

Acoustic Report: Development Application

7-11 King William Street, Bayswater

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CONTENTS

EXECUTIVE SUMMARY.....	i
1. INTRODUCTION.....	1
2. CRITERIA.....	2
2.1. Noise Emissions	2
2.2. Noise Separation	5
2.3. Noise Intrusion	8
2.4. Green Star.....	9
2.4.1. Green Star - Residential	9
2.4.2. Green Star - Commercial	10
3. NOISE EMISSION PRELIMINARY ASSESSMENT.....	11
3.1. Methodology	11
3.1.1. Meteorological Conditions	11
3.1.2. Topographical Data.....	11
3.1.3. Ground Absorption	12
3.1.4. Source Sound Levels	12
3.2. Results and Assessment	13
3.3. Recommendations.....	13
4. NOISE SEPARATION.....	14
4.1. Separating Walls	14
4.1.1. Walls Separating Sole-Occupancy Units	15
4.1.2. Walls Separating Sole-Occupancy Unit to Public Corridor or the Like	16
4.1.3. Walls Separating Sole-Occupancy Unit to Lift and Stairs	17
4.1.4. Wall Construction Deemed to Satisfy	17
4.1.5. Green Star Commercial.....	18

4.2.	Separating Floors	20
4.2.1.	Floors Separating Sole-Occupancy Units	20
4.2.2.	Apartment Balconies/Common areas	21
4.2.3.	Floor Construction Deemed to Satisfy	21
4.3.	Penetrations and Flanking Paths	21
4.4.	Services	22
4.4.1.	Services Deemed to Satisfy	23
4.5.	Special Cases	25
4.5.1.	Car Park	25
4.5.2.	Commercial Tenancy	25
4.5.3.	Residents Amenity	25
5.	NOISE INTRUSION ASSESSMENT	26
5.1.	Methodology	27
5.2.	Results	28

List of Tables

Table 2-1:	EPNR Adjustments Where Characteristics Cannot Be Removed	2
Table 2-2:	EPNR Baseline Assigned Levels	3
Table 2-3:	EPNR Assigned Levels	4
Table 2-4:	NCC Deemed-to-Satisfy Provisions and Verification Methods	7
Table 2-5:	Noise Targets for Noise Sensitive Land-Use	8
Table 2-6:	Design Sound Levels from AS2107 for Relevant Areas	10
Table 3-1:	Modelling Meteorological Conditions	11
Table 3-2:	Source Sound Power Levels, dB	12
Table 3-3:	Predicted Levels and Assessment, dB L_{A10}	13

Table 4-1: Proposed Party Wall Construction (SOU to SOU).....	15
Table 4-2: Proposed Common Wall Construction (SOU to Corridor).....	16
Table 4-3: Proposed Core Wall Construction (SOU to Lift/Stairwell).....	17
Table 4-4: Green Star Commercial Walls.....	19
Table 4-5: Proposed Party Floor Construction (Any Space Above SOU).....	20
Table 4-6: Construction Options for Services Risers.....	22
Table 4-7: Construction Options for Services in Ceilings.....	23
Table 5-1: Minimum Construction Requirements.....	28

List of Figures

Figure 1-1: Site Locality.....	1
Figure 3-1: Overview of Noise Model.....	12
Figure 4-1: Typical Floor Wall Mark-up.....	14
Figure 4-2: Commercial Wall Mark-up.....	18
Figure 5-1: Site Locality in Relation to SPP 5.4 Trigger Distances.....	26
Figure 5-2: Noise Exposure Forecast Table from Guidelines.....	27
Figure 5-3: Distances from Railway Across Typical Floor Plan.....	27

Appendices

Appendix A – Development Plans.....	30
Appendix B – Terminology.....	31

EXECUTIVE SUMMARY

It is proposed to construct a multi-storey residential development at 7-11 King William Street, Bayswater. The development consists of:

- Ground floor services, commercial tenancy, residents' amenity, lobby and stores;
- Level 1 car parking, 2x apartments, bike store and workshop;
- Level 2 to Level 8, 10x apartments each; and
- Mechanical plant at roof level.

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

Noise from typical mechanical plant has been assessed against the requirements of the *Environmental Protection (Noise) Regulations 1997*. At this stage, the following is recommended:

- Once the mechanical plant has been designed and selected, the noise levels shall be reviewed prior to Building Permit;
- 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.

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, Class 2 to Class 9 Buildings* and specifically Part F7, with this project also needing to meet the Green Star requirements.

At this stage, broad advice on the expected construction has been provided and as the project progresses into detailed design, these will be refined along with greater detail to control penetrations and flanking paths.

Noise Intrusion

The site is in proximity to the passenger railway and therefore compliance with *State Planning Policy No. 5.4 Road and Rail Noise* is required. Façade construction requirements have been provided to achieve compliance as well as giving general consideration to road traffic noise on King William Street, although this is not strictly an assessable road.

1. INTRODUCTION

It is proposed to construct a multi-storey residential development at 7-11 King William Street, Bayswater as located in *Figure 1-1*. The development (refer *Appendix A* plans) consists of:

- Ground floor services, commercial tenancy, residents' amenity, lobby and stores;
- Level 1 car parking, 2x apartments, bike store and workshop;
- Level 2 to Level 8, 10x apartments each; and
- Mechanical plant at roof level.

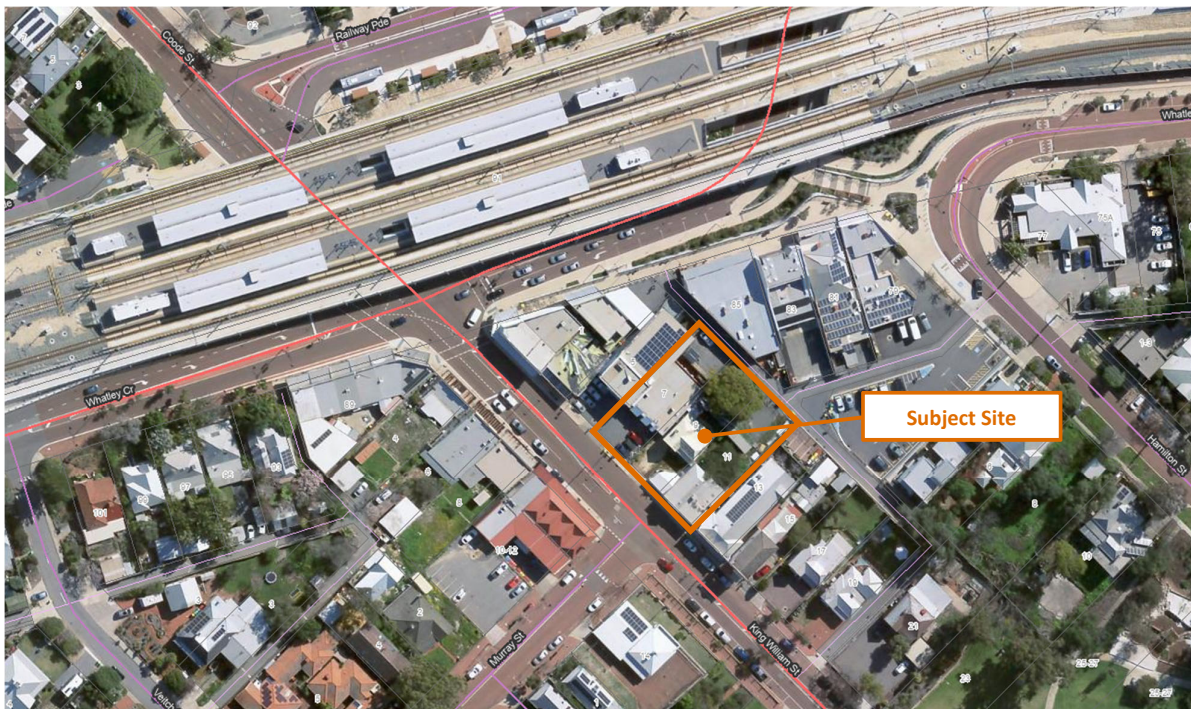


Figure 1-1: Site Locality

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) Part F7*; and
- Noise intrusion - in this case from road traffic addressing the requirements of *State Planning Policy No. 5.4 Road and Rail Noise*.

The project is only at Development Application (DA) stage and therefore much of the detailed design is yet to occur. For noise emissions, typical noise levels from air-conditioning units have been assumed and modelled to neighbouring premises. For compliance with the NCC, the focus is on the criteria with broad advice provided based on the current understood construction. With regard to rail traffic noise intrusion, this has been undertaken in a reasonable level of detail using the screening tables of SPP 5.4.

Appendix B 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

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations or EPNR) 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 B*). 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
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

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 either 4 or 6 dB. The area of the project is within the Bayswater Town Centre Structure Plan. Whilst it is expected the area will be a mix of commercial and residential, any influencing factor associated with commercial zoning has not been accounted for to be conservative. Whatley Crescent is considered a major road (>15,000 vehicles per day) whilst King William Street a secondary road (between 6,000 and 15,000 vpd).

Table 2-3 shows the assigned levels including the influencing factor at the following receiving locations, deemed most critical:

- R1 – 93 Whatley Crescent, Bayswater
- R2 – 3 Veitch Street, Bayswater
- R3 – 2 Murray Street, Bayswater
- R4 – 1 Murray Street, Bayswater
- R5 – 21 King William Street, Bayswater
- R6 – 4 Hamilton Street, Bayswater
- R7 – 1 Hamilton Street, Bayswater
- R8 – 86 Railway Parade, Bayswater
- R9 – 78 Railway Parade Bayswater (Bayswater Hotel).

Other than R5, all residences are within 100 metres of Whatley Crescent and therefore obtain the maximum traffic factor of 6 dB. For R5, the traffic factor is 4 dB, with King William Street being a secondary road within 100 metres (2 dB) and Whatley Crescent a major road within 450 metres (2 dB).

Table 2-3: EPNR Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
R1 to R4 and R6 to R9 +6 dB IF Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	51	61	71
	0900 to 1900 hours Sunday and public holidays (Sunday)	46	56	71
	1900 to 2200 hours all days (Evening)	46	56	61
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	41	51	61
R5 +4 dB IF Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	49	59	69
	0900 to 1900 hours Sunday and public holidays (Sunday)	44	54	69
	1900 to 2200 hours all days (Evening)	44	54	59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	39	49	59

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

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.

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 2 and 3 buildings as follows:

F7P1 Sound Transmission Through Floors

A floor separating sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, 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 with spectrum adaptation term ($D_{nT,w} + C_{tr}$) not less than 45 for airborne sound; and*
- (b) A weighted standardised impact sound pressure level ($L_{nT,w}$) not more than 62 for impact generated sound.*

F7P2 Sound Transmission Through Walls

A wall, including services and their penetrations, must minimise the transmission of sound such that -

- (a) For airborne sound –*
 - a. A wall separating sole-occupancy units has a weighted standardise level difference with spectrum adaptation term ($D_{nT,w} + C_{tr}$) not less than 45; and*
 - b. A wall separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification, has a weighted standardised level difference ($D_{nT,w}$) not less than 45; and*
 - c. Any door assembly located in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby, or the like, has a weighted standardised level difference ($D_{nT,w}$) not less than 25; and*
- (b) For impact generated sound, a wall must have sufficient sound insulation to prevent illness or loss or amenity to the occupants if the wall separates –*
 - a. A bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining sole-occupancy unit; or*
 - b. A sole-occupancy unit from a plant room or lift shaft.*

Note as kitchens generally form part of an open plan area, these are also treated as requiring impact insulation.

The following Deemed-to-Satisfy Provisions are provided:

F7D5 Sound insulation rating of floors

- (1) A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an L_{nw} (impact) not more than 62 if it separates –
- (a) sole-occupancy units; or
 - (b) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

F7D6 Sound insulation rating of walls

- (1) A wall in a Class 2 or 3 building must –
- (a) have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates sole-occupancy units; and
 - (b) have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and
 - (c) be of discontinuous construction] it separates –
 - (i) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or
 - (ii) a sole-occupancy unit from a plant room or lift shaft.
- (2) A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an R_w not less than 30.

For the purposes of [F7D6(1)(c), discontinuous construction means a wall having a minimum 20 mm cavity between two separate leaves, and –

- (a) for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and
- (b) for other than masonry, there is no mechanical linkage between leaves except at the periphery.

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 apartments). Where the design aspiration is higher than the minimum amenity, the Principal Client is referred to the Association of Australasian Acoustical Consultants (AAAC) Star Ratings for Townhouses and Apartments v1.0. The AAAC Guideline document compares and considers the NCC ratings in the context of suitability for use as a general standard with higher requirements deemed appropriate for increasing levels of luxury. A star rating system (2 – 6 stars) is attributed for sound ratings.

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

Description	Deemed-to-Satisfy (Laboratory)	Performance Requirement (On-Site)
F7P1 & F7D5 Sound Insulation Rating of Floors		
Separating SOU's Separating SOU from plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.	$R_w + C_{tr} \geq 50$ $L_{n,w} \leq 62$	$D_{nT,w} + C_{tr} \geq 45$ $L_{nT,w} \leq 62$
F7P2 & F7D6 Sound Insulation Rating of Walls		
Separating SOU's	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$
Separating SOU from plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.	$R_w \geq 50$	$D_{nT,w} \geq 45$
Separating a bathroom, sanitary compartment, laundry or kitchen in one SOU from a habitable room (other than a kitchen) in an adjoining SOU	Discontinuous Construction	N/A
Separating a SOU from a plant room or lift shaft	Discontinuous Construction	N/A
A door separating SOU from a stairway, public corridor, public lobby or the like.	$R_w \geq 30$	$D_{nT,w} \geq 25$
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)

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, habitable¹ 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.

2.4. Green Star

This project is also targeting a Green Star 'equivalency rating' including Acoustic Comfort points.

2.4.1. Green Star - Residential

For **residential spaces**, 2 of the following 3 are to be satisfied:

- Maximum Internal Noise Levels;
- Acoustic Separation; and
- Impact Noise Transfer.

The project goal is to meet the Acoustic Separation and Impact Noise Transfer Requirements as outlined below:

Acoustic Separation – Residential

The requirements are:

- All walls and floors (excluding riser walls) separating enclosed spaces must exceed the NCC requirements by 5 points;
- Party walls separating open plan kitchens (where joinery units are fixed) from another open plan kitchen/living room shall be discontinuous in construction; and
- Entry doors must have perimeter and threshold seals.

Impact Noise Transfer – Residential

The requirements are:

- $L_{nT,w} \leq 55$ for floors above Class 2 and 3 buildings accommodation spaces; and
- $L_{nT,w} \leq 60$ for all other spaces.

2.4.2. Green Star - Commercial

For **commercial spaces** (Base Build), the following are to be satisfied:

- Maximum Internal Noise Levels;
- Acoustic Separation.

Maximum Internal Noise Levels – Commercial

The requirements are:

- Internal ambient noise levels in the regularly occupied areas must be no greater than the upper range value relevant to the activity type in each space as recommended in the current AS/NZS 2107:2016:

Table 2-6: Design Sound Levels from AS2107 for Relevant Areas

Type of Occupancy	Activity	Design Sound Level Range, dB L _{Aeq}
Public Buildings	Coffee Shops	40 to 50
Office Buildings	General Office	40 to 45
	Meeting Room Small	40 to 45

Acoustic Separation - Commercial

The requirements are:

- $R_w \geq 45$ for all partitions separating spaces which are:
 - Fixed without a door; and
 - Glazed partitions without a door.
- $R_w \geq 40$ for all partitions fronting a room (from an open plan area);
- $R_w \geq 35$ (in composite with door and partition) for all partition types that contain a door; and
- $R_w \geq 50$ through floors between occupied spaces.

3. NOISE EMISSION PRELIMINARY ASSESSMENT

3.1. Methodology

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.1* with the ISO 9613-2:2024-01 algorithms selected, as they include the influence of wind and are considered appropriate given the relatively short source to receiver distances. Input data required in the model are listed below and discussed in *Section 3.1.1* to *Section 3.1.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)	Night (7.00pm to 7.00am)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.1.2. Topographical Data

Topographical data was on file from previous projects in the area originating from Landgate and combined with the *Appendix A* plans.

Surrounding existing buildings were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. Single storey buildings are modelled with a height of 3.5 metres and any double storey buildings identified assumed to be 7.0 metres in height with receivers 1.4 metres above ground.

Figure 3-1 shows a 3D overview of the noise model with the location of all relevant receivers identified. Pink dots on the roof of the subject site represent a nominal 72 air-conditioning condenser units.

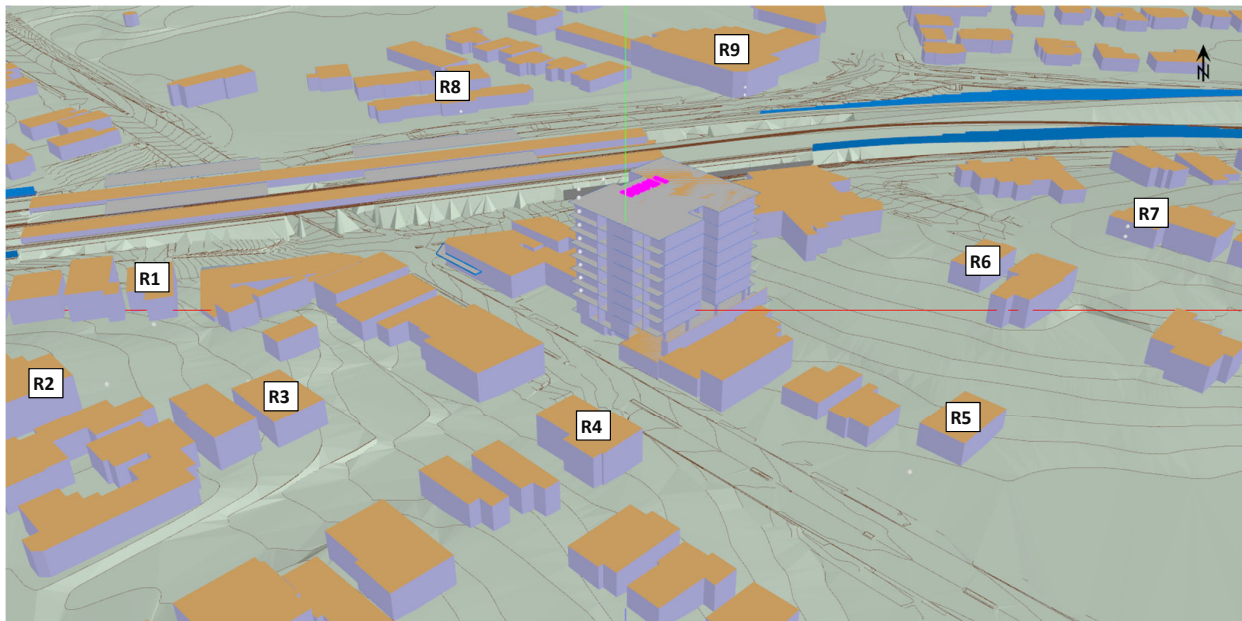


Figure 3-1: Overview of Noise Model

3.1.3. Ground Absorption

The ground attenuation has been assumed to be 0.0 (0%) for the roads and 0.5 (50%) elsewhere, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.1.4. Source Sound Levels

The sound power level used in the modelling is provided in *Table 3-2* and is indicative only.

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
72x Outdoor Condensing Units (each) (Model RXC50AV1A)	72	63	61	61	57	52	47	38	62

The following is noted in relation to *Table 3-2*:

- Air-conditioning (A/C) sound levels are estimated from previous projects and are located at 1.0m above roof level;
- A/C noise sources are assumed to be L_{A10} unless noted otherwise.

3.2. Results and Assessment

Noise modelling was undertaken with the calculation results shown in *Table 3-3* and assessed against the most critical night-time assigned level. Note due to the modelling assuming multiple plant operating simultaneously, no adjustments are applied for intrusive characteristics (e.g. tonality) as plant is likely to be operating at different speeds.

Table 3-3: Predicted Levels and Assessment, dB LA10

Receiver	Predicted Noise Level	Night-time Assigned Level	Assessment
R1 – 93 Whatley Crescent	24	41	Complies
R2 – 3 Veitch Street	25	41	Complies
R3 – 2 Murray Street	23	41	Complies
R4 – 1 Murray Street	20	41	Complies
R5 – 21 King William Street	18	39	Complies
R6 – 4 Hamilton Street	21	41	Complies
R7 – 1 Hamilton Street	23	41	Complies
R8 – 86 Railway Parade	23	41	Complies
R9 – 78 Railway Parade (Bayswater Hotel)	21	41	Complies

From the above it is evident compliance is calculated to be achieved based on the assumptions of this report.

3.3. Recommendations

At this stage, mechanical plant has not been designed such that the assessment has been based on nominal sound levels. As such, the following is recommended:

- Once the mechanical plant has been designed and selected, the noise levels shall be reviewed prior to Building Permit;
- 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.

4. NOISE SEPARATION

At this stage of the project, the construction materials may change, however the following sections provide some broad information for key areas based on current understanding.

4.1. Separating Walls

A typical wall mark-up is provided in *Figure 4-1*. This shows the minimum performance requirement in accordance with Green Star, since this is more critical than NCC.

R _w 55	
R _w 55 & DC	
R _w + C _{tr} 55 & DC	
R _w + C _{tr} 55	
Recommended	

Note: D.C. is Discontinuous Construction

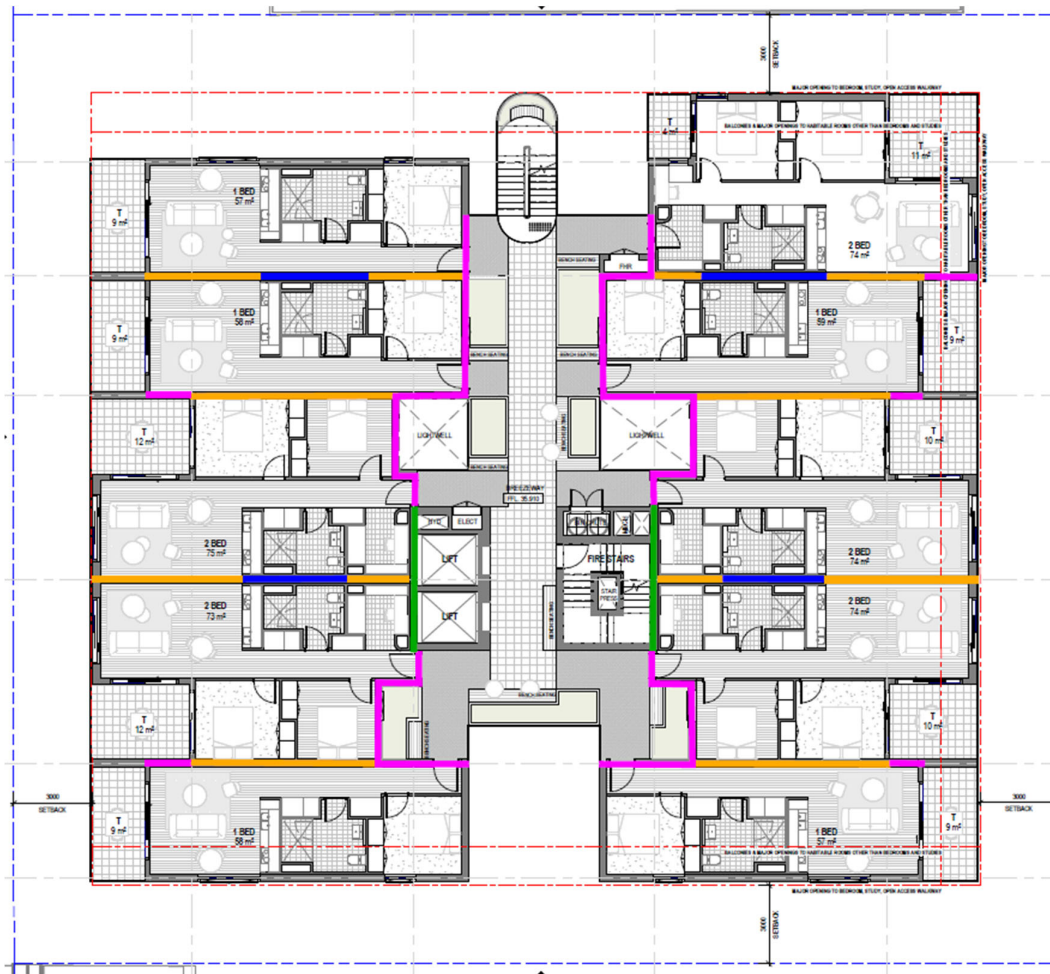
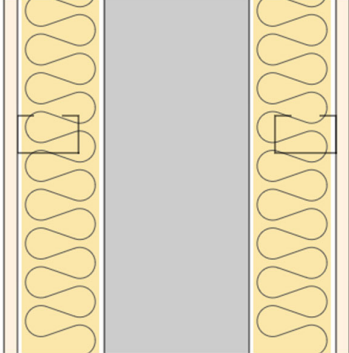
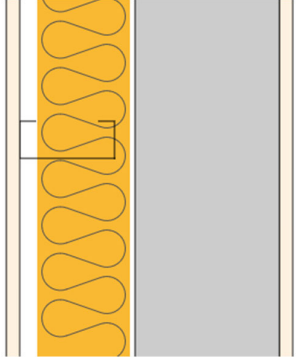
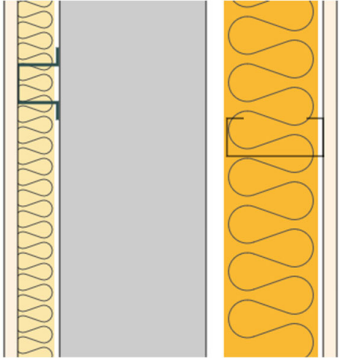


Figure 4-1: Typical Floor Wall Mark-up

4.1.1. Walls Separating Sole-Occupancy Units

Table 4-1 provides various wall constructions suitable between sole-occupancy units (party walls). These serve as examples only until the project moves to detailed design. The walls below can be used to achieve $R_w + C_{tr} \geq 55$ (orange line) as well as those requiring discontinuous construction (blue line).

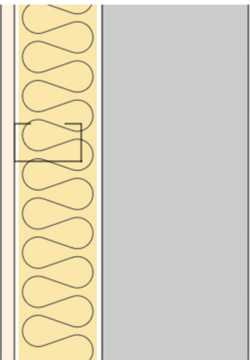
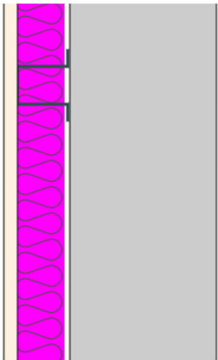
Table 4-1: Proposed Party Wall Construction (SOU to SOU)

Description	Image
<p>Min. 140mm thick core filled concrete blockwork (260 kg/m³) with –</p> <ul style="list-style-type: none"> • Each side to be 1x 13mm thick plasterboard on min 64mm Steel Stud spaced min. 20mm from blockwork; • 75mm thick, 11kg/m³ <i>Acoustigard</i> (or equivalent) between studs; • ~CSR 4175(a) (sim). 	
<p>Min. 140mm thick core filled concrete blockwork (260 kg/m³) with –</p> <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard direct stick; • Other side to be 1x 13mm thick plasterboard on min 92mm Steel Stud spaced min. 20mm from blockwork with 90mm thick, Gold Batts R2.0 between studs; • CSR 4065(c). 	
<p>Min. 140mm thick core filled concrete blockwork (260 kg/m³) with –</p> <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard direct stick on 28mm furring channel on adjustable clips to create 40mm cavity with 50mm thick, 14 kg/m³ <i>Acoustigard</i> (or equivalent) insulation; • Other side to be 1x 13mm thick plasterboard on min 92mm Steel Stud spaced min. 20mm from blockwork with 90mm thick, Gold Batts R2.0 between studs; • ~CSR 4260(a) (sim). 	

4.1.2. Walls Separating Sole-Occupancy Unit to Public Corridor or the Like

Table 4-2 provides various wall constructions suitable as walls between a sole-occupancy unit and public corridor, public lobby or the like, or parts of different classification. The walls below can be used to achieve $R_w \geq 55$ (pink line).

Table 4-2: Proposed Common Wall Construction (SOU to Corridor)

Description	Image
Min. 140mm thick core filled concrete blockwork (260 kg/m ³) with – <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard on min 64mm Steel Stud spaced min. 20mm from blockwork with 75mm thick, 11kg/m³ <i>Acoustigard</i> (or equivalent) between studs; • Siniat PMW5151. 	
Min. 140mm thick core filled concrete blockwork (260 kg/m ³) with – <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard direct stick on 28mm furring channel on adjustable clips to create 50mm cavity with 50mm thick, 11 kg/m³ R1.2 Pink Partition Batt (or equivalent); • Siniat PMW2151. 	

In this project, it is understood that the public corridors adjoining SOU's are currently deemed as 'enclosed', such that the $R_w \geq 55$ (Green Star) requirement is mandatory and as such, has been marked as solid lines on Figure 4-1.

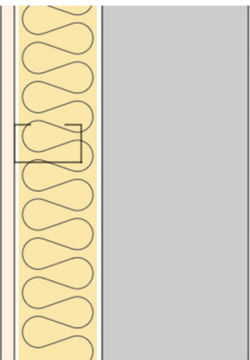
The Code permits apartment entry doors in these walls to be rated lower than walls at $R_w \geq 30$, however there is no such allowance for windows. As such, either:

- Windows shall be removed from these walls;
- Windows to be installed that maintain $R_w \geq 55$ (confirmed by glazier), noting these would be fixed windows and a significant double or possibly triple glazed system; or
- Certifier to deem window locations as separating SOU to unenclosed corridor such that no mandatory requirement exists. In this case, glazing to be minimum $R_w + C_{tr} \geq 28$, likely achievable with 6.38mm thick laminated glass in fixed/awning style frame with acoustic seals.

4.1.3. Walls Separating Sole-Occupancy Unit to Lift and Stairs

Table 4-3 provides a wall construction suitable between a sole-occupancy unit and a lift or stairwell (core walls). The wall below can be used to achieve $R_w \geq 55$ and discontinuous construction (green line). This same wall would also be recommended for the apartment adjoining the car park.

Table 4-3: Proposed Core Wall Construction (SOU to Lift/Stairwell)

Description	Image
<p>Min. 150mm thick concrete with –</p> <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard on min 64mm Steel Stud spaced min. 20mm from blockwork with 75mm thick, 11kg/m³ Acoustigard (or equivalent) between studs; • Siniat PMW5251. 	

4.1.4. Wall Construction Deemed to Satisfy

Within Specification F5.2, 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) **Concrete** – Joints between concrete slabs or panels and any adjoining construction must be filled solid.
- (c) **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.

4.1.5. Green Star Commercial

Figure 4-2 shows the interpretation of the Green Star requirements for the commercial spaces of the project.

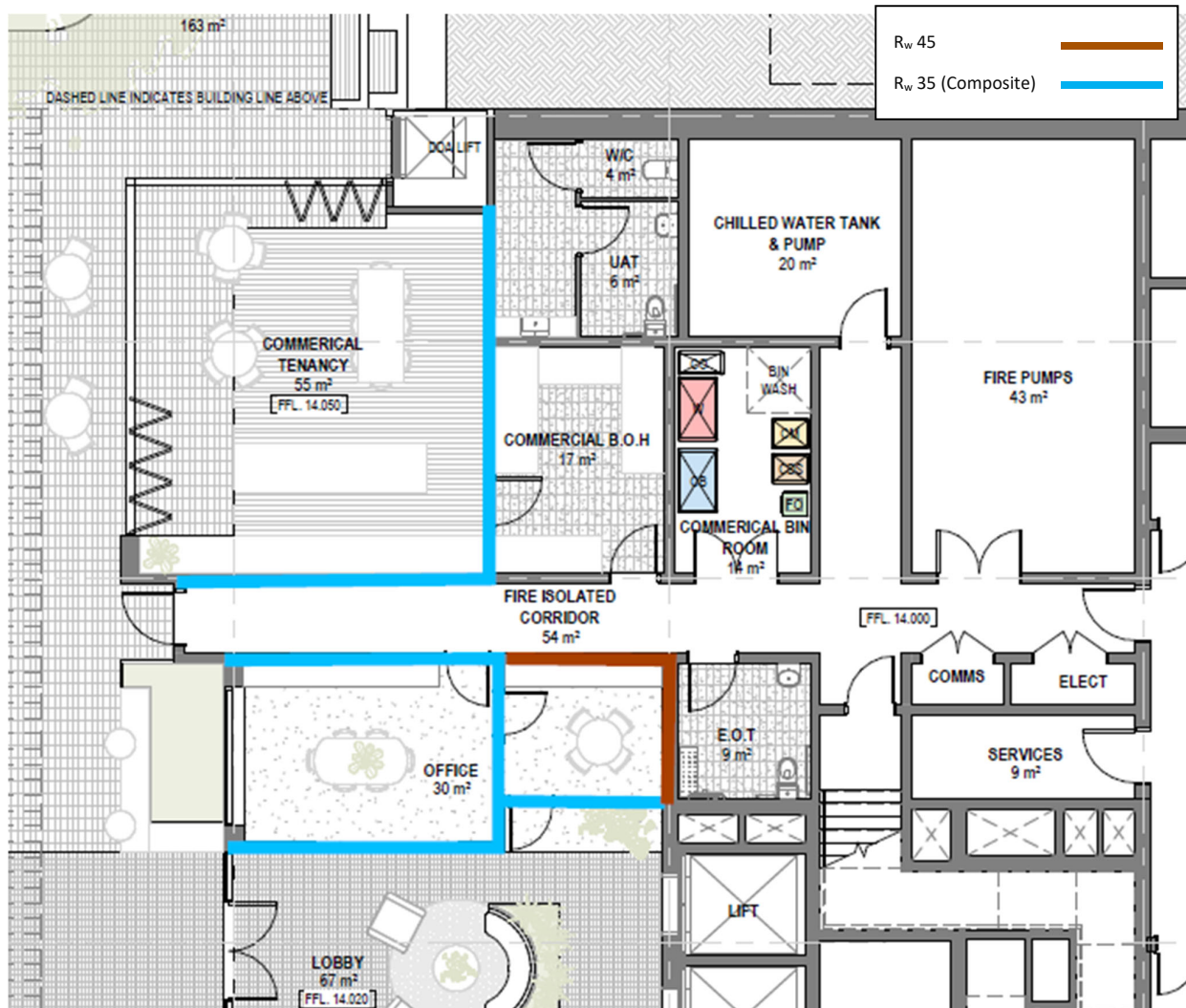


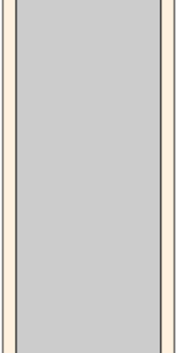
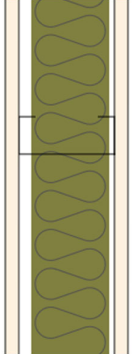
Figure 4-2: Commercial Wall Mark-up

The recommended approach is for all walls to achieve R_w 45, with typical walls provided in *Table 4-4*. Whilst some walls are marked as R_w 35, these are composite performance which the walls and/or glazing will downgrade, such that the wall itself is best kept at R_w 45 and run from slab to slab.

All doors in marked walls shall be 35mm thick, solid timber core doors with full perimeter acoustic seals.

Any glazing shall be minimum 10.38mm thick laminated glass in foxed frames, achieving minimum R_w 35.

Table 4-4: Green Star Commercial Walls

Description	Image
<p>Min. 140mm thick concrete blockwork (180 kg/m³) with –</p> <ul style="list-style-type: none"> • 13mm plasterboard direct fixed each side; • Siniat PMW1453. 	
<p>Min. 92mm steel stud with –</p> <ul style="list-style-type: none"> • 13mm thick plasterboard to each side; • 70 Soundscreen R2.0 cavity insulation; • CSR 1030(g). 	

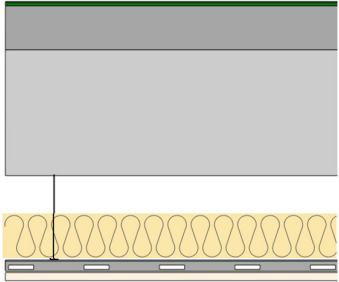
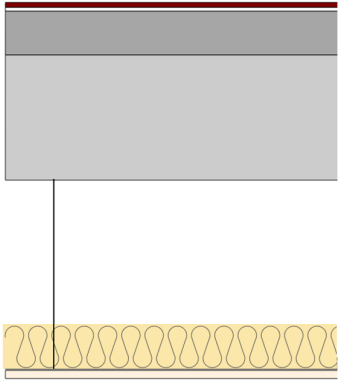
4.2. Separating Floors

The acoustic requirements for all floors (other than ground) are the same being $R_w + C_{tr} \geq 55$ and $L_{n,w} \leq 55$, again determined by the Green Star requirements, rather than NCC.

4.2.1. Floors Separating Sole-Occupancy Units

Table 4-5 provides suitable floor constructions.

Table 4-5: Proposed Party Floor Construction (Any Space Above SOU)

Description	Image
<p>70mm concrete topping on 200mm, 260 kg/m² hollow core slab (shown) or min. 200mm thick concrete slab with -</p> <ul style="list-style-type: none"> • Hard floor finish (e.g. vinyl) on medium ($\Delta 14$ dB) performance impact mat; • 75mm thick, 14kg/m³ fibrous insulation or 50mm thick 24 kg/m³ fibrous insulation above ceiling • 1x 13mm plasterboard suspended minimum 150mm from slab on lightweight metal frame. 	
<p>70mm concrete topping on 200mm, 260 kg/m² hollow core slab (shown) or 200mm thick concrete slab with -</p> <ul style="list-style-type: none"> • Hard floor finish (e.g. tiles) on medium ($\Delta 14$ dB) performance impact mat (above or below screed); • 75mm thick, 14kg/m³ fibrous insulation or 50mm thick 24 kg/m³ fibrous insulation above ceiling; • One layer of 13mm plasterboard suspended minimum 300mm from slab on lightweight metal frame. 	

Note Level 1 apartments are to still incorporate an impact mat to hard floors, as Green Star requires $L_{n,w} \leq 60$ for other spaces.

Where the floor finish is carpet, the $L_{n,w}$ is nominally 45 dB and thus significantly below that required in the Code.

4.2.2. Apartment Balconies/Common areas

Where balconies/common areas are located above the inside of an apartment, these must be treated the same as an apartment floor – refer *Section 4.2.1*.

Where these areas are vertically stacked, a common interpretation of the Code by Building Certifiers is understood to be that where balconies are entirely external of internal building space(s) and do not share a floor with a sole-occupancy unit below, these are not strictly assessed against the Code and as such, no impact isolation would be mandatory.

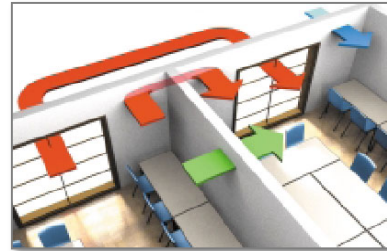
Practically speaking, impact noise transfers horizontally and diagonally down through connected structural elements. Therefore in these cases impact isolation treatment is still recommended.

4.2.3. Floor Construction Deemed to Satisfy

The same Deemed to Satisfy provisions of *Section 4.1.4* are also relevant to floors.

4.3. Penetrations and Flanking Paths

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



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.*

4.4. Services

It is common for another person's hydraulic services to be located in a vertical service riser and in ceiling spaces of another sole-occupancy unit. Where the room of the sole-occupancy unit is a habitable space (including open plan entry corridors and kitchens), the minimum NCC requirement is $R_w + C_{tr} \geq 40$. Where the room of the sole-occupancy unit is non-habitable, the minimum performance requirement is $R_w + C_{tr} \geq 25$. *Table 4-6* and *Table 4-7* provides construction options for service risers and ceiling spaces.

Table 4-6: Construction Options for Services Risers

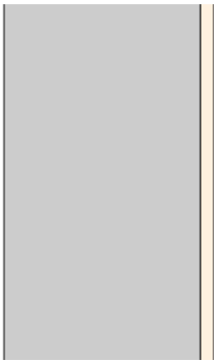
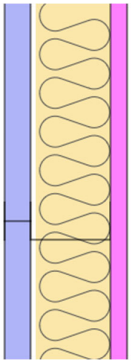
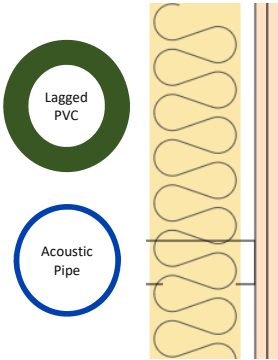
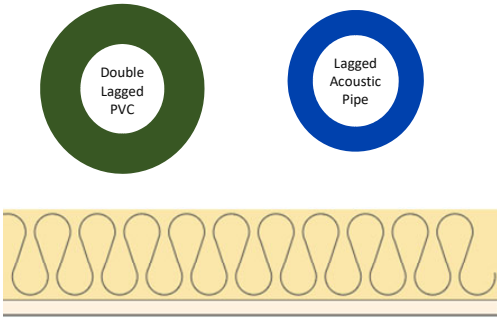
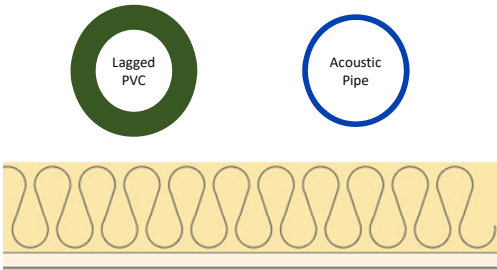
Description	Image
<p>$R_w + C_{tr} \geq 40$</p> <p>Min. 190mm thick concrete blockwork (140 kg/m³) with –</p> <ul style="list-style-type: none"> • One side to be 1x 13mm thick plasterboard direct stick; • ~Siniat PMW1503 (sim). 	
<p>$R_w + C_{tr} \geq 40$</p> <p>Min. 25mm thick Gyprock Shaft Liner Panel in 102 C-H Stud with –</p> <ul style="list-style-type: none"> • 75mm Glasswool <i>Acoustigard</i> 11kg/m³ insulation; and • 16mm Fire-rated plasterboard; • CSR 7655. 	
<p>$R_w + C_{tr} \geq 40$</p> <p>2 x 13mm thick plasterboard with -</p> <ul style="list-style-type: none"> • 75mm Glasswool <i>Acoustigard</i> 11kg/m³ insulation between studs; • PVC pipe wrapped in <i>Soundlag 4525</i> or equivalent or Acoustic pipe (e.g. <i>Raupiano Plus</i>). 	

Table 4-7: Construction Options for Services in Ceilings

Description	Image
<p>$R_w + C_{tr} \geq 40$</p> <p>1 x 13mm thick plasterboard -</p> <ul style="list-style-type: none"> 75mm thick, 14kg/m³ fibrous insulation or 50mm thick 24 kg/m³ fibrous insulation above ceiling; PVC pipe wrapped in 2 x <i>Soundlag 4525</i> or equivalent; or Acoustic pipe (e.g. <i>Raupiano Plus</i>) wrapped in <i>Soundlag 4525</i> or equivalent; No more than 1 downlight per 1m² 	
<p>$R_w + C_{tr} > 25$</p> <p>1 x 13mm thick plasterboard -</p> <ul style="list-style-type: none"> 75mm thick, 11kg/m³ fibrous insulation or 50mm thick 18 kg/m³ fibrous insulation above ceiling; PVC pipe wrapped in <i>Soundlag 4525</i> or equivalent; or Acoustic pipe (e.g. <i>Raupiano Plus</i>). 	

4.4.1. Services Deemed to Satisfy

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 –
- 40 if the adjacent room is a habitable room (other than a kitchen); or
 - 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/m².*
- (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.*

4.5. Special Cases

4.5.1. Car Park

Whilst noise from the sole-occupancy units to the car park is not considered, the opposite is and with this in mind, the following general advice is provided:

- Car Park Entry Gate:
 - Is to be a hinged/sliding 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 Embelton's;
 - 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 or paved finish to minimise tyre squeal. Where the concrete is to be sealed, a product such as Aquaron 1000 by Markham is understood to be suitable and not contribute to tyre squeal.

4.5.2. Commercial Tenancy

Such spaces can be relatively noisy and with an apartment above, it is recommended the ceiling to the commercial tenancy be 13mm thick sound-rated plasterboard with minimum 75mm thick, 14 kg/m³ Acoustigard (or equivalent) insulation above. Acoustic panels shall be fixed to the underside of this ceiling to control reverberation within the space. Any penetrations to the ceiling are to be acoustically treated.

4.5.3. Residents Amenity

With the car park located above this amenity space, it is recommended the ceiling be equivalent to that described for the commercial tenancy with the incorporation of anti-vibration hangers.

5. NOISE INTRUSION ASSESSMENT

With reference to the PlanWA Maps (refer *Figure 5-1*), the site is within the trigger distance of the passenger railway. The site is not within the trigger distance of any assessable roads and therefore road traffic noise is not specifically assessed, although it should be noted that roads such as King William Street and Whatley Crescent do carry reasonably significant traffic volumes. It is further noted that the PlanWA trigger distance for the railway follows the old alignment and has not yet been updated to the new alignment. The assessment uses the new alignment.



Figure 5-1: Site Locality in Relation to SPP 5.4 Trigger Distances

5.1. Methodology

The methodology used in this assessment is to follow the screening assessment procedure provided in the Guidelines (refer Figure 5-2). The passenger railway is as close as 50 metres from the proposed development, with noise levels therefore up to 60 dB LAeq(Day). Figure 5-3 shows the noise contours based on the screening table across the subject site.

Railway Transport Corridor Classification		Forecast period average noise level and exposure category based on distance from nearest rail centreline (m)																		Forecast Excess Noise Level, dB	Exposure Category	Policy requirements for noise-sensitive land-use and/or development	
		adjacent	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	175	200				
Passenger railways	Fremantle, Midland and Thornlie main lines only	68	64	62	60	59	58	56	56	55	54	53	52	52	51	51	49	48			0 or less	-	No further measures
	All other metro passenger rail lines, and where multiple metro rail services share the same transport corridor	70	66	64	62	61	60	58	57	56	56	55	54	54	53	52	51	50			1 to 3	A	Noise-sensitive land-use and/or development is acceptable, subject to:
Freight railways, up to 1 movement per hour		72	68	65	63*	62*	60*	59*	58*	57*	57*	56	55	55	54	53	52	51			4 to 7	B	Mitigation measures in accordance with an approved noise management plan;
																					8 to 11	C	or quiet house package as specified
																					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	

Figure 5-2: Noise Exposure Forecast Table from Guidelines

* Assists to mitigate short term noise events from freight rail.



Figure 5-3: Distances from Railway Across Typical Floor Plan

5.2. Results

From *Section 5.1*, the proposed development has noise levels of up to 60 dB $L_{Aeq(Day)}$ from the passenger railway. *Table 5-1* provides the minimum recommended construction in order to meet the indoor noise target of *Table 2-5* from railway noise, as well as adopting a general minimum performance for inner city living and road traffic noise from King William Street.

These recommendations are preliminary and subject to change during detailed design.

Table 5-1: Minimum Construction Requirements

Element	Room	Minimum Construction
External Glazing	Bedrooms	Where glazing is no more than 65% of the floor area, adopt the following: <ul style="list-style-type: none"> All glazing to be minimum $R_w + C_{tr} \geq 32$. Such glazing would require 10.38mm thick laminated glass in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent). Irrespective of glazing size, this also applies to any fronting King William Street.
		Where glazing is no more than 50% of the floor area, adopt the following: <ul style="list-style-type: none"> Minimum $R_w + C_{tr} \geq 30$. Such glazing would require 6.5mm thick Acoustic Laminate in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent).
		Where glazing is no more than 35% of the floor area, adopt the following: <ul style="list-style-type: none"> Minimum $R_w + C_{tr} \geq 28$. Such glazing would require 6.38mm thick laminated glass in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent).
	Living	Where glazing is no more than 80% of the floor area, adopt the following: <ul style="list-style-type: none"> All glazing to be minimum $R_w + C_{tr} \geq 32$. Such glazing would require 10.38mm thick laminated glass in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent). Irrespective of glazing size, this also applies to any fronting King William Street.
		Where glazing is no more than 65% of the floor area, adopt the following: <ul style="list-style-type: none"> Minimum $R_w + C_{tr} \geq 30$. Such glazing would require 6.5mm thick Acoustic Laminate in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent).
		Where glazing is no more than 50% of the floor area, adopt the following: <ul style="list-style-type: none"> Minimum $R_w + C_{tr} \geq 28$. Such glazing would require 6.38mm thick laminated glass in fixed/awning style windows and sliding doors, both with acoustic seals (or equivalent).
External Doors	Entry	Door to be minimum 35mm thick solid, timber core door with full perimeter acoustic seals achieving minimum $R_w \geq 30$.

Element	Room	Minimum Construction
External Walls	All	External walls to achieve $R_w + C_{tr} \geq 45$ such as Cladding to 190mm thick concrete blockwork, 20mm gap to steel stud with 75mm thick, 11 kg/m ³ fibrous insulation and 13mm thick plasterboard.
Roof / Ceiling	All	Understood to be concrete roof exceeding acoustic requirement of minimum $R_w + C_{tr} \geq 35$.
Notification	Lot	As per SPP 5.4 requirements.

SPP 5.4 does not apply to the commercial spaces, however Green Star does require the upper range to be satisfied. For the purpose of this DA report, all glazing to the Commercial Tenancy, Office, Lobby and Residents' Amenity shall be minimum 10.38mm thick laminated glass. Any openable windows shall be fixed/awning style with acoustic seals. Glass doors shall have the same glass, again with acoustic seals. It must be noted that indoor design sound levels would only be achieved with doors/windows closed, most significant for the commercial tenancy which is shown to have large bi-folding doors.

Appendix A – Development Plans



MURRAY STREET

KING WILLIAM STREET

Revisions / A 23.04.2026 For Information

OB

Project / 7-11 King William Street

Drawing / General Arrangement - Floor Plan - Level Ground

Project No / 223272

Author / OB

Scale: @ A1 / 1 : 100

Drawing No. / DA01.101

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PRELIMINARY

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Project / 7-11 King William Street

Drawing / General Arrangement - Floor Plan - Level 1

Project No / 223272

Author / OB

Scale: @ A1 / 1 : 100

Drawing No. / DA01.102

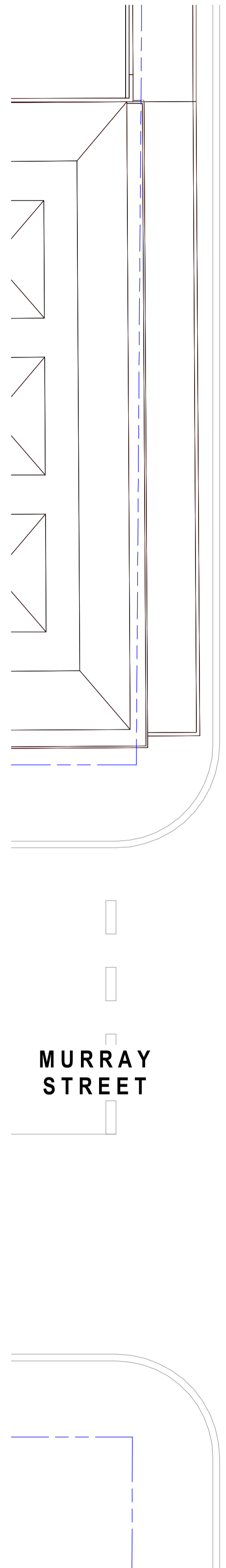
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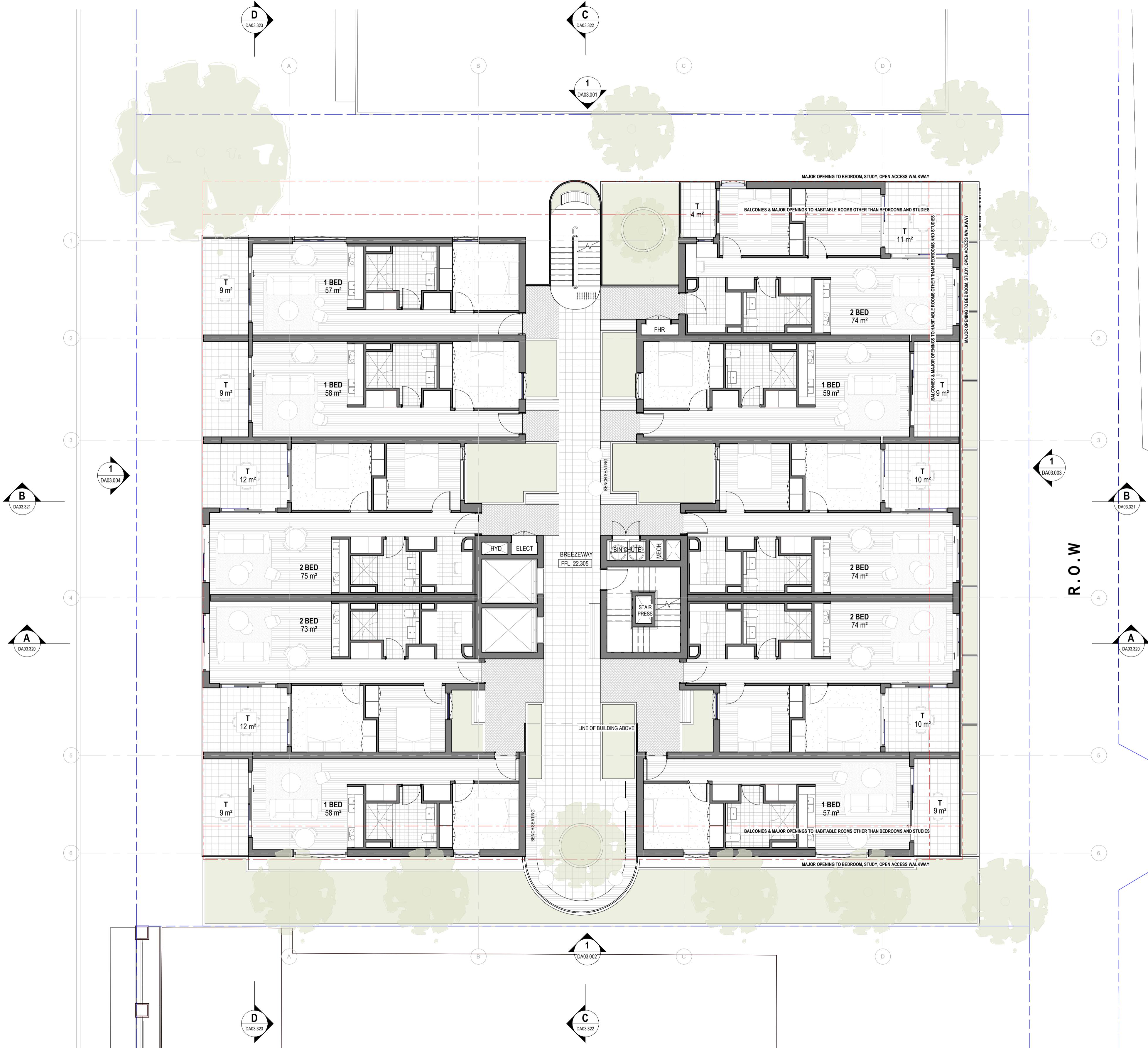
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KING WILLIAM STREET

MURRAY STREET

R.O.W.



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Project / 7-11 King William Street

Drawing / General Arrangement - Floor Plan - Level 2

Project No / 223272

Author / OB

Scale: @ A1 / 1 : 100

Drawing No. / DA01.103

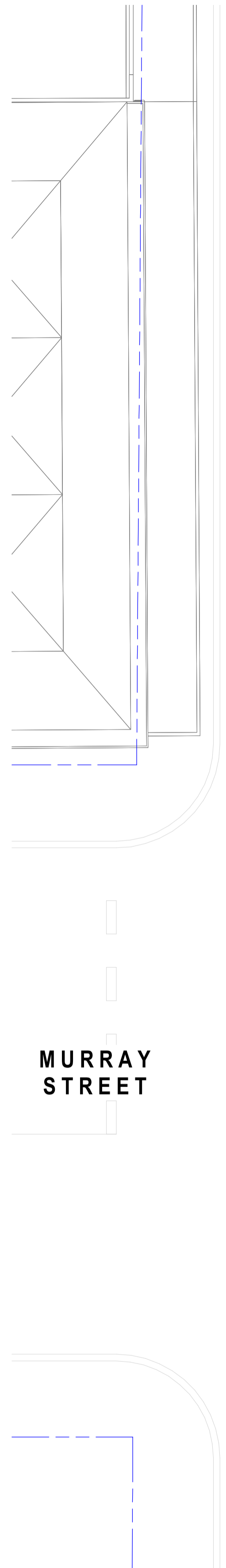
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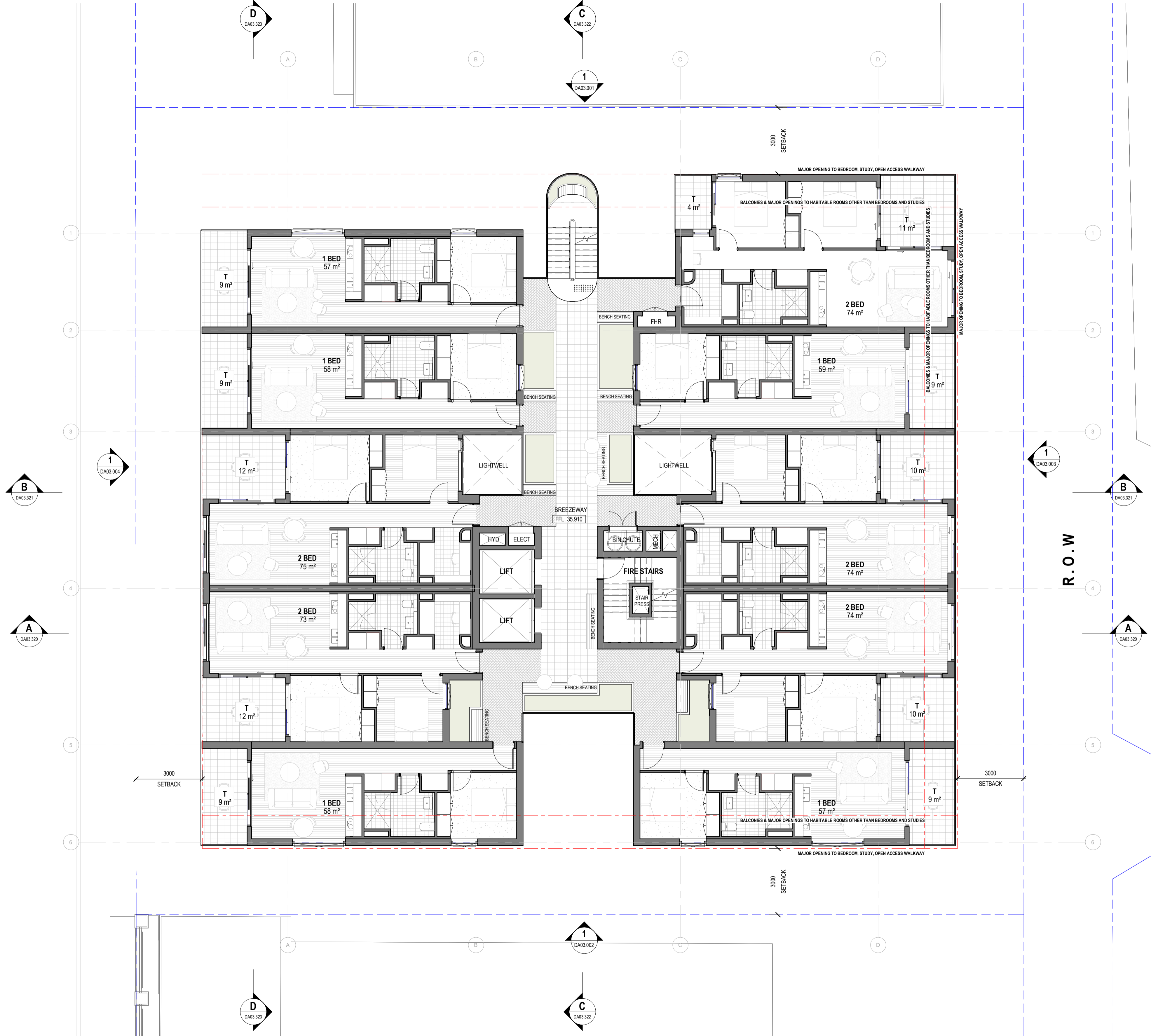
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Project / 7-11 King William Street

Drawing / General Arrangement - Floor Plan - Typical Level

Project No / 223272

Author / OB

Scale: @ A1 / 1 : 100

Drawing No. / DA01.104

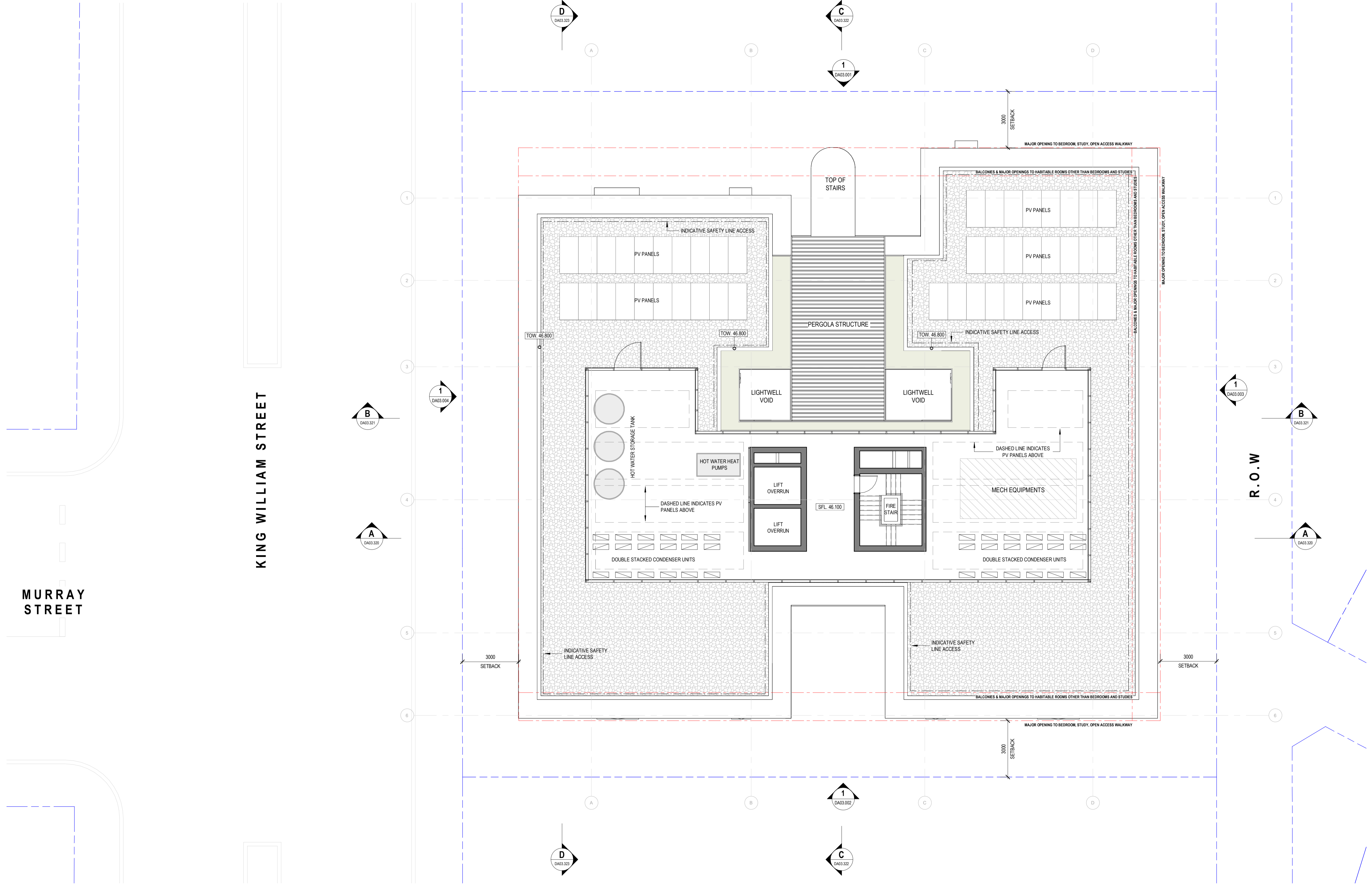
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OB

Project / 7-11 King William Street

Drawing / General Arrangement - Floor Plan - Roof

Project No / 223272

Author / OB

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LEGEND - EXTERNAL MATERIALS & FINISHES

MATERIAL CODE	MATERIAL DESCRIPTION
G. GLAZING & GLASS	
GGT-01	VISION GLAZING COLOUR: CLEAR
GSP-01	SPANDREL GLAZING COLOUR: TO MATCH PPC-01
P. PAINT & APPLIED COATINGS	
PPC-01	POWDERCOAT 01 FINISH: WHISPER WHITE OR SIMILAR LOCATION: TOWER
PPC-02	POWDERCOAT 02 FINISH: NATURAL BRONZE/ TERRAIN OR SIMILAR LOCATION: TOWER
R. ROOFING	
RMT-01	METAL ROOF FINISH: PPC-01
W. WALL & WALL COMPONENTS	
MBA-01	METAL BALUSTRADE FINISH: PPC-01 LOCATION: TOWER
WBR-01	BRICK PATTERNED LAY - STRETCHER BOND COLOUR: NATURAL CLAY, TUMBLED FINISH
WBR-02	BRICK PATTERNED LAY - SOLDIER COURSE COLOUR: NATURAL CLAY, TUMBLED FINISH
WCF-01a	CONCRETE FORMLINER 01a FINISH: SINUS 271100 REKLI LINER OR SIMILAR COLOUR: NATURAL BRONZE/ TERRAIN OR SIMILAR LOCATION: TOWER
WCF-01b	CONCRETE FORMLINER 01b FINISH: SINUS 271100 REKLI LINER OR SIMILAR COLOUR: WHISPER WHITE OR SIMILAR LOCATION: TOWER
WLO-01	LOUIRE 01 FINISH: NATURAL BRONZE/ TERRAIN OR SIMILAR LOCATION: PLANT SCREENS
VMC-01	METAL CLADDING 01 FINISH: NATURAL BRONZE/ TERRAIN OR SIMILAR LOCATION: PODIUM
VMC-02	METAL CLADDING 02 FINISH: WHISPER WHITE OR SIMILAR LOCATION: TOWER
WSC-01	SCREEN 01 FINISH: WEBFORGE COLOUR: NATURAL BRONZE/ TERRAIN OR SIMILAR
WSC-02	SCREEN 02 FINISH: WEBFORGE COLOUR: WHISPER WHITE OR SIMILAR



KING WILLIAM STREET

Revisions / A 23.04.2026 For Information

OB

Project / 7-11 King William Street

Drawing / Building Elevation - North

Project No / 223272

Author / OB

Scale: @ A1 / 1 : 100

Drawing No. / DA03.001

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Appendix B – 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.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- **L_{eq}**

The L_{eq} level represents the average noise energy during a measurement period.

- **L₁**

The L₁ level represents the noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L₁₀**

The L₁₀ level represents the noise level exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

- **L₉₀**

The L₉₀ level represents the noise level exceeded for 90 percent of the measurement period and is considered to represent the “background” noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four 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.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

- the presence in the noise emission of tonal characteristics where the difference between -
 - (a) the A-weighted sound pressure level in any one-third octave band; and
 - (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\text{slow}}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

- a variation in the emission of noise that —
 - (a) is more than 3 dB $L_{A\text{Fast}}$ or is more than 3 dB $L_{A\text{Fast}}$ in any one-third octave band; and
 - (b) is present for at least 10% of the representative assessment period; and
 - (c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

- a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

- **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 10m². 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.

- **$L_{Aeq(Day)}$**

The $L_{Aeq(Day)}$ level is the logarithmic average of the L_{Aeq} levels from 6.00am to 10.00pm.

- **$L_{Aeq(Night)}$**

The $L_{Aeq(Night)}$ level is the logarithmic average of the L_{Aeq} levels from 10.00pm to 6.00am.

- **$L_{A10,18hour}$**

The $L_{A10,18hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00am and midnight.

- **$L_{Aeq,24hour}$**

The $L_{Aeq,24hour}$ level is the logarithmic average of the L_{Aeq} levels from over an entire day.

- **Noise-sensitive land use and/or development**

Land-uses or development occupied or designed for occupation or use for residential purposes (including dwellings, residential buildings or short-stay accommodation), caravan park, camping ground, educational establishment, child care premises, hospital, nursing home, corrective institution or place of worship.

- **About the Term 'Reasonable'**

An assessment of reasonableness should demonstrate that efforts have been made to resolve conflicts without comprising on the need to protect noise-sensitive land-use activities. For example, have reasonable efforts been made to design, relocate or vegetate a proposed noise barrier to address community concerns about the noise barrier height? Whether a noise mitigation measure is reasonable might include consideration of:

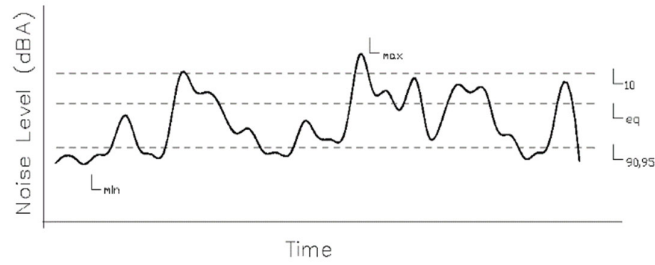
- The noise reduction benefit provided;
- The number of people protected;
- The relative cost vs benefit of mitigation;
- Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
- Existing and future noise levels, including changes in noise levels;
- Aesthetic amenity and visual impacts;
- Compatibility with other planning policies;
- Differences between metropolitan and regional situations and whether noise modelling requirements reflect the true nature of transport movements;
- Ability and cost for mobilisation and retrieval of noise monitoring equipment in regional areas;
- Differences between Greenfield and infill development;
- Differences between freight routes and public transport routes and urban corridors;
- The impact on the operational capacity of freight routes;
- The benefits arising from the proposed development;
- Existing or planned strategies to mitigate the noise at source.

- **About the Term 'Practicable'**

'Practicable' considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. It is defined as "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (*Environmental Protection Act 1986*). These may include:

- Limitations of the different mitigation measures to reduce transport noise;
- Competing planning policies and strategies;
- Safety issues (such as impact on crash zones or restrictions on road vision);
- Topography and site constraints (such as space limitations);
- Engineering and drainage requirements;
- Access requirements (for driveways, pedestrian access and the like);
- Maintenance requirements;
- Bushfire resistance or BAL ratings;
- Suitability of the building for acoustic treatments.

- **Chart of Noise Level Descriptors**



- **Austrroads Vehicle Class**

VEHICLE CLASSIFICATION SYSTEM	
AUSTRROADS	
CLASS	LIGHT VEHICLES
1	BIKE CAR, VAN, TRUCK, AND BUSES (EXCEPT TOWERS)
2	BIKE (TOWNS) BIKE (COUNTRY ROAD)
HEAVY VEHICLES	
3	TRUCK AND TRUCK OR BUS > 12 axes
4	TRUCK AND TRUCK OR BUS > 12 axes, 3 axle group
5	TRUCK OR TRUCK OR BUS > 12 axes, 2 axle group
6	TRUCK AND ARTICULATED > 12 axes, 3 axle group
7	TRUCK AND ARTICULATED > 12 axes, 2 or 4 axle groups
8	TRUCK AND ARTICULATED > 12 axes, 3 axle group
9	TRUCK AND ARTICULATED > 12 axes, 3 axle group or 7 axle, 3 axle group
LONG VEHICLES AND ROAD TRAINS	
10	TRUCK OR TRUCK OR BUS > 12 axes, 4 axle group
11	TRUCK OR TRUCK OR BUS > 12 axes, 3 or 4 axle groups
12	TRUCK OR TRUCK OR BUS > 12 axes, 3 axle group

- **Typical Noise Levels**

