ACOUSTIC REPORT

FOR

121 FITZGERALD STREET WEST PERTH

5 December 2023

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EXECUTIVE SUMMARY

A hostel is proposed to operate at 121 Fitzgerald Street West Perth. Graham Farmer Fwy and Fitzgerald Street are the major/significant traffic routes and located within the trigger distances to the subject site. Acoustic Engineering Solutions (AES) has been commissioned by Fitzgerald House Pty Ltd to undertake:

- Traffic noise assessment in accordance with the State Planning Policy 5.4 - Road and Rail Noise (the SPP5.4); and
- Noise impact assessment in accordance with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

An acoustic model is developed using SoundPlan v8.0. For road traffic noise, the *Calculation of Road Traffic Noise* algorithm is selected. For the noise emissions from proposed hostel, the ISO 9613 prediction algorithm is selected. The acoustic model is used to predict:

- Onsite traffic noise levels from Fitzgerald Street and Graham Farmer Fwy; and
- Noise emissions from the proposed hostel operations.

TRAFFIC NOISE ASSESSMENT

Attended traffic noise monitoring was undertaken onsite during the peak hour (between 4:30pm and 5:30pm) of Fitzgerald Street on Wednesday 29th November 2023. The acoustic model is calibrated using the noise monitoring results.

Day-time noise levels $L_{Aeq(Day)}$ are predicted and then adjusted according to the SPP5.4 Guidelines. For the future road traffic conditions, the highest adjusted day-time noise level $L_{Aeq(Day)}$ falls into exposure category:

- C for both the ground and upper floors.

To comply with the requirements of SPP5.4 and achieve reasonable indoor amenity, the following measures are recommended:

- Implement the "Quiet House" package C for both the ground and upper floors.
- Incorporate "Notification on Title".

"Quiet House" package C is detailed in APPENDIX C and also in the SPP5.4 Guidelines.

ENVIRONMENTAL NOISE ASSESSMENT

Three worst-case operational scenarios of the proposed hostel are modelled:

Scenario 1 represents the worst-case operation of mechanical plant.
Scenario 2 represents the worst-case patron conversations.
Scenario 3 represents short events of car-door closing in a car-park area.

After preliminary modelling, Fitzgerald House Pty Ltd agrees to install a 1.8m colorbond fence along the front site boundary with R2. This short solid boundary fence is required to reduce noise propagation towards R2 from car-door closing and to achieve evening/night-time compliance with the Regulations for scenario 3.

Five closest residential and commercial premises are selected for the detailed assessments of noise emissions from the proposed hostel. Noise levels are predicted for the default "worst-case" meteorological conditions. The predicted worst-case noise levels are adjusted to account for their dominant characteristics according to the Regulations and then assessed against the criteria set by the Regulations. The compliance assessment concludes that full compliance is achieved for the proposed hostel.

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1.0 INTRODUCTION

A hostel is proposed to operate at 121 Fitzgerald Street West Perth. Graham Farmer Fwy and Fitzgerald Street are the major/significant traffic routes and located within the trigger distances to the subject site. Acoustic Engineering Solutions (AES) has been commissioned by Fitzgerald House Pty Ltd to assess:

- Road traffic noises in accordance with the State Planning Policy 5.4 - Road and Rail Noise (SPP5.4); and
- Noise emission from the proposed hostel in accordance with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

1.1 HOSTEL

Figure 1 in APPENDIX A presents an aerial view of the subject site and surrounding area including the attended noise monitoring location and selected noise-sensitive receivers.

Figure 2 in APPENDIX A presents the proposed hostel floor plans. The hostel building is a two-storey building of cavity brick walls and metal roofing with Anticon underneath. Suspended ceilings with 16mm ceiling tiles are present on both the ground and upper floors. Front doors will be aluminium framed glass panel while both back doors to be solid fire rated doors. All windows and doors will be replaced as per recommendations of section 8.0 based on the road traffic assessment. An addition will be built in the front as a reception.

Most bedrooms are located on the upper floor. TV lounge, laundry and kitchen/living/dining area are located on the ground floor. A courtyard is located in the front with 2.4m brick wall of "feature" breeze block section. The rear drying area has 2.4m colour bond fencing.

Toilets and showers are located on both the ground and upper floors. The toilet/shower vents of upper floor are located above the roof while the toilet/shower vents of ground floor are ducted to the rear wall. Kitchen rangehood outlet is located above the roof. Two Bonair evaporative and two split air-conditioning units will be installed.

The hostel is proposed to have a maximum capacity of 48 and to operate 24 hours a day and 7 days a week. The hostel does not provide meals to its customers. A weekly delivery is planned between 9am and 1pm on a weekday excluding public holidays. Minivans are used for the weekly delivery.

Car parking bays are available onsite: One drop off bay at the front and the manager bay at the rear. No solid site boundary fences are present except for the courtyard and rear drying area.

2.0 NOISE CRITERIA

2.1 STATE PLANNING POLICY 5.4

Noise management for land use and road/rail transport corridor planning in Western Australia is implemented through the WAPC State Planning Policy 5.4 "*Road and Rail Noise*" (SPP5.4). SPP5.4 sets out the noise targets, as shown in Table 2-1.

Table 2-1: Noise Targets

Proposals	New/Upgrade	Noise Targets in dB(A)		
		Outdoor		Indoor
		Day[1] $L_{Aeq(Day)}$	Night[2] $L_{Aeq(Night)}$	L_{Aeq}
Noise-sensitive Land-use and/or Development	New noise-sensitive land-use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	$L_{Aeq(Day)}$ = 40 (living and work areas) $L_{Aeq(Night)}$ = 35 (Bedrooms)
Roads	New	55	50	NA
	Upgrades	60	55	NA
Railways	New	55	50	NA
	Upgrades	60	55	NA

The noise target is to be measured at one meter from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source.

2.1.1 Notification on Title

A notification on title is required as a condition of subdivision (including strata subdivision) and development approval for the purposes of noise-sensitive development as well as planning approval involving noise-sensitive development to advise that the site is located in a noise-affected area where existing and/or forecasted noise levels are to exceed the outdoor noise targets shown in Table 2-1, regardless of proposed noise attenuation measures. The notification on title should be identified in the noise management plan.

[1] Day: from 6am to 10pm.
[2] Night: from 10pm to 6am.

2.2 ENVIRONMENTAL NOISE REGULATIONS

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations). The Regulations set noise limits which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises. These noise limits are defined as 'assigned noise levels' at receiver locations. Regulation 7 requires that "noise emitted from any premises or public place when received at other premises must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind".

Table 2-2 presents the assigned noise levels at various premises.

Table 2-2: Assigned noise levels in dB(A)

Type of Premises Receiving Noise	Time of Day	Assigned Noise Levels in dB(A)[3]		
		$L_{A\,10}$	$L_{A\,1}$	$L_{A\,max}$
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + Influencing factor	55 + Influencing factor	65 + Influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + Influencing factor	50 + Influencing factor	65 + Influencing factor
	1900 to 2200 hours all days	40 + Influencing factor	50 + Influencing factor	55 + Influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + Influencing factor	45 + Influencing factor	55 + Influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80

For highly noise sensitive premises, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on road classification and land use zonings within circles of 100 metres and 450 metres radius from the noise receiver locations.

[3] Assigned level L_{A1} is the A-weighted noise level not to be exceeded for 1% of a delegated assessment period.
Assigned level L_{A10} is the A-weighted noise level not to be exceeded for 10% of a delegated assessment period.
Assigned level L_{Amax} is the A-weighted noise level not to be exceeded at any time.

2.2.1 Correction for characteristics of Noise

Regulation 7 requires that that "noise emitted from any premises or public place when received at other premises must be free of:

(i) tonality;
(ii) impulsiveness; and
(iii) modulation.

when assessed under Regulation 9".

If the noise exhibits intrusive or dominant characteristics, i.e. if the noise is impulsive, tonal, or modulating, noise levels at noise-sensitive premises must be adjusted. Table 2-3 presents the adjustments incurred for noise exhibiting dominant characteristics. That is, if the noise is assessed as having tonal, modulating or impulsive characteristics, the measured or predicted noise levels have to be adjusted by the amounts given in Table 2-3. Then the adjusted noise levels must comply with the assigned noise levels. Regulation 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

Table 2-3: Adjustments for dominant noise characteristics

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.			Adjustment where noise emission is music	
Where tonality is present	Where Modulation is present	Where Impulsiveness is present	Where Impulsiveness is not present	Where Impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

2.2.2 Vehicle Noise

Regulation 3(a) states that *nothing in these regulations applies to the following noise emissions —*

(a) Noise emissions from the propulsion and braking systems of motor vehicles operating on a road.

If it is open to public, a car park is considered to be a road and therefore vehicle noise (propulsion and braking) is not strictly assessed. However, noise from car door closing still requires assessment, as this does not form part of the propulsion or braking systems.

2.2.3 Influencing Factors

Five closest noise-sensitive and commercial receivers are selected for detailed assessment of noise impacts, as shown in Figure 1 in APPENDIX A. R1 to R3 and R5 are the noise-sensitive receivers while R4 is the future commercial receiver.

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Influencing factor varies from residence to residence depending on the surrounding land use. The traffic flow data published in the Main Roads website indicate that both the Fitzgerald Street and Graham Farmer Fwy are classified as the major road. Fitzgerald Street and Graham Farmer Fwy are less than 100m from the selected receivers. Therefore, a transport factor of 6 dB applies to R1 to R3 and R5.

Figure 3 in APPENDIX A presents the planning scheme zone map 2 of the City of Vincent. The hostel, R1, R2 and R5 are located within the "Mixed Use" zone while R3 and R4 are located within "Commercial" zone. Table 2-4 presents the calculation of influencing factors and Table 2-5 presents the calculated assigned noise levels for the selected receivers.

Table 2-4: Calculation of influencing factors.

Closest Residents	Transport Factor in dB	Commercial Land		Influencing Factor in d(B)
		Within 100m Radius	Within 450m Radius	
R1	6	88%	65%	14
R2	6	92%	65%	14
R3	6	82%	65%	13
R5	6	86%	65%	14

Table 2-5: Calculated assigned noise levels in dB(A)

Closest Residents	Assigned Noise levels in dB(A)			
	Day[4] Monday to Saturday	Day[5] Sunday and Public Holiday	Evening[6]	Night[7]
	L_{A10}			
R1, R2 & R5	59	54	54	49
R3	58	53	53	48
R4	60	60	60	60

[4] 0700 to 1900 hours for Monday to Saturday.
[5] 0900 to 1900 hours for Sunday and public holidays.
[6] 1900 to 2200 hours for all days.
[7] 2200 to 0700 hours for Monday to Saturday but to 0900 for Sunday and public holidays.

Closest Residents	Assigned Noise levels in dB(A)			
	Day[4] Monday to Saturday	Day[5] Sunday and Public Holiday	Evening[6]	Night[7]
L_{A1}				
R1, R2 & R5	69	64	64	59
R3	68	63	63	58
R4	75	75	75	75
L_{Amax}				
R1, R2 & R5	79	79	69	69
R3	78	78	68	68
R4	80	80	80	80

3.0 NOISE MONITORING

Attended traffic noise monitoring was performed onsite at the most exposure location to Fitzgerald Street, as shown in Figure 1 and Figure 4 in APPENDIX A, between 4:30pm and 5:30pm (peak hour of Fitzgerald Street) on Wednesday 29th November 2023, when it was calm sunny day with temperature of about 24^{0}C.

Noise levels were recorded using a Nor139 Sound Level Meter (SLM). The SLM complies with the instrumentation requirements of AS2702:1984[8] and SPP5.4 Guidelines[9]. The SLM was programmed to record the S (slow) and A-weighted noise levels of L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} in every 15-minute interval. The SLM microphone was placed at 1.4m above the ground pointing to Fitzgerald Street. The SLM was calibrated using an SV33A Class 1 Sound Calibrator immediately before and after the measurements. No level difference was observed between the two calibrations.

Attended noise monitoring was undertaken to:

- Quantify the current noise levels at the most exposure location onsite during the peak hour;
- Determine the peak-hour relationships between L_{A10} and L_{Aeq}; and
- Calibrate the acoustic model.

Noise levels were measured in accordance with the measurement procedures of SPP5.4 Guidelines[5] and AS2702:1984[4].

Figure 5 in APPENDIX A presents the logged noise levels for the peak hour (between 4:30pm and 5:30pm, referring to Figure 6). Table 3-1 summarises the monitoring results and Table 3-2 presents the standard deviations of measured noise levels. It is shown that the variations of logged noise levels L_{A10} and L_{Aeq} are within 0.5 dB. The level difference between L_{A10} and L_{Aeq} during the peak hour is 3.1 dB. It may not be exactly equal to the level difference between $L_{A10,18hour}$ and $L_{Aeq(Day)}$, but it is expected to be at a similar level.

Table 3-1: Measured Noise Levels in dB(A).

Time Intervals	Measured Noise Levels in dB(A)				Difference (dB)
	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10} - L_{Aeq}
4:30pm – 5:30pm (Peak Hour)	77.9	71.6	59.0	68.5	3.1

[8] Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise.
[9] Road and Rail Noise Guidelines, September 2019.

Table 3-2: Standard Deviation of Measured Noise Levels in dB.

Time Intervals	Standard Deviation of Measured Noise Levels in dB			
	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}
4:30pm – 5:30pm (Peak Hour)	1.7	0.3	0.5	0.5

Figure 6 and Figure 7 in APPENDIX A shows that the traffic flows reduce significantly after 7pm. The traffic noise from Fitzgerald Street and Graham Farmer Fwy should become much lower after 7pm. It is expected that the average daily noise level $L_{Aeq(Day)}$ is less than the measured peak-hour noise level $L_{Aeq(PeakHour)}$ because the noise level L_{Aeq} become lower during non-peak hours.

4.0 NOISE MODELLING

4.1 METHODOLOGY

An acoustic model is developed using SoundPlan v8.0 program. For traffic noise, the *Calculation of Road Traffic Noise* (the CoRTN) algorithm is selected. For the noise emissions from the proposed hostel, the ISO 9613 prediction algorithm is selected. The acoustic model is used to predict:

- Traffic noise levels from Fitzgerald Street and Graham Farmer Fwy; and
- Noise emissions from the proposed hostel operations.

The acoustic model does not consider noise emissions from the other road traffic, neighbouring commercial premises; birds; aircraft; dog barking; etc.

4.2 INPUT DATA

4.2.1 Topography

The ground elevation contours of the subject site and surrounding area are obtained from the intramaps of the City of Vincent. The road surfaces of Fitzgerald Street and Graham Farmer Fwy are assumed to be reflective while the other area is assumed to have averaged ground absorption of 0.6.

The hostel building and the existing buildings surrounding the subject site are digitized into the acoustic model. The proposed reception building and 2.4m brick/colorbond fences for the front courtyard and rear drying area are considered.

4.2.2 Closest Receivers

Five neighbouring residential and commercial receivers are selected, as shown in Figure 1 in APPENDIX A, for the detailed assessments of noise impact from the proposed hostel. R1 and R5 represents the front and back receivers of the same neighbouring residence. R2 is located within the "Mixed Use" zone and represents a future noise-sensitive receiver. R3 represents the upper floor residential receiver (the ground floor units are shops). R4 is located within the "Commercial" zone and represents a future commercial receiver.

R3 is the upper floor receiver at 4.5m above the ground while the other receivers are the ground receivers at 1.5m metres above the ground.

4.2.3 Building Façade Receivers

Seven representative receivers close to building facades are selected, as shown in Figure 2 in APPENDIX A, for the detailed assessment of traffic noise impact. G1 to G4 are the ground receivers at 1.4 metres above the ground while T1 to T3 are the upper floor receivers at 4.4

metres above the ground. G1 is located at the centre of courtyard while the other receivers are located at 1m from the building facades. G2 is 1m from the front entry door.

4.2.4 Source Sound Power Levels

Table 4-1 presents the sound power levels of noise sources in the hostel. The overall noise levels of mechanical plant were provided by Fitzgerald House Pty Ltd but their spectrum shapes were obtained from the AES database for similar equipment. The sound power level of a patron conversation was measured for another AES project.

Table 4-1: Sound power levels.

Equipment	Number	Overall Sound Power Levels in dB(A)
Rangehood Outlet	1	74
Rangehood Inlet	1	82
Toilet vent		62
Feature Ceiling Fan	1	81
Bonair Evaporative AC Unit	2	73
Split Air-Conditioner	2	65
TV Audio	1	79
Skope Glass-Door Fridge	2	60
Chest Freezer	1	60
5-Burner Cooktop with Oven	3	72
Coffee Vending Machine		79
Washer	2	77
Dryer	2	66
Patron Conversation		66
Car door Closing L_{Amax}		86

4.2.5 Traffic Data

Graham Farmer Fwy and Fitzgerald Street are classified as the major/significant traffic routes in the SPP5.4 Guidelines. The other major and significant traffic routes are more than 300m away from the subject site. Fitzgerald Street and Graham Farmer Fwy are the only roads to be considered in this study.

Traffic flow data for Fitzgerald Street (North of Newcastle Street) and Graham Farmer Fwy (East of Mitchell Fwy) are obtained from the Main Roads website. The traffic flow data include traffic volumes, vehicle speeds, and the percentages of heavy vehicles. Table 4-2 presents the traffic flow data. As suggested in the SPP5.4 Guidelines, the future (year 2043) traffic flow data are assumed to be 2.5% annual traffic growth over 20 years.

Table 4-2: Current and Future Traffic Flows.

Direction	Speed Limit (km/Hour)	Average Daily Traffic Flows (Monday to Friday)		
		Current	Future (2043)	Heavy Vehicles
Graham Farmer Fwy				
Both	80	56,614	84,922	9.4%
Eastbound	80	31,235	46,853	9.7%
Westbound	80	25,379	38,069	9%
Fitzgerald Street				
Both	60	19,432	29,148	9.2%
Northbound	60	8,756	13,134	7%
Southbound	60	10,676	16,014	11%

Figure 6 and Figure 7[10] in APPENDIX A presents the averaged daily traffic flow data for Monday to Friday. The traffic flow data indicate that the daily traffic peak hour is from:

- 4:30pm to 5:30pm with the traffic flow of 1635 (for both directions) on Fitzgerald Street; but
- 4:15pm to 5:15pm with the traffic flow of 4809 (for both directions) on Graham Farmer Fwy.

[10] Obtained from the Main Road website.

The night-time (10pm to 6am) traffic flow rate (vehicle number per hour) is less than:

- 16% of the day-time traffic flow rate for Fitzgerald Street; but
- 18% of the day-time traffic flow rate for Graham Farmer Fwy.

For such traffic flow rates, it is expected that the night-time traffic noise level $L_{Aeq(night)}$ is much lower than the daytime noise level $L_{Aeq(Day)}$, and their difference ($L_{Aeq(Day)}$ - $L_{Aeq(night)}$) should be greater than 5dB. Therefore, daytime noise level $L_{Aeq(Day)}$ is more critical for compliance assessment.

4.2.6 Road Surface Corrections

Fitzgerald Street is assumed to have a stone mastic asphalt surface. Table 4-3 presents a summary of relative noise relationships between different types of road surfaces.

Table 4-3: Noise Relationship between Different Road Surfaces.

Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+ 3.5 dB	+ 2.5 dB	+ 1.5 dB	0 dB	- 0.2 dB	- 1.5 dB	- 2.5 dB

4.3 CORRECTION OF FAÇADE REFLECTION

The CoRTN algorithm does not calculate the noise reflections from building facades. According to the SPP5.4 Guidelines, the predicted noise levels $L_{A10,18hour}$ are adjusted by 2.5 dB to account for the facade reflections for all of the receivers.

4.4 NOISE LEVEL CONVERSION

The CoRTN algorithms were originally developed to calculate the $L_{A10,18hour}$ noise levels. SPP5.4 however uses noise levels of $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$. Generally the relationship between the parameters varies depending on the composition of traffic on the road. For most cases, the difference between $L_{Aeq(Day)}$ and $L_{A10,18hour}$ is about 3 dB[11]. Based on the measured peak-hour noise level difference (3.1 dB) shown in Table 3-1, the following relationship is used:

$$L_{Aeq(Day)} = L_{A10,18hour} - 3 \qquad \text{dB(A)}$$

[11] NSW Road Noise Policy, 2011.

4.5 METEOROLOGY

For the environmental noise modelling, the "default" worst-case meteorological conditions[12] are assumed, as shown in Table 4-4.

Table 4-4: Worst-case meteorological conditions.

Time of day	Temperature Celsius	Relative Humidity	Wind speed	Wind Direction
Day (0700 --- 1900)	20° Celsius	50%	≤5 m/s	All
Evening (1900 --- 2200)	15° Celsius	50%	≤5 m/s	All
Night (2200 --- 0700)	15° Celsius	50%	≤5 m/s	All

4.6 NOISE MODELLING SCENARIOS

Fitzgerald House Pty Ltd advised:

- The hostel operates 24 hours a day and 7 days a week.
- A maximum capacity of 48 patrons is proposed.
- Four toilets/showers are located on the ground floor and four toilets/showers are on the upper floor. The upper floor toilet vents are located above the roof while the ground floor toilet vents are ducted to the rear wall.
- Two Bonair evaporative air-conditioning (AC) systems will be installed. One Bonair outdoor unit sits on the roof while another Bonair outdoor unit sits on the ground against rear building wall under the stairs.
- Two split air-conditioners are installed to service the two rear bedrooms on ground floor, and their outdoor units are wall-mounted.
- A feature ceiling cooling fan is installed in the TV lounge.
- One TV screen with audio will be installed on walls in the TV lounge.
- No amplified or live music plays.
- No meals are provided.
- The kitchen is open kitchen with living/dining area. The kitchen has:
  - ➢ A rangehood. The rangehood exhaust outlet is located above the roof.
  - ➢ 2x skope glass door fridge;
  - ➢ 3x 5 burner cooktop with oven beneath;
  - ➢ 1x chest freezer; and
  - ➢ 1x coffee vending machine.

[12] Guideline: Assessment of Environmental Noise Emissions, Draft for Consultation, May 2021.

- Front doors will be aluminium framed glass panel while both back doors to be solid fire rated doors. All windows and doors will be replaced with new ones as per recommendations given in section 8.0 (based on the road traffic assessment).
- The laundry is located on the ground floor with two washers and two dryers.
- One vacuum cleaner will be used to clean rooms.
- The front entry door is kept closed with an auto closer.
- A weekly delivery is planned between 9am and 1pm on a weekday excluding public holidays. Minivan is used for the weekly delivery.
- Car parking bays are available onsite: One drop off bay at the front and the manager bay at the rear.

Based on the provided information, the following worst-case operational scenarios are modelled:

Scenario 1: All items of the following mechanical plant operate simultaneously:

- One TV and one feature ceiling cooling fan in the TV lounge.
- All items of Kitchen Equipment: 1 X Rangehood, 2 X Skope glass door fridges, 3 X 5 burner cooktop with oven, 1 X Chest freezer and 1 X Coffee vending machine.
- Laundry machines: 2 X Washers and 2 X Dryers.
- 2 X Bonair evaporative air-conditioning systems.
- 2 X split air-conditioning (AC) systems.
- 8 X Toilet/Shower vents.
- One vacuum cleaner at the upper-floor back room of Bunks and Robes.

Scenario 2: 40% of 48 patrons talk simultaneously (19 conversations in total):

- One conversation in each of 6 Bunks and Robes.
- 6 outdoor conversations (in the courtyard); and
- 7 indoor conversations (in the TV lounge and living/dining area).

Scenario 3: A car door is closed in the front car park bay.

For scenarios 1 and 2, the double doors to the courtyard and the two back doors are assumed to be fully opened but the front entry door is assumed to be closed.

Scenario 1 represents the worst-case operation of mechanical plant while scenario 2 represents the worst-case patron conversations. Scenario 3 represents the short events of closing vehicle doors. Scenario 3 includes the door closing of minivans for weekly delivery.

5.0 NOISE CONTROL

After preliminary modelling, Fitzgerald House Pty Ltd agrees to implement the following noise control measure:

- Install a 1.8m colorbond fence along the front site boundary with R2, as shown in a thick black line in Figure 2 in APPENDIX A.

This short solid boundary fence is required to reduce noise propagation towards R2 from car-door closing and to achieve evening/night-time compliance with the Regulations for scenario 3.

6.0 TRAFFIC NOISE PREDICTIONS

6.1 MODEL CALIBRATION

The acoustic model for road traffic noises from Fitzgerald Street and Graham Farmer Fwy was calibrated based on the measured peak-hour $L_{A10,1h}$ (71.6 dB(A) shown in Table 3-1) by comparing the predicted peak-hour $L_{A10,1h}$ with the measured peak-hour $L_{A10,1h}$ at the logger location.

6.2 POINT MODELLING RESULTS

As shown in Figure 6 and Figure 7, the night-time (10pm to 6am) traffic flow rate is less than 18% of the day-time (6am to 10m) traffic flow rate. This traffic rate indicates that the night-time traffic noise level $L_{Aeq(Night)}$ is more than 5dB lower than the daytime traffic noise level $L_{Aeq(Day)}$. The daytime traffic noise level $L_{Aeq(Day)}$ compliance guarantees the night-time traffic noise level $L_{Aeq(Night)}$ compliance.

Table 6-1 presents the predicted and adjusted A-weighted day-time traffic noise levels $L_{Aeq(Day)}$. Since they do not account for building facade reflections, the predicted traffic noise levels are adjusted by adding 2.5dB to account for façade reflections. According to the SPP5.4 Guidelines, the predicted and adjusted traffic noise levels are rounded to integer numbers. Table 6-1 indicates that under the future road traffic conditions, the highest adjusted day-time traffic noise level $L_{Aeq(Day)}$ is:

- 64 dB(A) for the ground level.
- 66 dB(A) for the upper floor level.
- 56 dB(A) in the courtyard.

Table 6-1: Predicted and Adjusted Day-time Traffic Noise Levels $L_{Aeq(Day)}$ in dB(A).

Receivers	Current		Future (2043)	
	Predicted Level	Adjusted Level	Predicted Level	Adjusted Level
G1	51	54	53	56
G2	60	63	62	64
G3	54	56	56	58
G4	45	47	47	49
T1	62	64	64	66

Receivers	Current		Future (2043)	
	Predicted Level	Adjusted Level	Predicted Level	Adjusted Level
T2	58	60	60	62
T3	48	50	49	52

6.3 TRAFFIC NOISE CONTOURS

Figure 8 to Figure 11 in APPENDIX B present the predicted traffic noise level $L_{Aeq(Day)}$ contours at 1.4m above the ground. The black lines represent the proposed 2.4m brick/ colorbond fences. These noise contours include the barrier effects of the proposed/existing buildings and boundary fences, but do not account for building facade reflections.

Figure 8 and Figure 9 present the daytime traffic noise level $L_{Aeq(Day)}$ contours for the current road traffic conditions while Figure 10 and Figure 11 show the daytime traffic $L_{Aeq(Day)}$ contours for the future road traffic conditions.

Figure 8 and Figure 10 show the traffic $L_{Aeq(Day)}$ contours at the ground level (1.4m above the ground) while Figure 9 and Figure 11 show the traffic $L_{Aeq(Day)}$ contours at the upper floor level (4.4m above the ground).

7.0 NOISE EMISSIONS FROM THE HOSTEL

Table 7-1 presents the predicted worst-case noise emissions from the hostel. For scenario 3, the predicted noise levels are in L_{AMax} level. It is shown that for all scenarios the predicted day and evening/night-time noise levels are at similar levels (within 0.1 dB). The highest noise level is predicted at:

- R4 for scenario 1; but
- R1 for scenarios 2 and 3.

Table 7-1: Predicted worst-case noise levels in dB(A).

Receivers	Scenario 1		Scenario 2		Scenario 3	
	Day	Evening/Night	Day	Evening/Night	Day	Evening/Night
R1	39.5	39.5	41.0	41.0	55.1	55.1
R2	31.9	31.9	27.2	27.2	48.4	48.4
R3	34.0	34.0	30.1	30.1	52.6	52.7
R4	48.7	48.6	14.5	14.5	29.4	29.5
R5	37.4	37.4	19.4	19.4	31.9	32.0

7.1 WORST-CASE NOISE CONTOURS

Figure 12 to Figure 14 in APPENDIX B present the worst-case noise contours at 1.5m above the ground. The black lines represent the proposed solid fences including the proposed 1.8m short boundary fence. The noise contours represent the worst-case noise propagation envelopes from the hostel, i.e., worst-case propagation in all directions simultaneously. Since the predicted day and evening/night-time noise levels are at similar levels, the noise contours represent worst-case day, evening and night-time noise emissions from the hostel.

8.0 TRAFFIC NOISE ASSESSMENT AND RECOMMENDATIONS

Under the SPP5.4, noise mitigation measures are necessary if the adjusted noise levels of a new development exceed the outdoor target levels.

For the future road traffic conditions, the highest adjusted day-time noise level $L_{Aeq(Day)}$ falls into exposure category:

- C for both the ground and upper floors.

To comply with the requirements of SPP5.4 and achieve reasonable indoor amenity, the following measures are recommended:

- Implement the "Quiet House" package C for both the ground and upper floors.
- Incorporate "Notification on Title".

"Quiet House" package C is detailed in APPENDIX C and also in the SPP5.4 Guidelines.

8.1 WINDOWS AND DOORS

The front two Bunks and Robes on the upper floor have the glazing to floor ratios of about 43% and 52%. To comply with the requirements of "Quiet House" package C,

- The front fixed windows should achieve Rw + Ctr 37 (minimum 12.5mm VLam Hush or double insulated glazing 8mm VFloat – 16mm Gap – 10.5mm Hash). Alternatively the glazing area is reduced to below 40% of floor area and then a minimum 10 mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 34dB).
- The front entry door should achieve Rw 32 (minimum 10mm single glazing insert) acoustically rated door and frame system with acoustic seals.
- The two back doors should be 40mm solidcore timber doors with acoustic seals (to achieve Rw 30 for the door and frame systems).

As advised, the roof is metal roofing with Anticon underneath. Suspended ceilings with 16mm ceiling tiles are present on both the ground and upper floors. To comply with the roof-ceiling requirement of "Quiet House" package C, the upper floor suspended ceiling should be affixed using steel furring channels beneath ceiling rafters/supports. R4.1 Bradford gold ceiling insulation batts are recommended to be added above the ceiling tiles.

9.0 NOISE IMPACT ASSESSMENT

9.1 ADJUSTED NOISE LEVELS

According to Table 2-3, the predicted noise levels shown in Table 7-1 should be adjusted by:

- 5 dB if the noise received exhibits tonality; or
- 10 dB if the noise received exhibits impulsiveness.

Mechanical plant may radiate tonal noise components. Therefore, a 5dB tonality adjustment applies to the predicted noise levels for scenario 1.

Conversations are broadband noises, and no adjustment applies to the predicted noise levels for scenario 2.

Scenario 3 considers the car-door closing noise only. The car-door closing noise may exhibit implusiveness and then a 10dB adjustment applies.

Table 9-1 presents the adjusted worst-case A-weighted noise levels.

Table 9-1: Adjusted worst-case noise levels in dB(A).

Receivers	Scenario 1	Scenario 2	Scenario 3
R1	44.5	41.0	65.1
R2	36.9	27.2	58.4
R3	39.0	30.1	62.7
R4	53.7	14.5	39.5
R5	42.4	19.4	42.0

9.2 COMPLIANCE ASSESSMENT

Scenarios 1 and 2 generate continuous noise emissions, and then their noises should be assessed against the assigned noise levels L_{A10}. Car door closing is a short event. The noise from a car door closing is predicted in L_{Amax} level and the assigned noise levels L_{Amax} apply for scenario 3.

Table 2-5 shows that Sunday and evening-time assigned noise levels are the same and lower than the day-time ones on Monday to Saturday while Table 7-1 shows that the

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predicted day and evening-time noise levels are at similar levels (within 0.1 dB). Therefore, the evening-time compliance guarantees the day-time compliance.

9.2.1 Evening

Table 9-2 presents evening-time compliance assessment. It is shown that the adjusted noise levels are much below the assigned noise levels at all receiver locations for all of the scenarios. This concludes that compliance with the Regulations is achieved for both the day and the evening.

Table 9-2: Evening-time compliance assessment.

Receivers	Assigned Levels L_{A10} in dB(A)	Adjusted Noise Levels in dB(A)		Assigned Levels L_{A10} in dB(A)	Adjust L_{Amax}
		Scenario 1	Scenario 2		Scenario 3
R1	54	44.5	41.0	69	65.1
R2	54	36.9	27.2	69	58.4
R3	53	39.0	30.1	68	62.7
R4	60	53.7	14.5	80	39.5
R5	54	42.4	19.4	69	42.0

9.2.2 Night

Table 9-3 presents compliance assessment for the night-time operations. It is shown that that the adjusted noise levels are below the night-time assigned noise levels at all receivers. This concludes that the night-time compliance is achieved.

Table 9-3: Night-time compliance assessment.

Receivers	Assigned Levels L_{A10} in dB(A)	Adjusted Noise Levels in dB(A)		Assigned Levels L_{A10} in dB(A)	Adjust L_{Amax}
		Scenario 1	Scenario 2		Scenario 3
R1	49	44.5	41.0	69	65.1

Receivers	Assigned Levels L_{A10} in dB(A)	Adjusted Noise Levels in dB(A)		Assigned Levels L_{A10} in dB(A)	Adjust L_{Amax}
		Scenario 1	Scenario 2		Scenario 3
R2	49	36.9	27.2	69	58.4
R3	48	39.0	30.1	68	62.7
R4	60	53.7	14.5	80	39.5
R5	49	42.4	19.4	69	42.0

The above assessments conclude that full compliance is achieved for the proposed hostel.

APPENDIX A SITE LAYOUTS

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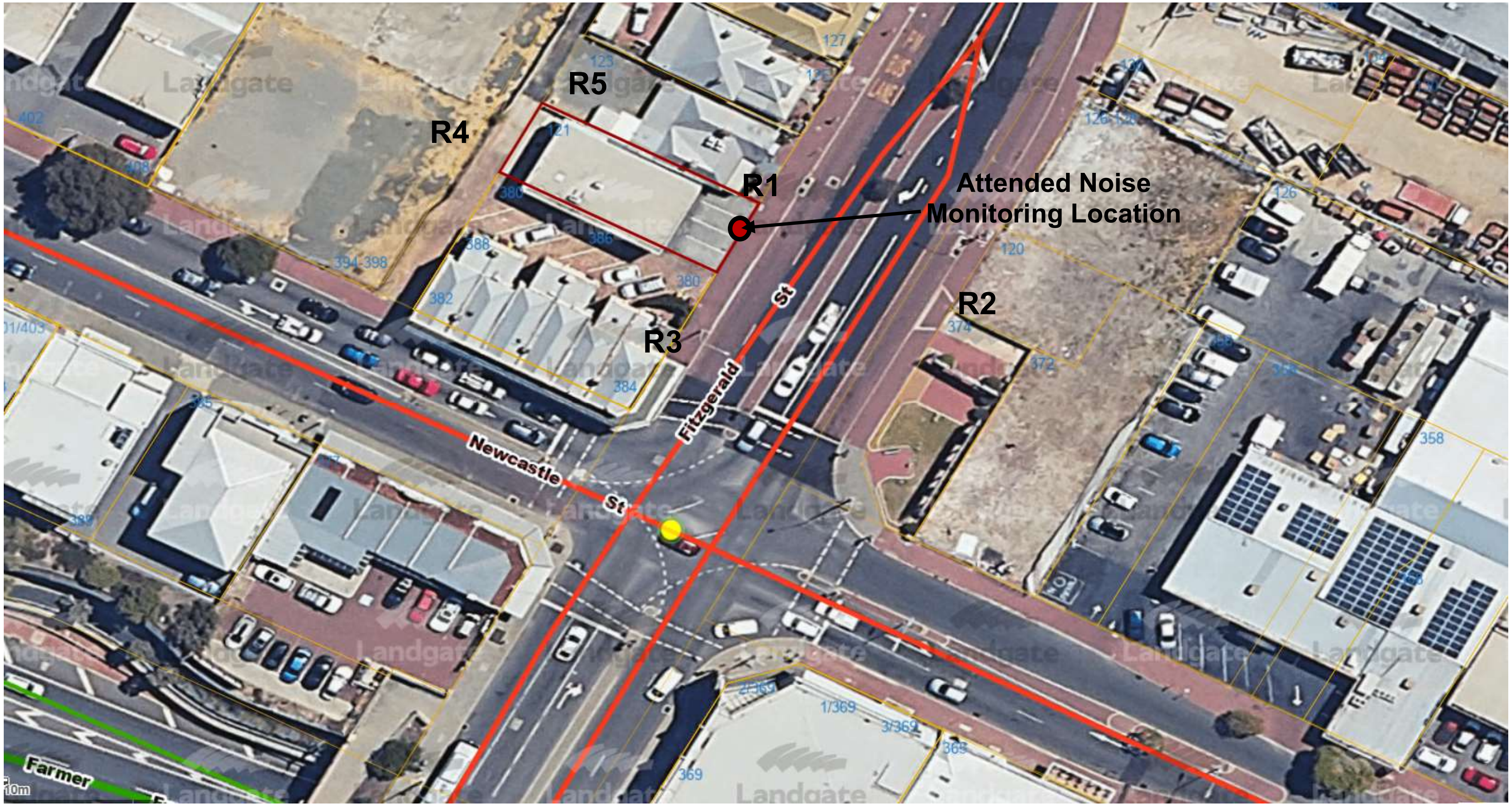

Figure 1: Aerial view of subject site and surrounding area.

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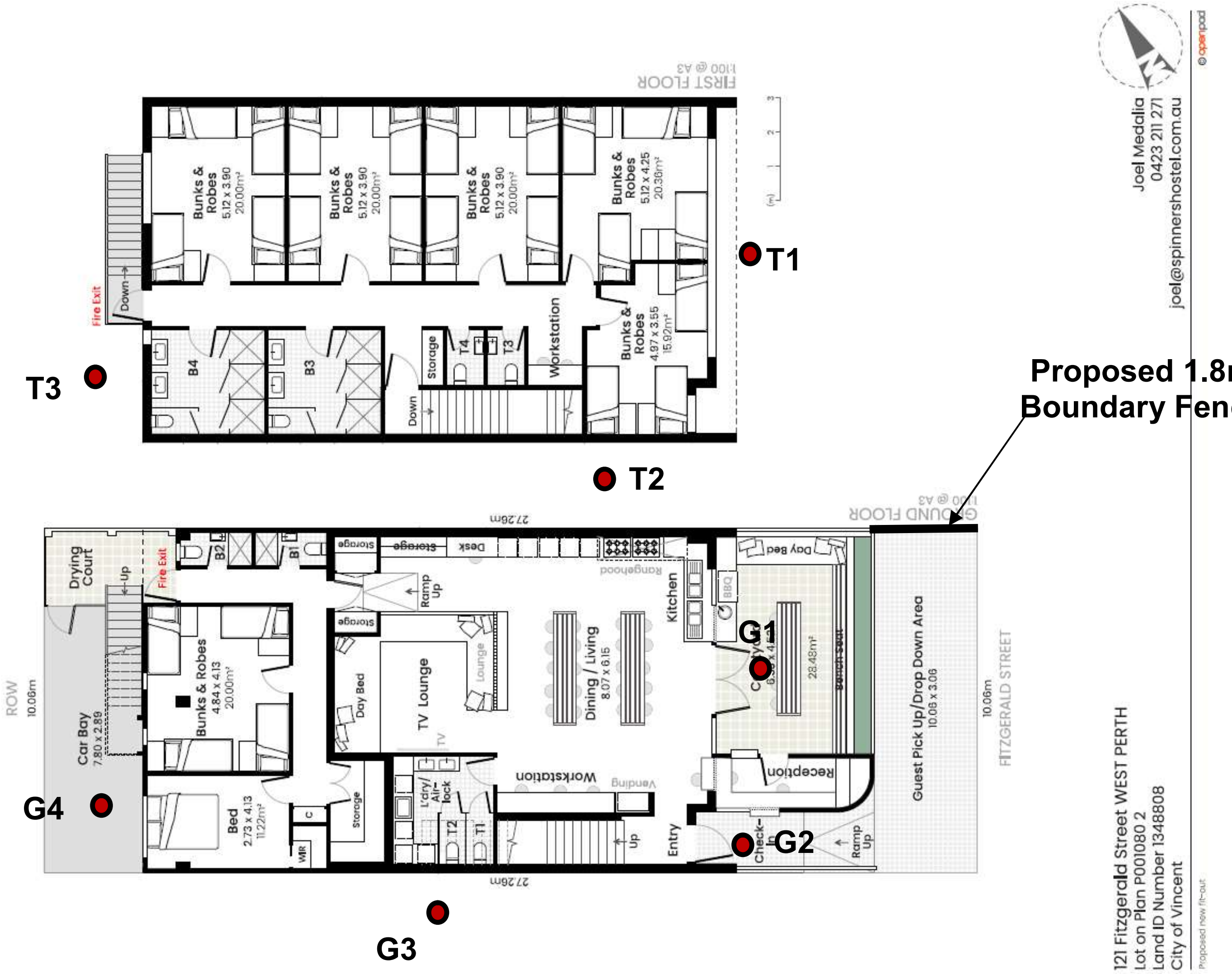

Figure 2: Floor plans.

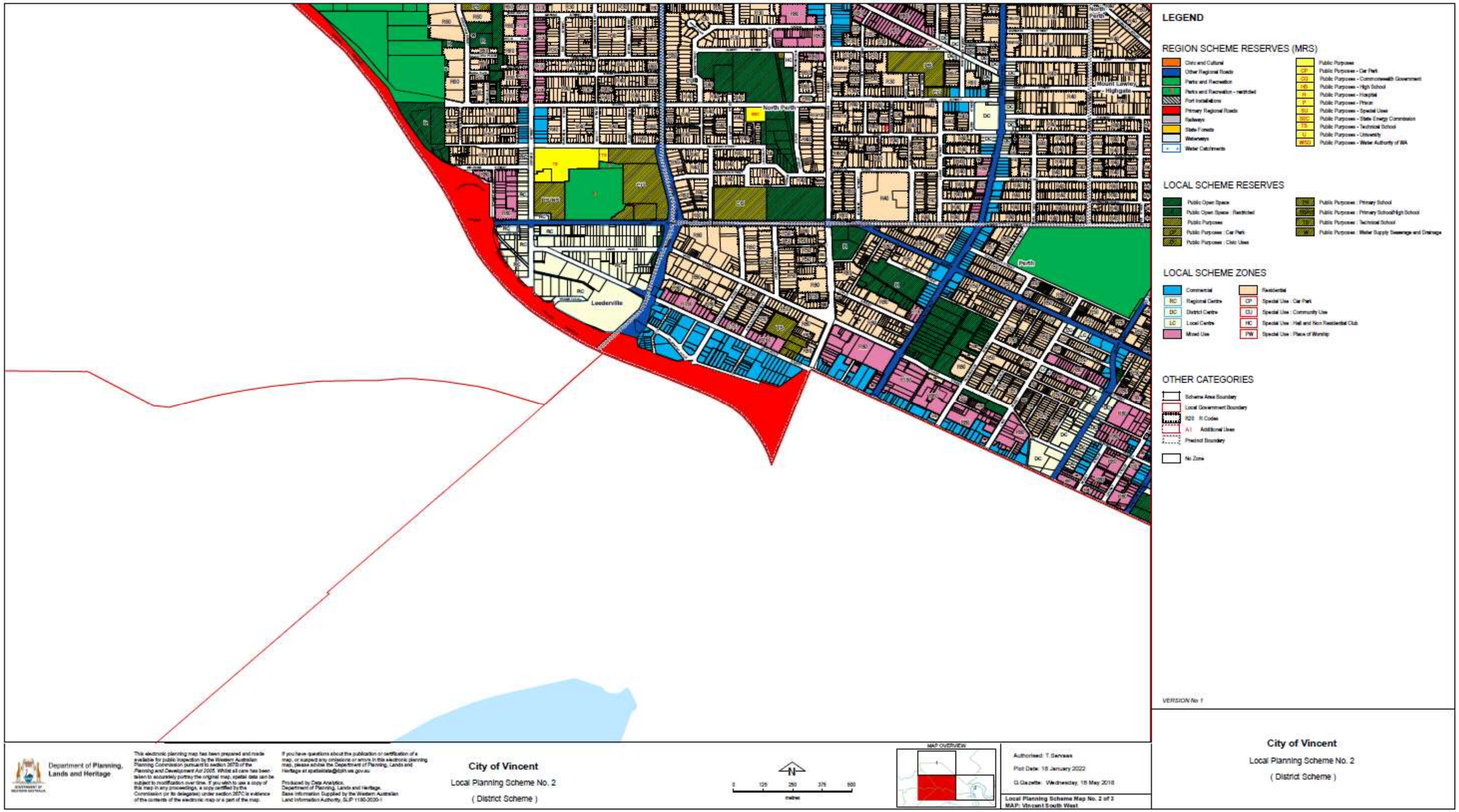

Figure 3: Local planning scheme map 2 of the City of Vincent.

Figure 4: Photo of the sound level meter.

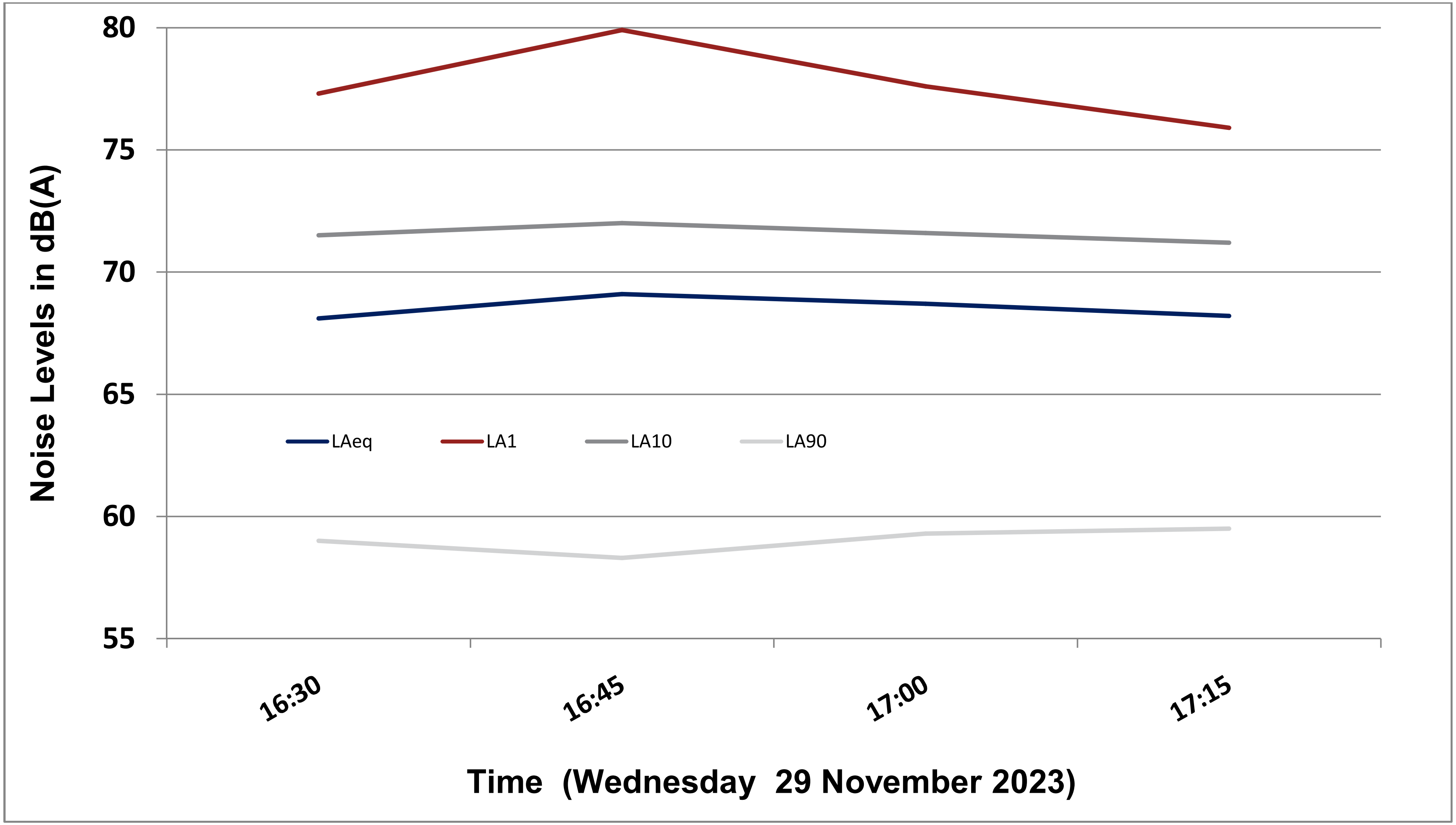

Figure 5: Measured noise levels from 4:30pm to 5:30pm on Wednesday 29/11/2023.

mainroads WESTERN AUSTRALIA

SITE 4391

Hourly Volume

Fitzgerald St (1300280)

North of Newcastle St (SLK 0.08)

2021/22
Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	74	46	120	3	4	7	5.8
01:00	50	33	83	2	4	6	7.2
02:00	32	22	54	0	2	2	3.7
03:00	21	26	47	2	3	5	10.6
04:00	33	68	101	3	10	13	12.9
05:00	72	280	352	5	52	57	16.2
06:00	171	673	844	21	145	166	19.7
07:00	265	1171	1436	38	144	182	12.7
08:00	371	1279	1650	43	107	150	9.1
09:00	419	789	1208	52	78	130	10.8
10:00	408	591	999	47	64	111	11.1
11:00	444	595	1039	42	67	109	10.5
12:00	495	595	1090	42	60	102	9.4
13:00	504	570	1074	34	59	93	8.7
14:00	608	573	1181	43	60	103	8.7
15:00	737	569	1306	50	53	103	7.9
16:00	1006	555	1561	52	56	108	6.9
17:00	1015	570	1585	49	53	102	6.4
18:00	614	473	1087	28	47	75	6.9
19:00	404	358	762	16	32	48	6.3
20:00	329	303	632	14	30	44	7.0
21:00	293	256	549	10	20	30	5.5
22:00	229	177	406	8	14	22	5.4
23:00	162	104	266	6	9	15	5.6
TOTAL	8756	10676	19432	610	1173	1783	9.2

Peak Statistics

		All NB	All SB	All Both	Heavy NB	Heavy SB	Heavy Both
AM	TIME	11:45	07:30	08:00	09:15	06:30	06:30
	VOL	489	1296	1650	57	162	192
PM	TIME	16:30	12:00	16:30	15:15	13:15	15:30
	VOL	1055	595	1635	54	64	114

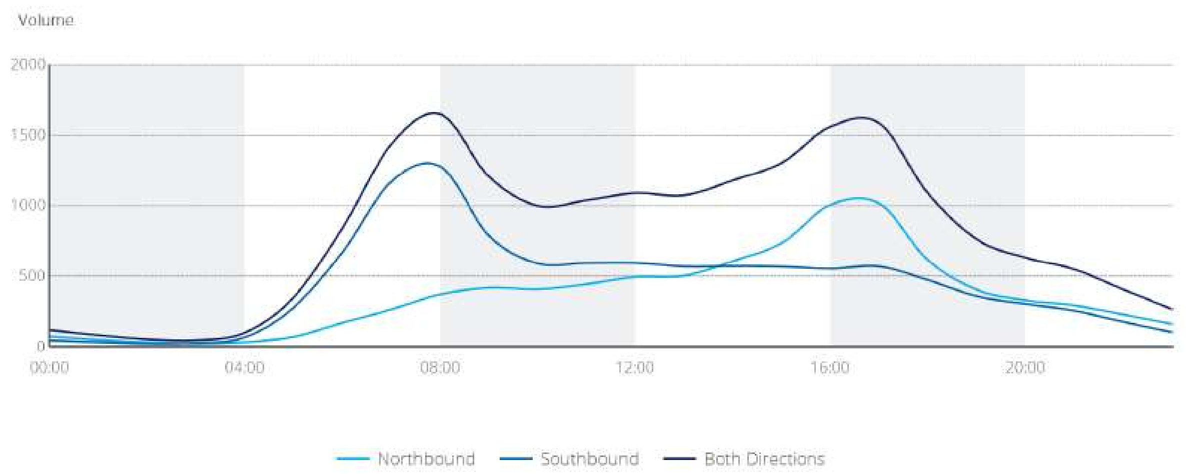

Figure 6: Weekday traffic flows for Fitzgerald Street.

mainroads WESTERN AUSTRALIA

SITE 50943

Hourly Volume

2021/22
Monday to Friday

Graham Farmer Fwy (H020)

East of Mitchell Fwy (SLK 0.27)

	All Vehicles			Heavy Vehicles			
	EB	WB	Both	EB	WB	Both	%
00:00	112	151	263	10	8	18	6.8
01:00	63	89	152	7	5	12	7.9
02:00	56	79	135	7	7	14	10.4
03:00	135	75	210	12	10	22	10.5
04:00	416	171	587	33	22	55	9.4
05:00	1412	453	1865	158	44	202	10.8
06:00	2361	1034	3395	295	124	419	12.3
07:00	2791	1534	4325	231	165	396	9.2
08:00	2265	1601	3866	187	157	344	8.9
09:00	1708	1333	3041	213	179	392	12.9
10:00	1597	1325	2922	213	174	387	13.2
11:00	1705	1359	3064	229	183	412	13.4
12:00	1695	1419	3114	232	176	408	13.1
13:00	1616	1522	3138	230	199	429	13.7
14:00	1788	1951	3739	220	198	418	11.2
15:00	2120	2326	4446	217	202	419	9.4
16:00	2430	2339	4769	199	157	356	7.5
17:00	2392	2007	4399	147	103	250	5.7
18:00	1505	1430	2935	67	64	131	4.5
19:00	1017	904	1921	45	39	84	4.4
20:00	719	722	1441	32	27	59	4.1
21:00	673	655	1328	23	22	45	3.4
22:00	418	574	992	19	17	36	3.6
23:00	241	326	567	11	14	25	4.4
TOTAL	31235	25379	56614	3037	2296	5333	9.4

Peak Statistics

AM	TIME	06:45	07:30	07:00	06:15	11:45	06:15
	VOL	2819	1656	4325	299	184	439
PM	TIME	16:30	15:45	16:15	12:30	14:30	14:30
	VOL	2531	2388	4809	240	207	443

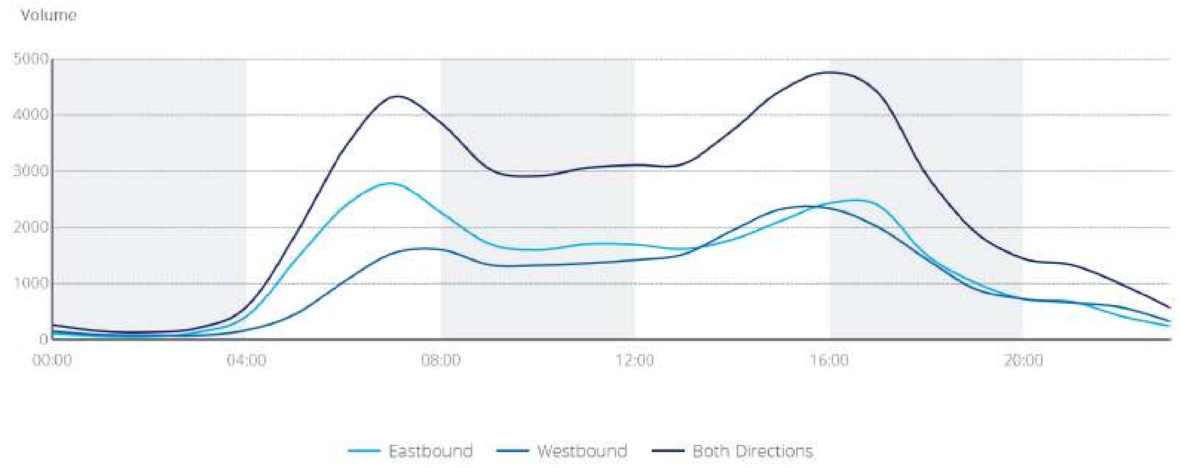

Figure 7: Weekday traffic flows for Graham Farmer Fwy.

APPENDIX B NOISE CONTOURS

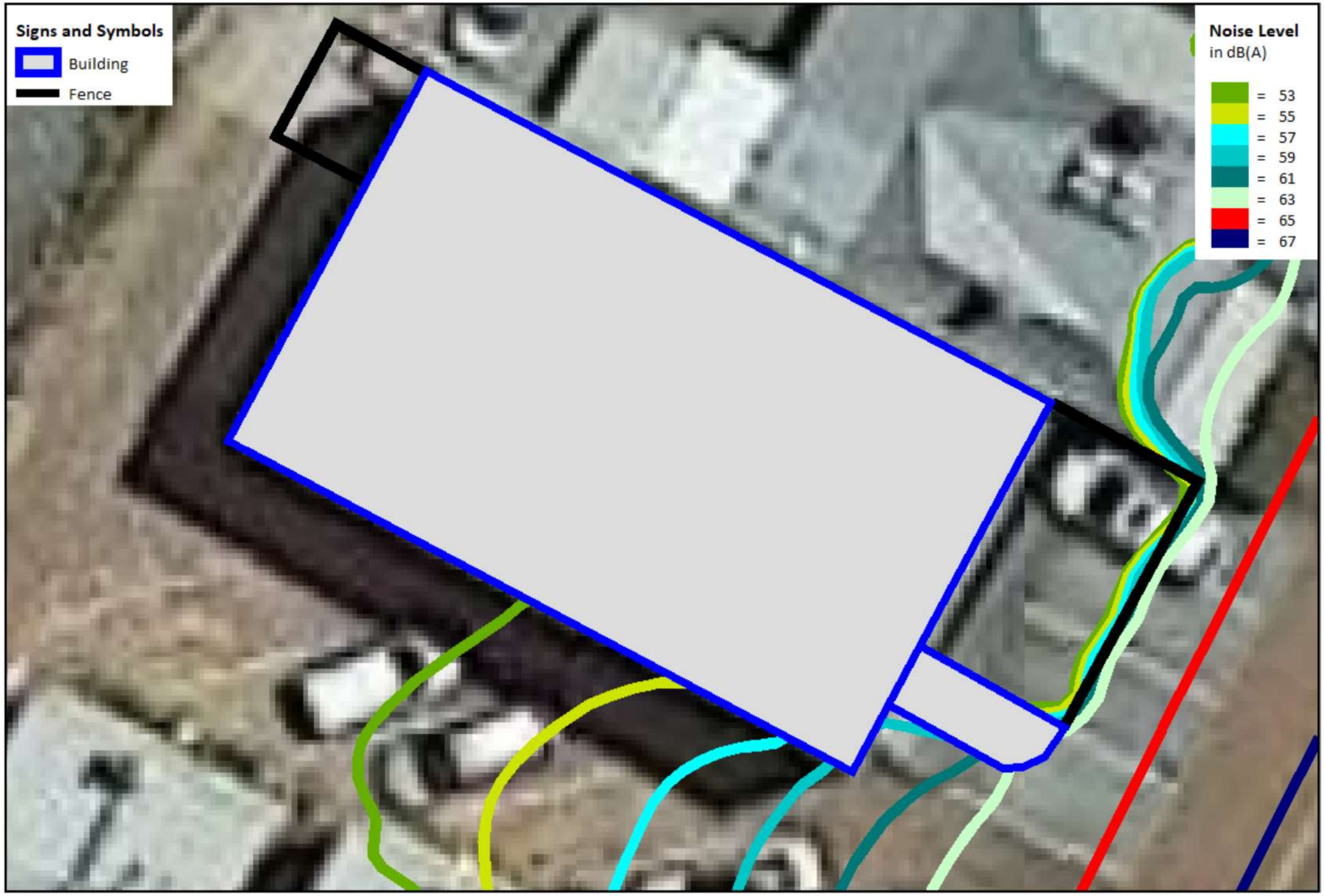

Figure 8: Day-time $L_{Aeq(Day)}$ contours at 1.4m above the ground for current traffic flows.

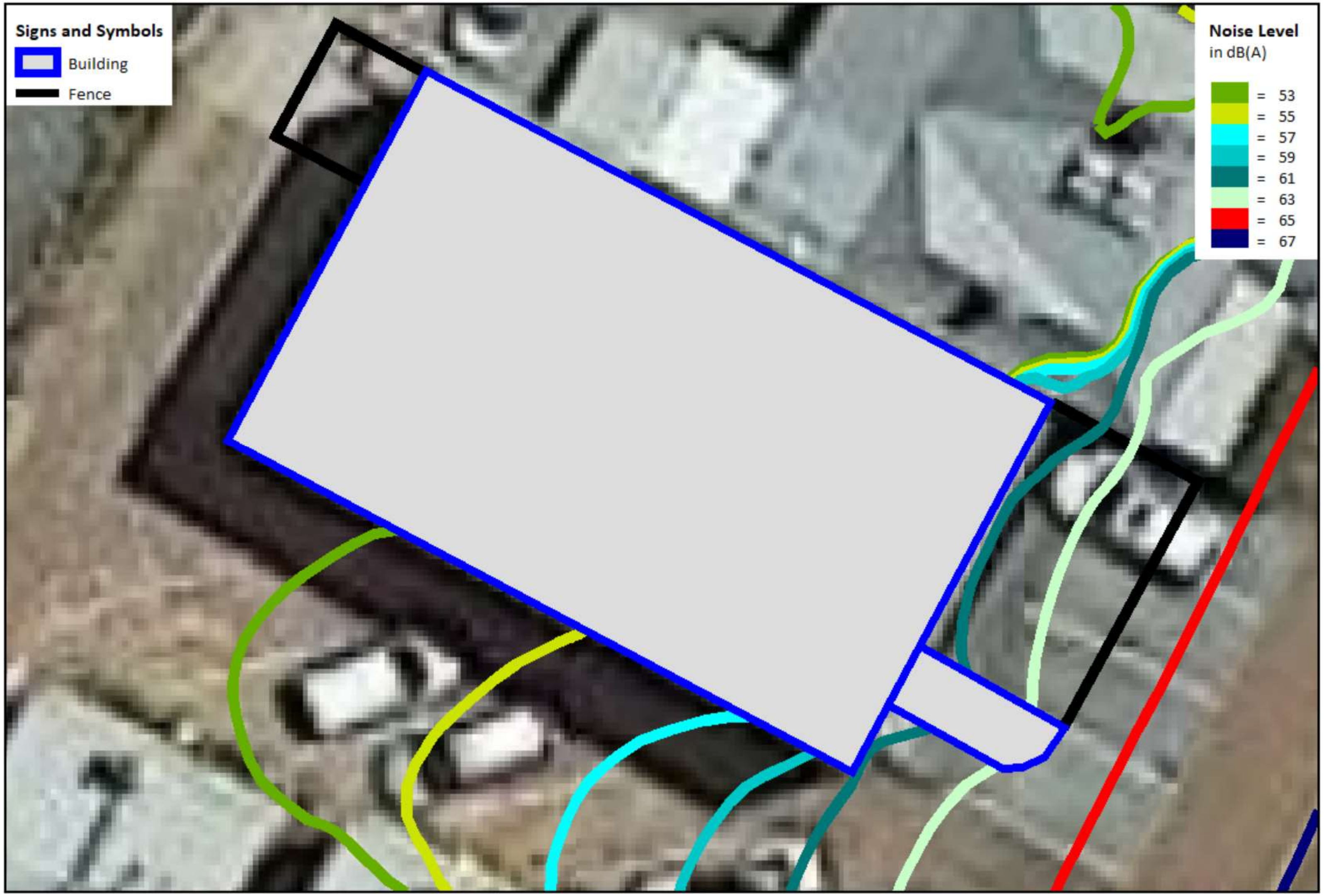

Figure 9: Day-time $L_{Aeq(Day)}$ contours at 4.4m above the ground for current traffic flows.

Figure 10: Day-time $L_{Aeq(Day)}$ contours at 1.4m above the ground for future traffic flows.

Figure 11: Day-time $L_{Aeq(Day)}$ contours at 4.4m above the ground for future traffic flows.

Figure 12: Worst-case noise contours at 1.5m above the ground for scenario 1.

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Figure 13: Worst-case noise contours at 1.5m above the ground for scenario 2.

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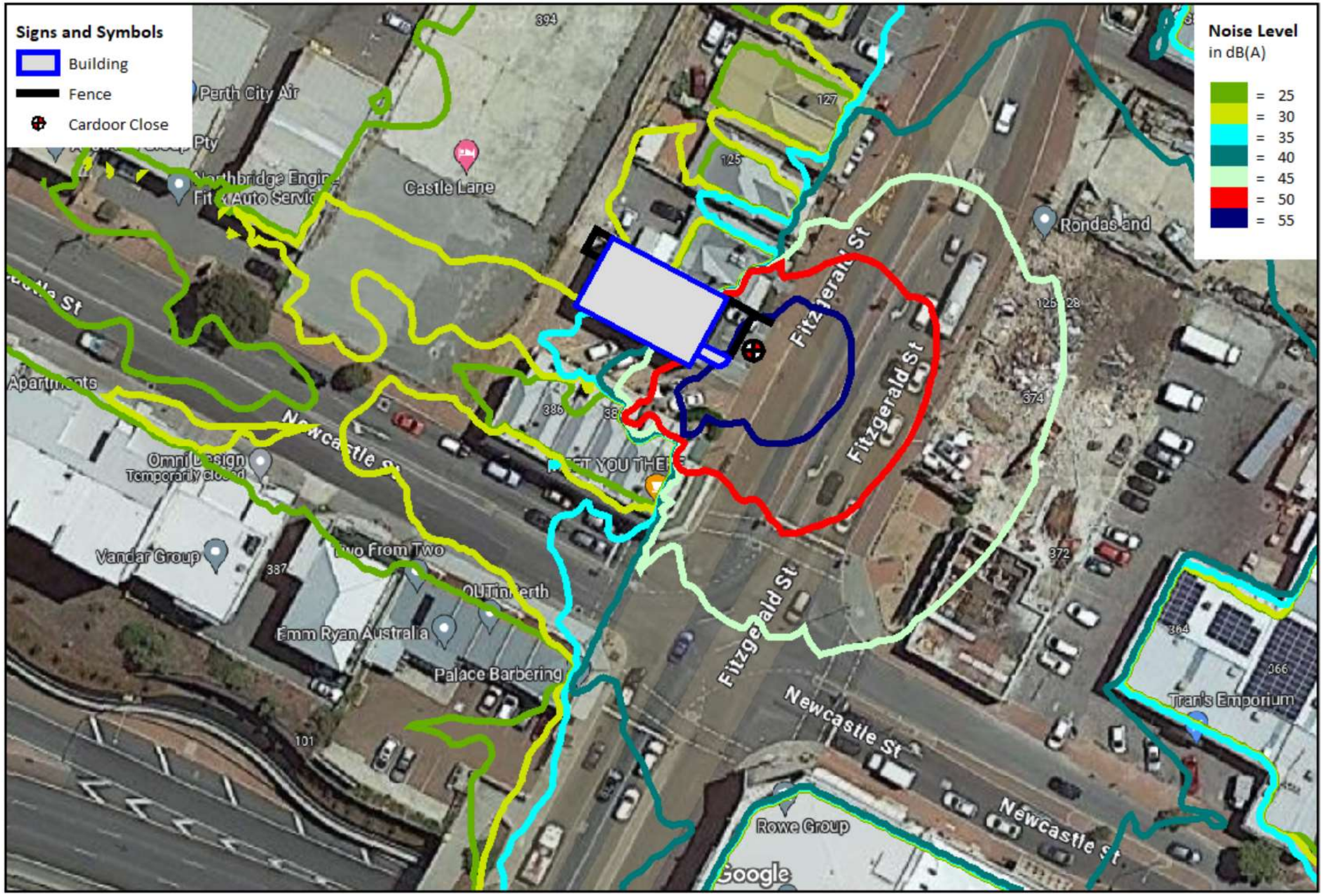

Figure 14: Worst-case noise contours at 1.5m above the ground for scenario 3.

APPENDIX C QUIET HOUSE PACKAGES

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Exposure Category	Orientation to corridor	Acoustic rating and example constructions: Walls	External doors	Windows	Roofs and ceilings of highest floors	Outdoor living areas	Mechanical ventilation / air conditioning considerations
A **Quiet House A**	Facing	**Bedroom and indoor living and work areas to Rw+Ctr 45dB** • One row of 92mm studs at 600mm centres with: – Resilient steel channels fixed to the outside of the studs; and – 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and – 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and – Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. – Single leaf of 150mm brick masonry with 13mm cement render on each face. – Double brick: two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms:** • Fully glazed hinged door with certified Rw+Ctr 28dB rated door and frame including seals and 6mm glass Other external doors to Rw+Ctr 25dB, e.g. • 35mm solid core timber hinged door and frame system certified to Rw 28dB including seals • Glazed sliding door with 10mm glass and weather seals	**Bedrooms:** • Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 28 dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: as per above but must be sealed awning or casement type windows (Rw+Ctr 31dB). **Indoor living and work areas** • Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 25dB). • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 28 dB). • Up to 80% floor area: As per Bedrooms at up to 60% area (Rw+Ctr 31dB).	**To Rw+Ctr 35dB** • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level.	• Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces • Evaporative systems require attenuated ceiling air vents to allow closed windows • Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements • Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side on						
	Opposite		As per 'Facing' above, except Rw+Ctr values may be 3dB less, e.g. glazed sliding door with 10mm glass and weather seals for bedrooms.	As above, except Rw+Ctr values may be 3dB less, or max % area increased by 20%			
			No specific requirements				
A **Quiet House A+**	All	As per Quiet House A, except double leaf masonry / brick construction only.	As per Quiet House A.	As per Quiet House A, except that • 'Side-on' requirements same as 'Facing'. • All windows comprise minimum 6 mm thick laminated or toughened glass in sealed awning or casement frames. Polymer (e.g. uPVC) window framing should be used. Evaporative air conditioning systems are not recommended. • No external doors for bedrooms with entry 'Facing' transport corridor	No specific requirements		
B **Quiet House B**	Facing	**Bedroom and indoor living and work areas to Rw+Ctr 50dB** • Single leaf of 90mm clay brick masonry with: – A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; – A cavity of 25mm between leaves; – 50mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and – One layer of 10mm plasterboard fixed to the inside face • Single leaf of 220mm brick masonry with 13mm cement render on each face • 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face • Double brick: two leaves of 90mm clay brick masonry with: – A 50mm cavity between leaves – 50mm glass wool or polyester cavity insulation (R2.0+) – resilient ties where required to connect leaves • Double brick: two leaves of 110mm clay brick masonry with a 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** • Fully glazed hinged door with certified Rw+Ctr 31dB rated door and frame including seals and 10mm glass • Other external doors to Rw+Ctr 28dB, e.g. • As per Quiet House A Bedrooms.	**Bedrooms:** • Total external door and window system area up to 40% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31 dB). • Up to 60% floor area: as per above but must be minimum 10 mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 34dB). **Indoor living and work areas** • Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 28dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 31 dB). • Up to 80% floor area: As per Bedrooms at up to 60% area (Rw+Ctr 34dB).	**To Rw+Ctr 35dB** • Concrete or terracotta tile or metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level	
	Side-on		As per Quiet House A 'Facing' above (Rw+Ctr values may be 3dB less, or max % area increased by 20%).				
	Opposite		As per Quiet House A 'Side-on' above.				
B **Quiet House B+**	All	As per Quiet House B example above, except use double leaf masonry construction only.	As per Quiet House B, except • No external doors for bedrooms with entry 'Facing' or 'Side-on' to transport corridor	As per Quiet House B, except that • 'Side-on' requirements become the same as Quiet House B 'Facing'. • All windows comprise minimum 6 mm thick laminated or toughened glass in sealed awning or casement frames. Polymer (e.g. uPVC) window framing should be used. • Evaporative air conditioning systems are not recommended.	As per Quiet House C (to Rw+Ctr 40dB).		

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Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation / air conditioning considerations
		Walls	External doors	Windows	Roofs and ceilings of highest floors	Outdoor living areas	
C **Quiet House C**	Facing	Bedroom and indoor living and work areas to Rw+Ctr 50dB • As per Quiet House B example above	Bedrooms • External doors to bedrooms facing the corridor are not recommended. Other external doors to Rw+Ctr 30dB, e.g. • Fully glazed hinged door with certified Rw+Ctr 31dB rated door and frame including seals and 10mm glass. • 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified Rw 32dB acoustically rated door and frame system including seals	Bedrooms: • Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31 dB). • Up to 40% floor area: as per above but must be minimum 10 mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 34dB). **Indoor living and work areas** • Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 34 dB).	To Rw+Ctr 40dB • To all bedrooms, 2 layers of 10mm plasterboard, or one layer 13 mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters / supports. • R3.0+ insulation batts laid in cavity. • Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens.	As per Quiet House B	• Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces • Evaporative systems require attenuated ceiling air vents to allow closed windows • Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements • Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-on		As per Quiet House B 'Facing' above (Rw+Ctr values may be 3dB less, or max % area increased by 20%).				
	Opposite		As per Quiet House A 'Facing' above.				
C **Quiet House C+**	All	As per Quiet House B example above, except using double leaf masonry construction only. • Double brick: two leaves of 90mm clay brick masonry with: – A 50mm cavity between leaves – R2.0+ cavity insulation – resilient ties where required to connect • Double brick: two leaves of 110mm clay brick masonry with a 50mm cavity between leaves and R2.0+ cavity insulation	As per Quiet House C, except • No external doors for bedrooms with entry 'Facing' or 'Side-on' to transport corridor.	As per Quiet House C, except that • 'Side-on' requirements same as Quiet House C 'Facing'. • All windows into habitable areas comprise minimum 6 mm thick glazing in sealed awning or casement frames. Polymer (e.g. uPVC) window framing and hardware which cannot rattle loose should be used throughout. • Evaporative air conditioning systems are not recommended.	To Rw+Ctr 45dB As per Quiet House C, except • the roof must be concrete or terracotta tile construction with sarking (i.e. no steel sheet roof option). • Ceilings to bedrooms must be constructed from at least 2 overlapping layers of flush plasterboard.		

Footnotes:

- The airborne weighted sound reduction index (Rw) and traffic correction term (Ctr) are published by manufacturers/suppliers, can be determined by acoustical consultants or measured in accordance with AS ISO 717.1. Higher Rw+Ctr values infer greater sound insulation. All values are minimum Rw+Ctr (dB)
- Example construction for different external wall ratings of Rw+Ctr 45dB and 50dB are provided and are listed within Specification F5.2 in Volume 1 Part F of the National Construction Code. These values are based on the installation and sealing of joints and penetrations in accordance with Specification F5.2.
- Window and external door sound reduction values provided are based on the provision of suitable acoustic seals to prevent sound leakage. To comply with the above ratings, all external glass windows and doors specified under requirements A, B and C must have the following:
  - Operable windows and external doors must have a seal to restrict air infiltration fitted to each edge and doors must have a drop seal to provide an airtight seal when closed
  - Within doors or fixed framing, glazing must be set and sealed using an airtight arrangement of non-hardening sealant, soft rubber (elastomer) gasket and/or glazing tape, or be verified by manufacturer or approved person that the construction system as to be installed achieves the relevant Rw+Ctr value
  - In this context, a seal is foam or silicon based rubber compressible strip, fibrous seal with vinyl fin interleaf or the like. Brush / pile type seals without this seal included are not allowed.
  - Glazing referenced can be monolithic, laminated or toughened safety glass
- Any penetrations in a part of the building envelope must be acoustically treated so as not to degrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar