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Acoustic Report: Development Application

#9 Coongan Avenue, Greenmount

Reference: 25019799-01A

Prepared for:
Regis

Reference: 25019799-01A

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CONTENTS

List of Tables

List of Figures

Appendices

EXECUTIVE SUMMARY

An extension is proposed for the existing aged care facility at #9 Coongan Avenue, Greenmount. The proposed extension consists of:

- Lower Ground Level with carpark, kitchen, laundry and logistics stores;
- Ground Floor with 48 bedrooms, 5 sitting areas, 3 living/dining areas, as well as an admin room and a café.

The project is only at Development Application stage and therefore much of the detailed design is yet to occur, however this report discusses the acoustic requirements in relation to noise emissions, noise separation and noise intrusion.

Noise Emissions

Once mechanical plant has been designed and selected, an assessment will be undertaken to ensure compliance with the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*. At this stage, the following is recommended:

- All exhaust fans shall be located inside the ceiling void and shall be axial fan type, allowing the incorporation of an attenuator if required;
- All fans shall be variable speed drive so that maximum speed is only occurring when necessary with demand;
- Air-conditioning shall have a 'night' / 'quiet' mode option, in case required for prior to 7.00am operation, subject to final detailed analysis;
- All plant shall be selected for quiet operation;
- All plant is to be appropriately vibration isolated to 95% isolation efficiency.

Compliance is expected from the waste collection and delivery vehicles if undertaken in the basement loading bay between 7am and 7pm Monday to Saturday in the quietest reasonable manner. This includes using reverse broadband alarms to minimise any disturbance.

Noise Separation

Separation of sole-occupancy units is a requirement under the *National Construction Code* for sound transmission and insulation. In this case, the relevant section is Volume One of the *Building Code of Australia* as well as Volume Three Plumbing Code of Australia.

At this stage, a number of acceptable forms of construction have been put forward. As the project progresses into detailed design, these will be refined along with greater detail to control penetrations and flanking paths, as well as suggestions for improved acoustic performance where considered warranted.

Noise Intrusion

With regard to road traffic noise impacts, the development was assessed against the *State Planning Policy No. 5.4 Road and Rail Noise* with the units on the north side calculated to be above the outdoor noise targets. Therefore, construction will need to be reviewed for these units during detailed design in order to achieve acceptable internal noise levels.

1. INTRODUCTION

An extension is proposed for the existing aged care facility at #9 Coongan Avenue, Greenmount as located in *Figure 1-1*. The proposed extension (refer *Appendix A* plans) consists of:

- Lower Ground Level with carpark, kitchen, laundry and logistics stores;
- Ground Floor with 48 bedrooms, 5 sitting areas, 3 living/dining areas, as well as an admin room and a café.

Figure 1-1: Site Locality

With regard to acoustics, the following will need to be addressed as the design progresses:

- Noise emissions – considering noise from the proposed mechanical plant against the requirements of the *Environmental Protection (Noise) Regulations 1997*;
- Noise separation – considering construction requirements to satisfy *National Construction Code* (NCC) *Volume One Building Code of Australia (BCA),* as well as *Volume Three Plumbing Code of Australia (PCA);* and
- Noise intrusion - in this case from road traffic addressing the requirements of *State Planning Policy No. 5.4 Road and Rail Noise Guidelines* (the SPP 5.4 Guidelines).

The project is only at Development Application (DA) stage and therefore much of the detailed design is yet to occur. For noise emissions, the criteria are provided with detailed modelling to occur at later stages once design has occurred. For compliance with the NCC, the focus is also on the criteria with broad advice provided until project specifics are known. For road traffic noise intrusion, the screening assessment procedure provided in the SPP 5.4 Guidelines has been followed.

Appendix C contains a description of some of the terminology used throughout this report.

2. CRITERIA

Each of the relevant criteria are discussed in the following sections. Compliance with these will be further worked through during detailed design.

2.1. Noise Emissions

2.1.1. Regulations 7, 8 & 9

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations or EPNR). This group of regulations provide the prescribed standard for noise as follows:

*"**7. Prescribed standard for noise emissions***

(1) Noise emitted from any premises or public place when received at other premises –

(a) 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; and

(b) must be free of –

(i) tonality; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *"noise is to be taken to be free of these characteristics if:*

(a) *the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and*

(b) *the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] … are made to the noise emission as measured at the point of reception."*

Table 2-1: EPNR Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources

present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2: EPNR Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	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 (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 2 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor at the receiving locations.

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *"a period of time of not less than 15 minutes, and not exceeding 4 hours*, *determined by* an *inspector* or *authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission"*. An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

Table 2-3: EPNR Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+2 dB IF Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	47	57	67
	0900 to 1900 hours Sunday and public holidays (Sunday)	42	52	67
	1900 to 2200 hours all days (Evening)	42	52	57
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	37	47	57

2.1.2. Regulation 14A

"14A. Waste Collection and Other Works

(1) Regulation 7 does not apply to noise emitted in the course of carrying out class 1 works if –

(a) The works are carried out in the quietest reasonable and practicable manner; and

(b) The equipment used to carry out the works is the quietest reasonably available;

class 1 works means specified works carried out between -

(a) 0700 hours and 1900 hours on any day that is not a Sunday or a public holiday; or

(b) 0900 hours and 1900 hours on a Sunday or public holiday.

specified works means -

(a) The collection of waste; or

(b) The cleaning of a road or the drains for a road; or

(c) The cleaning of public places, including footpaths, cycle paths, car parks and beaches;"

In the case where specified works are to be carried out outside of class 1, a noise management plan is to be prepared and approved by the CEO.

2.2. Noise Separation

National Construction Code (NCC) *Volume One Building Code of Australia* Part F7 provides the relevant minimum requirements for this project. The NCC separates the Performance Requirements into floors and walls for Class 9c buildings as follows:

F7P3 Sound Transmission Through Floors in a Residential Care Building

A floor separating sole-occupancy units must minimise the transmission of airborne and impact generated sound such that the separating floor, including the effect of services and their penetrations, has -

(a) A weighted standardise level difference ($D_{nT,w}$) not less than 40 for airborne sound; and
(b) A weighted standardised impact sound pressure level ($L_{nT,w}$) not more than 62 for impact generated sound.

F7P4 Sound Transmission Through Walls in a Residential Care Building

(1) A wall separating sole-occupancy units, or a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated Ensuite), laundry, plant room or utilities rooms, including the effect of services and their penetrations, must minimise the transmission of -

(a) Airborne sound such that the wall has a weighted standardised level difference ($D_{nT,w}$) not less than 40; and
(b) Impact generated sound, if the wall separates a sole-occupancy unit from a kitchen or laundry.

(2) Sound insulation required by (1) must be sufficient to prevent illness or loss of amenity to the occupants.

The following Deemed-to-Satisfy Provisions are provided:

F7D5 Sound insulation rating of floors

(2) A floor in a Class 9c building separating sole-occupancy units must have an R_w not less than 45.

F7D6 Sound insulation rating of walls

(3) A wall in a Class 9c building must have an R_w not less than 45 if it separates -

(a) sole-occupancy units; or

(b) a sole-occupancy from a kitchen, bathroom, sanitary compartment (not being an associated Ensuite), laundry, plant room or utilities room.

(4) In addition to (3), a wall separating a sole-occupancy unit in a Class 9c building from a kitchen or laundry must comply with F7D4(2).

For the purposes of F7D6(4):

(i) for other than masonry, be two or more separate leaves without rigis mechanical connection except at the periphery; or

(ii) be identical with a prototype that is no less resistant to the transmission of impact sound … than a wall listed in [Specification 28].

Table 2-4 provides a summary of the Performance Requirements and Deemed-to-Satisfy provisions.

Note - the NCC/BCA represents a minimum (statutory) acoustic amenity and may not be considered suitable for all types of developments (e.g. high end developments). Where the design aspiration is higher than the minimum amenity, Lloyd George Acoustics should be advised.

Table 2-4 NCC Deemed-to-Satisfy Provisions and Verification Methods

Description	Deemed-to-Satisfy (Laboratory)	Performance Requirement (On-Site)
F7P3 & F7D5 Sound Insulation Rating of Floors		
Separating SOU's	$R_w \geq 45$ $L_{n,w} \leq 62$	$D_{nT,w} \geq 40$ $L_{nT,w} \leq 62$
F7P4 & F7D6 Sound Insulation Rating of Walls		
Separating SOU's	$R_w \geq 45$	$D_{nT,w} \geq 40$
Separating SOU from kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room.	$R_w \geq 45$	$D_{nT,w} \geq 40$
Separating SOU from a kitchen or laundry	Discontinuous Construction	N/A
F7D7 Sound Insulation Rating of Internal Services		
SOU (Habitable) to duct, soil, waste, water supply or storm water (not associated with the SOU)	$R_w + C_{tr} \geq 40$	N/A
SOU (Non-Habitable) to duct, soil, waste, water supply or storm water (not associated with the SOU)	$R_w + C_{tr} \geq 25$	N/A

SOU – Sole-Occupancy Unit

2.3. Noise Intrusion

The criteria relevant to this project is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). SPP 5.4 is supported by the *Road and Rail Noise Guidelines* (the Guidelines) and the Department of Planning, Lands and Heritage mapping. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards.

Table 2-5 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-5: Noise Targets for Noise Sensitive Land-Use

Scenario	Outdoor Noise Target		Indoor Noise Target	
Noise-sensitive land-use and/or development	55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of a noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment has been undertaken.

In the application of the noise targets, the objective is to achieve:

- Indoor noise levels as specified in *Table 2-5* in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

[1] *A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.*

3. NOISE EMISSIONS

3.1. Mechanical Plant

Noise from mechanical plant is required to comply with the prescribed standards of the *Environmental Protection (Noise) Regulations 1997* at the nearest residences. With mechanical plant likely operating more than 10% of the time, the allowable levels are provided in *Table 2-3* and are as follows:

- 47 dB L_{A10} during the daytime, 7.00am to 7.00pm Mondays to Saturdays;
- 42 dB L_{A10} during the daytime on Sundays, 9.00am to 7.00pm and on the evening on all days, 7.00pm to 10.00pm;
- 37 dB L_{A10} during the night, being 10.00pm to 7.00am Mondays to Saturdays and through to 9.00am on Sundays.

For the most part, it is expected that any external mechanical plant will be located on the roof, which is advantageous for existing neighbouring buildings as the roof itself will screen the plant to the lower level neighbours. The exception is likely to be car park exhaust fans and other exhaust fans (fire pump and waste area). In these cases, allowance should be made for attenuators within ductwork, again to be assessed during detailed design.

Some general considerations are:

- Following mechanical plant selection, noise emissions are to be modelled and assessed prior to Building Permit;
- Supply/exhaust fans (e.g. for lower ground level) are to have an allowance for attenuators if required;
- All fans shall be variable speed drive so that maximum speed is only occurring when necessary with demand;
- Where car park fans are required, these shall incorporate CO_2 sensors so they only operate as required;
- Air-conditioning shall have a 'night' / 'quiet' mode option to minimise noise emissions at night;
- Consider acoustic screens around mechanical plant;
- All plant shall be selected for quiet operation;
- All plant is to be appropriately vibration isolated to 95% isolation efficiency.

3.2. Waste Collection and Deliveries

Regulation 14A provides requirements for the collection of waste, stating that this activity can be exempt from having to comply with *Regulation 7* prescribed standards, provided it is undertaken between 7am and 7pm Mondays to Saturdays and undertaken in the quietest reasonable manner. Collection outside of these hours will require a separate noise management plan.

Noise from delivery vehicles is required to comply with the *Regulation 7* prescribed standards at the nearest residences. As the Loading Bay located in the basement is shielded by nearby buildings, compliance is expected when undertaken between 7am and 7pm Mondays to Saturdays and in the quietest reasonable manner. This includes using reverse broadband alarms to minimise any disturbance.

4. NOISE SEPARATION

At this stage of the project, the construction materials are unknown and will be considered further at detailed design, however the following sections provide some broad information for key areas.

4.1. Separating Walls

The following sections show the minimum performance requirement in accordance with the NCC, however it should be noted that for higher end developments, these performances should be exceeded.

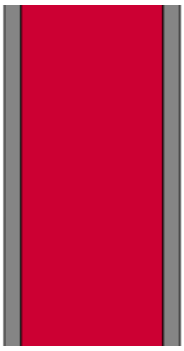
4.1.1. Walls Separating Sole-Occupancy Units

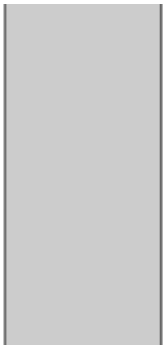
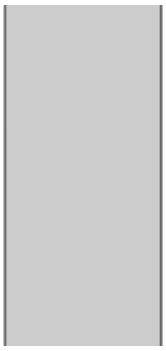
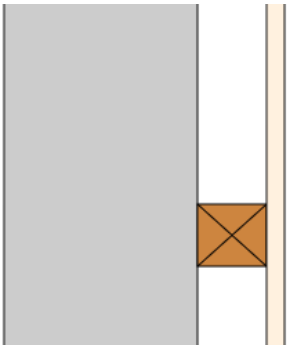
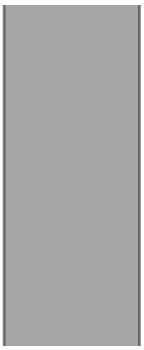
Table 4-1 provides various wall constructions suitable between SOU rooms (party walls) that can be used to achieve $R_w \geq 45$. These wall constructions can also be used between an SOU room and all other room types, except a kitchen or laundry where discontinuous construction must be provided. These serve as examples only until the project moves to detailed design.

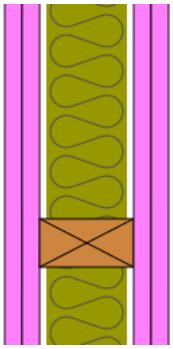
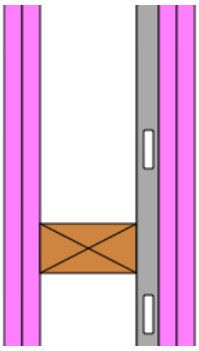
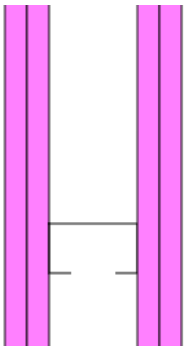
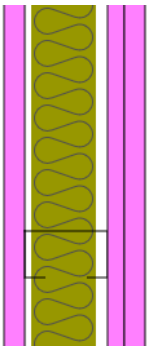
This same wall construction is also recommended between the admin room & café and Staff & Laundry, noting that the Code has no specific wall construction requirements between these areas.

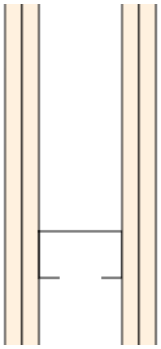
It should further be noted that locating services within lightweight walls is not preferred and ideally these should be located on intra-unit walls or within service risers. Where hydraulic services must be located in the lightweight party wall, the CSR Gyprock Silencer must be incorporated. Hydraulic services must not be chased in masonry walls.

Table 4-1 Indicative Party Wall Construction

Description	Image	Estimated Performance R_w
110mm thick brick masonry with – • 13mm cement render on each face.		45 **Not** Discontinuous Construction

Description	Image	Estimated Performance R_w
110mm thick concrete brickwork		45 **Not** Discontinuous Construction
190mm thick concrete blockwork		45 **Not** Discontinuous Construction
140mm thick concrete blockwork, the face shell thickness of the blocks being not less than 44mm and with – • 50mm x 50mm timber battens spaced at not more than 610mm centres screw-fixed on one face of the blocks into resilient plugs with rubber inserts between battens and the wall; and • The face of the battens clad with 13mm plasterboard.		45 **Not** Discontinuous Construction
100mm thick concrete panel		45 **Not** Discontinuous Construction

Description	Image	Estimated Performance R_w
One row of 70mm x 35mm timber studs at not less than 600mm centres with - • 75mm thick glass or mineral wool insulation with a minimum density of 8 kg/m^3 positioned between studs; and • Two layers of 13mm fire-protective plasterboard fixed on each face.		45 **Not** Discontinuous Construction
One row of 70mm x 35mm timber studs at not less than 450mm centres with - • 28mm furring channels installed horizontally on one side; and • Two layers of 13mm fire-protective plasterboard fixed on each face.		45 **Not** Discontinuous Construction
One row of 64mm steel studs with - • Two layers of 16mm fire-protective grade plasterboard fixed on each face.		45 **Not** Discontinuous Construction
One row of 64mm steel studs with - • One layer of 16mm fire-protective grade plasterboard fixed to one face; and • 50mm thick glass or mineral wool with a density of 11 kg/m^3 positioned between the studs; and • Two layers of fire-protective grade plasterboard fixed to the other face, the inner layer being 16mm thick and the outer layer being 13mm.		45 **Not** Discontinuous Construction

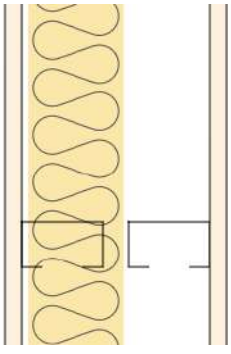
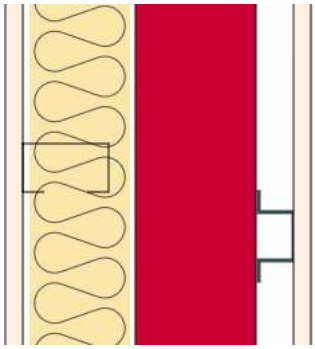
Description	Image	Estimated Performance R_w
One row of 64mm steel studs with - • Two layers of 13mm plasterboard fixed on each face.		45 **Not** Discontinuous Construction

4.1.2. Walls Separating Sole-Occupancy Unit to Stairs and Dirty Utility

Table 4-2 provides various wall constructions that can be used to achieve $R_w \geq 45$ and discontinuous construction, which is only required where an SOU room adjoins a kitchen or laundry. Although the Code specifically only requires discontinuous construction where an SOU room adjoins a kitchen or laundry, discontinuous construction is also recommended between the following areas:

- SOU room to stairs; and
- SOU room to Dirty Utility.

Table 4-2 Indicative Discontinuous Walls

Description	Image	Estimated Performance R_w
Two rows of 64 mm Studs with – • Minimum 20mm gap between studs; • 1x 13mm plasterboard on each side • 75mm, 14 kg/m^3 *Acoustigard* insulation (or equivalent) between one row of studs; • CSR 10029		52 Discontinuous Construction
90mm thick brick / blockwork with – • 13mm thick plasterboard on 28mm furring channels to on one side; • 13mm thick plasterboard to 64mm steel stud spaced 20mm from brick/block with 75mm thick, 14 kg/m^3 *Acoustigard* insulation (or equivalent). • CSR 4205 (sim)		52 Discontinuous Construction

4.1.2.1. Further Consideration for Stairs

To minimise the impact noise associated with stairs, the following is recommended:

- Handrails are to be connected to the internal wall or the stairs themselves rather than the adjoining unit walls;
- Handrails are to be flat bar types and possibly plastic covered in preference to hollow tube type; and
- Stairs are to be formed separate to structural elements so they are self-supporting and maintain a clear gap to any unit wall. Gaps can be filled with non-hardening mastic if necessary.

4.1.3. Doors of Sole Occupancy Units

There is no requirement for entry doors in Class 9c buildings. Unit entry doors in Class 2/3 buildings are to achieve minimum R_w 30 performance so this same approach can be taken.

Such performance is readily achievable with minimum 40mm thick, solid timber core doors with perimeter acoustic seals such as Raven RP10 (perimeter) and RP8Si (bottom).

4.1.4. Intra-unit Walls

The Code does not provide any acoustic rating requirements for internal walls. The exception to this is where a wall may also be separating the hydraulic services in the ceiling space above a wet area from an adjoining habitable space. In this instance, the only requirement is for the wet area walls to be constructed full height. Where a wall separates two wet areas, the wall does not need to be full height.

4.1.5. Wall Construction Deemed to Satisfy

Within S28C3, installation details are provided and these must also be followed to achieve the acoustic ratings as follows:

(a) Masonry units must be laid with all joints filled solid, including those between the masonry and any adjoining construction.

(b) Joints between concrete slabs or panels and any adjoining construction must be filled solid.

(c) For sheeting materials –

- *(i) If one layer is required on both sides of a wall, it must be fastened to the studs with joints staggered on opposite sides; and*
- *(ii) If two layers are required, the second layer must be fastened over the first layer so that the joints do not coincide with those of the first layer; and*
- *(iii) Joints between sheets or between sheets and any adjoining construction must be taped and filled solid.*

(d) Timber or steel-framed construction – perimeter framing members must be securely fixed to the adjoining structure and

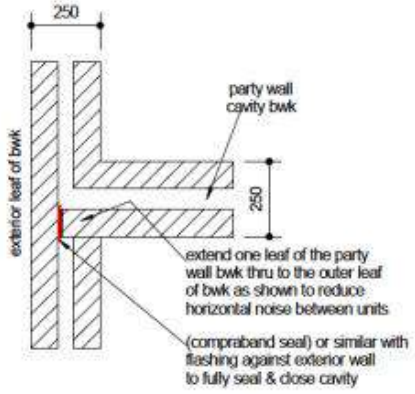
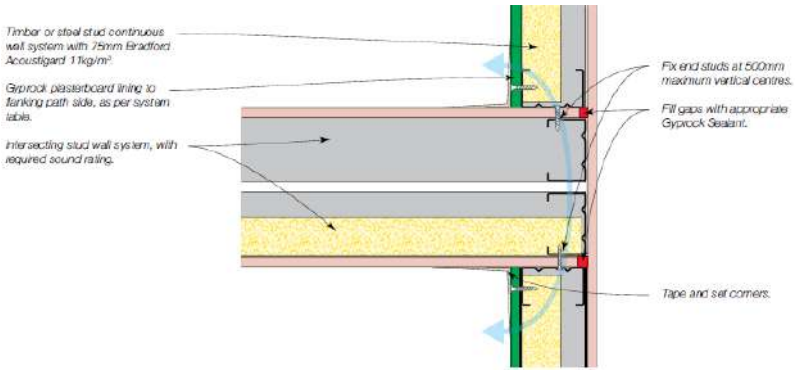
- *(i) Bedded in resilient compound; or*
- *(ii) The joints must be caulked so that there are no voids between the framing members and the adjoining structure.*

4.1.6. Wall Flanking Paths and Penetrations

Care is required to control flanking paths (see adjoining image), which can exist where a party wall meets an external wall for instance.

It is particularly important for the party wall to extend through the external wall and corridor walls where these have a cavity, with examples of how this is achieved shown in *Table 4-3* effectively requiring other wall cavities to be closed.

Table 4-3 Control of Flanking Path for Party Walls

Masonry	Lightweight
	

Where ties are used in the cavity, these must be kept clean of mortar (unlike that shown on the adjoining image). This is particularly important where anti-vibration ties are used, with the mortar droppings bridging the cavity.

Other controls that can be considered are:

- Glazing to be minimum 6mm thick, irrespective if required for control of ambient noise or not. Windows are to be awning style and both windows and sliding doors are to incorporate acoustic seals. This will assist in minimising noise transfer via windows, even when closed.
- Where box gutters exist, these should not align with party walls. Where this does occur, the box gutter is to be wrapped in 50mm thick, 11kg/m^3 fibrous insulation and boxed in with 9mm thick compressed fibre cement sheet.

As per F7D7, the following are provided as deemed to satisfy:

(5) Where a wall required to have sound insulation has a floor above, the wall must continue to –

(a) the underside of the floor above; or

(b) a ceiling that provides the sound insulation required for the wall.

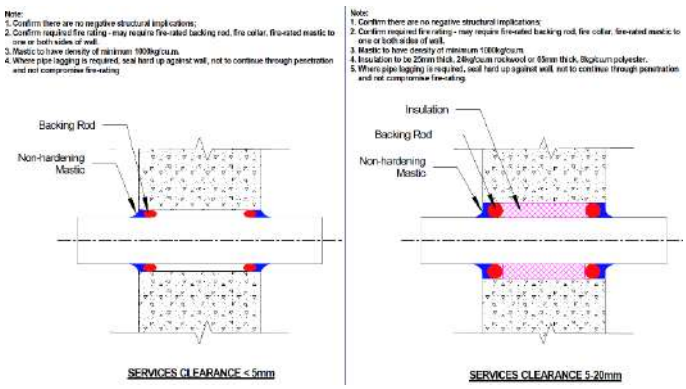
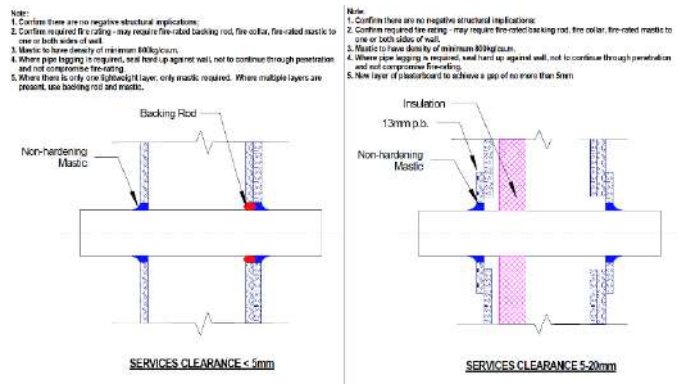
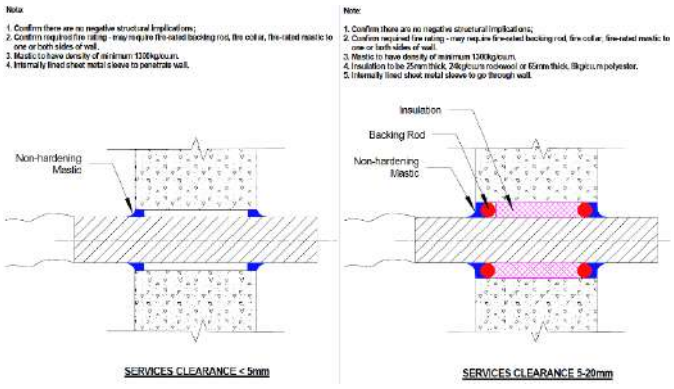
(6) Where a wall required to have sound insulation has a roof above, the wall must continue to –

(a) the underside of the roof above; or

(b) ceiling that provides the sound insulation required for the wall.

Where a pipe, duct or similar penetrates a sound-rated wall, these must be cut neatly with the size of the opening minimised and acoustically sealed with typical details shown in *Table 4-4* sealants such as fire-rated mastic.

Table 4-4 Typical Sealing for Wall Penetrations

Description	Detail
Pipe Through Concrete Sound-Rated Wall	
Pipe Through Plasterboard Sound-Rated Wall	
Mechanical Duct Through Sound-Rated Wall	

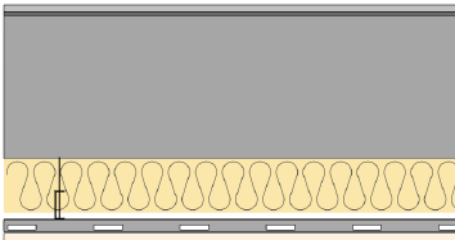
4.2. Separating Floors

Section 4.2.1 to *Section 4.2.4* discuss the proposed constructions for floors noting there is both a minimum airborne requirement ($R_w \geq 45$) and impact requirement ($L_{n,w} \leq 62$) where a room is located below, however this is not applicable in this instance.

4.2.1. Floors Separating Sole-Occupancy Units

Table 4-5 provides a review of the various proposed party floors.

Table 4-5 Indicative Floor Construction Between Units

Description	Image	Estimated Performance
100mm thick concrete slab with - • Carpet on underlay		R_w 45 $L_{n,w}$ 55
150mm thick concrete slab with - • 75mm thick, 14kg/m^3 fibrous insulation above ceiling; • One layer of 13mm plasterboard suspended minimum 150mm from slab on lightweight metal frame.		R_w 55 $L_{n,w}$ 55

4.2.2. SOU Above Car Park

Provided the slab is a minimum 100mm thick, $R_w \geq 45$ is achieved. Impact noise from the SOU to the car park is not a concern, however impact from the car park to the units must be considered as follows:

- Car Park Entry Gate:
  - Is to be a hinged type door, fitted with a 'slow-down device';
  - Is to be supported via its own structure;
  - Motors are to be vibration isolated to achieve minimum 97% isolation efficiency with guidance provided by a mount supplier such as Mason Mercer;
  - Stopping points are to be vibration isolated;
  - Closing latches to be quiet in operation; and
  - Noise levels must comply with the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

- Car Park Floor
  - Shall be constructed so that there are no significant gaps in construction or where these exist, are to be filled with non-hardening mastic;
  - Drainage grates and other trafficable panels are to be plastic or metal with rubber gasket and secure to avoid excess banging;
  - Brushed concrete finish to avoid tyre squeal. Where the concrete is to be sealed, a product such as Aquron 1000 by Markham is understood to be suitable and not contribute to tyre squeal.

Similarly impact from the SOU to Laundry is not a concern, however vice versa is. It is recommended all plant and associated pipework be vibration isolated to minimum 95% isolation efficiency.

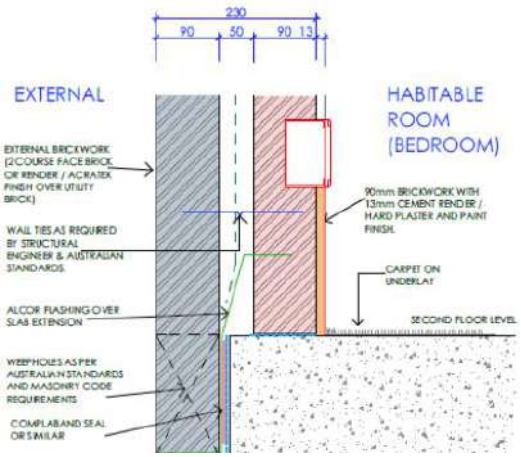
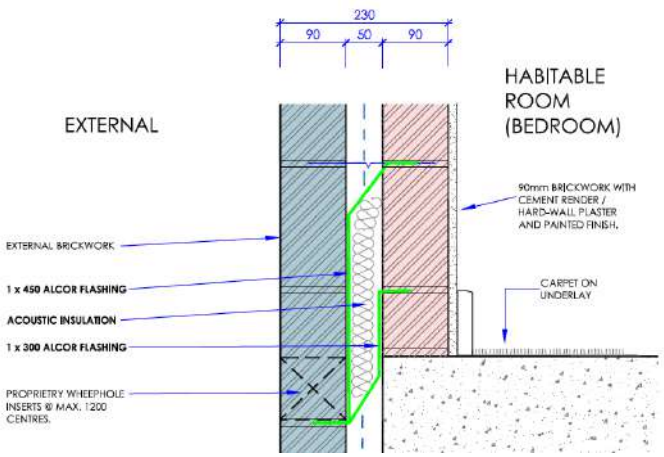
4.2.3. Floor Construction Deemed to Satisfy

The same Deemed to Satisfy provisions of *Section 4.1.5* are also relevant to floors.

4.2.4. Floor Flanking Paths and Penetrations

Similar to *Table 4-3* flanking via the floor slab must be controlled to close off the external cavity with two options provided in *Table 4-6*. This is critical where glazing exists above and below the floor as the noise can pass through the aluminium frames. Essentially, the floor slab is to extend to the inside of the outer leaf or the cavity be sealed in some other way. This naturally occurs where balconies exist such that it is not an issue in these circumstances.

Table 4-6 Floor Flanking Control

Extend Floor Slab	Seal Cavity (1200mm Either Side of Stacked Glazing)
	

4.3. Services

4.3.1. Deemed to Satisfy Requirements

F7D7 Sound insulation rating of internal services

(1) If a duct or soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an $R_w + C_{tr}$ (airborne) not less than –

(a) 40 if the adjacent room is a habitable room (other than a kitchen); or

(b) 25 if the adjacent room is a kitchen or non-habitable room.

(2) If a stormwater pipe passes through a sole-occupancy unit, it must be separated in accordance with (1)(a) and (b).

F7D8 Sound isolation of pumps

A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating or other pump."

Specification 28C3 provides the following in relation to services:

(e) Services must not be chased into concrete or masonry elements.

(f) A door or panel required to have a certain $R_w + C_{tr}$ that provides access to a duct, pipe or other service must –

(i) Not open into any habitable room (other than a kitchen); and

(ii) Be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10mm, be fitted with a sealing gasket along all edges and be constructed of –

(A) Wood, particleboard or blockboard not less than 33mm thick; or

(B) Compressed fibre-reinforced cement sheeting not less than 9mm thick; or

(C) Other suitable material with a mass per unit area not less than 24.4kg/m^2.

(g) A water supply pipe must –

(i) Only be installed in the cavity of discontinuous construction; and

(ii) In the case of a pipe that services only one sole-occupancy unit, not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10mm to the other wall leaf.

(h) Electrical outlets must be offset from each other –

(i) In masonry walling, not less than 100mm; and

(ii) In timber or steel-framed walling, not less than 300mm.

Section 4.3.2 to *Section 4.3.4* discuss the relevant requirements for hydraulic, electrical and mechanical services.

4.3.2. Hydraulic Services

To clarify *Section 4.3.1*, the NCC is only concerned with noise from a pipe, which is not associated with the SOU it adjoins. Therefore, water supply pipes only serving the SOU it is within, do not require any treatment for acoustic purposes. Also note that pipes include stormwater as well as soil, waste and water supply.

4.3.2.1. General Design Planning

The layout of units will in some cases dictate the path of the hydraulic services. However where practicable, the locations of hydraulic services should be in the least noise-sensitive space available (for instance run the main water supply in the corridor rather than a unit). Steps such as these will minimise the noise impacts and project costs by reducing the amount of lagging necessary.

Some general points to note are:

- Plumbing and drainage systems must be designed, constructed and installed in a manner that does not create undue noise.
  - Cold water, non-drinking water and fire-fighting water services must be installed in accordance with AS/NZS 3500.1;
  - Heated water services must be installed in accordance with AS/NZS 3500.4;
  - Sanitary plumbing and drainage systems must be installed in accordance with AS/NZS 3500.2.
- The preference should be for a person's pipework to be contained within their own room rather than penetrating the slab and running in the ceiling space of a room below. As well as minimising potential noise issues, this will also minimise the amount of lagging necessary and therefore result in cost savings. For instance:
  - Run pipes within cupboards or oversized skirting boards to service risers;
  - Use P trap type toilets where the wall behind is a service riser.
- Where pipe work must run in the ceiling space of another unit, preference is to be given to running above non-habitable areas;
- Pipework is not to be chased within common sound-rated walls;
- Plastic water supply pipes, such as those supplied by Rehau are to be used rather than copper pipes;
- The number of bends and elbows are to be minimised;
- Flow velocity in pipes is to be minimised;
- Avoid pipe work in the same ceiling space as ductwork. Where this is necessary, the distance between the pipe and the return air grille, supply air register or exhaust fan should be maximised;
- Ensure pipe work does not contact lightweight structures such as ceiling hangers;
- Wet area internal walls (excluding those between two wet areas) are to be from slab to slab where pipes are located within the ceiling space to minimise the transfer of hydraulic services noise from a wet area ceiling to an adjoining habitable room. Where these walls are of mass construction and not load bearing, they are to stop short of the slab by maximum 20mm with the gap being sealed by non-hardening mastic. This is to assist in minimising transfer of impact noise;
- Floor wastes should not be central to a room in order to minimise the length of pipe run;
- Tap fixtures should not be mounted on party walls but rather utilise the intra-unit walls and in the case of sinks be bench mounted. Taps should be selected for quiet operation, having soft closing action;

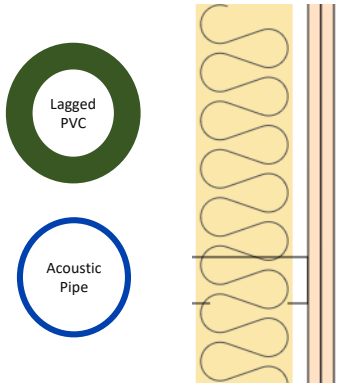
- Water hammer arresters installed where appropriate to limit the pressure on the delivery side to no more than 500kPa, particularly for dishwashers and washing machines and flexible hoses fitted to water supply and drainpipes for washing machines and dishwashers.
- Selection of quiet valves and cisterns should be given preference to noisier models. Toilets are to be installed on a silicone bed with a clear gap (can be covered in non-hardening mastic) between the pan and tiles.
- Where pipes are acoustically lagged, the lagging is to be pushed hard up to the underside of the slab. Where a fire collar is installed, it may not be permissible to lag right up to the collar.
- Pipes located within the side of the wall of discontinuous construction must not bridge the discontinuity.
- When selecting plant and comparing manufacturers, select equipment with lower noise levels.
- Hot water systems are to be selected for quiet operation and installed on isolation mounts. Consideration can be given to installing a timer on heat pump systems to minimise night-time operation.
- For treatment of penetrations, refer to *Section 4.1.6* and *Section 4.2.4*.

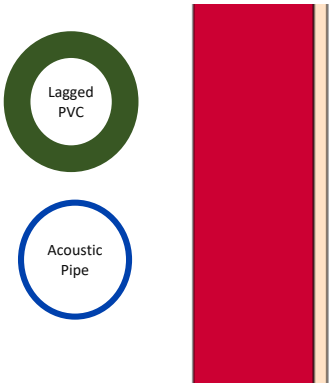
4.3.2.2. Hydraulic Service Risers

Table 4-7 provides the service riser construction to be used for the containment of hydraulic services.

Also of note is that the $R_w + C_{tr}$ performance is a combination of the surrounding construction as well as use of lagged pipe or acoustically rated pipe, which attenuates the pipe noise and therefore is considered to contribute to the $R_w + C_{tr}$ performance.

Table 4-7 Indicative Hydraulic Service Riser Wall Construction

Description	Image	Estimated Performance $R_w + C_{tr}$
• PVC pipe wrapped in *Soundlag 4525* or Acoustic Pipe; • 92mm Steel Stud with 75mm Acoustigard, 14 kg/m^3; • CSR 7220(e); • Note: Can reduce to 1 layer of moisture resistant plasterboard in bathrooms.		$R_w + C_{tr}$ 42

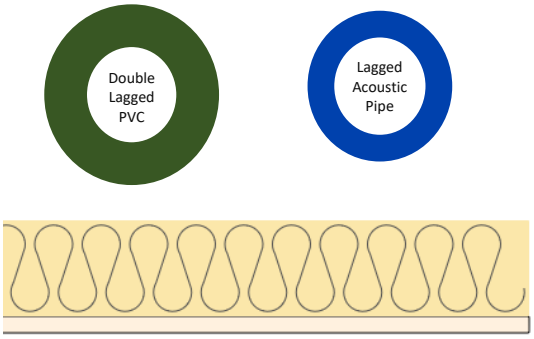
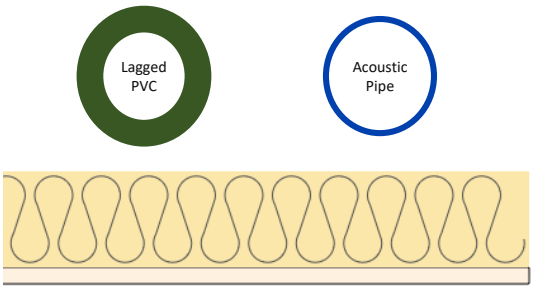
Description	Image	Estimated Performance $R_w + C_{tr}$
• PVC pipe wrapped in *Soundlag 4525* or Acoustic Pipe; • 90mm brick with 10mm plasterboard or cement render.		$R_w + C_{tr}$ 45

4.3.2.3. Hydraulic Services in Ceilings

Table 4-8 provides the construction requirements for hydraulic services within another SOU ceiling space. Again, the performance requirements are achieved by the surrounding construction as well as the use of pipe lagging or acoustic rated pipe.

Prior to closing off the ceiling space, it is imperative that the lagging installation is checked as this can become loose and/or damaged during the construction process.

Table 4-8 Indicative Treatment for Hydraulic Services in Ceilings

Description	Image	Estimated Performance $R_w + C_{tr}$
Above Habitable Areas (incl kitchens) 1 x 13mm thick plasterboard - • 75mm Glasswool *Acoustigard* 14kg/m^3 insulation above ceiling; • PVC pipe wrapped in 2 x *Soundlag 4525* or equivalent; or • Acoustic pipe (e.g. *Raupiano Plus*) wrapped in *Soundlag 4525* or equivalent; • No more than 1 downlight per 1m^2		$R_w + C_{tr} \geq 40$
Above Wet Areas 1 x 13mm thick plasterboard - • 75mm Glasswool *Acoustigard* 11kg/m^3 insulation above ceiling; • PVC pipe wrapped in *Soundlag 4525* or equivalent; or • Acoustic pipe (e.g. *Raupiano Plus*).		$R_w + C_{tr} \geq 25$

4.3.2.4. Fixing of Pipes

All pipes are to use acoustically rated clips with preference given to fixing to the least noise sensitive wall. For instance, where the pipe is within a service riser and adjoins a bathroom and a living room, clip the pipe to the bathroom wall. Where possible, pipes in service risers are to be clipped in line with the floor slab.

4.3.2.5. Pipe Lagging

Where pipes are to be lagged, this must be installed strictly in accordance with manufacturer's specifications. Lagging at both longitudinal and latitudinal joints are to overlap by a minimum of 50mm and taped. The circumference is to also be taped at a minimum of 500mm intervals to secure lagging. Wrapping is to be well sealed to the slab and wall penetrations. Proprietary products are to be used such as:

- *Nuwrap 5* by Thermotec;
- *Soundlag 4525* by Pyrotek.

Note that minor gaps in lagging can significantly downgrade their performance and as such, it is recommended lagging be installed by a specialist contractor such as Benz Industries or Watsons Noise Control.

4.3.2.6. Pipes Cast in Slabs

Once a pipe is cast into a slab, the noise can transfer in all directions throughout the structure and becomes uncontrolled. For instance, noise from a pipe cast into a slab may transfer horizontally to an adjoining unit. It is therefore generally not permissible to cast pipes into slabs, columns or walls that adjoin a unit. The exception is the waste pipe for vertically stacked balconies, where the pipe is solely contained in the balcony slab.

4.3.2.7. Access Panels

Access panels are to meet the minimum requirements specified by the NCC (refer *Section 4.3.1*). Proprietary panels are available to satisfy the $R_w + C_{tr}$ 25 requirement (considered equivalent to R_w 30 requirement, which relates to the older BCA) such as *Rondo SRAP FE/SB*. The Code does not permit panels to open into habitable spaces and as such this should be avoided. There are however some circumstances where this is unavoidable. In the case of a ceiling, the Trafalgar R_w 34 panel is appropriate and in the case of a service riser, the *Rondo Panther HP-51 Access Panel*, or approved equivalent, shall be used.

4.3.2.8. Toilets

To minimise pan noise, the acoustic underlay used between the tiles and slab is to be extended under the toilet and the toilet installed on a silicone bed with bolts holding the toilet in place being neoprene *Rawlnut* fixings or equivalent. There is to remain a gap between the tiles and pan, which is then filled with non-hardening mastic.

The cisterns are to be selected for quiet operation and fixed to the wall with neoprene *Rawlnut* fixings.

4.3.2.9. Vibration Isolation

A flexible coupling must be used at the point of connection between the service pipes and any circulating or other pump. If piping between the pump and flexible connection requires support, this is to be via anti-vibration hangers.

All plant (pumps, hot water systems etc) are to be mounted on anti-vibration mounts capable of 97% minimum isolation efficiency.

4.3.3. Electrical Services

4.3.3.1. Electrical Boxes

The preference should be for electrical boxes to be located on non-sound rated intra-unit walls and in these cases, there are no specific acoustic requirements. Where electrical boxes, including light switches, are located on a sound-rated wall, the following is to be undertaken:

- Where electrical boxes exist on either side, boxes are to be offset by a minimum 300mm and preferably on either side of a stud.
- Recessed electrical boxes are to be equivalent to Clipsal or Legrand Fire Rated Wall Boxes. If multiple boxes are required, these must be separated by a minimum of 100mm.
- Cabling is to run in the cavities and is not to be chased.
- Light switches should be selected for quiet operation.

4.3.3.2. Vibration Isolation

All equipment is to be mounted on anti-vibration mounts/hangers capable of 97% minimum isolation efficiency.

4.3.3.3. Further Electrical Items

In addition to the previous items:

- For treatment of penetrations, refer to *Section 4.1.6* and *Section 4.2.4*.
- Conduits located within the side of the wall of discontinuous construction must not bridge the discontinuity.
- When selecting plant and comparing manufacturers, select equipment with lower noise levels.
- Where a manufacturer can provide an acoustic enclosure (e.g. for a generator), this shall be selected.

4.3.4. Mechanical Services

Noise from mechanical services is assessed under a separate report with this section referring predominantly to NCC related aspects.

4.3.4.1. General Design Planning

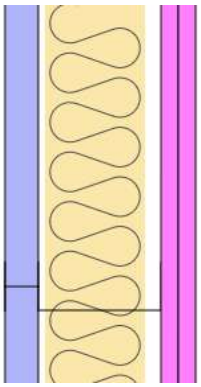
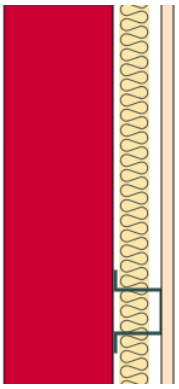
Below are general recommendations that relate to good mechanical design in order to minimise noise:

- Select equipment for quiet operation including condensers with a night-time 'quiet' mode;
- Program fans to only run when necessary (e.g. CO_2 sensors) and to incorporate variable speed drives;
- Flexible ductwork is to be neatly fitted to avoid misaligning or kinking the duct and shall not be squashed between other services (e.g. hydraulic pipes);
- In room air-conditioning shall comply with the maximum recommended design sound level of AS2107, with the design being the responsibility of the consultant and contractor;
- Grilles and registers are to be selected for quiet operation;
- Flow velocity in ducts to be minimised as per manufacturer's specifications and generally as follows:
  - Flexible ducts to bedrooms 2.5 m/s;
  - Metal ducts to bedrooms 3 m/s;
  - Flexible ducts to living areas 3 m/s; and
  - Metal ducts to living areas 4.5 m/s.
- Ductwork is not to touch lightweight structures such as ceiling hangers;
- Metal ductwork is not to directly touch the slab. Where the duct is pushed hard-up due to ceiling space restrictions, a 5mm neoprene mat is to be located between the duct and slab;
- Concealed fan coil units are to be located above the ceiling of a non-noise-sensitive room such as bathrooms or corridor;
- Supply and return air paths are to avoid passing through wet areas, where hydraulic services are contained in the ceiling space. Where this occurs, treatment to the grilles will be required to minimise noise from the hydraulic services into the adjoining space. Where either return or supply air must go through the wet area, preference should be given to the supply air;
- The ceiling insulation to be installed above the acoustic boots;
- Ducts are not to be connected to the slab above using folded sheet metal angles;
- For treatment of penetrations, refer to *Section 4.1.6* and *Section 4.2.4*.

4.3.4.2. Mechanical Service Risers

Table 4-9 provides the service riser construction to be used for the containment of mechanical services noting that in these cases, the service riser must provide the full performance requirement, unlike hydraulics where the pipes can be treated.

Table 4-9: Indicative Mechanical Service Riser Wall Construction

Description	Image	Estimated Performance $R_w + C_{tr}$
102mm Shaft wall C-H Stud system (Alternative Option to AFS) – • One side having 2x 13mm thick Fyrchek; • 75mm thick, 14 kg/m^3 *Acoustigard* between studs; and • Other side 25mm Shaft Liner. • CSR Ref: 7665(c).		46
90mm Brick with – • 13mm plasterboard on furring channel to create 40mm cavity; • Insulation to be 25mm thick, 24 kg/m^3 fibrous insulation.		43

4.3.4.3. Access Panels

Refer *Section 4.3.2.7*.

4.3.4.4. Vibration Isolation

- All plant (fans, air-conditioning etc.) are to be isolated in order to achieve 97% isolation efficiency;
- Flexible connections are to be used between fans and sheet metal ductwork. Flexible connection to be 4kg/m^2 loaded vinyl and must not be 'stretched' (i.e. must be oversized) or misaligned.

4.4. Other

Some other items that are worth considering for improved acoustic amenity are discussed below.

4.4.1. Doors

Unit entry doors are covered in *Section 4.1.3*, as these are required to have specific acoustic performance. To achieve this rating, perimeter acoustic door seals are required, which also has the benefit of minimising impact noise as the door closes.

Closing of cupboard doors, unit doors and stairwell doors can often be heard in nearby units and as such, there is benefit in providing felt pads or compressible seals in these cases also. Similarly, soft closing mechanisms shall be incorporated for all drawers.

Sliding doors and wardrobes should also be selected for quiet operation and soft rubber bumpers installed at the point of impact. A resilient mat such as 5mm Impactamat should also be set under the base tracks of these doors where there is a unit below.

4.4.2. Rain Noise

It is recommended 60mm thick, R1.3 *Anticon 60* be placed between any metal deck roof and the top of the purlins and minimum R3.5 insulation overlaid above the ceilings below the metal deck roof to minimise rain noise.

Box gutters can also be a significant source of rain noise and where these exist above an SOU, these are to have insulation to the underside and 6mm compressed cement sheeting to box around.

4.4.3. Enclosed Lobby

To minimise impact and airborne noise within enclosed lobby/corridor areas, it is recommended these have a carpeted floor finish. As well as satisfying the impact Code requirement, the carpet will assist in minimising reverberation within such spaces.

Where a hard floor finish is preferred, consideration can be given to acoustic absorption on walls and/or ceilings. Whilst it is recommended this be considered throughout, the main entry lobby is likely to be particularly reverberant that such treatment is strongly recommended in this area.

4.4.4. Wind and Thermal Noise

This aspect is to be considered by others such as a façade engineer with regard to wind induced noise around the structure, particularly perforated panels.

Thermal/structural expansion of the structure shall also be considered to minimise creaking and popping noises.

4.4.5. Aged Care Unit Living

Potential occupants of the units should be notified within the agreements that irrespective of the acoustic quality of units, some noise will always be audible between units. The strata agreement should include advice such as:

- Advise of time/use restrictions for common areas;
- All chairs on hard floor finishes, including external balconies are to be fitted with felt pads.
- Testing of emergency equipment (where relevant) are to be during agreed times with occupants and must be within the hours of Monday to Saturday 7am to 7pm.

5. NOISE INTRUSION

With regard to road traffic noise impacts, the proposed aged care extension is considered noise sensitive and the nearest units are located within approximately 145 metres from Great Eastern Highway (refer *Figure 5-2*). This road is considered a 'Strategic Freight/Major Traffic Route' in accordance with the PlanWA Maps and as such, a noise assessment is required against *State Planning Policy No. 5.4 Road and Rail Noise*.

The methodology used in this assessment is to follow the screening assessment procedure provided in the Guidelines. From Table 2 of the Guidelines (refer *Figure 5-1*), noise levels at the units on the north side of the proposed extension (as shown in *Figure 5-3*) are assessed as 56 dB $L_{Aeq(Day)}$, with Great Eastern Highway being a total of 4 lanes and at a distance of 145 metres from the proposed site. Therefore, the units on the north side of the proposed extension are considered to fall within Exposure A. All other units are located in an area below the outdoor noise target.

Transport Corridor Classification		Number of lanes (both directions), including bus/priority lanes and entrance/exit ramps	Forecast noise exposure category based on lot distance(m) from edge of nearest main road carriageway (not entrance/exit ramps)																				
			adjacent	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	175	200	225	250	275	300
Strategic freight/major traffic route • 500 or more Class 7-12 Austroads vehicles per day, or • 50,000+ vehicles per day		2 to 4 lanes	72	68	66	65	62	62	61	61	60	59	59	58	57	57	56	55	54	53	52	51	50
		5 to 6 lanes	74	70	68	66	65	64	63	62	61	61	60	59	59	58	58	57	56	55	54	53	52
		7 to 8 lanes	74	72	69	68	66	65	64	64	63	62	62	61	60	60	59	58	57	56	55	54	53
		9 to 10 lanes	77	73	70	69	67	66	65	65	64	63	63	62	61	61	60	59	58	57	56	55	54
		10 or more lanes	78	74	71	70	68	67	66	66	65	64	64	63	62	62	61	60	59	58	57	56	56
Other significant freight / traffic routes • Any actual or planned future State Administered Road • Local Government Roads Carrying 100 or more Class 7 – 12 Austroads vehicles/day • 25,000+ vehicles per day: vehicles/day	Urban Region Scheme areas 60-80 km/hr	1 to 2 lanes	67	64	62	61	60	59	58	57	56	56	55	54	54	53	53	52	51	50	49	48	47
		3 to 6 lanes	69	66	64	63	62	61	60	59	58	58	57	56	56	55	55	54	53	52	51	50	49
	Urban Region Scheme areas 100+ km/hr	1 to 2 lanes	70	67	65	64	63	62	61	60	59	59	58	57	57	56	56	55	54	53	52	51	50
		3 to 6 lanes	74	70	68	66	65	64	63	62	61	61	60	60	59	59	58	57	56	55	54	53	52
	Rural areas 60-80 km/hr	1 to 2 lanes	62	59	57	56	55	54	53	52	51	51	50	49	49	48	48	46	45	44	43	42	41
		3 to 4 lanes	66	63	61	60	59	58	56	56	55	54	53	53	52	52	51	50	49	48	47	46	45
	Rural areas 100+ km/hr	1 to 2 lanes	67	64	62	61	60	59	58	57	56	55	54	54	53	53	52	51	50	49	48	47	46
		3 to 4 lanes	69	66	64	63	62	61	60	59	58	57	56	56	55	55	54	53	52	51	50	49	48

Forecast Excess Noise Level, dB	Exposure Category	Policy requirements for noise-sensitive land-use and/or development
0 or less	-	No further measures
1 to 3	A	Noise-sensitive land-use and/or development is acceptable, subject to: mitigation measures in accordance with an approved noise management plan; or quiet house package as specified
–	*A+	
4 to 7	B	
–	*B+	
8 to 11	C	
–	*C+	
12 to 15	D	Noise-sensitive land-use and/or development is not recommended. There is no default quiet house option due to excessive forecast noise; professional design input is required in order to achieve compliance with relevant criteria. If noise sensitive land-use and/or development is unavoidable, an approved noise management plan is required to demonstrate compliance with the noise target (see Table 1).
16 +	E	

* Applies to mitigate short-term noise events from freight rail.

Figure 5-1: Noise Exposure Forecast Table from Guidelines

As the units on the north side of the proposed extension are above the outdoor noise targets, construction shall be reviewed during detailed design in order to achieve acceptable internal noise levels.

Figure 5-2: Subject Site Locality in Relation to Road (Source: DPLH PlanWA)

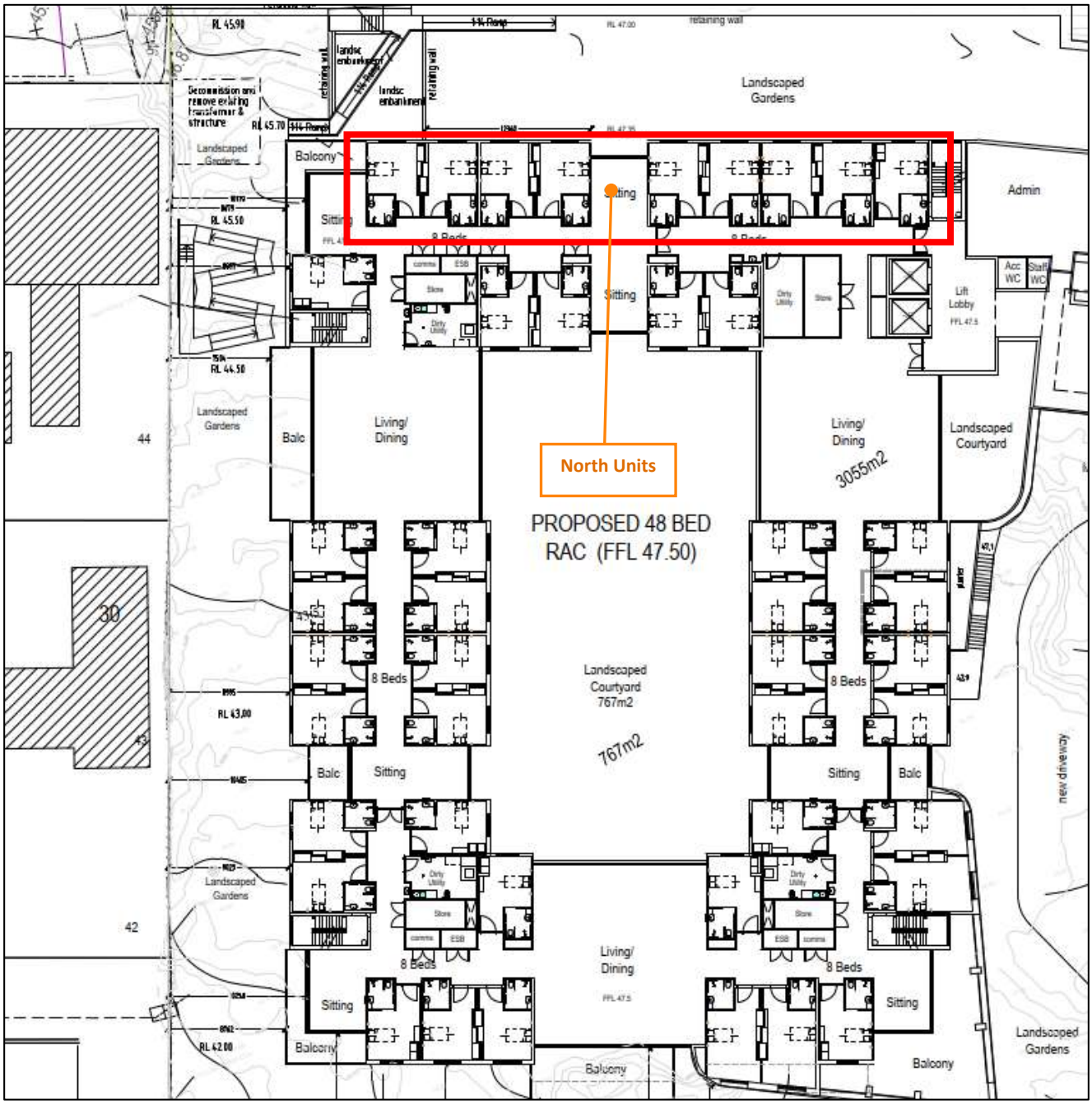
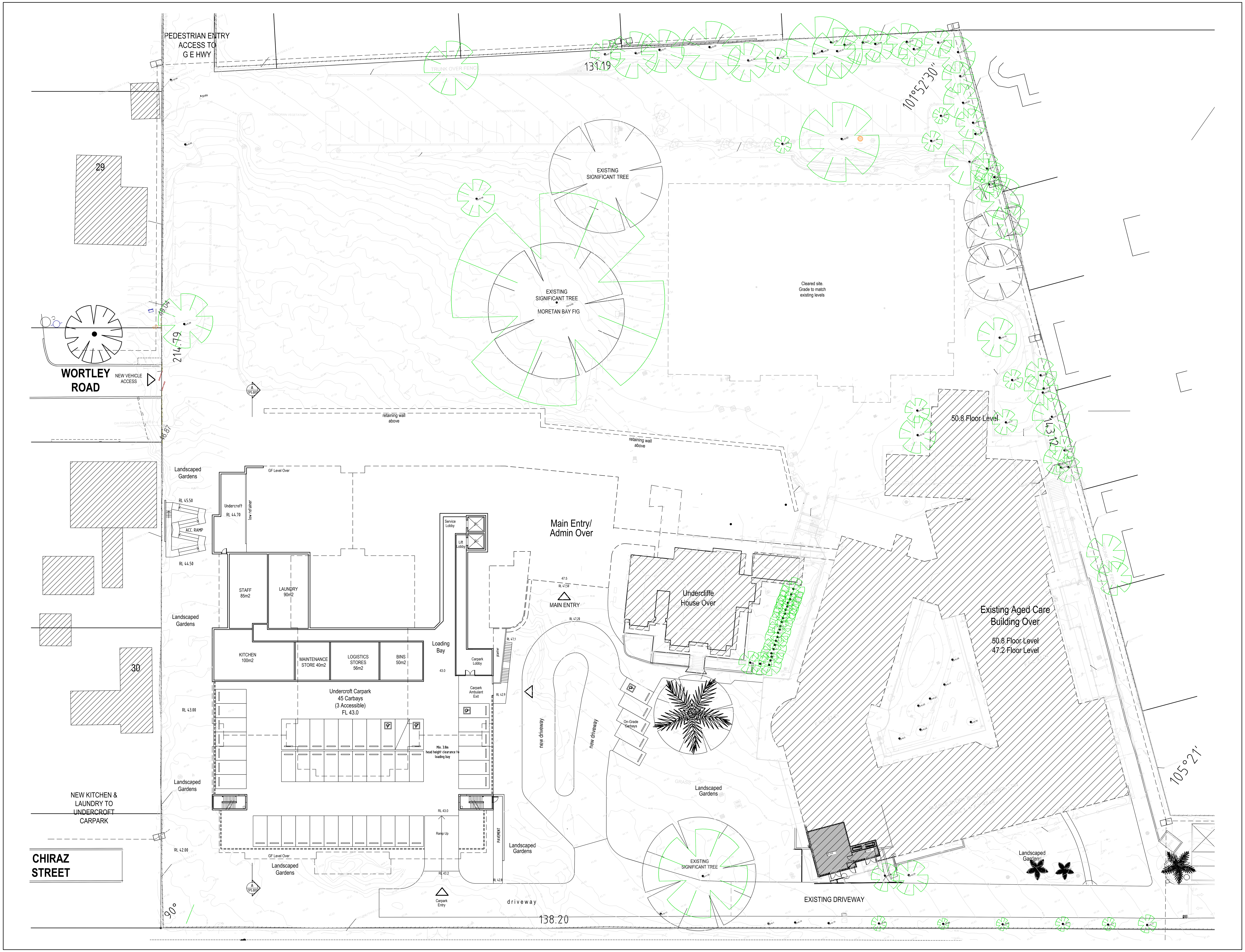


Figure 5-3: North Units

Appendix A – Development Plans



WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE TO SCALED DIMENSIONS. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL DIMENSIONS BEFORE WORK STARTS.

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Notes:

Client:

regis aged care

Architect:
LW
L1. 25 LLANEAST ST
ARMADALE VIC 3143

Project:
REGIS GREENMOUNT PROPOSED 48 BED EXTN REDEVELOPMENT

Address:
9 COONGAN AVE
GREENMOUNT WA 6056

Project No.:
1093

Status:
DRAFT TOWN PLANNING

REV.	DESCRIPTION	DATE
A	DRAFT DA ISSUE	28/2/2025

Layout:
PROPOSED FLOOR PLAN LOWER GROUND LEVEL (UNDERCROFT)

Drawing Scale:	Sheet Size:	Drawn By:	Checked By:
1:300	A1	AL/FX	PL

Drawing No: TP.001

Revision: A


PEDESTRIAN ENTRY ACCESS TO G E HWY
EXISTING DRIVEWAY & CARBAYS
131.19
101°52'30"
EXISTING SIGNIFICANT TREE
EXISTING DRIVEWAY & CARBAYS
Landscaped Gardens
EXISTING SIGNIFICANT TREE
MORETAN BAY FIG
Cleared site. Grade to match existing levels
214.79
WORTLEY ROAD
NEW VEHICLE ACCESS
29
30
50.8 Floor Level
143.12
retaining wall
Landscaped Gardens
DEMOLISH EXISTING COVERED WALKWAY AND REPLACE WITH NEW GLAZED ENCLOSED WALKWAY. INTERFACE WORK TO BE UNDERTAKEN IN CONSULTATION WITH HERITAGE CONSULTANT.
EXISTING HERITAGE BUILDING. RESTORATION WORK INTERNALLY AND EXTERNALLY. REFURBISH INSIDE TO NEW RAC DAY AREAS. WORKS TO BE UNDERTAKEN IN CONSULTATION WITH HERITAGE CONSULTANT. REFER ELEMENT 2024 CONSERVATION MANAGEMENT STRATEGY FOR UNDERCLIFFE HOUSE.
Decommission and remove existing transformer & structure
Balcony
Sitting
8 Beds
Admin
Cafe
Lift Lobby
Entry Lobby & Reception
Living/ Dining
3055m2
Landscaped Courtyard
MAIN ENTRY
Drop - Off
Garden
Office
Cinema
Private Dining
St Serv
Library
376m2
EXISTING HERITAGE UNDERCLIFFE HOUSE
47.8 Floor Level
Existing Aged Care Building Over
PROPOSED 48 BED RAC (FFL 47.50)
Landscaped Courtyard 767m2
767m2
EXISTING AGED CARE BUILDING
50.8 Floor Level
47.2 Floor Level
PAVED AREA TO INTEGRATE TO EXISTING HERITAGE HOUSE LANDING & STAIRS
new driveway
On Grade Carpark 6 Carbays
Refurbish existing facade & Entry Lobby to Training room
80m2 New Training Room
Remove existing Portico, driveway & Carbays. New landscaped gardens
Landscaped Gardens
Landscaped Garden
EXISTING SIGNIFICANT TREE
EXISTING DRIVEWAY
CHIRAZ STREET
Balc
Balcony
Carpark Entry
138.20
90°
103

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PROPOSED FLOOR PLAN GROUND LEVEL

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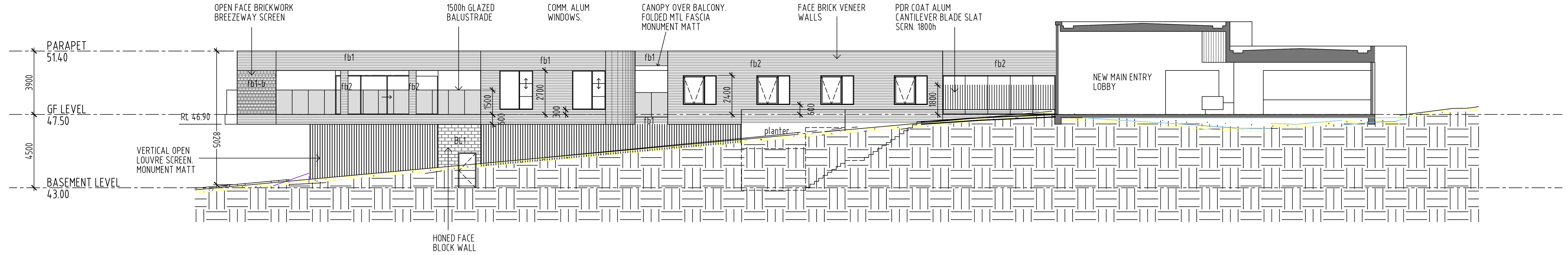

EAST ELEVATION
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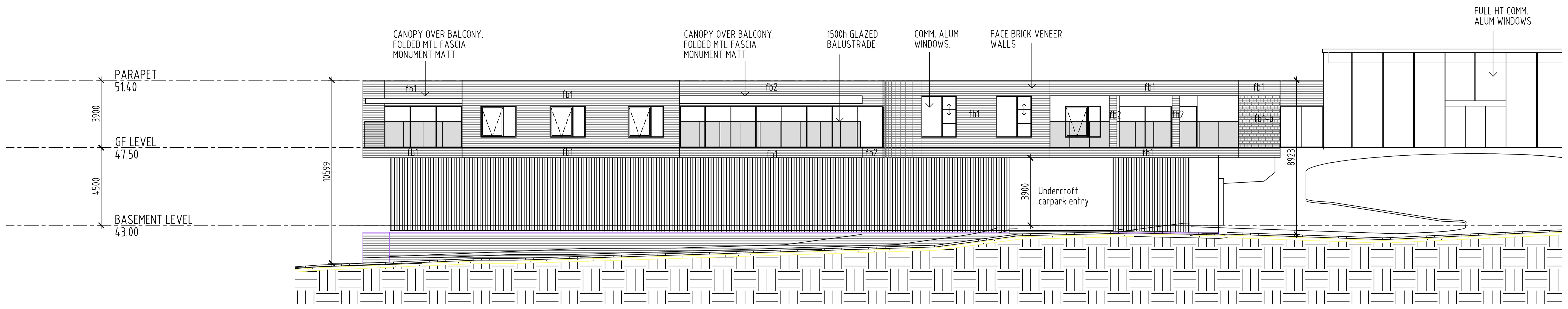

SOUTH ELEVATION
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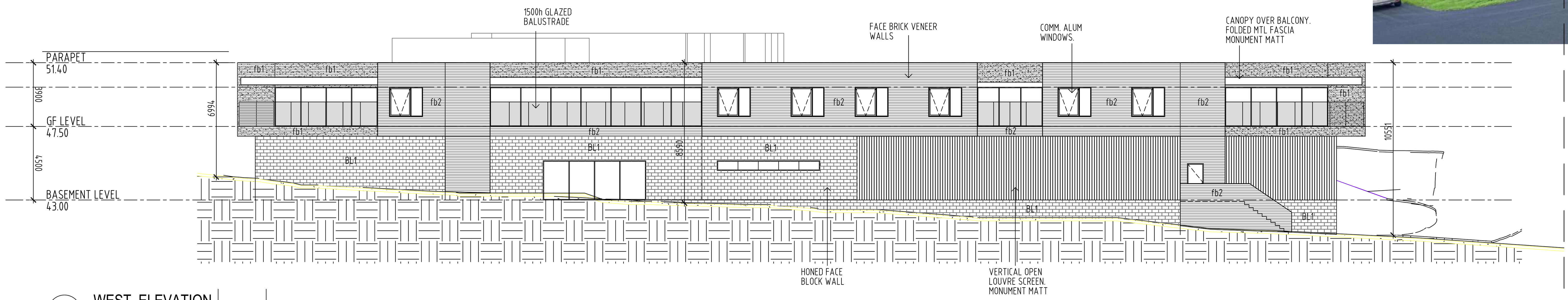
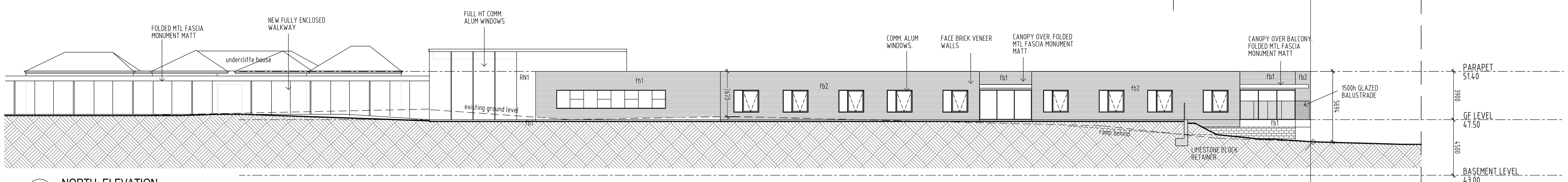
Artists Impression



WEST ELEVATION
1.200



NORTH ELEVATION
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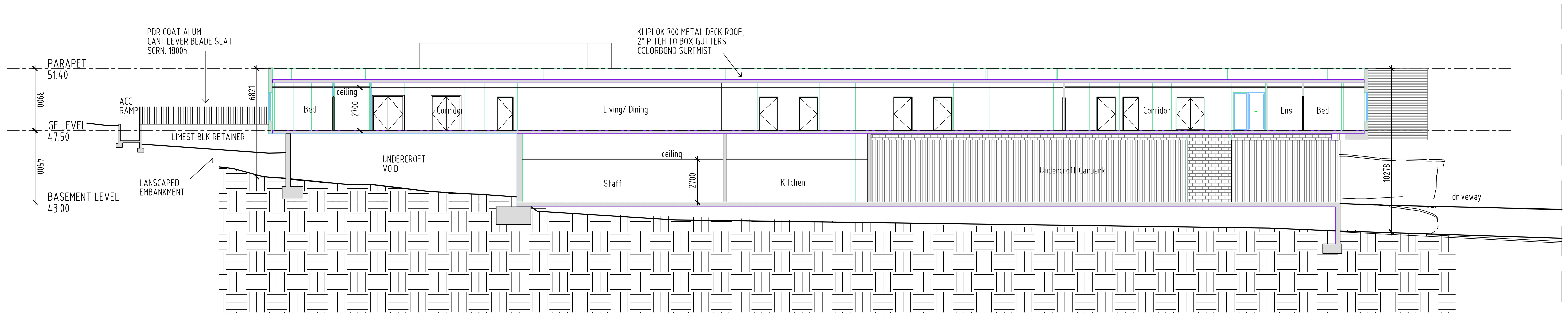

SECTION A-A
1.200

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ELEVATIONS & SECTIONS

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Drawing No:	Revision:
TP5.001	A

Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

$$= \frac{1}{10}(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}) + \frac{1}{20}(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450})$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise

$\%\ \text{Type A}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a 100m radius of the premises receiving the noise

$\%\ \text{Type B}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for a major road (> 15,000 vpd) within 450m

= 6 for a major road within 100m

The nearest noise sensitive premises are identified as:

- 30 Wortley Rd, Greenmount
- 23 Chiraz St, Greenmount

From the Main Roads WA Traffic Map (refer *Figure B-4*), *Table B-1* shows the relevant roads and their traffic counts within the inner (100 metre radius) and outer (450 metre radius) circles.

Table B-1: Relevant Roads within 100m and 450m Radii

Receiver	Within 100m		Within 450m
	Major Road (+ 6 dB)	Secondary Road (+ 2 dB)	Major Road Not Within 100m (+ 2 dB)
Nearest noise sensitive premises	-	-	Great Eastern Highway (35,201 vpd 2024/25 #2015)

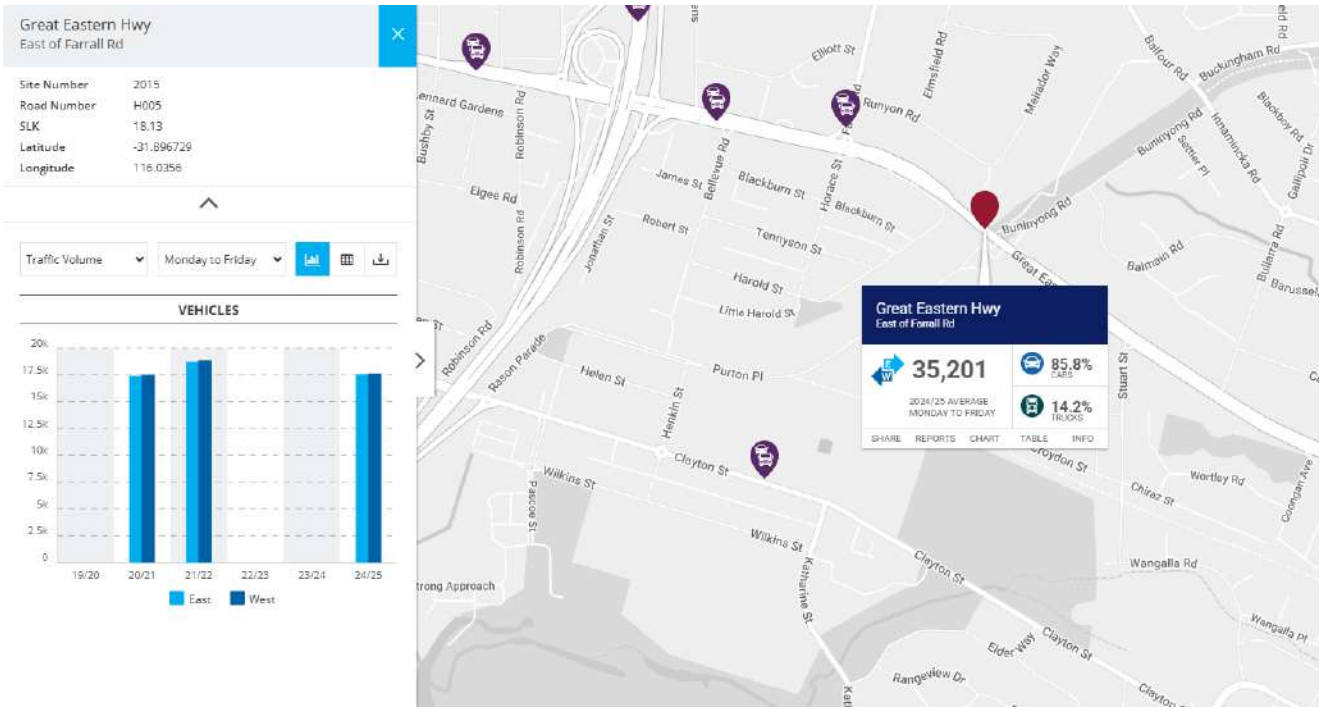

Figure B-4: MRWA Published Traffic Data

Table B-2 combines the percentage land types and transport factor to calculate the influencing factor, noting there is no industrial or commercial land within a 450 metre radius of the nearest noise sensitive premises.

Table B-2: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
Nearest noise sensitive premises	0	0	2	**2**

The influencing factor calculated in *Table B-2* is combined with those baseline assigned levels of *Table 2-2*, resulting in the project assigned levels provided in *Table 2-3*.

Appendix C – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **R_w**

This is the weighted sound reduction index. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

- **C_{tr}**

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of – 4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -12 dB.

- **$L'_{n,w}$**

This is the weighted normalised impact sound pressure level, which is determined by measuring the sound pressure level in the receiving room in one-third-octave bands between 100 Hz and 3.15 kHz and moving a grading curve in integral steps, such that the curve is as high as possible without the sum of deficiencies exceeding 32 dB. The normalisation is to a receiving room sound absorption area of $10m^2$. The lower the $L'_{n,w}$ value the better the acoustic performance.

- **Assessment Method**

Means a method used for determining that a Building Solution complies with the Performance Requirements.

- **Verification Method**

Means a test, inspection, calculation or other method that determines whether a performance solution complies with the relevant performance requirements.

- **Performance Solution**

Means a method of complying with the performance requirements other than by a deemed to satisfy solution.

- **Deemed to Satisfy Provisions**

Means provisions which are deemed to satisfy the Performance Requirements.

- **Deemed to Satisfy Solution**

Means a method of satisfying the deemed to satisfy provisions.

- **Expert Judgement**

Means the judgement of an expert who has the qualifications and experience to determine whether a Performance Solution or Deemed to Satisfy Solution complies with the Performance Requirements.

- **Habitable Room**

Means a room used for normal domestic activities, and

a) includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom; but

b) excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes-drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.

- **Public Corridor**

Means an enclosed corridor, hallway or the like which –

a) Serves as a means of egress from 2 or more sole-occupancy units to a required exit from the storey concerned; or

b) Is required to be provided as a means of egress from any part of a storey to a required exit.

- **Performance Requirement**

Means a requirement which states the level of performance which a Performance Solution or deemed to satisfy solution must meet.

- **Sole Occupancy Unit**

Means a room or other part of a building for occupation by one or joint owner, lessee, tenant, or other occupier to the exclusion of any other owner, lessee, tenant, or other occupier and includes –

a) a dwelling; or

b) a room or suite of rooms in a Class 3 building which includes sleeping facilities; or

c) a room or suite of associated rooms in a Class 5, 6, 7, 8 or 9 building; or

d) a room or suite of associated rooms in a Class 9c aged care building, which includes sleeping facilities and any area for the exclusive use of a resident.

- **Class 2 Building**

A building containing 2 or more sole occupancy units each being a separate dwelling.

- **Class 3**

A residential building, providing long term or transient accommodation for a number of unrelated persons, including –

a) a boarding house, guest house, hostel, lodging house or backpacker accommodation.

b) a residential part of a hotel or motel.

c) a residential part of a school.

d) accommodation for the aged, children or people with disability.

e) a residential part of a health-care building which accommodates members of staff.

f) a residential part of a detention centre

g) a residential care building.