESSED TO: State Environmental Planing Policy
LIMITING CRITERIA: 35 dB(A) - Bedroom (2200-0700)
40 dB(A) - Other (0700-2200)

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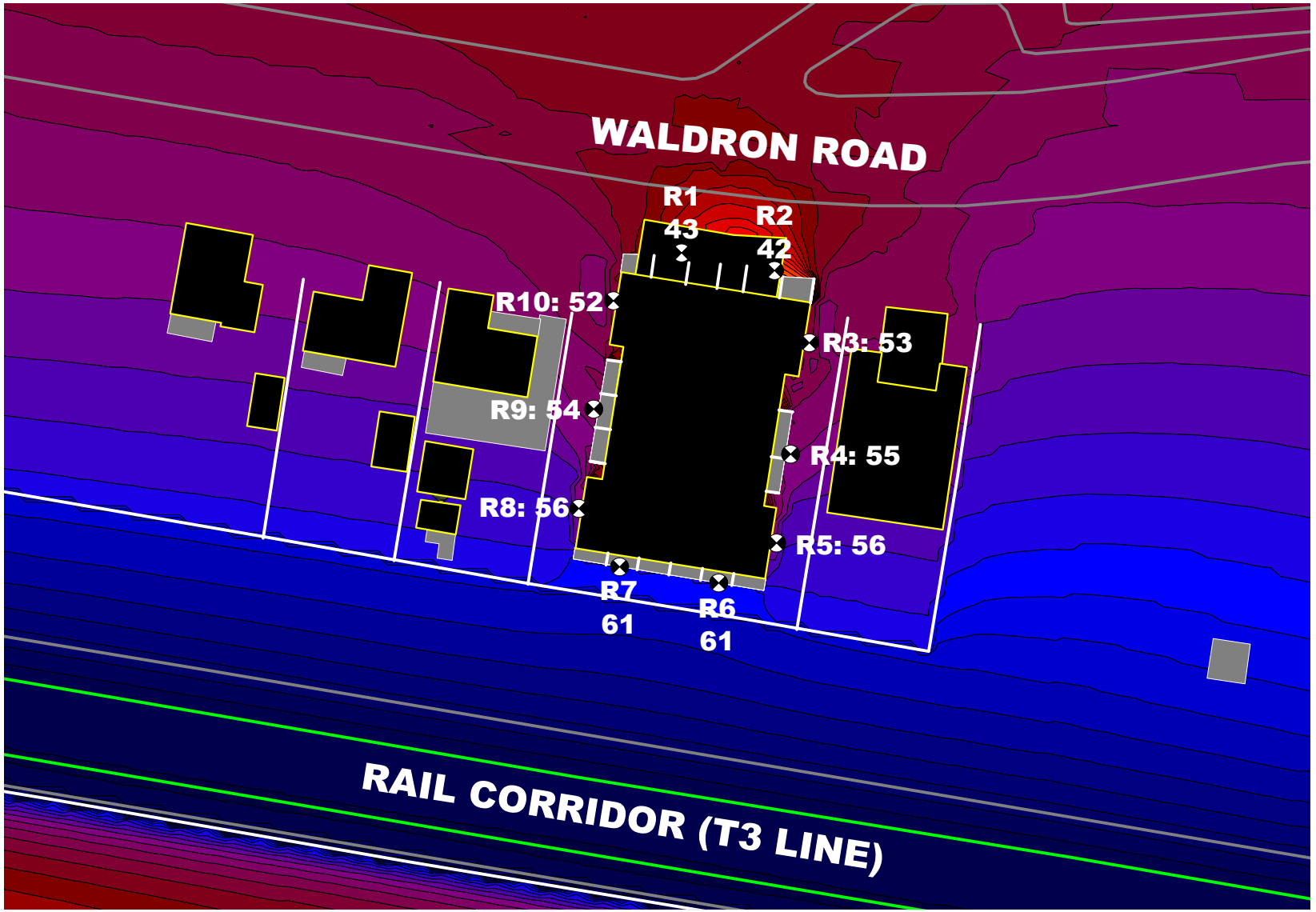

Scenario 1
(Third Floor)
**** NOISE SOURCES ****

~ Rail Traffic Noise from Railway Corridor (T3 Line)

Note:

- LAeq,daytime noise level contours shown and receiver points are at a height of 1.5 m above the third floor.

- Night-time noise levels are approximately 3 dB lower.

- The maximum reading at the subject building is 61 dB.

PRINT DATE: 07/12/17

Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 0.0 dB
> 10.0 dB
> 20.0 dB
> 30.0 dB
> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB

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CONSULTANTS IN NOISE & VIBRATION
A.B.N 12 058 524 771 Commercial 1 (Unit 27), 637 - 645 Forest Road, Bexley 2207
E- mail Nick@KoikasAcoustics.com F (02) 9587 5337 P (02) 9587 9702

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill
ASSESSED TO: State Environmental Planing Policy
LIMITING CRITERIA: 35 dB(A) - Bedroom (2200-0700)
40 dB(A) - Other (0700-2200)

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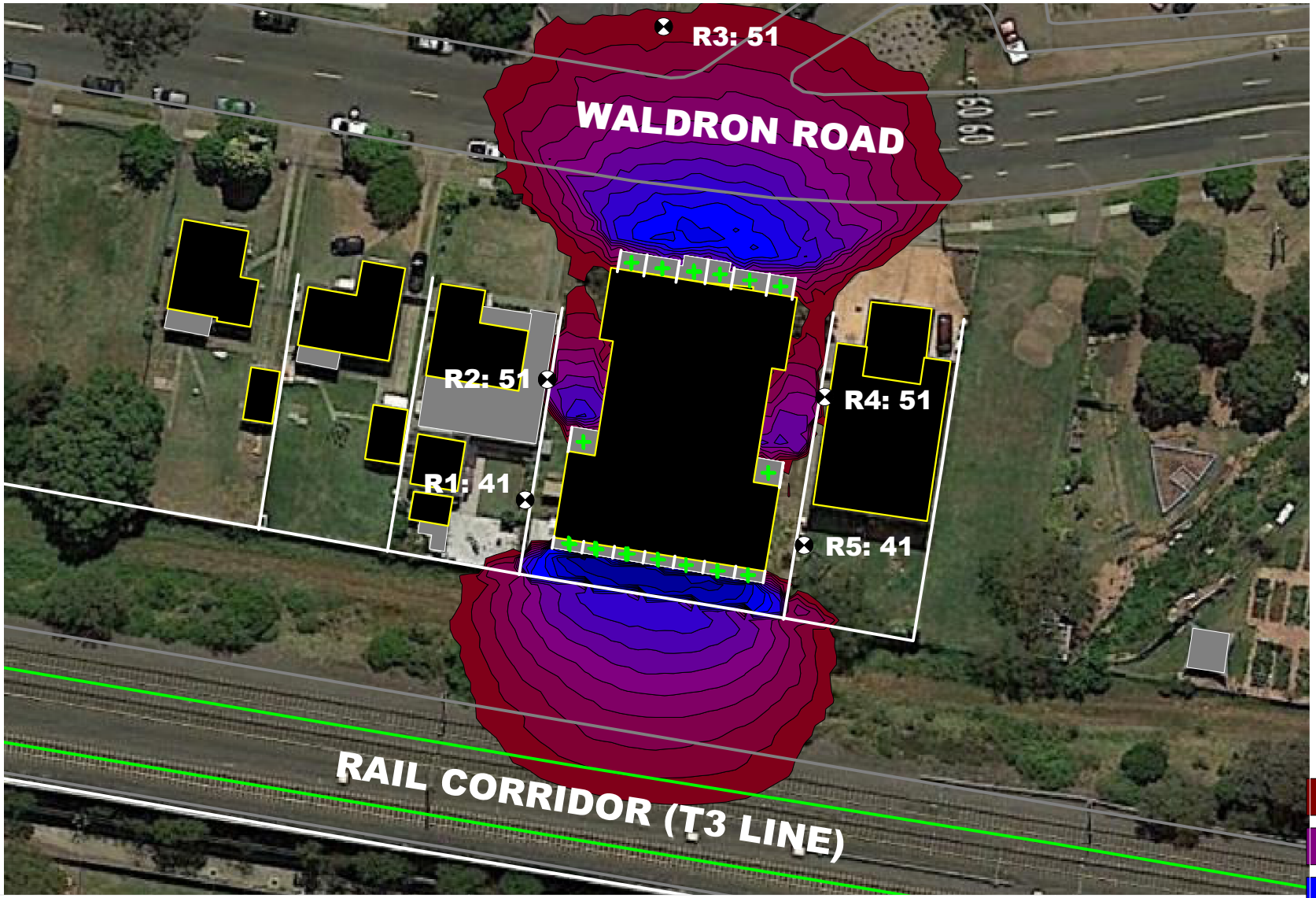

Scenario 2
**** NOISE SOURCES ****

~ 45 x people talking with raised vocal efforts

Note:

- LAeq,15mins noise level contours shown and receiver points are at a height of 1.5 m above the ground.

- Noise level contours end at the limiting criteria of 51 dB.

- The maximum reading to the neighbouring premises is 51 dB.

PRINT DATE: 22/08/18

- Point Source
- Line Source
- Building
- Barrier
- 3D-Reflector
- Contour Line
- Receiver
- Calculation Area

> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB

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A.B.N 12 058 524 771 Commercial 1 (Unit 27), 637 - 645 Forest Road, Bexley 2207
E- mail Nick@KoikasAcoustics.com F (02) 9587 5337 P (02) 9587 9702

JOB NUMBER: 3281
CLIENT: Eminent Constructions Pty Ltd C/- Denis Antipas
SITE ADDRESS: No. 73-75 Waldron Road, Chester Hill
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 51 dB(A) - Residential (1800-2200)

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APPENDIX C

APPENDIX C

APPENDIX C

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3281*
Client *Eminent Constructions Pty Ltd C/- Denis Antipas*
Site *No. 73-75 Waldron Road, Chester Hill*
Room *Room 214*

ROOM DATA
Height= 2.5 m Depth= 3.35 m
Width= 6.5 m VOL= 54.4 m3

	LAeq,9hrs (Night-time)	63	125	250	500	1k	2k	4k	8k	Area
	Bedroom, tile floor, furnished (RT60, sec)	*0.3*	*0.3*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.46*
	EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB] - West (R8)	34	39	44	45	46	45	41	30	52
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	12.5
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	1.2
STL 3										
STL 4										
	Noise through Component 1	1	2	2	0	-2	-4	-4	-20	8
	Noise through Component 2	9	7	12	9	7	8	-1	-15	17
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 1	**10**	**9**	**13**	**10**	**8**	**10**	**5**	**3**	**18**
	EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB] - South (R7)	41	46	51	52	54	53	50	39	60
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	3.8
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	4.6
STL 3										
STL 4										
	Noise through Component 1	3	3	4	1	1	-2	-1	-16	10
	Noise through Component 2	22	20	25	22	20	22	14	0	30
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 2	**22**	**20**	**25**	**22**	**20**	**22**	**15**	**5**	**30**
	EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

	Noise Transmission Through Each Façade LAeq,Period [dB]								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	10	9	13	10	8	10	5	3	18
Façade 2	22	20	25	22	20	22	15	5	30
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**22**	**20**	**25**	**22**	**21**	**23**	**15**	**9**	**31**

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3281*
Client *Eminent Constructions Pty Ltd C/- Denis Antipas*
Site *No. 73-75 Waldron Road, Chester Hill*
Room *Room 109*

ROOM DATA
Height= 2.5 m Depth= 3.35 m
Width= 6.5 m VOL= 54.4 m3

	LAeq,9hrs (Night-time)	63	125	250	500	1k	2k	4k	8k	Area
	Bedroom, tile floor, furnished (RT60, sec)	*0.3*	*0.3*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.46*
	EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB] - East (R5)	31	36	41	41	43	41	37	26	48
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	12.5
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	1.2
STL 3										
STL 4										
	Noise through Component 1	-2	-1	-1	-4	-5	-8	-8	-24	5
	Noise through Component 2	6	4	9	5	4	4	-5	-19	14
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 1	**8**	**7**	**10**	**7**	**7**	**7**	**4**	**3**	**14**
	EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB] - South (R6)	36	41	47	47	49	48	44	33	55
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	3.8
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	4.6
STL 3										
STL 4										
	Noise through Component 1	-2	-2	0	-4	-4	-7	-7	-22	6
	Noise through Component 2	17	15	21	17	15	17	8	-6	25
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 2	**17**	**15**	**21**	**17**	**16**	**17**	**9**	**4**	**25**
	EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY OF RESULTS

	Noise Transmission Through Each Façade LAeq,Period [dB]								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	8	7	10	7	7	7	4	3	14
Façade 2	17	15	21	17	16	17	9	4	25
Façade 3	0	0	0	0	0	0	0	0	0
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**18**	**16**	**22**	**18**	**16**	**18**	**11**	**8**	**26**

TRAFFIC NOISE INTRUSION CALCULATIONS

Job *3281*
Client *Eminent Constructions Pty Ltd C/- Denis Antipas*
Site *No. 73-75 Waldron Road, Chester Hill*
Room *Room 324*

ROOM DATA
Height= 2.5 m Depth= 3.35 m
Width= 6.5 m VOL= 54.4 m3

	LAeq,9hrs (Night-time)	63	125	250	500	1k	2k	4k	8k	Area
	Bedroom, tile floor, furnished (RT60, sec)	*0.3*	*0.3*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.46*
	EXTERNAL FAÇADE 1 - NOISE LEVEL, LAeq, Period [dB] - West (R8)	31	36	41	41	43	41	37	26	48
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	12.5
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	1.2
STL 3										
STL 4										
	Noise through Component 1	-2	-1	-1	-4	-5	-8	-8	-24	5
	Noise through Component 2	6	4	9	5	4	4	-5	-19	14
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 1	**8**	**7**	**10**	**7**	**7**	**7**	**4**	**3**	**14**
	EXTERNAL FAÇADE 2 - NOISE LEVEL, LAeq, Period [dB] - South (R7)	36	41	47	47	49	48	44	33	55
STL 1	*Double Brick + Render on inside wall*	*35*	*40*	*47*	*50*	*53*	*54*	*50*	*54*	3.8
STL 2	*6.38mm laminated*	*17*	*25*	*27*	*31*	*34*	*31*	*36*	*39*	4.6
STL 3										
STL 4										
	Noise through Component 1	-2	-2	0	-4	-4	-7	-7	-22	6
	Noise through Component 2	17	15	21	17	15	17	8	-6	25
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 2	**17**	**15**	**21**	**17**	**16**	**17**	**9**	**4**	**25**
	EXTERNAL FAÇADE 3 - NOISE LEVEL, LAeq, Period [dB] - Roof	37	42	48	48	52	51	46	36	57
STL 1	*0.42 custom orb, 150 rafters, 75 mineral wool (11kg/m3), 2x13 plasterboard*	*16*	*19*	*35*	*49*	*57*	*58*	*49*	*53*	21.8
STL 2										
STL 3										
STL 4										
	Noise through Component 1	25	28	21	6	2	0	4	-10	30
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 3	**25**	**28**	**21**	**8**	**7**	**6**	**7**	**5**	**30**
	EXTERNAL FAÇADE 4 - NOISE LEVEL, LAeq, Period [dB]									0
STL 1										
STL 2										
STL 3										
STL 4										
	Noise through Component 1	0	0	0	0	0	0	0	0	0
	Noise through Component 2	0	0	0	0	0	0	0	0	0
	Noise through Component 3	0	0	0	0	0	0	0	0	0
	Noise through Component 4	0	0	0	0	0	0	0	0	0
	NOISE THROUGH FAÇADE 4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

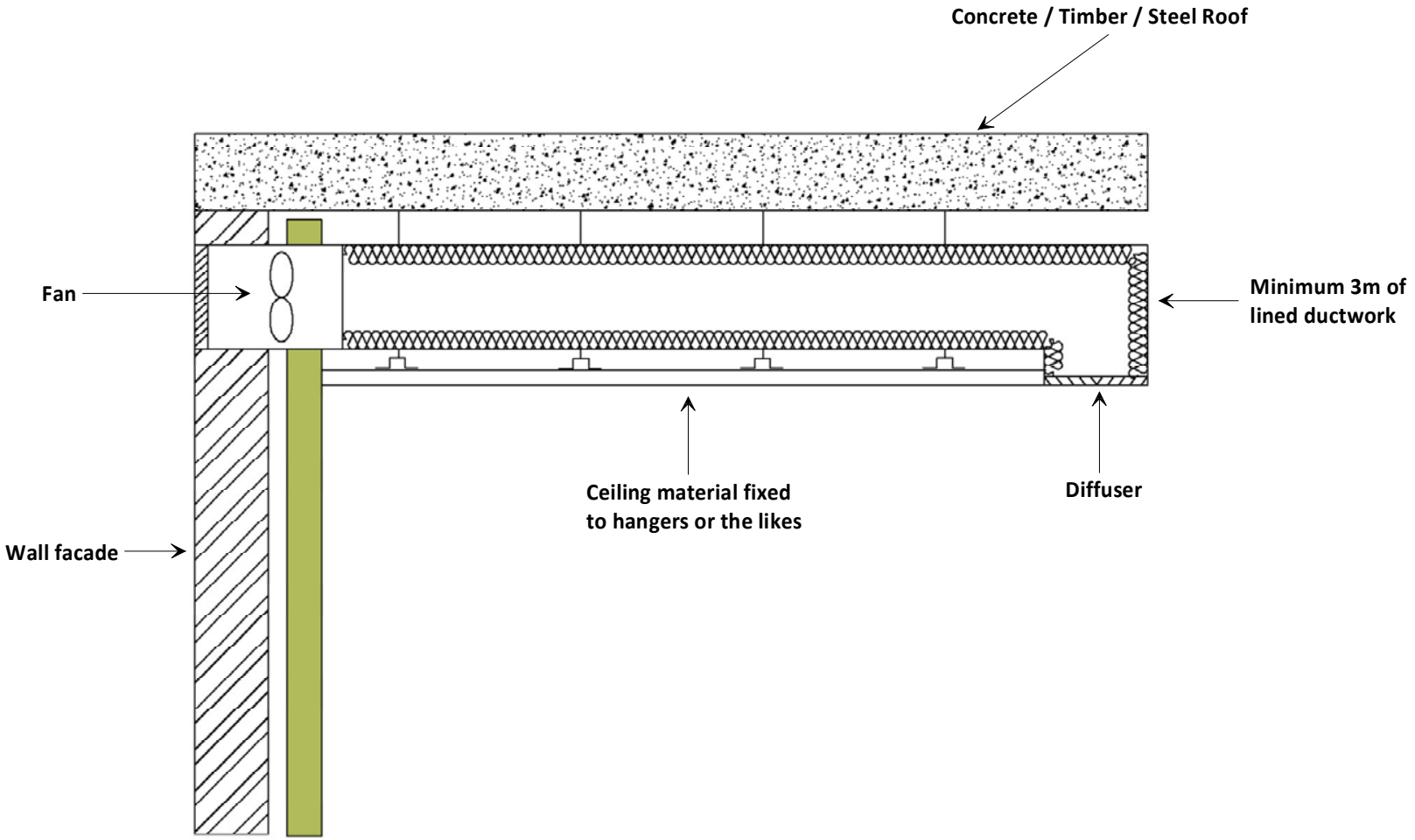
SUMMARY OF RESULTS

	Noise Transmission Through Each Façade LAeq,Period [dB]								
Frequency	63	125	250	500	1k	2k	4k	8k	Tot
Façade 1	8	7	10	7	7	7	4	3	14
Façade 2	17	15	21	17	16	17	9	4	25
Façade 3	25	28	21	8	7	6	7	5	30
Façade 4	0	0	0	0	0	0	0	0	0
CALCULATED INDOOR TRAFFIC NOISE LEVEL, LAeq, Period [dB]	**26**	**28**	**24**	**18**	**17**	**18**	**13**	**9**	**32**

APPENDIX D

APPENDIX D

APPENDIX D



KOIKAS ACOUSTICS PTY LTD
CONSULTANTS IN NOISE & VIBRATION
ABN 12 058 524 771
Commercial 1 (Unit 27)
637 - 645 Forest Road
BEXLEY NSW 2207
Ph: (02) 9587 9702
Fax: (02) 9587 5337
E-mail: Office@KoikasAcoustics.com

Project	Drawn by	Checked	File
ACOUSTIC DESIGN DETAIL	AS	N/A	Mech Vent Detail Wall.srf
Title	**Drawing Number**	**Revision**	**Scale**
Mechanical Ventilation Wall penetration	1 of 1	V1	NOT TO SCALE
			Date 19th April 2011

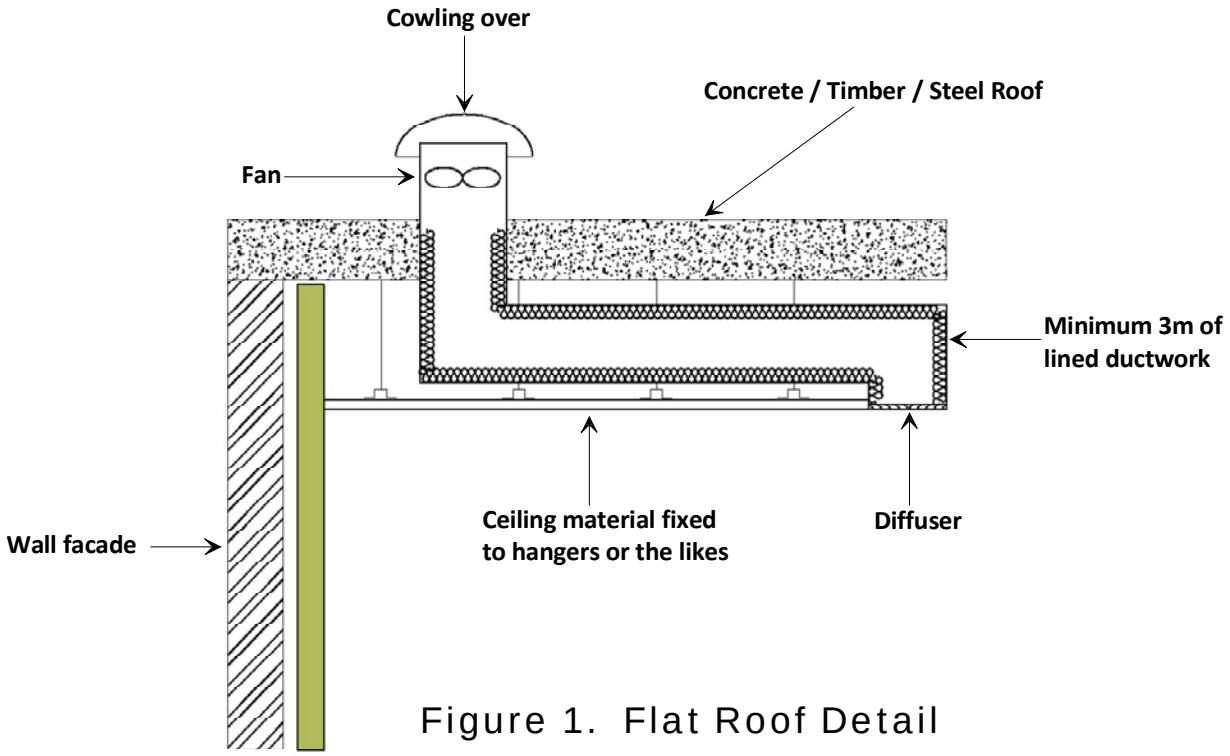


Figure 1. Flat Roof Detail

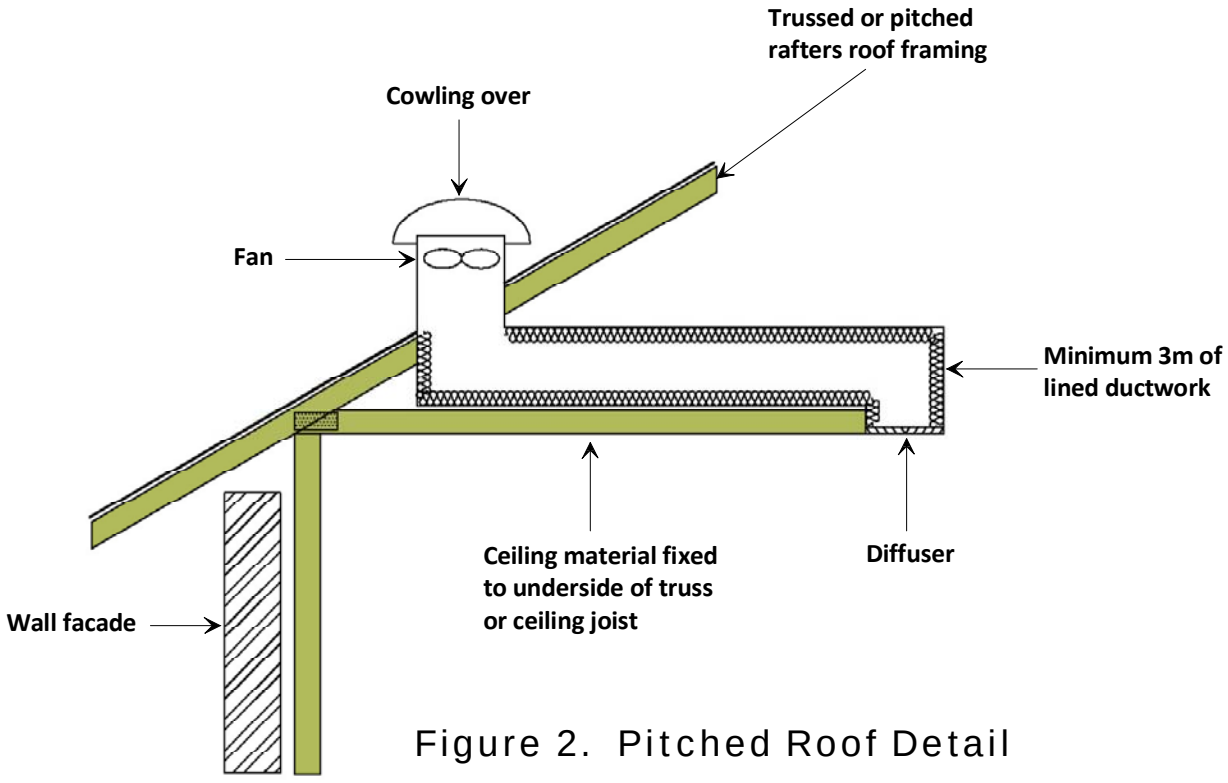


Figure 2. Pitched Roof Detail

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BEXLEY NSW 2207
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Ph: (02) 9587 9702
Fax: (02) 9587 5337
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MECHANICAL VENTILATION DETAILS

Figure 1. Flat Roof
Figure 2. Pitched Roof