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**DOOLEYS CLUB AND HOTEL DEVELOPMENT
EIS PLANNING PHASE ACOUSTIC REPORT**

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Project: **DOOLEYS CLUB AND HOTEL DEVELOPMENT**

Prepared for: **Dooleys Lidcombe Catholic Club Ltd**
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Lidcombe NSW 2141

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Report No.: **Rp 004 r04 2015562SY**

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EXECUTIVE SUMMARY

This Planning Phase Acoustic Report has been prepared on behalf of DOOLEYS Lidcombe Catholic Club (“the Proponent”). It accompanies an Environmental Impact Statement (EIS) prepared in support of State Significant Development Application SSD_7603 for the staged development of the DOOLEYS Lidcombe site (“DOOLEYS”) at Nos. 4B, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26 and 28 Board Street, Nos. 3, 5, 7, 9, 11 and 17 Ann Street, and Nos. 6, 8, 12A and 24-28 John Street, Lidcombe.

Marshall Day Acoustics (MDA) has been engaged to provide acoustic advice for early design phase involvement for the proposed Dooleys Club and Hotel Development.

This report identifies acoustic issues, proposes acoustic design criteria and provides recommendations for acoustic treatments at the schematic design stage. Site wide noise emission criteria are established to comply with Council, Regulatory and State requirements. An assessment has been conducted of the traffic impacts to surrounding residences of the concept design and high-level review of the site-wide development.

Design criteria for the Dooleys Club and Hotel development are nominated to match the intended usage of the spaces, achieve the desired amenity and cover mandatory legislative requirements including National Construction Code (NCC) and site-wide noise emission requirements.

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1.0 INTRODUCTION

This Planning Phase Acoustic Report has been prepared on behalf of Dooleys Lidcombe Catholic Club ("the Proponent"). It accompanies an Environmental Impact Statement (EIS) prepared in support of State Significant Development Application SSD_7603 for the staged development of the Dooleys Lidcombe site at Nos. 4B, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26 and 28 Board Street, Nos. 3, 5, 7, 9, 11 and 17 Ann Street, and Nos. 6, 8, 12A and 24-28 John Street, Lidcombe.

This application seeks staged development approval for tourist related purposes comprising a concept proposal (including building envelopes, basement envelope, land uses, internal roads and connections to external road network) and Stage 1 works (including early works, site preparation, basement excavation and above ground multi-deck car park) at Dooleys Lidcombe Catholic Club.

Details of the project are described below:

Concept Proposal (Phase 1)

A Concept Proposal has been prepared for the site to guide its future redevelopment and is intended to provide a statutory framework for the long term planning of the site. The concept proposal is for tourist related purposes, including building envelopes, basement envelope, land uses, internal roads and connections to external road network. Specifically, the concept proposal comprises:

- Two levels of basement car parking;
- New two storey podium containing new Club facilities and other facilities associated with the proposed hotel, including conferencing; food and beverage and gym;
- New 12 storey Club and hotel tower above the podium with approximately 260 rooms;
- New five storey above ground multi deck parking building (initially to provide car parking to enable the on-going operations of the existing Club through the redevelopment process); and,
- New internal road access and connection points to surrounding road network.

Detailed Proposal for "Stage 1" development

This is a detailed proposal for early works, site preparation, excavation of the basement and construction of the above ground multi deck car park.

- Bulk earthworks for two levels of basement;
- Hoarding;
- Site establishment;
- Infrastructure preparation works;
- Construction Management including proposed site access and construction traffic management;
- Construction of an above ground multi deck car park located between Board Street and Ann Street.

The purpose of this Planning Phase Acoustic Report is to provide an assessment of the proposal as described above and detailed within the EIS.

1.1 Report Scope

This report proposes acoustic design criteria, identifies acoustic issues, and provides recommendations for acoustic treatments at the current design stage.

In summary, site-wide design criteria are defined in Section 2.0, whilst design criteria for internal spaces defined in Section 3.0, including specific criteria for the Hotel in Section 3.1, and the Dooleys Club in Section 3.2.

Application of the design criteria to the concept design is further developed in the following sections;

- Vibration survey, Section 4.0
- Site-wide noise emission, Section 5.0
- Hotel, Section 6.0
- Dooleys Club, Section 7.0

Finally Section 8.0 highlights key aspects where careful consideration will be required as the design progresses, and where there will need to be continued dialogue with the client that also aligns with the developing design intent.

Acoustic terminology used throughout this report is described in Appendix A.

1.2 Project Description

The Dooleys Lidcombe Club development includes hotel and club spaces;

Hotel;

- Level 4+, hotel suites
- Hotel Lobby
- Business centre
- Hotel gym health facility

Club;

- Gaming (indoor and outdoor smoking)
- VIP Gaming
- Coffee shop
- Indoor and outdoor bar / restaurant with outdoor play area
- Main ground level lobby
- Restaurants (Yum Cha, Vietnamese, Steak House, Modern Italian Restaurant)
- Cocktail lounge / sports bar with external terrace
- Conference rooms (conference theatre / conference room / pre-function) and John Meaney Room
- Back of house areas
- Administration offices

Shared;

- Shared lobby entrance
- basement levels carpark

In addition there will be a separate 610 capacity external carpark.

1.3 Design basis

Table 1 outlines the understanding of the client intent for the various spaces within the Dooleys development, and the design basis for acoustic input to the project on the understanding that operationally the Hotel and Dooleys Club will operate co-operatively but be under separate management.

Table 1: Acoustic design basis

Development	Space	Design basis
Club	Gaming	The intent is to design a comfortable un-obtrusive acoustic amenity to the gaming areas, protecting from road / rail noise intrusion and from disturbances from other non-related activities within the Dooleys Club development.
Hotel	Hotel rooms	It is understood that the intent is for the Hotel and associated development to be of a 4 ½ star standard with a high standard of quality throughout. The design intent is for the Hotel component to be of similar or greater quality than other accommodation in the Inner West. However we also understand that the desire for luxury is to be balanced against construction cost to ensure the design does not go beyond the acoustic performance required to be fit for purpose. The façade construction is to be a curtain wall system with full height glazing. We propose internal noise levels from road traffic to be commensurate with Australian Standard recommendations for a hotel sleeping area adjacent a major road. Design of the acoustic isolation for Hotel guest rooms will be to minimum NCC compliance which is sufficient to control noise from normal activities in an adjacent room however disruptive behaviour may be audible (and would need to be addressed by management). We note that the brief identifies some interconnecting rooms which will require acoustic treatment to achieve minimum NCC code compliance.
Club	Conference room, conference theatre, John Meaney Room	The spaces are to provide a quality environment for conferences, business events, wedding receptions and the like. Internally the spaces will need to be acoustically treated to ensure high levels of speech intelligibility. We note that the brief identifies <i>'maximum possible sound proofing be included in the design, especially partition walls in subdivided, operable wall configurations'</i>. Design direction to date has been for; • Single operable wall between rooms • No floating floor construction
Club	Cocktail bar	It is understood the cocktail bar is to be capable of being used for a variety of functions from a lounge bar up to a nightclub venue, similar in intent to the Bellini Cocktail Bar with live performance and amplified music.
Club	Ground level bar / café	The impact of the bar / café on adjacent spaces will be designed on the basis that music will be limited to moderate background music and not expected to host live bands or raised amplified music typical of an event. Outdoor terrace areas on the northern sides of the development will face existing residential areas. Acoustic shielding will need to be provided, however noting that it may not be practical to allow for all operations at all times on these terraces.

Development	Space	Design basis
Club	Outdoor terraces	Outdoor terrace areas on the southern and western sides of the development will be exposed to significant levels of transportation noise from Church Street, Olympic Drive and the rail line. The intent is to ameliorate traffic noise as much as practicable, however noting that the transportation noise will not be able to be totally excluded from these areas.
Combined	Loading Dock	The loading dock located on levels B1/B2 will have a slip road entry from Olympic Drive with exit left onto Olympic Drive. Activities within the loading dock and internal passage within the Dooleys site will be subject to noise emission controls external to the Dooleys site. Operation times and traffic volumes are to be confirmed with issue of the traffic report.
Combined & External	Carpark	It is understood the carpark will be operational as per the Dooleys Club hours.
Hotel	Gym Health Facility	The gym will be restricted to light to moderate gym activity (i.e. not a commercial gym), typical for a hotel with no co-ordinated active classes, e.g. aerobics.
Combined	Lobby	As the main entrance space, the intent for the lobby is to provide an inviting acoustic ambience.
Club	Restaurants	Acoustic design input for restaurants will be for shell and core only, with separate fitout engagement for internal acoustic advice.

2.0 SITE-WIDE CRITERIA

This identifies design criteria that apply to the Dooleys Club and Hotel site, including;

- Rail vibration impacts from nearby rail operations to the Dooleys Club and Hotel site
- Site noise emission in operation of the Dooleys Club and Hotel site
- Construction noise and vibration impacts from construction works

Noise impacts from road and rail airborne noise impacts are addressed in the internal development design criteria in Section 3.0.

2.1 Rail Vibration

Assessment of the impact of rail vibration to the Dooleys development is of;

- Structural vibration
- Structure-borne noise.

2.1.1 Structure-borne noise criteria

In order to ensure that the cumulative effect of airborne train noise and structure-borne noise is less than the criteria, the predicted maximum structure-borne sound should be 10dB less than the airborne component, that is, maximum structure-borne noise levels should not exceed L_{Amax} 45 dB in the hotel rooms and L_{Amax} 55 dB in the gaming area.

2.1.2 Structural vibration criteria

Vibration criteria for continuous (and intermittent) vibration in buildings are presented in ISO Standard 10137¹. This standard specifies recommended limits for structural vibration for different building usages. These limits specify levels of vibration at a range of frequencies, defined as a series of spectral curves.

Curves designated 1.4 and 4 are considered to be the appropriate limits for the hotel rooms and the entertainment areas within the development respectively (note, Curve 1 applies to residential night-time and Curve 4 is normally used for office areas). Table 2 presents these curves in numeric form.

Table 2: Vertical vibration criteria – Curve 1.4 and Curve 4 from ISO 10137:2007

Criteria	Third Octave band mid frequency									Hz
	2	2.5	3.15	4	5	6.3	8	10-80		
Curve 1.4	118	115	112	109	107	105	103	103	L _v dB (re 1e-6 mm/s rms)	
Curve 4	127	124	121	118	116	114	112	112	L _v dB (re 1e-6 mm/s rms)	

The maximum vertical structural floor vibration in the respective building spaces should not exceed these one-third octave band limits when trains pass by the proposed development. Whilst this level of vibration is well below a level which may be considered for potential structural damage and are not injurious to health, some train passes may still be somewhat perceptible at times. This is not unexpected for properties adjacent to a railway line.

Note that for structural vibration at frequencies 8 Hz and above, the criteria are constant, with maximum recommended levels of L_v 103 dB and L_v 112 dB for the hotel rooms and the gaming area respectively. As consistent with the noise assessment, the 95th percentile statistical maximum vibration of all train passes is used for the structural vibration assessment.

2.2 Noise Emission

Table 3 summarises the applicable noise criteria by source as they apply to activities within the Dooleys Hotel and Club development and external carpark.

Table 3: Applicable criteria, external noise emission

Source / Activity	Assessment Metric	Document Status
Loading dock activity and carpark vehicle noise via internal driveway to carpark exits	INP	Planning condition, applied by council
Delivery vehicle entry / exit on surrounding roads	RNP	Planning condition, applied by council
Patron vehicle activity, surrounding roads	RNP	Planning condition, applied by council
Patron vehicle, carpark activity	INP	Planning condition, applied by council
Building services plant and equipment	INP	Planning condition, applied by council
Patron noise, via outdoor terraces and breakout from the building envelope	OLGR	Standard conditions relating to liquor license
	INP	Planning condition, applied by council

¹ ISO 10137:2007 – *Serviceability of buildings and walkways against vibrations*.

In summary, preliminary noise criteria are shown in Table 4. Detailed derivation of applicable criteria can be found in Appendix B.

Table 4: Summary of noise emission criteria

Assessment Metric	Period	Time	Criteria
Industrial Noise Policy (NSW INP)	Day	7:00am to 6:00pm Monday to Saturday; or 08:00am to 6:00pm on Sundays and public holidays	54 dB $L_{Aeq, 15minutes}$
	Evening	6:00pm to 10:00pm	50 dB $L_{Aeq, period}$
	Night	remaining periods	45 dB $L_{Aeq, period}$
Road Noise Policy (NSW RNP) – Arterial / Sub-arterial Road	Day	7:00am to 10:00 pm	60 dB $L_{Aeq(15hr)}$ 60 (external)
	Night	10:00pm to 7:00am	55 dB $L_{Aeq(9hr)}$ 60 (external)
Road Noise Policy (NSW RNP) – Local Road	Day	7:00am to 10:00 pm	55 dB $L_{Aeq(1hr)}$ (external)
	Night	10:00pm to 7:00am	50 dB $L_{Aeq(1hr)}$ (external)
Office of Liquor, Gaming and Racing (OLGR)	Day	10:00am to 6:00pm	54 ² dB L_{A10}
	Evening	6:00pm to 10:00pm	54 ² dB L_{A10}
	Night	10:00pm to midnight	49 ^{2,3} dB L_{A10}
	Night	Midnight to 4:00am ³	42 ^{2,3} dB L_{A10}
Sleep Disturbance	Night	10:00pm to 7:00am (typical)	60-65 L_{Amax} (external)

2.2.1 Emergency Plant and Equipment

It is proposed that for receivers external to the Dooleys site, that emergency plant and equipment is assessed only for maintenance operation. Where equipment operates during night-time periods, unplanned emergency operation may exceed the site noise criteria. On the basis maintenance operation is limited to daytime run only, daytime criteria as per Table 4 applies. The extent of the potential non-compliance will need to be determined during detailed design.

On the basis that maintenance operation can be planned and will only be an infrequent event, an allowed exceedance of 5-10dBA from typical background noise levels is recommended acceptable.

Confirmation will be required from Dooleys that the proposed method of compliance, and impact to the Dooleys site is acceptable.

2.3 Construction Noise and Vibration Impacts

An impact assessment has been conducted of construction noise and vibration impacts of Phase 1 construction works in MDA report Rp 001 r01 2016364SY. The report is an indicative assessment

² Overall value only, compliance is required in each octave band frequency

³ Inaudible within any habitable room in any residential premises

based on the projected construction works, establishing the likely impacts to surrounding residential receivers and potential mitigation measures that can be considered.

A Construction Noise and Vibration Management Plan (CNVMP) will be required to be developed in co-ordination with the construction team prior to the issue of the Construction Certificate with details of construction programming, construction plant and equipment and specific mitigation measures. Potential mitigation measures and construction management practices that should be considered in the CNVMP have been outlined in the impact assessment.

3.0 DEVELOPMENT DESIGN CRITERIA

This section outlines design criteria applicable to the various spaces within the Dooleys Hotel and Club development. In the absence of specific client direction of the intended acoustic amenity, the following outlines the applicable mandatory and non-mandatory recommended criteria that may apply.

Design criteria define the acoustic performance of a building and can be categorised as follows:

- Minimum legislative requirements, e.g. National Construction Code (NCC)
- Recommendations in standards or codes of practice such as Australian or ISO Standards
- Quality rating systems that relate performance benchmarks to subjective impressions of quality, such as the acoustic star rating system prepared by the Association of Australian Acoustical Consultants (AAAC).

These are summarised in Table 5.

Table 5: Acoustic issues and applicable sources for acoustic criteria

Applicable Space	Acoustic issue	Legislation	Standards	Quality rating
Hotel rooms	External noise intrusion, including traffic and entertainment noise	OLGR SEPP	AS2107	AAAC Star Rating/ Discretionary
Hotel rooms	Internal airborne sound transmission between adjacent hotel rooms	NCC	None	AAAC Star Rating/ Discretionary
Hotel rooms	Internal impact sound transmission between adjacent hotel rooms	NCC	None	AAAC Star Rating/ Discretionary
Whole building	Mechanical services noise levels, e.g. air-conditioning, exhaust	NCC	AS2107	AAAC Star Rating/ Discretionary
Whole building	Hydraulic services noise, e.g. caused by waste water and water supply systems	NCC	None	AAAC Star Rating/ Discretionary
Whole building	Fire services noise, such as that caused by fire and smoke extract systems	NCC	AS1668.1	AAAC Star Rating/ Discretionary
Club and Hotel public	Internal airborne sound transmission between enclosed private spaces	None	None	AS2822 / Discretionary
Club and Hotel public	Internal room reverberation characteristics	None	AS2107	Discretionary

Table 6: Notes to Table 5

Notes		
Legislation	NCC	<i>National Construction Code</i> . The particular version that applies depends on the date of the building permit, as advised by the building surveyor
	OLGR	<i>Office of Liquor, Gaming and Racing (OLGR)</i> . Standard Noise Conditions for entertainment noise from any licensed venue to the boundary of any noise affected dwelling.
	SEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
Standards	AS2107	Australian Standard 2107-2000: <i>Acoustics - Recommended design sound levels and reverberation times for building interiors</i>
	AS1668.1	AS/NZS 1668.1-1998: <i>The use of ventilation and air conditioning in buildings Part 1: Fire and smoke control in multi compartment buildings</i>
Quality rating	AAAC Star Rating	<i>Association of Australian Acoustical Consultants Star Rating System</i> for acoustic performance developed and published by the Association of Australian Acoustical Consultants (AAAC).
Discretionary	-	Quality ratings as nominated in a project design brief, or developed in conjunction with the client as required to achieve the project quality objectives

3.1 Design criteria – Hotel

The following sections outline design criteria for;

- Acoustic separation, including airborne noise and impact isolation, Section 3.1.1
- External noise intrusion, Section 3.1.2
- Building services noise levels, Section 3.1.3
- Reverberation time, Section Section 3.1.4
- Isolation of building services, Section 3.1.5

3.1.1 Acoustic separation

Design criteria for acoustic separation are provided in;

- National Construction Code (NCC), mandatory code requirements
- AAAC star rating system, recommended quality criteria

Refer to Appendix C for a full description of the above acoustic separation criteria.

Discussion and recommended criteria

In comparison, minimum NCC compliance for impact sound is comparable to a AAAC star rating '2 star' quality, whereas the NCC minimum for airborne sound equates to a AAAC star rating '4 star' quality. To appreciate the subjective quality, Table 7 provides a subjective indication of the acoustic amenity achieved with each of the star ratings for airborne noise transfer.

Table 7: AAAC acoustic star rating summary, inter-tenancy airborne noise transfer (minimum NCC outlined)

	Sound Insulation expressed as $D_{nT,w} + C_{tr}$				
	35	40	45	50	55
Type Of Noise Source	2 Star	3 Star	4 Star	5 Star	6 Star
Normal Speech	Audible	Just Audible	Not Audible	Not Audible	Not Audible
Raised Speech	Clearly Audible	Audible	Just Audible	Not Audible	Not Audible
Dinner Party/ Laughter	Clearly Audible	Audible	Just Audible	Not Audible	Not Audible
Shouting	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Small Television/ Small Entertainment System	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Large Television/ Large Hi-fi Music System	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Just Audible
DVD With Surround Sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible
Digital Television With Surround Sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible

On the understanding that there is greater tolerance for acceptable noise intrusion in short-stay hotel accommodation compared to permanent residential dwellings, the recommendation for design criteria is;

- Airborne separation between adjacent hotel rooms, recommend the minimum NCC regulations for airborne sound transmission through separating walls and floors is sufficient.
- Vertical impact isolation between hotel rooms, minimum NCC is deemed insufficient.

recommended criteria for floor impact sound insulation performance are shown below;

- Habitable rooms (3 star acoustic rating): $L'_{nT,w}$ 55
- Wet areas (2 star acoustic rating): $L'_{nT,w}$ 60

Recommendations are on the basis that wet areas are vertically stacked and there is greater tolerance in the wet areas in addition to raised continuous masking background noise levels from the bathroom exhaust which mitigates the impact of disturbances.

It is noted that the nominated acoustic criteria and treatment for floor impact sound insulation represent an acoustic amenity at the lower end of the AAAC star rating system, which has the potential to generate complaints with regard to floor impact noise transfer where the expectation are equivalent to a high-quality apartment.

In summary, the acoustic separation design criteria recommended for the hotel suites is listed in Table 8.

Table 8: Acoustic separation design criteria, hotel suites

Inter-tenancy partition	Sound insulation		
	Laboratory	On-site	Notes
Wall separating habitable rooms (i.e. bed / living)	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Wall impact isolation not required Applies to walls and doors with inter-connecting doors between hotel rooms
Wall separating wet areas	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Wall impact isolation not required
Wall separating a wet area or kitchen and a habitable room	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Discontinuous construction required
Wall separating a sole-occupancy unit from a stairway, public corridor, public lobby, etc	$R_w \geq 50$	$D_{nT,w} \geq 45$	Wall impact isolation not required
Wall separating a sole-occupancy unit from a plant room or lift shaft	$R_w \geq 50$	$D_{nT,w} \geq 45$	Discontinuous construction required
Floor separating sole-occupancy units (to bathroom)	$R_w + C_{tr} \geq 50$ $L_{n,w} \leq 60$	$D_{nT,w} + C_{tr} \geq 45$ $L'_{nT,w} \leq 60$	Floor impact isolation required
Floor separating sole-occupancy units (to habitable room)	$R_w + C_{tr} \geq 50$ $L_{n,w} \leq 55$	$D_{nT,w} + C_{tr} \geq 45$ $L'_{nT,w} \leq 55$	Floor impact isolation required
Floor separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like	$R_w + C_{tr} \geq 50$ $L_{n,w} + C_l \leq 62$	$D_{nT,w} + C_{tr} \geq 45$ $L_{nT,w} + C_l \leq 62$	Floor impact isolation required
Door separating a sole-occupancy unit from a public corridor, public lobby, etc	$R_w \geq 30$	$D_{nT,w} \geq 25$	

3.1.2 External Noise Intrusion

Hotel rooms will be subject to external noise intrusion from road and rail traffic, as well as entertainment noise associated with the Dooleys Club.

External noise intrusion criteria are provided in;

- Australian Standard AS/NZS 2107:2000 – recommendations for overall noise levels, including external noise ingress and building services
- AAAC star rating system, recommended for external noise ingress
- State Environmental Planning Policy (SEPP) (Infrastructure) 2007, mandatory requirements for residential developments near rail and major roadways
- Office of Liquor Gaming and Racing (OLGR) – mandatory criteria that apply to licensed venues (where hotel rooms are exposed to noise from licensed venues)
- Sleep disturbance criteria

Listing of the above acoustic criteria is presented in Appendix C2.

Discussion and Recommended Criteria - Road and Rail Traffic

For constant external noises (e.g. road noise) compliance with AS/NZS 2107:2000 'satisfactory' levels and a "3-star" acoustic rating under the AAAC star rating system is considered appropriate for the quality objectives outlined in the design basis. The recommended criteria are shown in Table 9.

Table 9: Recommended criteria, external noise intrusion for amenity

Dominant Noise Source	Application	Overall Target
Road and rail traffic	Hotel room, day (0700-2200hrs)	40dB $L_{Aeq, 15hr}$
	Hotel room, night (2200-0700hrs)	35dB $L_{Aeq, 9hr}$

These design targets are consistent with SEPP requirements for a residential development. Where the design achieves the above nominated constant noise level targets, typical night-time maximum internal noise level events are unlikely to cause sleep awakenings. It must be noted that at this level, peak road and rail traffic noise will still be audible and apparent.

Discussion and Recommended Criteria - Entertainment Noise

As identified in Section 1.3, the future Dooleys Club and Hotel will be under separate management but will operate co-operatively. Where the Hotel is to be considered completely independent, and there is complaint action taken by the Hotel to the OLGR against Dooleys Club, then OLGR criteria may strictly apply. Rather than strictly applying the OLGR criteria, more relaxed noise level criteria is suggested to provide a reasonable level of amenity in hotel rooms exposed to entertainment noise.

Where it is decided to take this approach, it is recommended that discussions are held between Dooleys Club and the hotel provider to confirm that suggested criteria reflect the expectations of both parties.

Preliminary criteria are shown in Table 10 based on assumptions of the minimum background noise levels in Hotel rooms.

Table 10: Preliminary OLGR external noise intrusion criteria for Hotel rooms

Dominant Noise Source	Application	Overall Target
Entertainment, Dooleys Club	Before midnight	30dB $L_{A10, 15min}$
	After midnight	25dB $L_{A10, 15min}$
		Inaudible

3.1.3 Building services noise levels

There are no mandatory requirements for building services noise levels, recommendations are provided in;

- AS/NZS 2107:2000, recommended overall noise levels
- AAAC Star rating system, recommended levels for amenity

A full listing of the acoustic criteria of the above is presented in Appendix C.

Discussion and Recommended Criteria

Recommendations for building services noise levels are shown in Table 11 for Hotel rooms and in Table 12 for common areas. Recommendations are in general accordance with AS/NZS 2107:2000, however the suggested criteria allow for tolerance of higher noise levels for building services operated by the Hotel guest.

Criteria are listed as both a noise rating and overall noise level. Building services are to achieve both nominated criteria with external road / rail traffic noise intrusion

Table 11: Recommended noise level criteria, Hotel Rooms

Source	Noise Rating (NR)	Overall Noise Level, dB L _{Aeq}
Air-conditioning noise - wall mounted unit at medium speed	NR40	45dBA
Fan coil unit noise in Hotel rooms:		
Low speed	NR30	36dBA
Medium speed	NR35	40dBA
Noise from a switched exhaust fan in a wet area	-	45dBA
Noise from any central building services (exhaust fans, chillers, lifts, etc) in a wet area	-	L _{max} ≤ 30dBA
Noise from any central building services (exhaust fans, chillers, lifts, etc) in a hotel bedroom or living room	-	L _{max} ≤ 25dBA
Noise in a wet area from any waste pipes serving any other hotel room	-	L _{max} ≤ 35dBA
Noise in a bedroom or living area from any waste pipes serving any other hotel room	-	L _{max} ≤ 25dBA

Table 12: Recommended noise level criteria, Hotel common areas

Room	Noise Rating (NR)	Overall Noise Level, dB L _{Aeq}
Hotel Reception	NR40	45
Terrace Lounge	NR40	45
Hotel Gym	NR35	40
Restaurants/Bars	NR40	45
Kitchens	NR40	50
Hotel corridors	NR40	45
Toilets	NR45	50
Business Centre, Meeting Rooms	NR35	40

3.1.4 Room acoustics

Recommendations for room reverberation times are provided in Table 13, adopted from AS/NZS 2107:2000. Suitable reverberation times are dependent upon the room volume and the space usage.

Table 13: Recommended reverberation times

Room	Maximum T ₆₀ , seconds
Hotel Reception	1.0

Room	Maximum T_{60} , seconds
Hotel Gym	0.8
Corridors	0.6
Restaurants/Bars	1.0
Business Centre, Meeting Rooms	0.8
Office administration	0.8

3.1.5 Isolation of building services

Design criteria for the isolation of services are provided in;

- National Construction Code (NCC), mandatory requirements
- AAC star rating system, recommended for amenity

Full listing of the acoustic criteria of the above is presented in Appendix C.

Discussion and Recommendation

It is considered that the NCC requirements for services adjacent to a habitable room are appropriate for hotel suites, noting NCC performance requirements for services adjacent to a wet area are too low for a quality residential application. On this basis the required design criteria are listed in Table 14.

Table 14: NCC requirements for acoustic separation of services that serve another hotel suite

Location	NCC requirement
Habitable room	$R_w + C_{tr} \geq 40$
Non-habitable or wet area	$R_w + C_{tr} \geq 25$

Where there is an intent to provide an improved amenity, for wet areas, a construction with a sound reduction performance of $R_w + C_{tr} \geq 35$ is considered suitable.

3.2 Design Criteria – Dooleys Club

In this section design criteria for Dooleys Club are identified for;

- Sound isolation
- Background noise levels
- Internal room acoustics.

3.2.1 Sound Isolation

Sound isolation between adjoining enclosed spaces is primarily dependent upon three factors;

- Activity noise levels in the source room
- Sound reduction between the rooms, and
- Ambient masking noise in the receiving room

Activity Noise Levels

For conference rooms where there will be more than one simultaneous conversation, activity noise levels will be dependent on the density of people and room reverberation characteristics. Room reverberation characteristics determine how quickly ambient background noise builds-up and

reduces. This will control the ambient noise level as people naturally raise their voice to be heard when the background ambient noise is high (i.e. as typically experienced in a busy café).

Higher noise levels will be expected for conference spaces, where noise levels will be raised further from amplified music or speech. Previous acoustic testing has been carried out by Marshall Day Acoustics in various licensed and music venues, with results shown in Table 15.

Table 15: Typical internal music noise levels

Description	L_{Aeq} dB
Typical upper levels in live “heavy” rock band/nightclub	107
Typical average levels in live “heavy” rock band/nightclub	98
Wedding band (loud)	94
Amplified music in bar (moderate)	87
3 piece jazz band (up tempo loud song)	89
3 piece jazz band (ballad – low)	80

Sound reduction

The sound reduction between adjacent spaces is dependent on the construction of the various building components separating the spaces, be it partition, ceiling, door, floor, etc. The sound reduction between adjacent spaces is generally described by the standardised level difference $D_{nT,w}$, as measured in the field under site conditions. The higher the $D_{nT,w}$, the better is the acoustic separation or sound reduction between the spaces.

Ambient noise level

The ambient noise level in the receiving room plays a significant role in masking intrusive speech from adjacent rooms. Noise from the air conditioning systems, road traffic and general activity within the building have a significant effect on the disturbance due to the masking they provide.

A direct trade-off with sound reduction applies, i.e. if the ambient background noise is reduced by 5dB, the noise reduction of the adjoining partition needs to be increased by 5dB to maintain the same level of speech privacy.

3.2.2 Background noise levels

The following lists suggested design overall background noise level targets for the Dooleys Club. Design targets are the overall level, combining noise from building services and external sources (road traffic, train pass-by and entertainment noise break-in).

Internal Spaces

Recommended design criteria for internal spaces are listed Table 16, taking into consideration the recommendations in AS/NZS 2107:2000, adapted for the various commercial public spaces.

Criteria are listed as both a noise rating and overall noise level. Building services are to achieve both nominated criteria with external road / rail traffic noise intrusion.

Table 16: Overall noise level criteria

Room	Noise Rating (NR)	Overall Noise Level, dB L_{Aeq}
Gaming (indoor)	NR40	45
Restaurants/Bars/Bistro	NR40	45
Conference Room / John Meaney Room	NR35	40
Meeting Rooms / Business Centre	NR35	40
Offices	NR40	45
Kitchens	NR40	50
Lobbies	NR40	50
Toilets	NR45	50
Basement car parks	NR50	60

To be acceptable, internal noise from mechanical services should be free of tonal and spectral content, and not exceed the nominated levels when measured at a distance of 1.2m above floor level, and 1.5m from any diffuser or wall.

In addition, for spaces that are exposed to rail traffic it is proposed to use the following L_{max} criteria for assessment of train noise:

- L_{Amax} 65 dB in the gaming area

Assessment of the maximum noise level (L_{Amax}) should be on the commonly occurring “typical maximum” events rather than an infrequent “worst-case” event which would potentially be significantly more complex and costly to mitigate, with relatively limited benefits.

Outdoor occupied areas

Table 17 lists suggested noise level criteria for outdoor occupied areas. As outdoor spaces, there are physical limits to the extent of acoustic controls available, therefore recommended noise level criteria in Table 17 will be reviewed against the level achievable for the location and the acoustic controls that are practically able to be implemented.

Table 17: Outdoor occupied areas

Location	Overall Noise Level, dB L_{Aeq}
Podium Deck (adjacent to the building core)	50
Outdoor Terraces	45-50
Outdoor gaming	50

3.2.3 Room acoustics

Internal room acoustics are an important factor in defining the acoustic amenity, particularly in rooms where good speech communication is important and in the overall build-up of noise with where activity is critical to the acoustic ambience.

Room acoustics within a space are commonly described by the reverberation time, which is measured in seconds and is an indication of how quickly sound decays within a space. The higher the reverberation time, the more reverberant or acoustically “live” is the space. A low reverberation time

indicates a quiet or acoustically “dead” space. The subjective acoustic impression of a space with a high reverberation time is that it may be considered too “live” or “noisy”.

Discussion and Recommended Design Criteria

Recommendations for room reverberation times are provided in Table 18, adopted from AS/NZS 2107:2000. Suitable reverberation times are dependent upon the room volume and the space usage.

Table 18: Recommended reverberation times

Room	Maximum T_{60} , seconds
Gaming (indoor)	0.7
Restaurants/Bars/Bistro*	1.0
Conference Rooms / John Meaney Room	0.7
Meeting Rooms / Business Centre	0.8
Offices	0.8
Entry / Lobby / Reception*	1.0

* - AS2107 recommends limiting reverberation times in these areas as far as practicably possible.

4.0 VIBRATION SURVEY

MDA has assessed the rail related structural vibration and structure borne noise within the proposed development by conducting a ground vibration survey of passing passenger trains.

Details of the survey are provided in Appendix D.

4.1 Assessment

Table 19 summarises the rail assessment.

Table 19: Assessment of 95th percentile maximum rail structural vibration and structure borne noise

Affected area	Prediction	Criteria	Assessment result
Ground level Gaming area			
Maximum structural floor vibration	L_V 99 dB @ 50Hz	L_V 112 dB	Complies
Noise level in room	L_{Amax} 44dB	L_{Amax} 55dB	Complies
Level 4 Hotel rooms Grid FFF			
Maximum structural floor vibration	L_V 92 dB @ 50Hz	L_V 103 dB	Complies
Noise level in room	L_{Amax} 36dB	L_{Amax} 45dB	Complies

Table 19 shows that the rail related structural vibration and structure-borne noise in the most exposed habitable spaces of the Dooleys development, is predicted to comply with the respective criteria by at least 9dB, which is a significant margin of compliance. Note that this prediction is based on the 95th percentile statistical maximum rail vibration.

Although the scenario of a single freight train pass is not assessed, calculations indicate that the respective structural vibration and structure borne noise predictions due solely to the “derived freight train” scenario also comply with a margin of at least 5dB.

On the basis of the survey data, design details and assumptions (refer to Appendix D), the structural vibration and structure-borne noise propagating from the railway across Church Street to the habitable spaces of the Dooleys development is expected to comply with the nominated criteria.

The assessment takes into account the 95th percentile statistical maximum rail vibration and, as the margin of compliance was significant, any excess rail related structural vibration and structure borne noise events noticeable within the habitable spaces of the development are expected to be minor and infrequent.

4.2 Recommendations

The following recommendations are made as the design progresses;

- At the detailed design stage of the project, it is recommended to review the design of the development with respect to the assumptions made in this assessment. Should either the final architectural or structural details vary significantly from those utilised for this assessment, then this rail assessment may be affected and require a review.
- Consideration should be made for a follow-up ground vibration survey during excavation for the carpark to assess ground vibration levels at the basement building structure, not able to be tested at the concept design stage.

5.0 APPLICATION – SITE-WIDE NOISE EMISSION

5.1 Overview

Noise emission from the Dooleys Club site must comply with site-wide noise emission criteria established in Section 2.0. Noise emissions include from activity within the Dooleys Club boundary, and impacts from vehicle traffic associated with development of the Dooleys Club site.

EIS Planning Approval is sought for the concept design (as described in this report), defined hereafter as Phase 1 of the Dooleys Club development. Phase 1 includes development of a new club and hotel building set above a basement carpark and loading area, plus an above ground carpark between Board Street and Ann Street.

Phase 2 of the development, which is beyond the scope of the EIS Planning Approval, is indicative in scope at the current stage, potentially incorporating 14,000 m² of retail floor area with residential and independent living areas above.

This report considers site-wide noise emission from activities within the Dooleys Club site for Phase 1 of the development as per the planning approval application.

For impacts to the local road network, this report considers the impact of increased vehicle traffic from Phase 1 for the new basement carpark and above ground carpark. A high-level review is conducted of additional impacts from Phase 2 in the absence of schematic design detail of car park locations, entry / exit points and Phase 2 building usages.

5.2 Site Noise Generating Activities

The following aspects of the development require consideration of the noise emission to external noise sensitive receivers for compliance with site noise emission criteria;

- Impact of vehicle traffic within Dooleys Club site boundary from;
 - o Ann Street ramp (within the Dooleys Club boundary)
 - o Above ground carpark
 - o Internal loading dock vehicle movements
- Impact of additional traffic to the existing road network resulting from;

- o Patron vehicle traffic entering and leaving the basement carpark via the Ann Street exit and Civic Avenue / shareway entry
- o Patron vehicle traffic entering and exiting the external above ground carpark between Board and Ann Street
- o Loading dock activity and associated delivery vehicle traffic via the Olympic Drive entry to the basement carpark
- Patron noise breakout from Dooleys Club external terraces
- External plant and equipment

Nearest affected receivers are detailed in Table 20 and Figure 1, selected to be representative for the purpose of the assessment and calculations.

Table 20: Noise sensitive receivers

Receiver	Location	Description
1	25-29 Ann Street	4 storey multi-unit residential, east facing balcony
2	19 & 21 Ann Street	Single storey residences
3	13 & 15 Ann Street	Single storey residences
4	2 Board Street	Single storey residential house
5	1 Board Street	Single storey residences
6	2-10 Ann Street	3 and 4 storey residential units respectively
7	36-44 John Street	Multi storey unit block (due completion 2017), 11 storey
8	22-26 Ann Street	Future 7 storey multi-storey residential development (under construction)
	12-20 Ann Street	Single storey residences
9	1 Ann Street	In construction, assumed maximum 2 storey residential housing

Figure 1 indicates the extent of the site and the location of the nearest affected occupancies, chosen as representative for the purpose of the calculations.

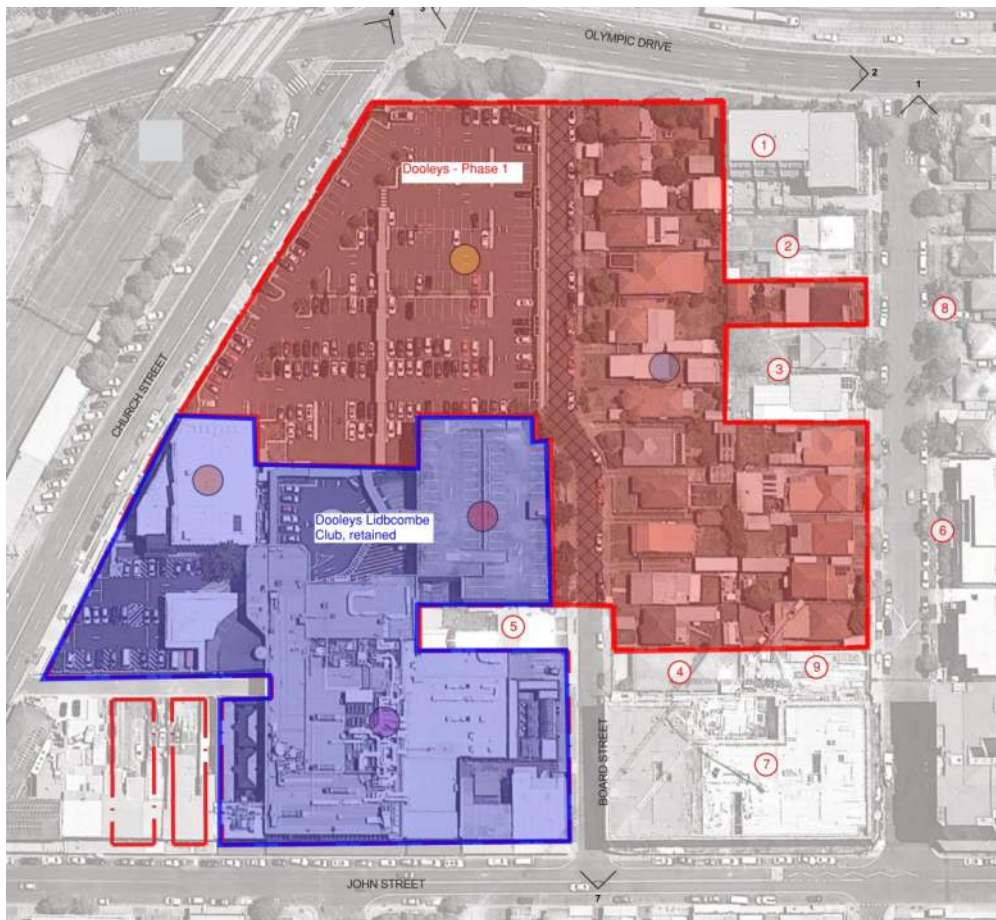


Figure 1: Representative receiver locations

5.3 Impact of Vehicle Traffic within the Dooleys Club Site Boundary

The following vehicle traffic is considered;

- Vehicle movements on the Ann Street ramp
- Vehicle movements within the Basement 02 loading dock
- Vehicle movements within the above ground carpark

For the assessment, it is considered the new road connecting existing Board Street and Church Street (Civic Avenue / shareway) is a publically accessible road. Where the road is considered a private road within Dooleys site boundary, noise emission will need to be considered as per vehicle traffic within the Dooleys Site Club boundary.

5.3.1 Vehicle Passage on the Ann Street Ramp

A new carpark ramp is proposed linking the underground carpark to Ann Street. The Ann Street ramp will be the exit point for all vehicles to the underground carpark, with entry via either, the Ann Street ramp, or via an entry only ramp on Civic Avenue / shareway accessible from Church Street, or John Street via Board Street.

As contained within the Dooleys site boundary, vehicle activity on the Ann Street ramp is required to comply with INP criteria as per Table 4 for Day, Evening and Night periods respectively. In addition as residences will be exposed to noise emission during the Night period, an assessment is conducted of the potential for sleep disturbance.

Most affected receivers from ramp vehicle movements are the residents directly to the west (receiver R1) and east (receiver R2) as shown in Figure 2.

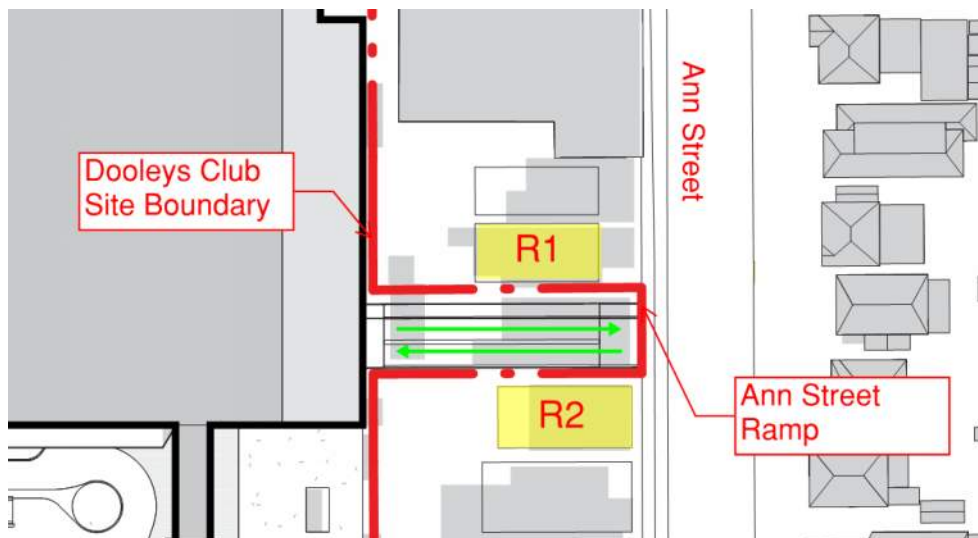


Figure 2: Ann Street ramp (entry and exit)

Predicted traffic data for the Ann Street ramp has been provided by GTA consultants, dated 20/9/2016 based on calculations conducted for the Dooleys Lidcombe Catholic Club Proposed Development Car Parking and Traffic Report ref. 16S1267000 (GTA Traffic Report) prepared by GTA Consultants, dated 8/7/2016. Hourly peak Car Park traffic estimates are reproduced in Table 21.

Table 21: Ann Street ramp peak traffic volumes, estimates provided by GTA Consultants

Period ¹	Ann Street Ramp Entry to the Carpark		Ann Street Ramp Exit from the Carpark	
	Peak (veh/hr)	Period (veh/period)	Peak (veh/hr)	Period (veh/period)
Day	16	144	26	234
Evening	72	267	43	160
Night	36	108	22	66

Note 1: Periods correspond to;

Day: 7:00am to 6:00pm Monday to Saturday; or 08:00am to 6:00pm on Sundays and public holidays

Evening: 6:00pm to 10:00pm

Night: remaining periods

The following acoustic controls are recommended for the carpark ramp;

- 2m high barrier to the ramp. Barrier height is to be 2m above adjacent residential lot ground levels (i.e. barrier will be greater than 2.0m above ramp / driveway level). Barrier is to extend from the ramp start to within 2m of the property boundary (to Anne St), or as close to the property boundary as feasible considering mandatory vision and safety requirements as required for vehicle exit point as per Figure 3. The final 2m section of the barrier to the boundary is to be 800mm high, equivalent construction.
- Barrier to have solid construction (no gaps) with minimum density 13kg/m² (e.g. 9mm Fibre Cement sheet). Note, may require a vision element near the road for vehicle visibility.

- For the upper 2m of the barrier an internal weatherproof acoustically absorptive lining with a NRC >0.7 is required, e.g. [Pyrotek Reapor](#) or equivalent (to the driveway side).

For strict compliance with the NSW INP criteria, the ramp barrier would be required to be built to 2 meters high for the entire extent of the Ann Street ramp to the property boundary. It is recognised however that a barrier to this extent would restrict vision to Ann Street and present a vehicle and pedestrian safety hazard. On this basis the recommendation is for the reduced height for the final section to the boundary. Strictly, exceedances of Evening and Night period criteria are expected to the front yard of immediately adjacent properties that are not shielded by the full height ramp barrier, however compliance would be achieved at the dwelling façade.

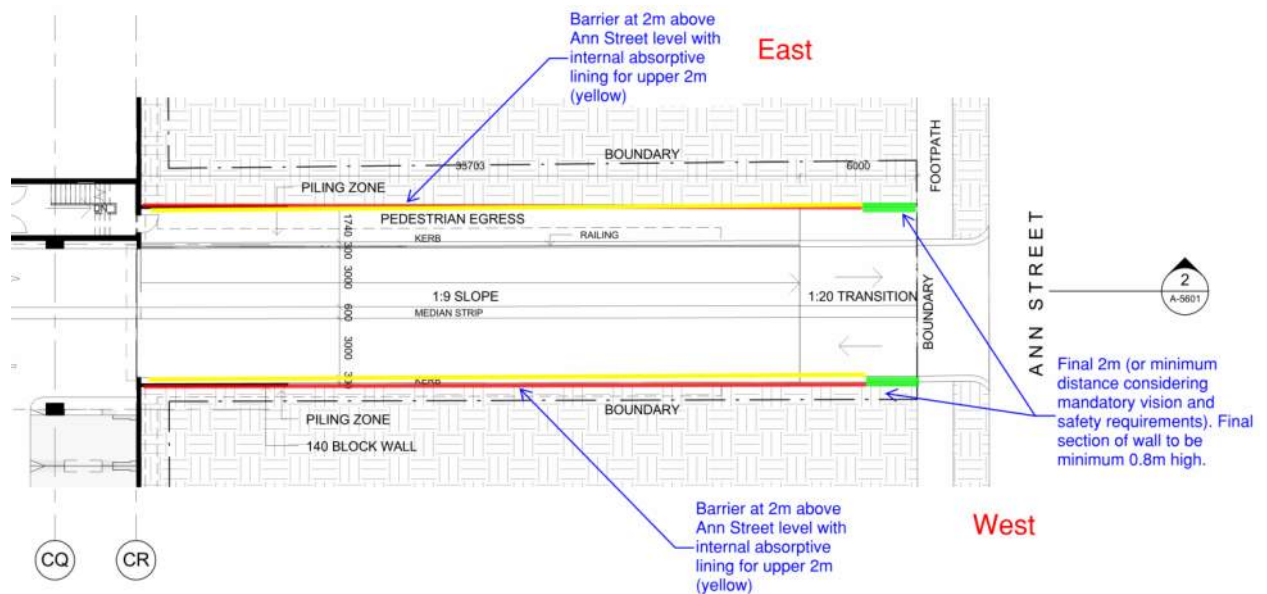


Figure 3: Ann Street ramp barrier details

Modelling has been conducted of noise levels to nominated receivers, shown in Figure 2. Modelling has been conducted on the basis of;

- Only passenger vehicles on the ramp, as access to the loading dock is via Olympic Drive
- Overall typical vehicle noise emission levels derived from previous MDA measurements of vehicle pass-by events and octave band noise emission data for passenger vehicles based on published vehicle noise emission data in the Federal Highway Administration FHWA Traffic Noise Model (TNM)
- Ramp entry and exit car speed is restricted to 20kph. Modelling assumes vehicles will typically cruise down the ramp on entry and accelerate up the ramp for exit
- No additional vehicle noise (e.g. loud music, tyre squeal, excessive acceleration, non-standard vehicles)
- No speed bumps or other traffic restrictions that create noise with vehicle passage
- For assessment against INP criteria, application of the 'Intermittent Noise' modifying factor as per Table 4.1 of the NSW INP for assessment during the Night-time period on the basis noise levels will vary substantially with intermittent ramp vehicle movements

Based on the nominated acoustic controls, predicted compliance at receiver locations shielded by the ramp barrier is shown in Table 22 assessed against NSW INP criteria, and Table 23 for sleep arousal criteria.

Table 22: Predicted compliance at receivers, INP criteria

Receiver	Period ¹	Criteria		Predicted Period, $L_{Aeq,period}$	Predicted peak, $L_{Aeq,15min}$	Complies?
		Amenity, $L_{Aeq, period}$	Intrusive, $L_{Aeq, 15min}$			
West, R1	Day	60	54	40	41	Yes
	Evening	50	54	44	44	Yes
	Night	45	47	42 ²	46 ²	Yes
East, R2	Day	60	54	39	40	Yes
	Evening	50	54	43	43	Yes
	Night	45	47	41 ²	46 ²	Yes

Note 1: Periods correspond to;

Day: 7:00am to 6:00pm Monday to Saturday; or 08:00am to 6:00pm on Sundays and public holidays

Evening: 6:00pm to 10:00pm

Night: remaining periods

Note 2: Predicted level includes a +5dB 'modifying factor' for intermittent noise as per Section 3.1 of the NSW Industrial Noise Policy

Table 23: Predicted Compliance at Receivers, Sleep Arousal

Receiver	Period	Acceptance Criteria (external)	$L_{Amax,avg}$	Predicted $L_{Amax,avg}$ (external)	Complies?
West, R1	Night	60-65		56	Yes
East, R2	Night	60-65		55	Yes

As shown in Table 22 and Table 23, compliance to INP and sleep arousal criteria is predicted with nominated acoustic controls.

5.3.2 Loading Dock Activities

Noise breakout from loading dock activities are required to comply with NSW INP criteria for activity within Dooleys Club boundaries as per Table 4. Noise breakout from the loading dock is potentially either via the Olympic Drive entry / exit or via the Ann Street ramp from noise breakout to the main carpark.

Breakout from the Olympic Drive entry /exit are predicted to comply with NSW INP without acoustic treatment on the basis of the distance to the nearest receiver, shielding from the western facing entrance and raised background noise level to nearest residences facing Olympic Drive.

Potential noise exposure from loading dock activities is to Ann Street residences adjacent to the Ann Street ramp exit. Noise breakout to the Ann Street ramp is via the roller door connecting the loading dock to the main Basement 02 carpark and Ann Street exit.

To control noise breakout, the following acoustic controls are required when the loading dock is in operation;

- Solid (i.e. airtight, non-perforated) roller door to the loading dock, closed when loading dock is in use.

On the basis of these controls noise levels at residences are predicted to comply with INP noise emission criteria of Table 4 with the roller door closed.

5.3.3 Above Ground Carpark

Patron vehicle traffic impacts from vehicle movements inside the external above ground carpark are addressed in Appendix G.

5.4 Impacts from Dooleys Club Traffic on the Road Network

Impacts from Dooleys Club traffic are considered from entry and exit to Dooleys carparks to residences on Ann Street and Board Street. Traffic volumes on Olympic Drive and John Street are considered to be sufficiently high, that any increases in noise levels from incremental increases traffic volumes from the Dooleys Club activities will be negligible.

Entry and exit points are as follows, shown in Figure 4;

- Basement carpark with Ann Street entry / exit, and Civic Avenue / shareway entry
- Above ground carpark with Ann Street entry / exit and Board Street with entry / exit

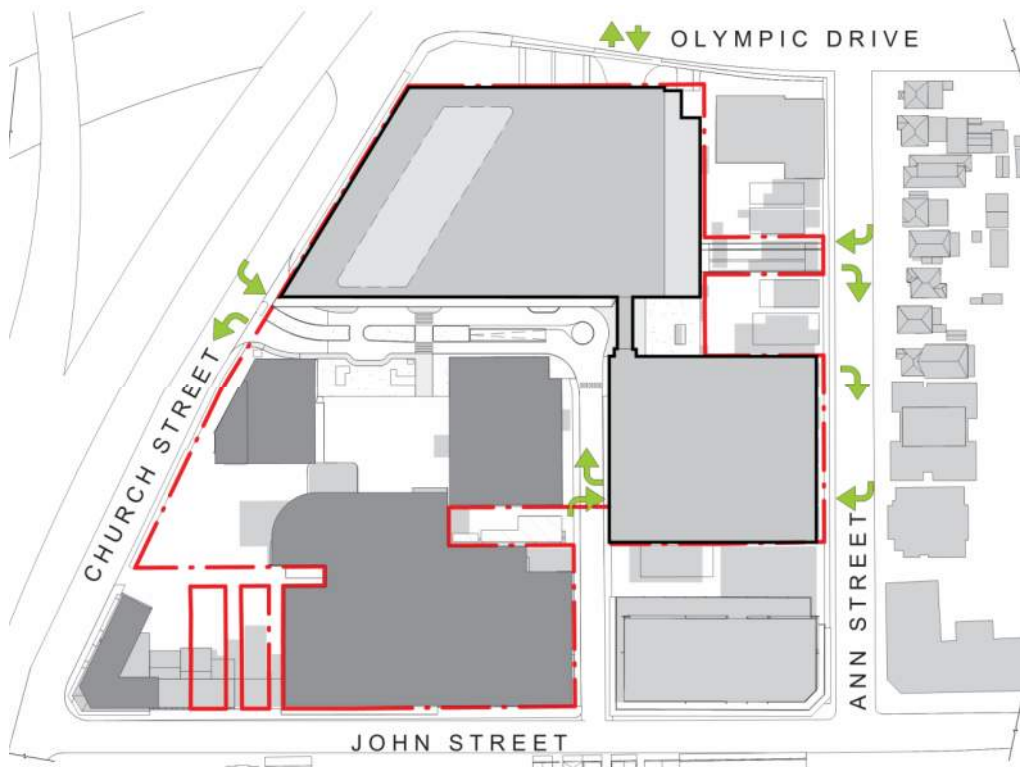


Figure 4: Site access points

Noise levels at affected receivers have been calculated using 3D noise modelling software, SoundPlan v7.4. Vehicle movements have been modelled using the methodology given in *Federal Highway Administration Model 2004 – the FHWA (TNM 2.5) model*.

The FHWA TNM 2.5 model allows direct calculation of L_{Aeq} noise levels, based on stated assumptions regarding the noise emission levels of various classes of vehicles. The calculation algorithms are generally considered to be mathematically more rigorous than those of the *Calculation of Road*

Traffic Noise (CoRTN) method, leading to greater validity at low traffic flows. Further the model provides for changes in vehicle noise emissions around features such as intersections.

The assessment considers the proposed post-development road strategy as presented in the GTA Traffic Report as follows;

- In principle Road and Maritime Service (RMS) support for left-turn entry and left-turn exit from Olympic Drive to the loading dock for trucks only
- Left turn entry to Ann Street from Olympic Drive (as per the existing traffic arrangement)
- Left turn exit to Olympic Drive from Ann Street in conjunction with the traffic mitigation strategy on Ann Street to prevent through traffic as per Figure 5



Figure 5: Traffic mitigation strategy, Traffic Modelling Report

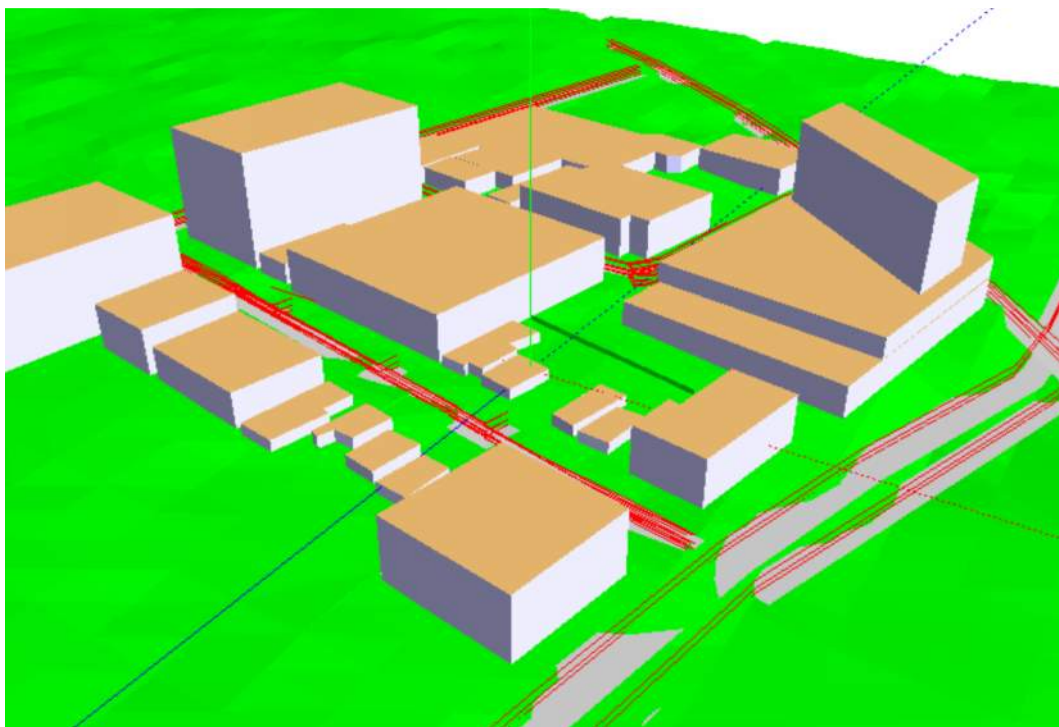


Figure 6: SoundPlan traffic model

Traffic speeds have been estimated based on existing local road speed limits and reasonable expectations of vehicle speeds between car park entry / exit points and road intersections.

5.4.1 Loading Dock Traffic

Proposed entry to and exit from the Basement 2 loading dock is via left turn to and from Olympic Drive. As per advised in the GTA Traffic Report, the intent is for retention of the Olympic Drive layout, with no additional deceleration lane on the basis of the limited truck movements to the Dooleys Club site.

Assessment is conducted of the impact to existing Ann Street receivers (Location #1, Figure 1) exposed to Olympic Drive. Olympic Drive is identified in the GTA Traffic Report as a RMS State Road and is classified in the RNP assessment criteria as an arterial / sub-arterial road. Existing noise levels at Receiver #1 are predicted to be in excess of the RNP assessment criteria.

Assessment of the noise impact to noise sensitive receivers is on the basis of;

- Loading Dock has 5 bays
- On the assumption of a minimum delivery time of 15 minutes per delivery, there is expected to be a maximum of up to 20 heavy vehicles per hour entry and exit to the loading dock

With the Dooleys Club development, noise levels at 25 Ann Street receivers are predicted to increase less than 1dB during early morning delivery periods (prior to 7a.m.). RNP Section 3.4 offers the following guidance when considering increases to traffic noise levels when existing levels are predicted to be in excess of the noise level criteria;

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

Overall noise impacts from additional traffic on Olympic Drive associated with loading bay activities to the Dooleys site are predicted to be negligible compared to overall noise levels from Olympic Drive traffic. On this basis additional mitigation measures for Olympic Drive receivers are not required.

5.4.2 Below Ground and Above Ground Carpark Traffic

Currently Ann Street (prior to the Dooleys Club development) serves only local Ann Street traffic or thoroughfare through Ann Street to John Street. Vehicles can enter Ann Street from a left turn at Olympic Drive or John Street, however there is no access to Olympic Drive from Ann Street. Similarly, prior to the Dooleys Club development, Board Street serves only local Board Street traffic with entry and exit only from John Street.

With Phase 1 Dooleys Club development, increased traffic is expected from;

- Ann Street – vehicle entry and exit from the basement via the Ann Street ramp and entry / exit from the above ground carpark Ann Street entrance / exit
- Board Street – vehicle entry to the underground carpark via the Civic Avenue / shareway ramp from Church Street and John Street, and entry / exit from the above ground carpark via the Board Street entrance / exit

Additional traffic on Olympic Drive and John Street are not considered a significant enough increase to materially increase receivers on these streets therefore are not assessed further.

Additional traffic on local roads associated with Dooleys Club carpark activity is assessed against the NSW RNP criteria in Table 4. Receivers are considered along Ann Street and Board Street as shown in Figure 7. Predicted traffic volumes associated for the existing and Phase 1 Dooleys Club development provided by GTA Consultants as part of the GTA Traffic Report assessment are listed in Table 24.

The following assumptions are made of existing traffic volumes;

- Peak Night-time traffic volumes for local roads, Ann Street and Board Street are 20% of the current PM peak values
- No increase to local traffic volumes from survey traffic data provided in the GTA Traffic Report. With additional multi-unit residential development on Ann Street (not associated with the Dooleys Club development), existing traffic volumes are expected to increase, however conservatively an increase has not been considered in this assessment.

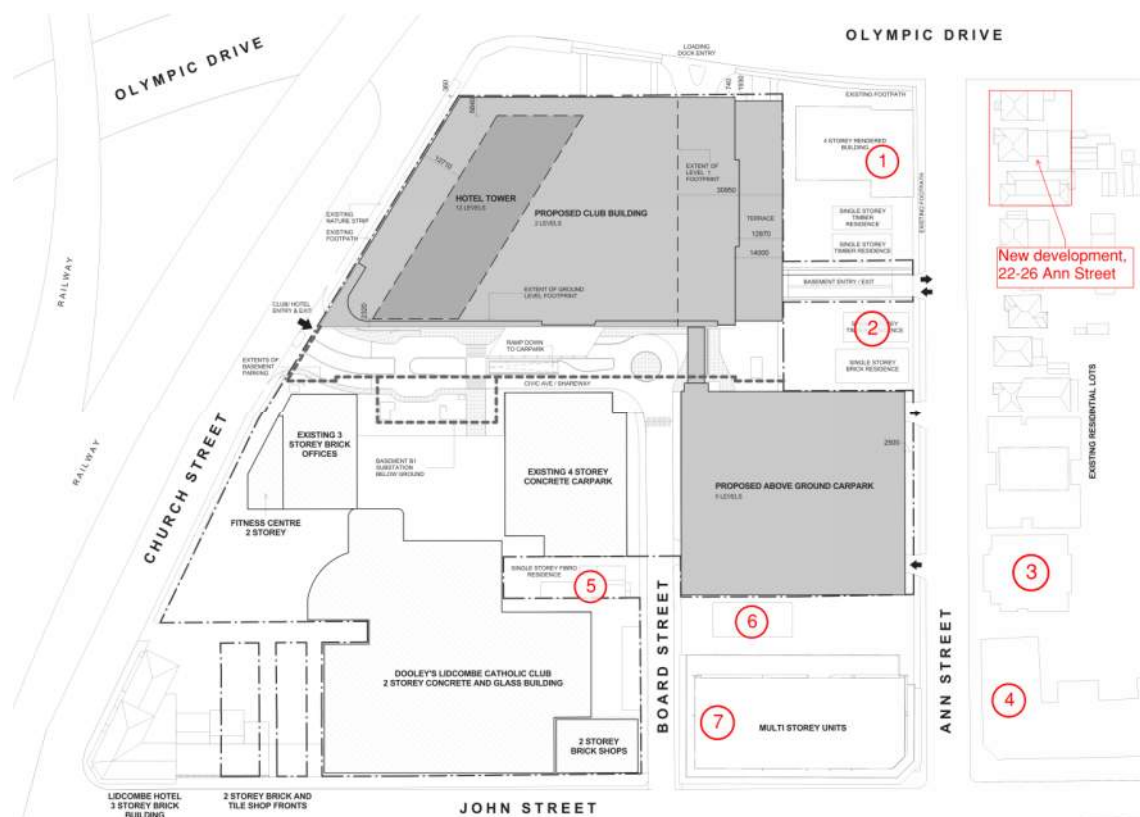


Figure 7: Assessed receivers for increased traffic volumes

Table 24: Predicted traffic volumes, provided by GTA Consultants

Road	#	Receiver Location	Existing Traffic, Pre-development (veh/hr)		Predicted Phase 1 Traffic (veh/hr)	
			Day ¹	Night ¹	Day ¹	Night ¹
Ann Street	1	25 Ann Street, Ground	103	21	243	92
	2	15 Ann Street			176	58
	3	2-10 Ann Street			227	83
	4	52-56 John Street, Level 1				
Board Street	5	1 Board Street	60	12		
	6	2 Board Street			127	64
	7	36-44 John Street, Level 1				

Note 1 Periods correspond to;

Day – 7 a.m. to 10 p.m.

Night – 10 p.m. to 7 a.m.

In considering the increased noise exposure to receivers, the following comments are made;

- Traffic mitigation measures are considered in the road network design by allowing a left turn to Olympic Drive from the Ann Street ramp exit (Figure 5). This reduces the traffic to receivers set-back from Olympic Drive, as vehicles intending to link to Olympic Drive will not be required transit all the way to John Street to exit
- Vehicle entry / exit from car parks are immediately adjacent to residence frontages. Physical barriers / noise control barriers are not considered feasible for resident frontages without a major impact to the residents amenity
- With already high noise exposure from Olympic Drive, residences are expected to be accustomed to higher noise levels and / or have noise control treatments included in the façade design (particularly for new multi-unit residential receivers)

In addition, residences at 13 and 15 Ann Street (location #2, Figure 7) have the potential to be exposed to higher traffic noise levels to the rear of the premises with increased exposure to road traffic with demolition of 14-18 Board Street. Dooleys Club development is for a landscape area with covered walkway between the above storey carpark and the Dooleys Club / Hotel. The recommendation is for the following;

- Minimum 1.8m high fence to the rear of the 13 Ann Street and 15 Ann Street properties. Fence to be solid with no air-gaps.

Predicted levels at typical receiver locations for peak Daytime and Night-time periods are shown in Table 25 and Table 26 respectively. Relative increases in noise level are shown compared to pre-development noise levels. It is noted that predicted levels of existing compliance are based on modelling, including assumptions as outlined in this assessment. It is noted that for all instances where existing compliance is expected is within the margin of tolerance of the modelling conducted.

Table 25: Daytime predicted levels

Road	#	Receiver Location	Predicted Noise Level, $L_{Aeq, 1hr}$, dB	Complies? (existing)	Complies? (Dooleys Club Phase 1 Development)	Increase Noise Level, dB
Ann Street	1	25 Ann Street, Ground	69	No	No	<1
	2	15 Ann Street	63	No	No	2
	3	2-10 Ann Street	65	No	No	3
	4	52-56 John Street, Level 1	63	No	No	3
Board Street	5	1 Board Street	63	No	No	2
	6	2 Board Street	60	Yes	No	1
	7	36-44 John Street, Level 1	62	Yes	No	4

Table 26: Night-time predicted levels

Road	#	Receiver Location	Predicted Noise Level, $L_{Aeq, 1hr}$, dB	Complies? (existing)	Complies? (Dooleys Club Phase 1 Development)	Increase Noise Level, dB
Ann Street	1	25 Ann Street, Ground	63	No	No	1
	2	15 Ann Street	59	No	No	4
	3	2-10 Ann Street	61	No	No	6
	4	52-56 John Street, Level 1	59	Yes	No	5
Board Street	5	1 Board Street	60	No	No	4
	6	2 Board Street	57	No	No	2
	7	36-44 John Street, Level 1	59	Yes	No	5

In summary;

- Receivers directly exposed to Olympic Drive (location #1) are expected to experience an increase in the order of 1dBA (Day and Night). Currently (prior to development) RNP noise criteria are not met for local roads due to exposure to Olympic Drive.
- Receivers set-back from Olympic Drive and John Street (locations #2, #3, #5 and #6) and exposed to carpark entry / exit points are expected to experience an increase in the order of 1-3dBA (Day) and 2-6dB (Night). Currently, noise levels at receivers are either not meeting or only marginally achieving RNP noise criteria for local roads.

- Receivers with exposure to John Street (locations #4 and #7) are expected to experience and increase in the order of 3-4dBA (Day) and 5dBA (night). Currently, noise levels at receivers are either not meeting or only marginally achieving RNP noise criteria for local roads.

On this basis that predicted noise levels will increase the existing noise level, and that RNP criteria will be exceeded with the proposed development, according to the RNP, noise mitigation measures are required to be considered for affected receivers.

To quantify the impact to amenity, typical perception of predicted relative increases at receivers is summarised in Table 27, noting person to person variation can vary substantially.

Table 27: Relative perception of change in sound level

Change in Sound Level (dBA)	Subjective Reaction	Impact / Adverse Affect
> 12	More than doubling of loudness	Severe
9-11	Double of loudness	Substantial
5-7	Appreciable change	Noticeable
3-4	Just perceptible change	Slight / minor
0-2	Imperceptible change	Negligible / less than minor

In addition, RNP Section 3.4 offers the following guidance when considering increases to traffic noise levels when existing levels are predicted to be in excess of the noise level criteria;

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

On this basis, the predicted typical subjective change to amenity is summarised in Table 28 at the nominated representative locations.

Table 28: Subjective changes to amenity with the Dooleys Club Development

Location	Typical Receiver	Day (7 am to 10 pm)	Night (10pm to 7am)	Comment
Directly exposed to Olympic Drive	#1	Minor, barely perceptible change	Minor, barely perceptible change	No appreciable loss to amenity
Set-back from Olympic Drive and John Street and exposed to carpark entry / exit points	#2, #3, #5 & #6	Up to just perceptible change	Up to noticeable, appreciable change	Impact to amenity with increased Night-time exposure
Exposure to John Street	#4, #7	Just perceptible change	Noticeable, appreciable change	Impact to amenity with increased Night-time exposure

Potential additional mitigation measures are;

- Consider reducing the local traffic speed on Board Street and Ann Street. The potential noise reduction from local vehicle traffic is expected to be up to 3dBA. Depending on the exposure to Olympic Drive, overall noise levels at receivers may be reduced by 1-3dBA from overall levels predicted in Table 25 and Table 26.
- Consider vehicle slow points on Ann Street and Board Street to restrict vehicle speeds. It is noted that any consideration for a slow point needs to be carefully considered, as whilst overall period noise levels may be reduced, residents may be exposed to different, potentially more subjectively prominent noise characteristics. Where due to a vehicle slow point there is repeated vehicle slow-down, bump and acceleration, this may be considered more annoying by immediately adjacent residences.

5.4.3 Assessment of Additional Traffic with Phase 2 Traffic Increases

As identified in Section 5.1, only a high level preliminary assessment is conducted of the impacts of Phase 2 of the Dooleys Club development based on indicative land uses and floor areas estimated for the eastern portion of the site as documented in the GTA traffic report.

Overall the car parking capacity of the site with Phase 2 is predicted to increase to approximately overall 1,500 car spaces for the site, increased from 859 car spaces for Phase 1 of the development.

In summary the GTA Traffic Assessment identifies the following;

- Phase 1 development land uses would typically generate peak activity on the weekend during the night, where Phase 2 (retail and residential) would likely peak on weekdays and / or weekends during the Day period
- Preliminary GTA estimates are for allowance for an additional 25% increase in peak Night road traffic volumes for completion of Phase 1 and 2 on the basis that a smaller proportion of additional traffic would be associated with function relation uses

Overall the expectation from the GTA Traffic Report is;

- Expectation of large increase to local traffic on Board Street with additional car parking capacity associated with new Phase 2 car park facilities
- Limited increase to local Ann Street traffic on the basis of an already high level of utilisation of basement carpark and above ground car park spaces for the Phase 1 development

On this basis, the high level assessment of the impact on acoustic amenity to surrounding receivers is as follows;

- Overall expect a marginal additional impact to Ann Street residences for the Evening and Night and time period with marginal increases in traffic volumes. For the Night period a 25% increase in traffic volumes an overall incremental increase from Phase 1 would be in the order of 1dBA.
- For Ann Street residences it is expected there would be a higher Daytime impact with a more prolonged period of high traffic from higher Daytime usage of the Phase 1 car parks. Increases during the Day period would be a lesser impact to amenity as they would be compared to relatively higher ambient traffic noise levels from Olympic Drive (particularly for residences closer to Olympic Drive). As RNP criteria are already exceeded, mitigation controls will need to be considered.
- Substantive incremental noise impacts are expected for Board Street residences on the basis of the increase of traffic volumes in the order of 150% for Day and Evening periods from additional car parking facilities accessible from Board Street. Overall increases in noise levels of 150% traffic

volumes can raise noise levels at receivers up to 4dBA. As RNP criteria are already exceeded, mitigation controls will need to be considered. On the basis of the extent of exceedances and the impact to amenity of the relative increases remedial controls may need to be considered for the residences to preserve their amenity.

5.5 External Plant and Equipment

MDA has conducted a review of the mechanical and electrical services spatial allocations for external plant and equipment shown in Appendix E. Table 29 lists concept acoustic allowances for outdoor plant in addition to the provisions already noted in the SB4 markup.

Table 29: Concept acoustic allowances for outdoor plant

Level	Aspect / Equipment	Recommended Allowance
Basement 2 & Basement1	Fan Room	SB4 nominal controls of intake and discharge attenuator are expected to be required
Basement 1	Louvres from Plantrooms to Church Street	Plant and equipment to be confirmed, recommend allowance for nominal 600mm depth acoustic louvres⁴ facing Church Street for noisy equipment
Basement	Carpark exhaust	Allow for intake and discharge attenuators to carpark exhaust
Level 2	Kitchen exhaust	Allow for intake and discharge attenuators to the kitchen exhaust. Attenuators will require internal finish suitable for kitchen exhaust applications.
Level 2	Club & Hotel Chilled Water	- Recommend locating in a fully enclosed plantroom with nominal 140mm hollow-core masonry perimeter walls (or performance equivalent) - Where required for ventilation, high performance acoustic louvres (600mm depth⁵) facing East or West (preferably). No louvres facing north to Ann Street residences. Extent of louvres to be minimised, with sections not required for ventilation either blanked or solid wall construction. - Acoustic rated plantroom doors (nominal R_w 35), requiring full perimeter seals. - On the basis of a metal deck roof, insulation and sealed flush plasterboard / fibre-cement sheeting (or mass equivalent) ceiling layer required to the full extent of the plantroom with nominal minimum 200mm depth cavity between layers. Alternatively, concrete slab roof is expected to be sufficient. - Allow for internal insulation facing to walls to limit noise build-up with the plantroom - For chiller units, see note below for vibration isolation of plant and equipment

⁴ Alternatively, an equivalent performance attenuator and non-acoustic weatherproof louvre combination is acceptable

⁵ Alternatively, an equivalent performance attenuator and non-acoustic weatherproof louvre combination is acceptable

Level	Aspect / Equipment	Recommended Allowance
Level 2	Hotel and Club Boilers	- Plantroom to be fully enclosed with either masonry or lightweight panel construction is suitable (lightweight will need to be a sandwich panel). - Where required for ventilation, moderate performance acoustic rated louvres, nominal 300mm depth²
Level 2	Refrigeration Plantroom	- Recommend locating in a fully enclosed plantroom with all acoustic controls as per Chilled Water Plantroom. - For chiller units, see note below for vibration isolation of plant and equipment
Level 2	K/E Odour Plant	- Intake and discharge attenuator to KEF, with lining to attenuators appropriate for kitchen exhaust applications - Where plant located outdoors (i.e. no plantroom), fan and connections to attenuators to be externally clad airtight in FC sheet with internal insulation. - Where located in a plantroom enclosure (sealing airtight to the discharge) with the North wall to be either masonry or performance equivalent lightweight construction. For ventilation, allow for acoustic louvres (nominal 300mm depth²) facing either south or west. Acoustic rated plantroom doors (nominal R_w 30), requiring full perimeter seals. On the basis of a metal deck roof, insulation and sealed flush plasterboard / fibre-cement sheeting (or mass equivalent) ceiling layer required to the full extent of the plantroom with nominal minimum 200mm depth cavity between layers. Alternatively, concrete slab roof is expected to be sufficient.
Level 2	Emergency Generators	- Allow for either; - Gensets located inside an airtight plantroom with 2-stage intake / discharge plenum accommodating attenuator / acoustic louvres Generator plantroom to be masonry construction with large air-cavity multiple mass layer ceiling construction. Allowance should be made for a construction similar to 2x16mm fire-rated plasterboard, 400mm air-cavity with infill insulation, 2x16mm fire-rated plasterboard (with metal deck roof above where required). - Generators exposed on the podium deck in high performance acoustic rated enclosures - Allow for residential / critical grade exhaust muffler, shielded from hotel rooms - Allow for spring vibration isolation and inertia base as per manufacturer recommendation for a rooftop installation
Level 2	Smoke Exhaust	Allow for discharge attenuator (reference below for basis for emergency plant criteria) and intake attenuator to achieve minimum AS1668 noise level requirements
Level 2	Small general and kitchen exhaust (no plantroom)	Allow for discharge and intake attenuators

Level	Aspect / Equipment	Recommended Allowance
Level 3	Plant	- Understand current design is for smoke / kitchen exhaust with south and west discharge. - Expect either moderate performance 300mm acoustic louvre or weatherproof louvres will be sufficient.
Rooftop	Cooling Tower	- On basis of exposure and distance to residences, recommend allowance for; - Low-noise cooling tower selections; and / or - Screening to the north (screen can be an acoustic louvre)

5.5.1 Future Changes to Level 2 Outdoor Areas

The level 2 outdoor deck has been assessed as per the design layout of outdoor dining limited to immediately adjacent to the level 2 hotel facade. It is expected additional acoustic controls will be required for plant and equipment if the podium is developed into an occupied deck area in the vicinity of the lift core.

5.6 Ground Floor North Facing External Terrace

The ground floor north facing external terrace includes the following;

- Outdoor seated terrace (licensed)
- Outdoor play area

Activities within the outdoor play area will need to be defined further as the design progresses, however modelling has been conducted on the basis that the outdoor play area is a supervised children's play area.

The outdoor terraces are immediately adjacent to overlooking apartments at 25-29 Ann Street, limiting the potential effectiveness of screening to raised receivers. Predicted levels of compliance and suggested acoustic controls are listed in Table 30.

Table 30: Ground floor, north terrace

Period	Time	Compliance Target, L_{A10} dB	Outdoor seated, Predicted L_{A10} @ 15m	Playroom / Splash / fit, Predicted L_{A10} @ 15m	Comment
Day	10:00am – 6:00pm	54	65-70	65-70	Expected to be achievable with; - Screen to seated patrons - Screen to outdoor play area
Evening	6:00pm – 10:00pm	50	65-70	65-70	Expected to be achievable with; - Semi-enclosed outdoor seating area sealing airtight to screen landscaped area - Semi-enclosed outdoor seating area sealing airtight to screen landscaped area - No or limited outdoor play
Night	10:00pm – midnight	45 ⁶	65-70	65-70	Not expected to be achievable even with both the outdoor seating and outdoor play area fully enclosed, and limited patron and outdoor play numbers
	Midnight – 4:00am	42 ^{6,7}	65-70	65-70	Not recommended

Note, for evening and night the OLGR criteria will be applicable criteria, compliance is required to be demonstrated in each octave band. For schematic design modelling, compliance predictions are shown for overall levels only.

6.0 APPLICATION – HOTEL

The following section discusses the current concept design for the hotel parts of the development.

6.1 Internal Separation

6.1.1 Internal Partitions

Internal partitions will need to be constructed to achieve minimum NCC sound isolation identified in Section 3.1. Table 31 lists partition constructions for hotel rooms to achieve minimum NCC requirements for plasterboard and masonry construction. Table 32 lists minimum construction for common risers to achieve minimum NCC isolation. Refer to Section 7.1 for hotel common areas.

⁶ A further 5dB penalty may apply where noise is considered intermittent.

⁷ In addition, required to be in-audible in any habitable room

Table 31: Partition constructions

Wall Rating	Construction	Example Acceptable Wall Construction	Acceptable Systems	Comment
$R_w + C_{tr} > 50$ (discontinuous)	Plasterboard	1x13mm fire-rated plasterboard* - Separate 92mm studs, separated by minimum 20mm air-gap (overall 200mm cavity lining between studs) 75mm thick, 14kg/m³ polyester insulation in each cavity 2x13mm fire-rated plasterboard*	- USG Boral, System ST90.1A (92mm studs) with 75mm thick 14kg/m³ insulation to each stud cavity - CSR Gyprock, System CSR 217 (92mm studs) with 75mm thick 14kg/m³ insulation to each stud cavity	Full height, slab-slab
$R_w + C_{tr} > 50$ (discontinuous)	Masonry	1x13mm fire-rated plasterboard on 28mm furring channels with 50mm thick 11kg/m³ insulation to the cavity - Minimum 150mm concrete panel or 140mm core-filled concrete block - Separate 64mm studs, separated by minimum 20mm air-gap (overall 84mm cavity lining between studs) with 75mm thick, 14kg/m³ polyester insulation in the cavity 1x13mm standard core plasterboard*	- USG Boral, System MWI.5B with 75mm thick, 14kg/m³ polyester insulation to the stud cavity - CSR Gyprock, System CSR 542 with 50mm thick 11kg/m³ insulation to the furring channel cavity and 14kg/m³ polyester insulation to the stud cavity	Full height, slab-slab
$R_w + C_{tr} > 50$	Plasterboard	2x13mm fire-rated plasterboard* - Rondo quiet (staggered) stud 90mm thick, 14kg/m³ polyester insulation in the cavity 2x13mm fire-rated plasterboard*	USG Boral, System SQ90.2A with 90mm thick, 14kg/m³ polyester insulation in the cavity	Full height, slab-slab

Wall Rating	Construction	Example Acceptable Wall Construction	Acceptable Systems	Comment
$R_w + C_{tr} > 50$	Masonry	1x13mm plasterboard on 28mm furring channels 150mm concrete panel or 140mm core-filled concrete block - Separate 64mm studs, separated by minimum 20mm air-gap (overall 84mm cavity lining between studs) with 75mm thick, 14kg/m³ polyester insulation in the cavity 2x13mm standard core plasterboard	- USG Boral, System MWI.5B with 75mm thick, 14kg/m³ polyester insulation to the stud cavity - CSR Gyprock, System CSR 542 with 50mm thick 11kg/m³ insulation to the furring channel cavity and 14kg/m³ polyester insulation to the stud cavity	Full height, slab-slab
$R_w > 50$	Plasterboard	2x13mm fire-rated plasterboard* 76mm stud with 75mm thick, 14kg/m³ polyester insulation in the cavity 2x13mm fire-rated plasterboard*	USG Boral, System SB120.1A (76mm stud) with 75mm thick, 14kg/m³ polyester insulation in the cavity	Full height, slab-slab
$R_w > 50$	Masonry	1x13mm plasterboard on 28mm furring channels with 30mm thick 14kg/m³ insulation 150mm concrete panel or 140mm core-filled concrete block 1x13mm plasterboard on 28mm furring channels with 30mm thick 14kg/m³ insulation	- USG Boral, System MWI.3B with 30mm thick 14kg/m³ insulation to each furring channel cavity - CSR Gyprock, System CSR 530 with 30mm thick 14kg/m³ insulation to each furring channel cavity	Full height, slab-slab
$R_w > 55$ (discontinuous)	Masonry	On the assumption lift shaft wall will be 300mm concrete; 20mm air-gap, minimum 64mm stud with internal 50mm thick 11kg/m³ insulation to the cavity 1x13mm plasterboard	- USG Boral, System SO.3A (stud wall only) with 50mm thick 11kg/m³ insulation to the cavity - CSR Gyprock, System CSR 085 (stud wall only) with 50mm thick 11kg/m³ insulation to the cavity	Full height, slab-slab

* Fire rated plasterboard is nominated for acoustic purposes only, 13mm fire-rated plasterboard can be substituted with minimum density 10.5kg/m² plasterboard

Table 32: Conceptual partition constructions, risers

Wall Rating	Construction	Lagging to pipework in riser	Example Acceptable Construction	Acceptable Systems
$R_w + C_{tr} > 40$	Plasterboard	All pipework lagged with Pyrotek 4525C, Bradford Acousti-Lag 45 or performance equivalent	1x16mm fire-rated plasterboard riser (no contact to pipework)	- USG Boral, Table H17 - CSR Gyprock, CSR SS12
$R_w + C_{tr} > 40$	Shaftwall	None	25mm Shaftliner (or performance based equivalent) 64CH55 stud - Internal 50mm thick 11kg/m³ infill insulation 2x 16mm fire-rated plasterboard*	- USG Boral, System SH120.1A with internal 50mm thick 11kg/m³ insulation - CSR 971 (102mm stud depth) with internal 50mm thick 11kg/m³ insulation
$R_w + C_{tr} > 30$	Plasterboard	All pipework lagged with Pyrotek 4525C, Bradford Acousti-Lag 45 or performance equivalent	10mm standard plasterboard riser (no contact to pipework)	- USG Boral, Table H18 - CSR Gyprock, CSR SS08
$R_w + C_{tr} > 30$	Shaftwall	None	25mm Shaftliner (or performance based equivalent) 64CH55 stud 1x 16mm fire-rated plasterboard*	- USG Boral, System SH60.1A - CSR Gyprock, CSR 970

6.1.2 Curtain Wall Facade

Sound isolation both vertically and horizontally are required to achieve the minimum NCC requirements between hotel suites.

Unless appropriately treated, sound flanking via facade systems can be a major problem that significantly downgrades the acoustic separation that can be achieved between hotel rooms. This is an issue for:

- Hotel rooms located adjacent on the same floor because of sound flanking via the junction between the end of the inter-tenancy wall and the facade
- Hotel rooms located one above another because of sound flanking via the junction between the slab edge and the facade.

The façade designer will need to demonstrate the façade system can achieve the required acoustic rating. Where the curtain wall façade is tendered as a separate performance package, minimum acoustic performance requirements identified in this report are to be achieved.

Figure 8 and Figure 9 provide some examples of the type of acoustic detailing that is likely to be required for a curtain wall system.

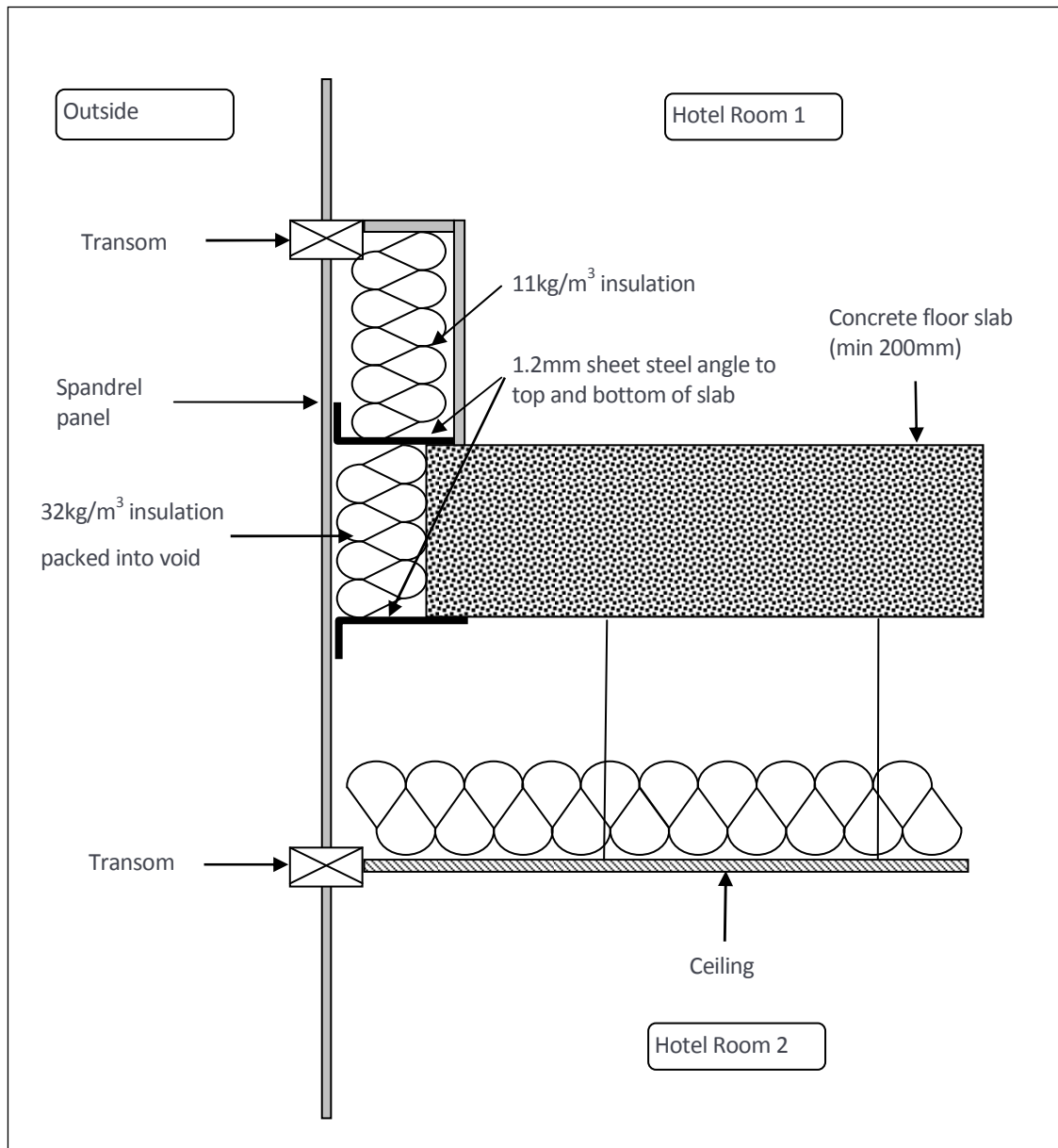


Figure 8: Conceptual detail for slab edge to facade acoustic treatment for hotel suite curtain wall (section)

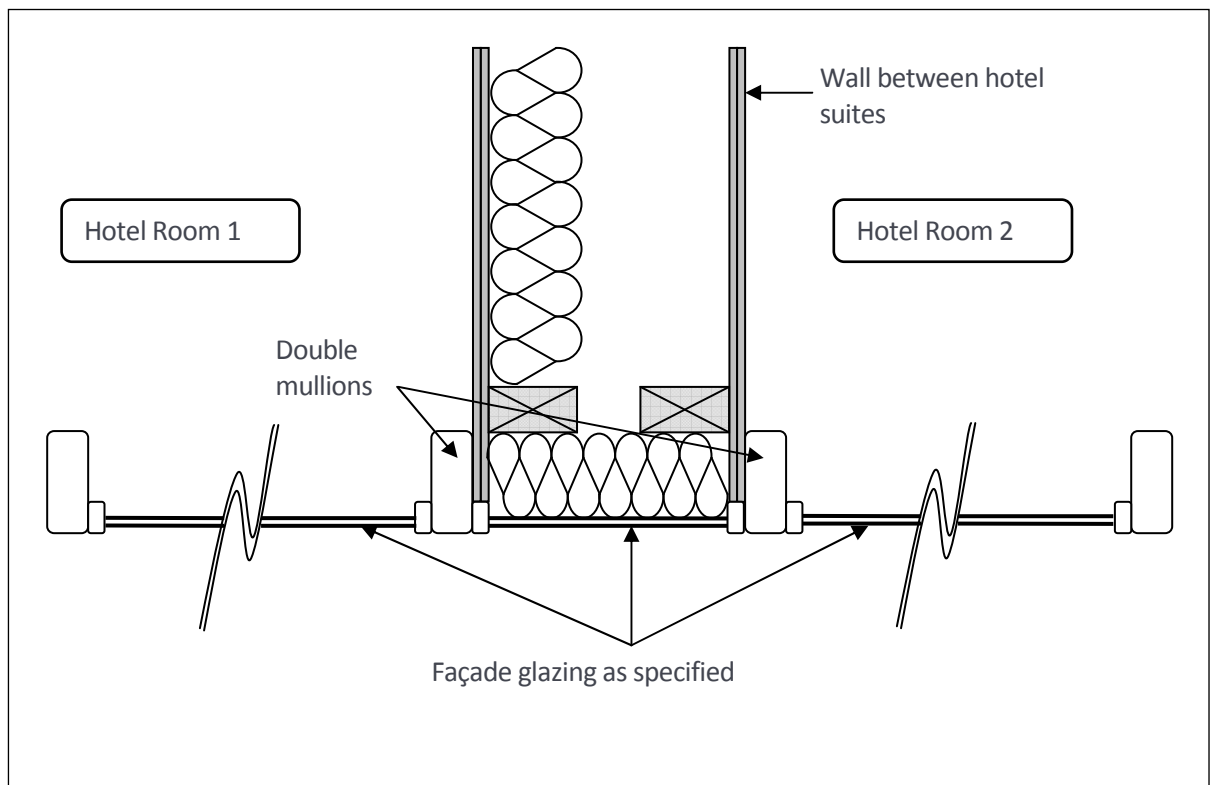


Figure 9: Conceptual detail for acoustic treatment for the junction between a façade utilising double mullions, and the end of the hotel suite wall (plan view)

6.1.3 Floor to Floor Impact Isolation

Typical hotel room floors are nominal 3100mm floor to floor spacing. It is understood that the floors are to be concrete construction with a minimum slab thickness of 200mm.

The recommended floor impact sound insulation treatments required to achieve the nominated criteria are shown in Table 33. Note requirements for insulation to the ceiling cavity may also be impacted by the requirements for the isolation of services.

Table 33: Floor impact sound insulation treatment

Source room	Receiving room	Floor impact criteria $L'_{nT,w}$	Floor finish	Acoustic underlay required ⁸ ?	Ceiling insulation required?
Hotel bedroom / lounge	Hotel bedroom / lounge	55	Carpet on foam underlay	✗	✗ (no in-ceiling services) ✓ (in-ceiling services) ⁹
			Tiles, timber or vinyl	✓	✓ ⁹
Hotel bedroom / lounge	Bathroom	60	Carpet on foam underlay	✗	✗ (no in-ceiling services) ✓ (in-ceiling services) ⁹
			Tiles, timber or vinyl	✗	✓ ⁹
Bathroom	Hotel bedroom / lounge	55	Tiles, timber or vinyl	✓	✓ ⁹
Bathroom	Bathroom	60	Tiles, timber or vinyl	✗	✓ ⁹

6.1.4 Hotel suite doors

Inter-connecting doors between hotel rooms

Inter-tenancy partitions must achieve an acoustic rating of $R_w + C_{tr}$ 50, as required by the NCC. Therefore inter-connecting doors located within walls separating hotel rooms must achieve a similar acoustic rating so as not to degrade the overall performance of the wall.

A proprietary acoustic rated door system will be required that can be demonstrated to achieve $D_w + C_{tr}$ > 45 in construction.

It is expected that such a door system will be expensive, and spatial allowance should be made for;

- 2x separate proprietary acoustic rated doors supplied with frame, typically minimum 45-50mm thickness door leaf with full perimeter and drop threshold acoustic seals
- Separate door frames, minimum separation 200mm separation between door leaves

Entry Doors to the Corridor

To achieve the minimum NCC acoustic rating of R_w 30 hotel entry doors must be minimum 38mm thick solid core timber doors, fitted with acoustic seals to the frame and an acoustic drop seal to the bottom of the door.

Frame seals may be extruded silicone seals rebated into the frame. No door undercut or door grilles will be allowable in hotel suite entry doors.

⁸ Example products include Damtec Standard 3mm, Regupol 4515 and Embelton Impactamat 5mm

⁹ Upgrade of the ceiling may be required, depending on the services installed in the ceiling void

6.2 Curtain Wall Facade

Hotel rooms are exposed to noise from;

- Rail traffic (passenger and freight)
- Road traffic from Olympic Drive and Church Street

Consolidated acoustic advice for the hotel curtain wall façade is provided in Appendix F.

6.3 Hotel Gym Health Facility

The hotel gym is located on level 2 adjacent to the kitchen and business centre. Hotel rooms are located directly above on level 4, with the sports bar located below on level 1. In the proposed location there is a risk of any impact activity being transferred directly to the structure then re-radiated as structure-borne noise elsewhere in either hotel rooms or adjacent sensitive spaces.

In addition resonant vibration of the floors slabs where connected to habitable spaces can be triggered by rhythmic activities, understanding that activities within the hotel gym health facility will be less than a commercial gym.

6.3.1 Isolated Floor

The recommendation is the entire gym floor be isolated using a floating floor system where there is the potential for impact equipment (such as treadmills, weight machines, free weights, exercise floors etc.) . It is recommended that a specialist floor isolation mount supplier is engaged to provide details suitable to progress the design.

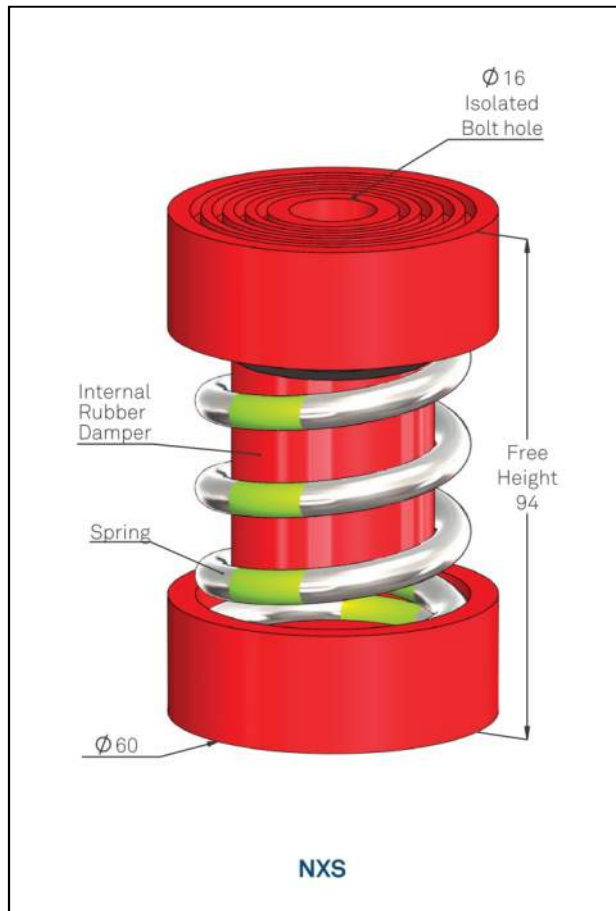
Approved suppliers include;

- Mason Industries
- Embelton

Allowance should be made for;

- 150mm concrete floating floor on specially designed gymnasium floating floor mounts, such as Embelton's Gym Floor Damped Spring NXS-14 as shown in Figure 10, or approved equivalent.

Figure 10: Gymnasium floating floor preliminary isolation mount selection



Consideration will also be required of the perimeter edge detail to ensure the floor is isolated from the structure. Façade junctions will need to be reviewed as the design progresses to ensure there is not excessive flanking to adjacent spaces.

6.3.2 Partition and Ceiling Detail

To isolate the wall and ceiling, a 'box-in-box' construction is recommended. Details for the 'box-in-box' isolated structure construction are shown in Figure 11.

In addition, allowance should be made for a proprietary acoustic rated entry door achieving R_w 40 with multiple perimeter bulb compression seals, adjustable drop threshold seal and multiple astragal seals for double leaf doors.

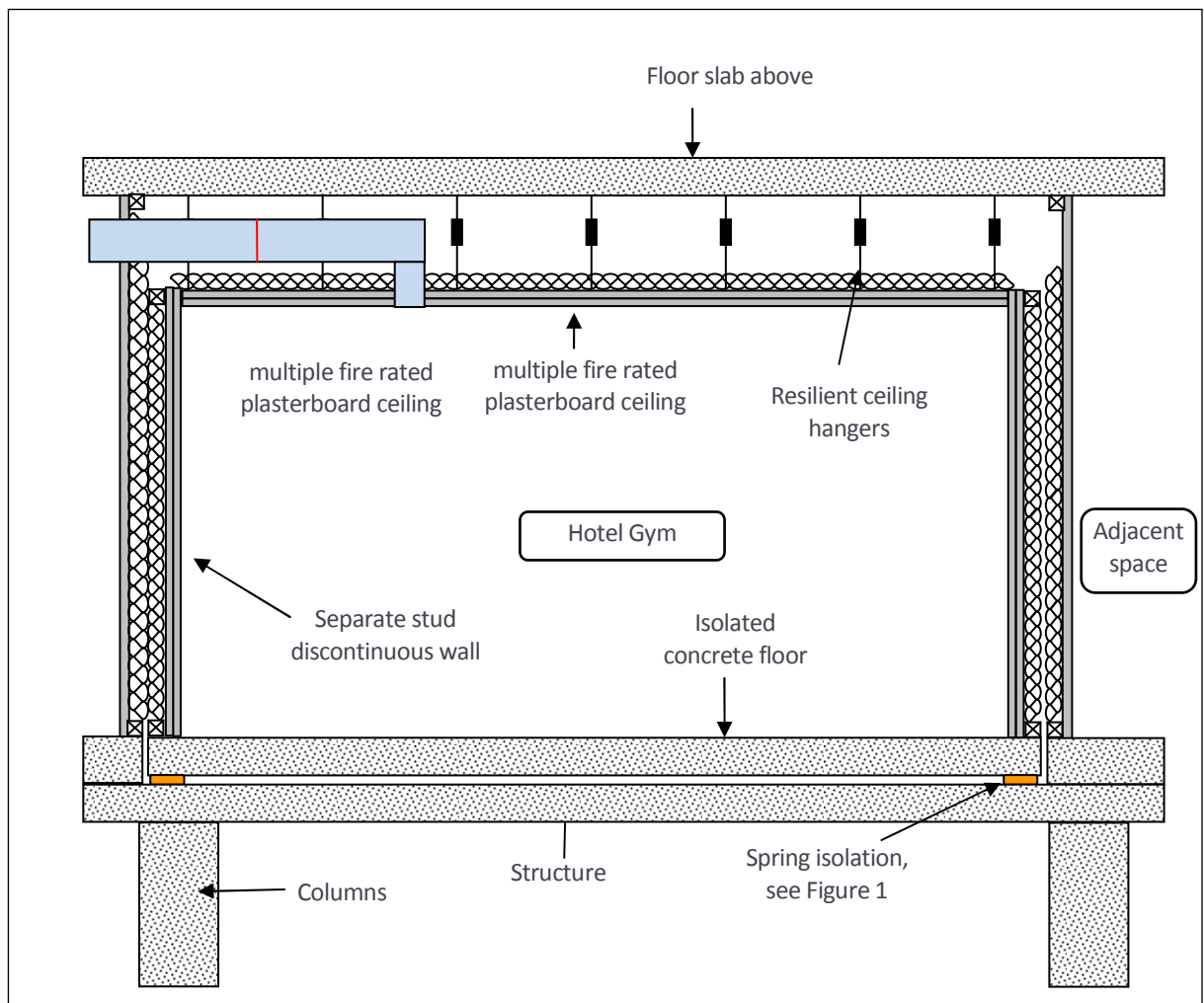


Figure 11: Schematic detail of the gym facility acoustic treatment

Services should make allowance for the following;

- Preferably rigid ductwork supply and ductwork connections to diffusers and grille returns with a flexible connection. Where flexible ductwork is required, extent should be minimised and make allowance to be wrapped with mass loaded vinyl.
- Preference for surface mounted light fittings, or recessed fittings with control of the breakout through the fitting.

Acoustic sealing of penetrations to the wall and ceiling will be required.

6.4 Internal Room Finishes

Sound absorption treatment to control reverberation and the build-up of activity noise will need to be developed as the design progresses. At this concept stage, a list of areas requiring room acoustic treatment is provided in Table 34 to assist with the design.

Table 34: Preliminary room acoustic treatments

Room	Carpet floor	Acoustic ceiling	Acoustic wall panels	Notes
Hotel Reception	-	✓	-	Acoustic ceiling minimum area of 50% NRC 0.7
Hotel Gym	✓	✓	-	Acoustic ceiling minimum NRC 0.7 performance
Corridors	(✓)	(✓)	-	Fitout of restaurants by others If corridors have carpeted floors, they can have a plasterboard ceiling. If a hard floor is used in the corridors, an acoustic ceiling is recommended
Restaurants/Bars	✓	✓	-	Acoustic ceiling minimum NRC 0.7 performance Fitout of restaurants by others
Business Centre, Meeting Rooms	✓	✓	✓	Acoustic ceiling minimum NRC 0.7 performance Wall panels to be approximately 20% of the floor area with minimum NRC 0.7

7.0 APPLICATION - DOOLEYS CLUB

The following section discusses the current schematic design for the Dooleys Club parts of the development covering;

- Internal partitions, glazing and doors, including specific requirements for operable walls and the cocktail lounge
- Room finishes
- External terraces
- Building envelope.

7.1 Internal Partitions, Glazing and Doors

The following outlines recommended partition ratings and constructions. For the Dooleys Club and hotel public facilities these are non-mandatory recommended wall constructions to achieve acoustic amenity as outlined in Section 3.0 and subsequent design discussions of intended acoustic amenity.

Table 35 lists recommended wall constructions for Dooleys Club and hotel public facilities, ground level to level 2. A mark-up of the ratings for solid partitions, glazing and doors is provided in Appendix H.

Table 35: Wall constructions, Dooleys Club and Hotel Public Facilities

Wall Rating	Construction	Acceptable wall system	Comment
R_w 55	Plasterboard (discontinuous)	2 x 13mm standard plasterboard on minimum 64mm steel stud, with 75mm thick, 11kg/m³ cavity insulation - Minimum 20mm clear space 2 x 13mm standard plasterboard on minimum 64mm steel stud, with 75mm thick, 11kg/m³ cavity insulation	- Full height, slab to slab - Where part of 'box-in-box' construction, inner leaf walls built to ceiling only, walls to support the ceiling. See comments below in Section 7.1.2. - Where part of 'box-in-box' construction, can be replaced with 140mm concrete block with 1x13mm plasterboard inner leaf
R_w 50	Plasterboard	2x13mm fire-rated plasterboard* 76mm stud with 75mm thick, 11kg/m³ polyester insulation in the cavity 2x13mm fire-rated plasterboard*	- Full height, slab to slab - Where part of 'box-in-box' construction, inner leaf walls built to ceiling only, walls to support the ceiling. See comments below in Section 7.1.2.
R_w 50 (dotted)	Plasterboard (discontinuous)	2 x 13mm standard plasterboard in 64mm steel with 75mm, 11kg/m³ cavity insulation 20mm clear space 1 x 13mm standard plasterboard in 64mm steel with 75mm, 11kg/m³ cavity insulation	Where part of 'box-in-box' construction, inner leaf walls built to ceiling only, walls to support the ceiling. See comments below in Section 7.1.2.
R_w 45	Plasterboard	2 x 13mm standard plasterboard in 64mm steel studs with 50mm, 11kg/m³ cavity insulation 1 x 13mm standard plasterboard	Full height slab-to-slab
R_w 45	Masonry	140mm core-filled blockwork; or 110mm hollow blockwork with 28mm furring channel and 13mm plasterboard with insulation infill	Full height slab to slab
R_w 40	Plasterboard	1 x 13mm standard plasterboard on 64mm steel studs with 50mm, 11kg/m³ cavity insulation 1 x 13mm standard plasterboard	- Full height where adjacent to non-flush plasterboard ceiling - To ceiling level only where flush plasterboard each side
R_w 40	Masonry	90mm hollow blockwork	- Full height where adjacent to non-plasterboard ceiling - Other masonry acceptable, where minimum weight equivalent.

Wall Rating	Construction	Acceptable wall system	Comment
Services wall (discontinuous), R_w 45	Plasterboard	1 x 13mm standard plasterboard in 64mm steel stud 50mm, 11kg/m³ cavity insulation 20mm space 1 x 13mm standard plasterboard in 64mm steel stud	Pipework to be mounted with resilient ties to the wet side
Services wall (discontinuous), R_w 45	Masonry (where structurally required)	140mm masonry blockwork wall with pipework chased into the wall 1x13mm plasterboard with timber / stone veneer finish on nominal 28mm acoustic resilient mounted clip with 25mm infill insulation.	Where abutting a commonly trafficked public occupied space replace resilient mounted clips with 64mm stud offset 20mm from the masonry wall (no structural connection).

* fire-rated plasterboard nominated for minimum density only, 13mm fire-rated plasterboard can be replaced where the density is greater than 10.5kg/m²

Table 36: Acoustic rated glazing

Rating	Example acceptable system	Above ceiling construction	Comment
R_w 55	Separate frame double glazing; 12.76mm laminated 300mm air-gap 10.38mm laminated	- Where part of 'box-in-box' construction, inner leaf walls built to ceiling only, walls to support the ceiling. See comments in Section 7.1.2. - Non-glazed areas to be constructed as per R_w 55 plasterboard construction	- Separate glazing frames with no structural connection required - Absorptive reveals
R_w 45	Common frame panels: 8mm glass 65mm air gap 12.38mm lam glass	As per R _w 45 plasterboard construction	Alternative is proprietary R_w 45 glazing system. Rating to include glazing and frame.
R_w 40	Double glazed system; 6mm glass 65mm air gap 6.38mm lam glass	2x13mm plasterboard baffle with insulation above the ceiling	- Double glazed unit with smaller air cavity, thicker glazing panels possible (only where noted) minor reduction in performance achieved with single 12.76mm laminated glazing. - Above ceiling baffle not required for plasterboard ceiling both sides of the partition

Rating	Example acceptable system	Above ceiling construction	Comment
R_w 35	10.38mm laminated	2x13mm plasterboard baffle	Above ceiling baffle not required where plasterboard ceiling each side

Table 37 lists recommended door constructions for Dooleys Club and hotel public facilities.

Table 37: Concept door constructions

Door Rating	Preliminary Construction
R_w 40	- Proprietary acoustic door with integrated frame, hardware and acoustic seals - acoustic rating R_w 40. Allow for 50-70mm solid core door with multiple sets of seals; or - Sound lock with one R_w 30 door and one R_w 20 door separated by 1m
R_w 35	Proprietary acoustic door with integrated frame, hardware and acoustic seals - acoustic rating R_w 35
R_w 30	40mm solid core door fitted with acoustic seals to the frame and bottom. - Door grilles not permitted.

7.1.1 Operable wall between Conference Rooms

It is not generally feasible to achieve high levels of acoustic separation between spaces that are divided by an operable wall as a result of the inherent limitations of having operable seals. From Marshall Day Acoustics experience, field acoustic ratings generally do not exceed D_w 40. On this basis, the recommendation is the operable walls are;

- Have a rated performance of R_w 48-52dB with rubber compression bulb seals to the head and threshold. Sliding sweep seals not allowable.
- Full height stud cavity plasterboard baffle above the ceiling to the underside of the slab above each operable wall system

7.1.2 Cocktail Lounge

The cocktail lounge has the potential to impact on the acoustic amenity of surrounding spaces when operated with loud amplified music, typical of a night-club. From previous MDA experience, typical noise levels in a night-club can regularly be at 100-105dBA, see Section 3.2.1.

The cocktail lounge is located on level 1, with adjacent sports bar and void with bridge. Other nearby spaces are;

- Level 1 conference rooms / pre-function areas,
- Circulation spaces to level 1 restaurants

The cocktail lounge is above the ground level gaming and immediately below the hotel reception / back of house.

At the current location, risks are identified when operated as a nightclub of;

- Structure borne noise to the structure re-radiated to noise sensitive hotel rooms, conference rooms and gaming areas

- Breakout via the room envelope to the lift void and surrounding circulation spaces

Recommendations are for;

- High sound isolation to the atrium void, either by solid discontinuous wall construction or heavy large air-cavity double glazing
- Floating floor, with 'box in box' partition and ceiling construction as per detailed below
- At each entry, an airlock arrangement with 2x sets of acoustic rated doors

Floating Floor and Isolated 'Box-in-Box' Construction

Allowance should be made for an acoustic floating floor of approximately 150mm thick concrete supported by vibration isolation mounts as marked-up in Appendix H.

We suggest the following performance specification for the vibration isolation mounts be provided where the design is developed. It is recommended that a specialist floating floor supplier be engaged to provide details suitable to progress the design, such as Mason Industries or Embelton, or approved equivalent.

At the schematic design stage the following guidance is provided to assist with preliminary design and selection of the mounts:

- The floating floor isolation mounts must achieve a minimum static deflection of 12mm under the applied load
- The mounts must achieve a natural frequency of less than 8Hz under the applied load
- The mounts are to be double deflection neoprene / rubber
- The mounts are to have a minimum unloaded height of 70mm
- A spacer shall be provided to form a minimum 150mm air space between the top of the internal beams and the underside of the Function room slab

Concept details of an Embelton floating floor construction are shown in Figure 12. Suitable products are also available from alternative suppliers which can be reviewed if required.

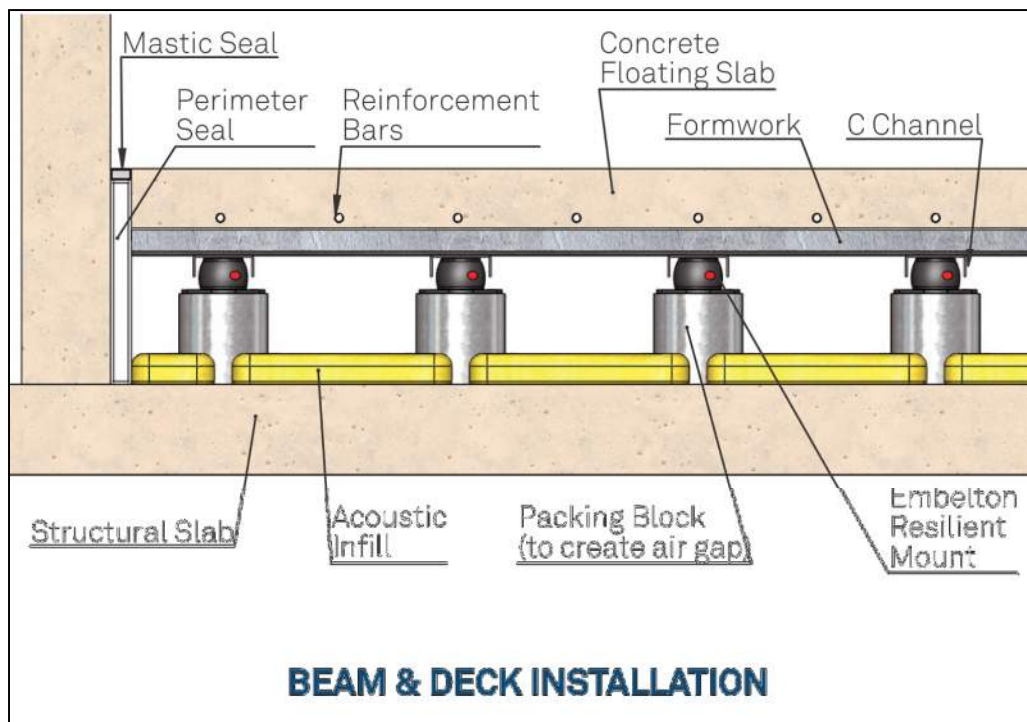


Figure 12: Example of Embelton floating floor construction

To isolate the wall and ceiling, a 'box-in-box' construction is recommended. Details for the 'box-in-box' isolated structure construction are shown in Section 6.3.2.

Consideration will also be required of the perimeter edge detail to ensure the floor is isolated from the structure. Column, façade and other junctions will need to be reviewed as the design progresses to treat sound flanking to other spaces.

7.1.3 Conference theatre, Conference Room and John Meaney Room

The design brief identified that the conference spaces design is to achieve the highest possible sound isolation. To achieve the briefed high level of isolation the following recommendations were made in concept design;

- Isolated floating floor
- Separately supported 'box-in-box' wall and ceiling construction
- 2x sets of acoustically rated operable walls between conference rooms

During schematic design development the decision was made to not have floating floors and associated structurally isolated 'box-in-box' construction from the two Level 01 conference rooms and the John Meaney Room. In addition the decision was made for a single operable wall between adjoining conference rooms.

The following is a brief comment on the potential implications of the deletion to communicate back to the client for consideration.

Implications of No Floating Floor to the Conference and John Meaney Room

The intent of a floating floor and 'box-in-box' isolated partition and ceiling construction is to control both airborne noise breakout to adjacent spaces and structure borne noise propagating via the structure and radiating elsewhere in the building.

We recognise that acoustic floating floors are not a common construction for hotel conference rooms. The recommendation was made on the basis that rooms could potentially hold weddings and

events with loud amplified music and that there are noise sensitive locations within the same structure (hotel rooms, gaming areas, etc.)

Given the deletion of the acoustic floating floors, it will be necessary to limit the allowable internal noise levels to control the risk of structure borne noise transfer into sensitive spaces. It is recommended that internal noise levels in the Conference rooms and the John Meaney Room should be limited to a maximum sound level of 85dBA. Internal noise levels higher than this limit represent a progressively higher risk of structure borne noise being audible in other areas and a source of complaint.

To provide context with regard to typical internal noise levels for events, previous acoustic testing has been carried out by Marshall Day Acoustics in various licensed and music venues, with average results shown in Table 38.

Table 38: Typical internal music noise levels

Description	L _{Aeq} dB
Typical upper levels in live “heavy” rock band/nightclub	107
Typical average levels in live “heavy” rock band/nightclub	98
Wedding band (loud)	94
Amplified music in bar (moderate)	87
3 piece jazz band (up tempo loud song)	89
3 piece jazz band (ballad – low)	80

It is recommended that Dooleys be advised of the design intent, and whether they consider an acoustic upgrade of the structure is required to suit the future use of the rooms.

7.2 Room finishes

Recommendations for internal finishes to achieve room reverberation design targets are listed in Table 39.

Table 39: Recommended room acoustic treatments

Area	Carpet floor	Acoustic ceiling	Acoustic wall panels	Notes
Gaming	✓	✓	-	Subject to specific acoustic requirements for the gaming area to achieve > NRC 0.75. Where plasterboard, recommend perforated plasterboard be provided to as much of the ceiling as practicable, with a minimum 12-15% open area, scrim backing and 40mm thick 32kg/m³ glasswool / polyester insulation behind (subject to selection). An example product is Knauf AcoustiShield C10 No. 8 plasterboard with 75mm 14kg/m³ glasswool backing.
Restaurants/Bars/Bistro	✓	✓	-	Acoustic ceiling minimum NRC 0.7 performance
Conference Rooms / John Meaney Room, Meeting Rooms	✓	✓	✓	Acoustic ceiling minimum NRC 0.7 performance Wall panels to be approximately 20% of the floor area Where operable walls are selected, an absorptive finish should be selected. The absorption performance should provide a minimum of NRC 0.6.
BOH Offices / administration	✓	✓	-	Acoustic ceiling minimum NRC 0.7 performance
Reception / Lobby	-	✓	-	Acoustic ceiling minimum area of 50% NRC 0.7
Corridors	(✓)	(✓)	-	If corridors have carpeted floors, they can have a plasterboard ceiling. If a hard floor is used in the corridors, an acoustic ceiling is recommended

7.3 Ground Level External Terraces Facing Olympic Drive

Noise exposure to external terraces has been identified as a potential risk to the acoustic amenity of the space, as noise levels will be substantially above that recommended for outdoor respite.

Noise levels in the range of 50-55dBA are recommended for outdoor terrace areas for general amenity and minimal constraint to normal conversation. On the basis of 1.2m high balustrades and openable glass louvres facing Olympic Drive, predicted levels are expected to be in the order of L_{Aeq} 63-68dB, exceeding the nominated targets for acoustic amenity.

An option for improving the acoustic amenity of the area is to provide an absorptive lining to the underside of the terrace roof to mitigate reverberant noise build-up, however it is noted the improvement expected to be in the order of 2-3dB only. Closing the louvres is expected to reduce internal levels by 5-10dB, depending on the seal that can be achieved between louvre blades.

The comparative impact on the ability to hold a conversation at 2m with raised traffic noise levels is shown in Figure 13, adapted from AS2822, showing that where normal conversational voice effort is

suitable where background noise levels are 50-55dBA, a raised voice is required when background noise levels are increased to 63-68dBA.

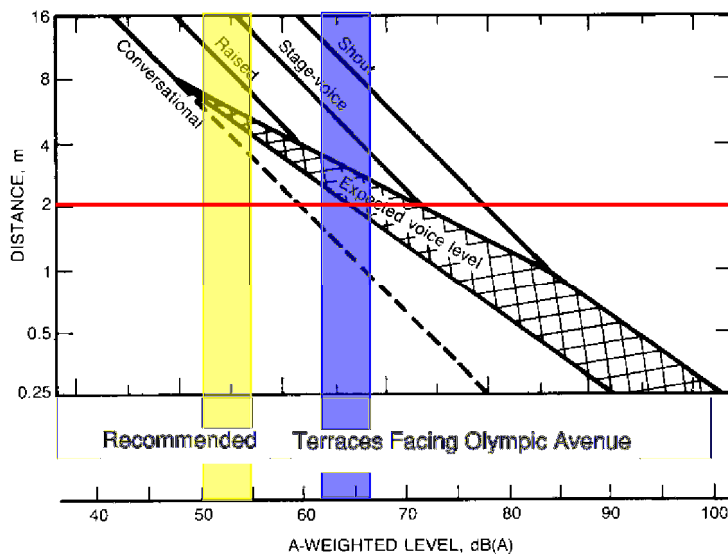


Figure 13: Impact to speech on outdoor terraces

Client consideration will be required as to whether this is suitable, or if outdoor terraces should be relocated away from Olympic Drive.

7.4 Building Envelope

A review of the building envelope has been conducted for Dooley Club and Hotel common areas and is provided in Appendix F.

8.0 FUTURE DESIGN CO-ORDINATION

At the schematic design a range of acoustic issues have been identified that will need to be considered throughout the design process to ensure the design intent for the project is achieved and that compliance with mandatory codes and legislation can be demonstrated.

As the design progresses, further development will be required of the intended activity and hours of operation that will need to be discussed with the client and the design team for the following;

- Outdoor ground level café / bistro and outdoor play area, considering the impact on nearby noise sensitive receivers
- Hotel gym health facility activities

For the following areas preliminary recommendations have been made that will require integration and co-ordination to the design as it progresses;

- Structural isolation and sound isolation of the cocktail lounge and hotel gym
- Screening of the rooftop deck from podium level plant and nearby noise sensitive residences
- D&C design of the building envelope

For the next stage of the design, the respective services design will need to consider;

- Design of internal air-conditioning systems to achieve nominated noise level criteria
- Noise emission of external plant and equipment to the Dooleys development and nearby noise sensitive receivers to nominated criteria

- Co-ordination of acoustic controls for services penetrating acoustic rated partitions

APPENDIX A GLOSSARY OF TERMINOLOGY

NR	Noise Rating A series of fixed frequency spectrum curves used to assess background noise and assign a single number value. NC curves are very similar and are used for the same purpose.
NRC	Noise Reduction Coefficient A single number rating between 0 and 1 of the ability of a material to absorb sound. It is the average of the absorption coefficients in the 250-2000Hz octave bands rounded to the nearest 0.05. The larger the number, the more absorptive the material.
RT or T₆₀	Reverberation Time The time (in seconds) taken for the sound pressure level generated by a particular noise incident to decay by 60 decibels following the conclusion of the noise event (hence T60 abbreviation). Reverberation Time is used for assessing the acoustic qualities of a space, describing how quickly sound decays within a space. The reverberation time is related to the room volume and total absorption.
Sound Isolation	Complete acoustical separation between two spaces such that there is no sound transmitted from one to another.
Impact sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
Flanking Transmission	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Structure-Borne Transmission	The transmission of sound from one space to another through the structure of a building.
R_w	Weighted Sound Reduction Index A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.
DnT_w	Weighted Standardised Level Difference A single number rating of the sound level difference between two rooms. DnT_w is typically used to measure the on-site sound insulation performance of a building element such as a wall, floor or ceiling
L_a	The vibration acceleration level referenced to a standard acceleration level, usually 10⁻⁶ m/s².
L_v	The vibration velocity level relative to a reference velocity, usually 1 x 10⁻⁹ m/s.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.

APPENDIX B ENVIRONMENTAL NOISE CRITERIA

The following sections identify environmental noise criteria and guidance for;

- NSW Industrial Noise Policy (INP)
- Office of Liquor, Gaming and Racing (OLGR)
- NSW Road Noise Policy (RNP)
- Sleep disturbance

B1 NSW Industrial Noise Policy

In NSW, the EPA INP is the guideline for assessing noise emissions from industrial and commercial facilities encompassing;

- Plant and equipment
- Activity within the site, including loading dock activities, vehicle movements and patrons

The INP sets out a procedure where a development can be assessed against a series of noise level criteria. In the INP, these criteria are called the *project specific noise levels* and are derived from an analysis of the ambient noise environment and zoning information with the background level described as the Rating Background Level (RBL).

Unattended logging was conducted to determine background noise levels in the vicinity of the Dooley Club in accordance with the NSW Industrial Noise Policy (INP) at locations identified in **Error! Reference source not found.** over the period of Friday 20th November 2015 to Wednesday 2nd December 2015. Logger positions were;

- Logger Position L1: Level 3 Dooley Club carpark
- Logger Position L2: Level 1 balcony, 34B John Street (facing Board Street)
- Logger Position L3: Dooley Club rooftop

Unattended logging was conducted with an ARL EL-316 Type 1, calibrated before and after deployment and found to be within acceptable drift. Data has been excluded for periods of rain and high wind conditions as per Section 3.4 of the NSW INP.

To establish the representative RBL, logger position L1 was deemed to be representative of surrounding residences, without direct exposure to Olympic Drive. Observed noise sources at the logger location were;

- (dominant) road traffic from nearby Olympic Drive
- Passenger and freight train pass-by to nearby Lidcombe station
- (daytime) Occasional construction noise from building site, corner John Street and Board Street
- General urban hum

A summary of the background noise level measurements is shown in Table 40.

Table 40: Industrial Noise Policy time periods and ambient noise levels

Receiver	Period	Time of day	RBL L_{90} dBA	L_{eq} dBA
Residences	Day	0700-1800hrs	49	59
	Evening	1800-2200hrs	49	54
	Night	2300-0700hrs	42	55

Note 1: Periods correspond to;

Day: 7:00am to 6:00pm Monday to Saturday; or 08:00am to 6:00pm on Sundays and public holidays

Evening: 6:00pm to 10:00pm

Night: remaining periods

Intrusiveness criteria

The intrusiveness noise assessment is based on knowledge of the background noise level at the receiver location. The intrusiveness criterion is the background noise level at the nearest noise sensitive location plus 5 dB. Therefore the noise emissions from the premises are considered to be intrusive if the A-weighted source noise level ($L_{Aeq, 15mins}$) is greater than the background noise level (L_{A90}) plus 5 dB.

Based upon noise logging conducted, noise limits for intrusiveness have been derived in accordance with the INP and are presented in Table 41 below.

Table 41: Derived Intrusiveness criteria

Time of Day	Rating Background Level, L_{90} dBA	Intrusiveness Criteria (RBL + 5 dB) $L_{eq, 15 min}$ dBA
Day	49	54
Evening	49	54
Night	42	47

Amenity criteria

The Amenity Criteria are designed to prevent industrial noise continually increasing above an acceptable level. The initial stage in determining the Amenity Criteria is to correct the acceptable noise levels set for the appropriate amenity area with the baseline noise monitoring. Based on defining characteristics outlined by the INP, nearby receivers have been defined as an Urban.

The Acceptable and Recommended Maximum noise levels applicable for the two residences are detailed in Table 42 below.

Table 42: Recommended Amenity L_{Aeq} noise levels

Period	Recommended Noise Level L_{eq} dBA	
	Acceptable	Recommended Maximum
Day	60	65
Evening	50	55
Night	45	50

Source: Table 2.1 NSW DECCW Industrial Noise Policy

Determination of Project Specific Noise Levels

The final process in determining the operational noise limits for the development, called the project specific noise levels, is to select the more stringent of either the Intrusiveness or Amenity Criteria that have been derived.

In their application note, the INP recommends that where the predicted Amenity noise level is below the Intrusive noise level for a proposed development, as is the case for this assessment, the operational noise levels need to be considered in relation to the differing assessment periods associated with each criteria.

Table 43: Noise emission criteria, NSW INP, L_{Aeq}

Period	Intrusiveness Criteria	Amenity Criteria	Project Specific Criteria
Day	54	60	54
Evening	54	50	50
Night	47	45	45

Note 1: Periods correspond to;

Day: 7:00am to 6:00pm Monday to Saturday; or 08:00am to 6:00pm on Sundays and public holidays

Evening: 6:00pm to 10:00pm

Night: remaining periods

Where applicable, noise sources must be modified where contain characteristics that are assessed as any of the following in accordance with Table 4.1 of the NSW INP;

- Tonal noise
- Low-frequency noise
- Impulsive noise
- Intermittent noise (applied only to night-time assessment)

In addition for single duration events in any 24-hour period, the acceptable noise level may be increased depending on the time of the adjustment.

Shoulder Period Assessment

In accordance with Section 3.3 of the NSW INP it is recognised that assessment can reasonably be considered against 'shoulder' period criteria instead of more stringent night-time criteria where it can be demonstrated that;

- An equivalent level of amenity is achieved in the shoulder period, indicated by the existing background noise levels, and
- The noise level and character are not intrusive

A shoulder period assessment has not been conducted for the Dooley Lidcombe site, however it is noted may be applicable based on review of noise logging data.

B2 Office of Liquor, Gaming and Racing Criteria (OLGR)

The Office of Liquor, Gaming and Racing (OLGR) sets the following standard conditions to be imposed on liquor licences for any entertainment noise from a licensed venue:

The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any octave band centre frequency (31.5 Hz – 8k Hz inclusive) by more than 5dB between 07.00am and 12.00 midnight at the boundary of any affected residence.

The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any octave band centre frequency (31.5 Hz – 8k Hz inclusive) between 12.00 midnight and 07.00am at the boundary of any affected residence.

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12.00 midnight and 07.00am.

Applicable background noise levels for noise exposure to nearby residences derived from noise logging measurements detailed in Section B1 and attended octave band measurements at the site are summarised in Table 44.

Table 44: Preliminary criteria, OLGR

Period	Time	Centre Frequency Octave Band, Hz									Overall, dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Day	10:00am – 6:00pm	64	62	55	52	50	50	47	41	31	54
Evening	6:00pm to 10:00pm	64	62	55	52	50	50	47	41	31	54
Night	10:00pm – midnight	59	57	50	47	45	45	42	36	26	49
	Midnight – 4:00am ¹⁰	52	50	43	40	38	38	35	29	19	42

B3 NSW Road Noise Policy

The noise level criteria for increased traffic flow as a result of land-use development with the potential to create additional traffic are set by the EPA's *Road Noise Policy*. Table 46 presents the traffic noise criteria for this development.

Table 45: Road Traffic Noise Criteria

Type of Development	Criteria	
	Day 0700-2200hrs	Night 2200-0700hrs
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{eq(15hr)}$ 60dBA (external)	$L_{eq(9hr)}$ 55dBA (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{eq(1hr)}$ 55dBA (external)	$L_{eq(1hr)}$ 50dBA (external)

Source: Table3 EPA – RNP

In addition to the above criteria, Section 3.4 of the RNP notes that “an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person” and that “for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2dB above that of the corresponding ‘no build option’”.

¹⁰ Inaudible within any habitable room in any residential premises

B4 Sleep Disturbance Criteria

Activities occurring on-site during the night period have the potential to cause sleep disturbance for the nearby residents.

The NSW EPA does not currently provide any criteria to assess sleep disturbance. Some discussion of the issue is given in the *Noise Guide for Local Government (NGLG)* and the EPA's most recent summary of research available is given in the *Road Noise Policy (RNP)*.

In the *Noise Guide for Local Government (NGLG)*, the EPA provides the following criteria as an example of a 'screening test' to determine the potential for sleep arousal:

- The L_{A1} level of any specific noise source should not exceed the background noise level (L_{A90}) by more than 15dB when measured outside a bedroom window.

L_{A1} is defined as the A-weighted noise level that is exceeded for 1% of the measurement time and is similar to, but numerically lower than L_{Amax} . The EPA has stated that it will accept analysis based on either L_{A1} or L_{Amax} descriptors.

In this instance, the 'screening test' for sleep disturbance becomes 57dB L_{Amax} at the facade of the residences.

In the INP application notes (last updated 12 June 2013), the EPA has recognised that the above criteria are "not ideal". However, the EPA "will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not, a more detailed analysis is required."

The EPA recommends that detailed analysis is carried out to address the extent to which sleep disturbance may occur. The use of the RNP by the EPA is recommended to review the extent of possible impacts.

The RNP suggests that potential sleep arousal from traffic should be assessed. The RNP has compared a number of sleep disturbance criteria and concluded the following:

- *Maximum internal noise levels below 50-55dB L_{Amax} are unlikely to cause awakening reactions*
- *One or two noise events per night, with maximum internal noise levels of 65-70dB L_{Amax} are not likely to affect health and wellbeing significantly.*

Based on these findings, a noise level of 60-65dB L_{Amax} outside an open bedroom window would be unlikely to cause awakening reactions (assuming that the facade of the residential building provides 10dB attenuation, which would be typical of a facade with partially open windows). Furthermore, one or two events with a noise level of 75-80dB L_{Amax} outside an open bedroom window would be unlikely to affect health and well-being significantly.

APPENDIX C BASIS FOR DESIGN CRITERIA

C1 Acoustic Separation

C1.1 National Construction Code

Table 46 summarises the sound insulation provisions of the NCC that define the minimum acoustic requirements for inter-tenancy walls and floors between hotel suites and to areas of different NCC classification .

Requirements are identified for;

- Airborne separation of walls and floors, demonstrated in a laboratory by a R_w and on-site by a D_w
- Impact isolation of floors, demonstrated by a $L_{n,w}$
- Discontinuous construction, construction requirement for impact isolation

Floor impact sound insulation ratings under site conditions are commonly expressed in terms of the field measured, weighted, standardised impact sound level, $L'_{nT,w}$. Laboratory performance is expressed as an $L_{n,w}$. A lower rating indicates a better acoustic performance.

Table 46: NCC inter-tenancy sound insulation requirements

Inter-tenancy partition	Sound insulation		Notes
	Laboratory	On-site	
Wall separating habitable rooms	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Wall impact isolation not required
Wall separating wet areas	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Wall impact isolation not required
Wall separating a wet area or kitchen and a habitable room	$R_w + C_{tr} \geq 50$	$D_{nT,w} + C_{tr} \geq 45$	Discontinuous construction required
Wall separating a sole-occupancy unit from a stairway, public corridor, public lobby, etc	$R_w \geq 50$	$D_{nT,w} \geq 45$	Wall impact isolation not required
Wall separating a sole-occupancy unit from a plant room or lift shaft	$R_w \geq 50$	$D_{nT,w} \geq 45$	Discontinuous construction required
Floor separating sole-occupancy units	$R_w + C_{tr} \geq 50$ $L_{n,w} + C_i \leq 62$	$D_{nT,w} + C_{tr} \geq 45$ $L_{nT,w} + C_i \leq 62$	Floor impact isolation required
Floor separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like	$R_w + C_{tr} \geq 50$ $L_{n,w} + C_i \leq 62$	$D_{nT,w} + C_{tr} \geq 45$ $L_{nT,w} + C_i \leq 62$	Floor impact isolation required
Door separating a sole-occupancy unit from a public corridor, public lobby, etc	$R_w \geq 30$	$D_{nT,w} \geq 25$	

C1.2 AAAC Star rating system

The AAAC star rating system varies from 1 star to 6-star, which spans the range from a very poor standard that does not achieve minimum performance levels, up to luxury standards considered suitable for example for expensive apartment penthouses.

Sound isolation criteria are shown in Table 47, listing criteria for airborne sound insulation and impact sound isolation performance.

Table 47: AAAC acoustic star rating summary: inter-tenancy sound insulation criteria

Intertenancy Activities	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Airborne Sound Insulation For Walls And Floors					
Between Separate Tenancies $D_{nT,w} + C_{tr} \geq$	35	40	45	50	55
Between A Lobby/Corridor & Bedroom $D_{nT,w} + C_{tr} \geq$	30	40	40	45	50
Between A Lobby/Corridor & Living Area $D_{nT,w} + C_{tr} \geq$	25	40	40	40	45
(b) Corridor, Foyer To Living Space Via Door(s) $D_{nT,w} \geq$	20	25	30	35	40
(c) Impact Isolation Of Floors					
Between Tenancies $L_{nT,w} \leq$	65	55	50	45	40
Between All Other Spaces & Tenancies $L_{nT,w} \leq$	65	55	50	45	40
(d) Impact Isolation Of Walls					
Between Tenancies	No	Yes	Yes	Yes	Yes
Between Common Areas & Tenancies	No	No	No	Yes	Yes

C2 External Noise Intrusion

C2.1 Australian Standard AS/NZS 2107:2000

Recommended overall internal noise levels for spaces of varying usage, applicable to semi-continuous sources (such as road traffic) are provided in AS2107:2000. To be achieved the summation of the background mechanical services and external noise intrusion must comply with recommended levels in Table 48.

AS2107:2000 shows both the preferred “satisfactory” and the highest allowable “maximum” internal noise level. Applicable recommendations for hotel suites are shown in Table 48. Higher quality developments should obviously aim to achieve lower levels of noise intrusion (i.e. the satisfactory level).

Table 48: AS/NZS 2107:2000 recommendations, overall noise levels

Area	Recommended Design Sound Level L_{Aeq} , dB	
	Satisfactory	Maximum
Hotels, sleeping area	35	40

C2.2 AAAC star rating system

The AAAC acoustic star ratings are shown in Table 49 for external noise intrusion for continuous noise sources and intermittent noise. As can be identified, AS/NZS 2107:2000 satisfactory levels equate to a 3 star rating.

Table 49: AAAC acoustic star rating summary: external noise intrusion

1. External Noise Intrusion		2 Star	3 Star	4 Star	5 Star	6 Star
(a) bedrooms						
continuous noises	$L_{Aeq} \leq$	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
intermittent noises	$ave L_{Amax} \leq$	50dB(A)	50dB(A)	45dB(A)	40dB(A)	35dB(A)

C2.3 State Environmental Planning Policy (Infrastructure) 2007

Residential developments near road and rail corridors are required to comply with State Environmental Planning Policy (SEPP) (Infrastructure) 2007 provisions as outlined below;

87 Impact of rail noise or vibration on non-rail development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

- (a) a building for residential use,
- (b) a place of public worship,
- (c) a hospital,
- (d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- (a) in any bedroom in the building--35 dB(A) at any time between 10.00 pm and 7.00 am,
- (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time.

102 Impact of road noise or vibration on non-road development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

- (a) a building for residential use,
- (b) a place of public worship,
- (c) a hospital,
- (d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(a) in any bedroom in the building--35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time.

C2.4 Office of Liquor Gaming and Racing (OLGR)

Noise level criteria for noise emissions from licensed premises are established in Section B2. OLGR criteria are applied when there is complaint from a licensed premises at another dwelling, which has been clarified to MDA as including hotel suites.

Background noise levels would be ambient background noise level inside the hotel suite as a worst-case assessment.

C3 Building Services Noise Levels

C3.1 Australian Standard AS/NZS 2107:2000

Recommendations in AS/NZS 2107:2000 are listed in Table 50 as overall levels to be achieved as the summation of the background and mechanical services and external noise levels.

Table 50: AS/NZS 2107:2000 recommendations

Area	Recommended Design Sound Level LAeq, dB	
	Satisfactory	Maximum
Hotels, sleeping area	35	40
Washrooms and toilets	45	55

C3.2 AAAC Star Rating System

AAAC recommendations for building services noise levels are listed in Table 51, listed as continuous and intermittent noise levels.

Table 51: AAAC acoustic star rating summary: building services noise

2. Internal Building Services and Appliances		2 Star	3 Star	4 Star	5 Star	6 Star
(a) bedrooms						
continuous noises	$L_{Aeq\ adj} \leq$	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
intermittent noises	$L_{Amax\ ave} \leq$	45dB(A)	40dB(A)	35dB(A)	30dB(A)	27dB(A)
(c) wet areas including bathrooms, ensuites and laundries						
continuous noises	$L_{Aeq\ adj} \leq$	55dB(A)	50dB(A)	45dB(A)	42dB(A)	40dB(A)
intermittent noises	$L_{Amax\ ave} \leq$	60dB(A)	55dB(A)	48dB(A)	42dB(A)	40dB(A)

C4 Isolation of Services

C4.1 National Construction Code

The NCC specifies minimum requirements for the acoustic separation between a sole-occupancy unit and a duct, soil, waste or water supply pipe, as detailed in Table 52. These acoustic separation requirements apply to riser shafts and ceilings.

The NCC is based on PVC or HDPE pipes, so noise assessments involving different pipe types such as cast-iron require interpolation.

Table 52: NCC requirements for acoustic separation of services from another tenancy

Location	NCC requirement
Habitable room	$R_w + C_{tr} \geq 40$
Non-habitable, wet area	$R_w + C_{tr} \geq 25$

In application to the Dooleys hotel suite design, the hotel suite entry open to the living / bedroom area is considered habitable and subject to the more stringent NCC requirement.

C4.2 AAAC star rating system

The AAAC star rating system does not explicitly set sound isolation requirements for services, instead recommending noise criteria for continuous (typically apply to mechanical services) and intermittent (typically applying the hydraulic services), see Table 53.

Table 53: AAAC acoustic star rating summary: external noise intrusion

Internal Building Service and Appliances	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Bedrooms					
Continuous Noises $L_{Aeq\ adj} \leq$	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
Intermittent Noises $_{ave} L_{Amax} \leq$	45dB(A)	40dB(A)	35dB(A)	30dB(A)	27dB(A)
(b) Other Habitable Rooms Including Open Kitchens					
Continuous Noises $L_{Aeq\ adj} \leq$	41dB(A)	40dB(A)	35dB(A)	30dB(A)	27dB(A)
Intermittent Noises $_{ave} L_{Amax} \leq$	55dB(A)	45dB(A)	40dB(A)	35dB(A)	32dB(A)
(c) Wet Areas Including Bathrooms, Ensuites And Laundries					
Continuous Noises $L_{Aeq\ adj} \leq$	55dB(A)	50dB(A)	45dB(A)	42dB(A)	40dB(A)
Intermittent Noises $_{ave} L_{Amax} \leq$	60dB(A)	55dB(A)	48dB(A)	42dB(A)	40dB(A)

APPENDIX D VIBRATION SURVEY

D1 Site description

The predictions are based on the Architectural drawings prepared by PTW Architects for concept design. The main features of the development are as follows:

- 4 basement level car parks
- Ground Level – Reception areas and approximately 5,000m² gaming entertainment area
- Levels 1 and 2 – Lobby, restaurants, bars and function areas, gymnasiums and facility areas
- Level 3 - Podium with a landscaped roof terrace and deck
- Level 4 to Level 11 – Hotel high rise

The habitable spaces most exposed to the railway fall into two categories:

- Commercial/work place areas: Gaming area facing Church Street (Ground level Grid PPPP)
- Hotel/sleeping areas: Hotel rooms facing Church Street on the lowest level of high rise (Level 4 Grid FFF)

D2 Rail survey

D2.1 Procedure

The ground vibration survey was conducted between 0645-0945 hrs) on 3 December 2015, using Bruel & Kjaer ICP 4507 accelerometers coupled to the ground and Bruel & Kjaer type 2250 precision signal analysers.

A total of 92 electric passenger train passes were measured at three positions over the three hour survey period, one near field position close to the railway reserve boundary and two positions along the Church Street boundary of the future Dooleys development, including one position most exposed to the Olympic Drive railway overpass. The positions are detailed in Figure 14.

Figure 14: Vibration measurement positions



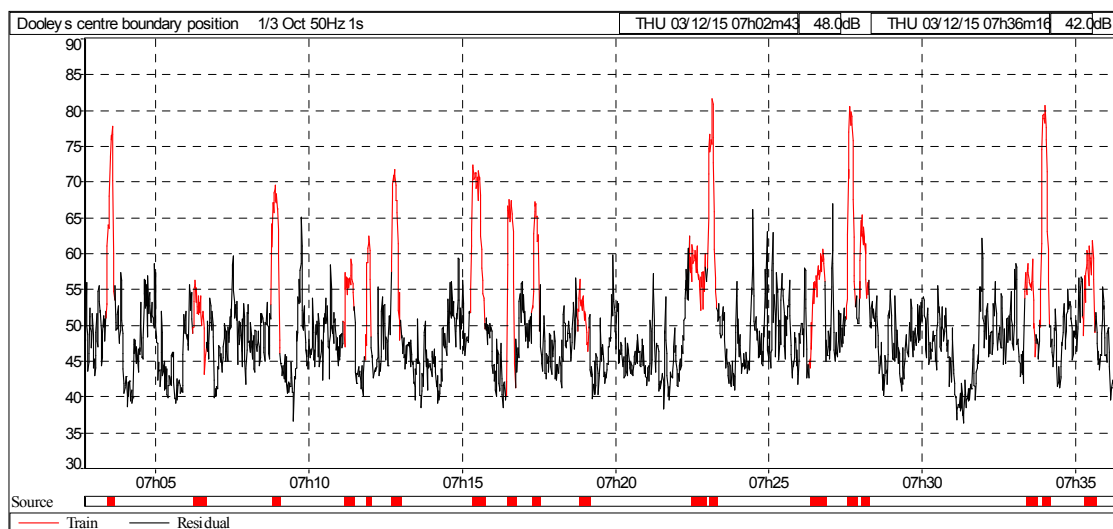
Note that the data from the near field measurement position is used as a reference to ensure that the ground vibration results at the two boundary positions are not affected by extraneous sources such as passing cars and trucks.

Electric passenger trains were observed to pass on the nearest tracks 1 – 4 in the directions shown in Figure 14. Tracks 1 and 3 were carrying city inbound trains. One diesel freight train was observed to pass on Track 1 soon after the 3 hour survey of 92 passenger trains was completed, therefore not measured.

D2.2 Results

The maximum one third octave spectral acceleration levels at each position are presented in Appendix C Figures C1 & C2. The spectral results show that for each train pass, the highest ground vibration acceleration level generally occurs at 50 Hz one third octave frequency band. As sample histogram of 50 Hz ground vibration showing individual train events is provided in Figure 2.

Figure 15: Vertical ground vibration acceleration at Dooleys Centre boundary position: L_a (dB re 10^{-6} m/s² rms)



The respective 95th percentile statistical maximum spectral vibration results calculated for each boundary position are summarised in Table 54.

Table 54: 95th percentile statistical maximum ground vibration acceleration, L_a dB (re $1e-6$ m/s² rms)

City inbound and outbound electric passenger trains*	Third octave band mid frequency											Hz
	12.5	16	20	25	31.5	40	50	63	80	100	125	
Church Street Dooleys centre boundary position	48	55	63	70	72	75	80	78	74	70	62	dB
Dooleys boundary position nearest the Olympic Drive railway overpass	50	54	58	67	70	86	96	88	90	91	90	dB

* one freight train pass is included in the statistical maximum based on ground vibration data derived from the MDA database

Table 54 shows that train induced ground vibration is significantly higher at the Dooleys boundary position nearest the Olympic Drive railway overpass.

As one freight train was observed to pass during the survey but not measured, we have allowed for one typical freight train pass-by on Track 1 (nearest track) in the 95th percentile statistical results of Table 2 by deriving freight train ground vibration based on MDA database of measured field data. The “derived freight train” ground vibration is included in the spectral acceleration data presented in Figure 16 and Figure 17 to show the significance compared to a typical passenger train pass-by.

As a result, freight train activity on the railway lines is included in the assessment to the order of one typical freight train pass-by on Track 1 per 92 passenger trains.

Further information regarding the derivation of the freight train ground vibration expected at the Dooleys site boundary can be provided upon request. As a conservative measure, the results from the boundary position nearest the railway overpass have been used to predict the structural vibration and structure-borne noise within the proposed development.

D3 Rail predictions

The 95th percentile maximum rail vibration results from Table 54 have been used to calculate the structural vibration and structure-borne noise at the habitable spaces most exposed to the railway. The calculations firstly require the survey vibration acceleration results (L_a) to be converted to vibration velocity level (L_v).

The subsequent analysis takes into account the transfer of ground vibration into the building foundations, the change in vibration through the building depending on floor level and the vibration effects of the floor slabs being suspended between columns. The assessment assumes that the building will be of masonry construction, founded on piles (i.e. no isolation) with masonry structural floors.

The structure-borne noise predictions assume that interior spaces will be fitted out with plaster board walls and ceilings with carpeted floors. On the basis of the above data and assumptions, the predictions for structural vibration and structure borne noise in the most affected habitable spaces of the development are summarised in Table 55.

Table 55: 95th percentile maximum rail structural vibration and structure-borne noise

Affected area	Structural floor maximum vertical vibration @ 1/3 octave band (LV dB re 1e-6 mm/s rms)	Structure-borne level in space (L_{Amax} dB)
Ground level Gaming area	L_v 99 dB @ 50Hz	44
Level 4 Hotel rooms Grid FFF	L_v 92 dB @ 50Hz	36

Note that as no criteria is nominated for the assessment of rail structure-borne noise in the commercial/work place areas, the structure-borne noise prediction for the Ground level Gaming area in Table 55 is presented for information only.

Figure 16: Train induced ground vibration at the Dooleys Centre boundary position

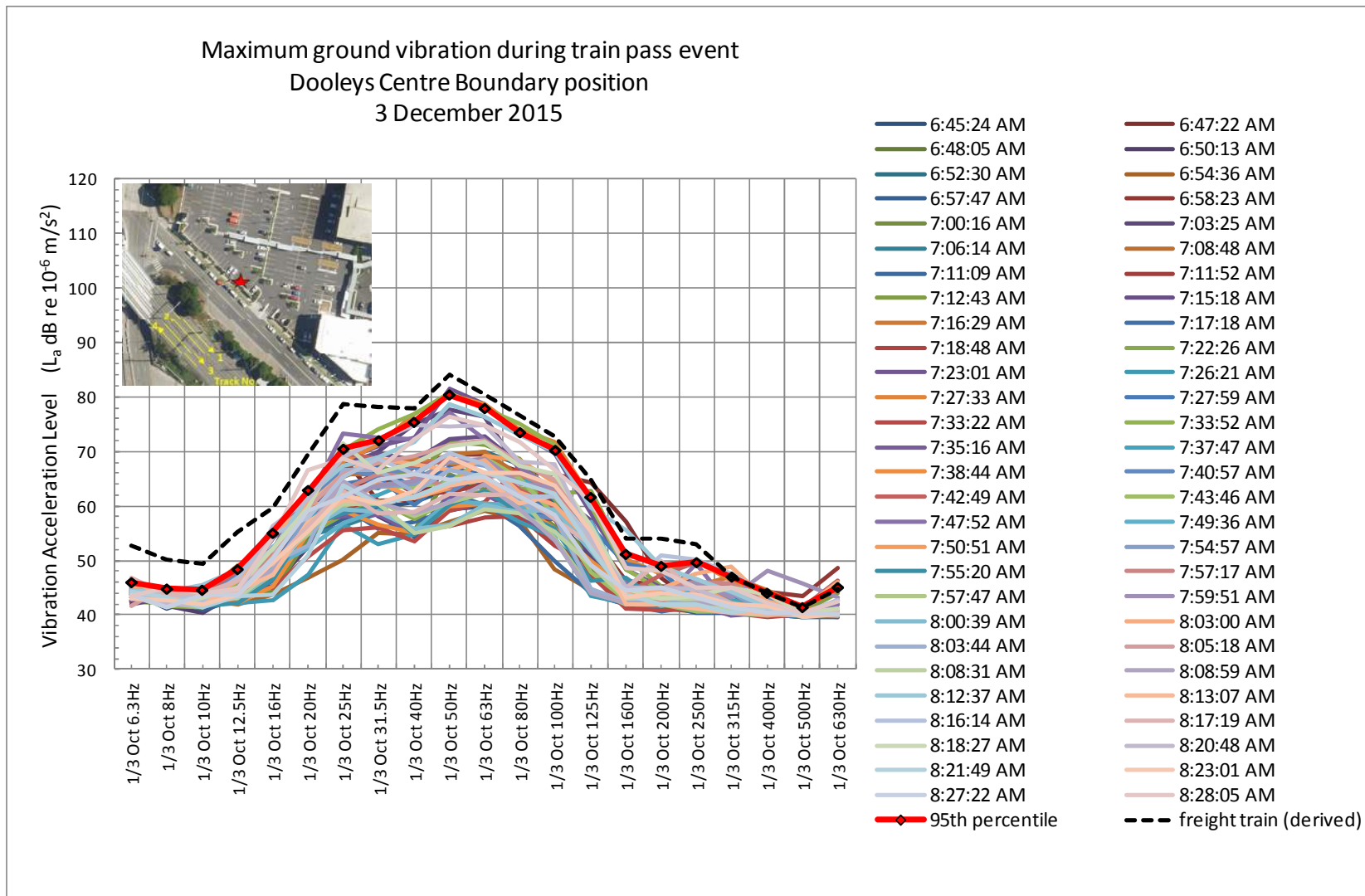
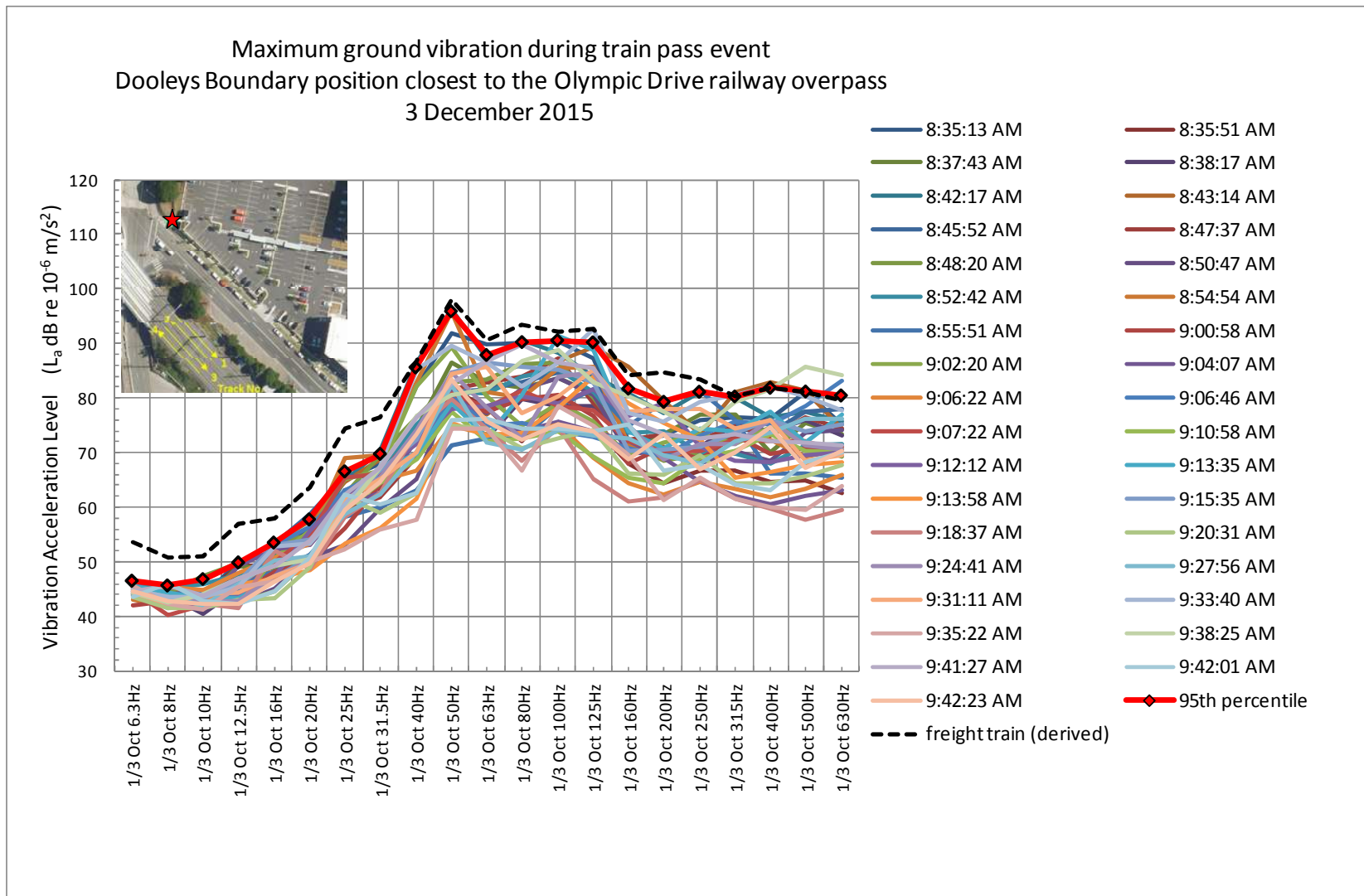
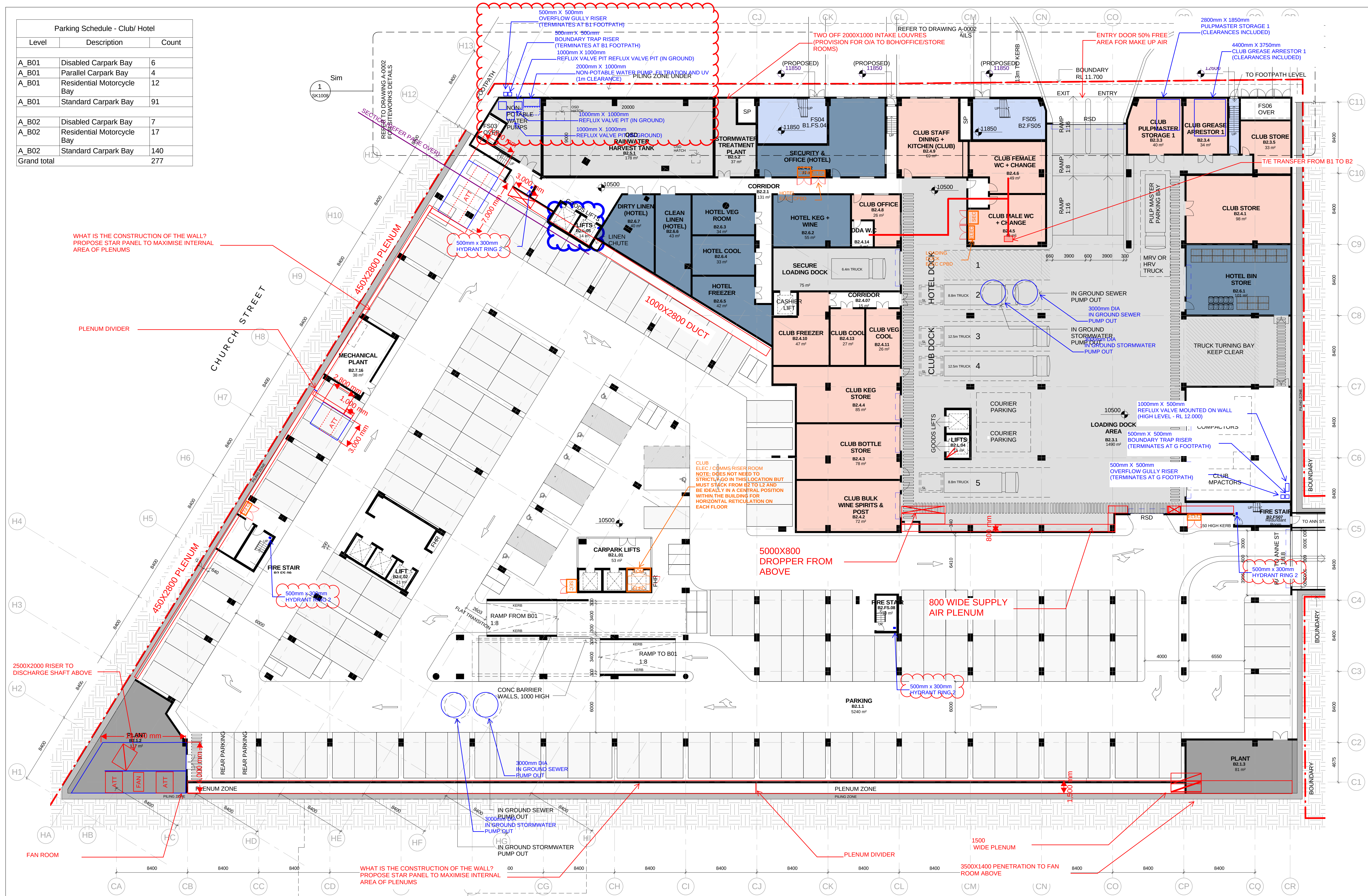


Figure 17: Train induced ground vibration at the Dooleys boundary position closest to the Olympic Drive railway overpass



APPENDIX E SERVICES SPATIAL ALLOWANCES

Parking Schedule - Club/ Hotel		
Level	Description	Count
A_B01	Disabled Carpark Bay	6
A_B01	Parallel Carpark Bay	4
A_B01	Residential Motorcycle Bay	12
A_B01	Standard Carpark Bay	91
A_B02	Disabled Carpark Bay	7
A_B02	Residential Motorcycle Bay	17
A_B02	Standard Carpark Bay	140
Grand total		277



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E	ISSUED FOR COORDINATION		08/02/16
D	ISSUED FOR COORDINATION		08/02/16
C	CONCEPT ISSUE		28/01/16
B	CONCEPT ISSUE		22/01/16
A	CONCEPT ISSUE		22/12/15

S4B STUDIO

DOOLEYS PRELIMINARY SERVICES SPATIALS

19/02/2016

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PTW Architects

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Sydney NSW Australia 2000

NSW Nominated Architects:

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B Architects No. 3916

D Jones Architects No. 4778

A Pridmore Architects No. 5897

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PTW

Approvals	By:	Date:
PTW Approval:		
Client Approval:		

Project:

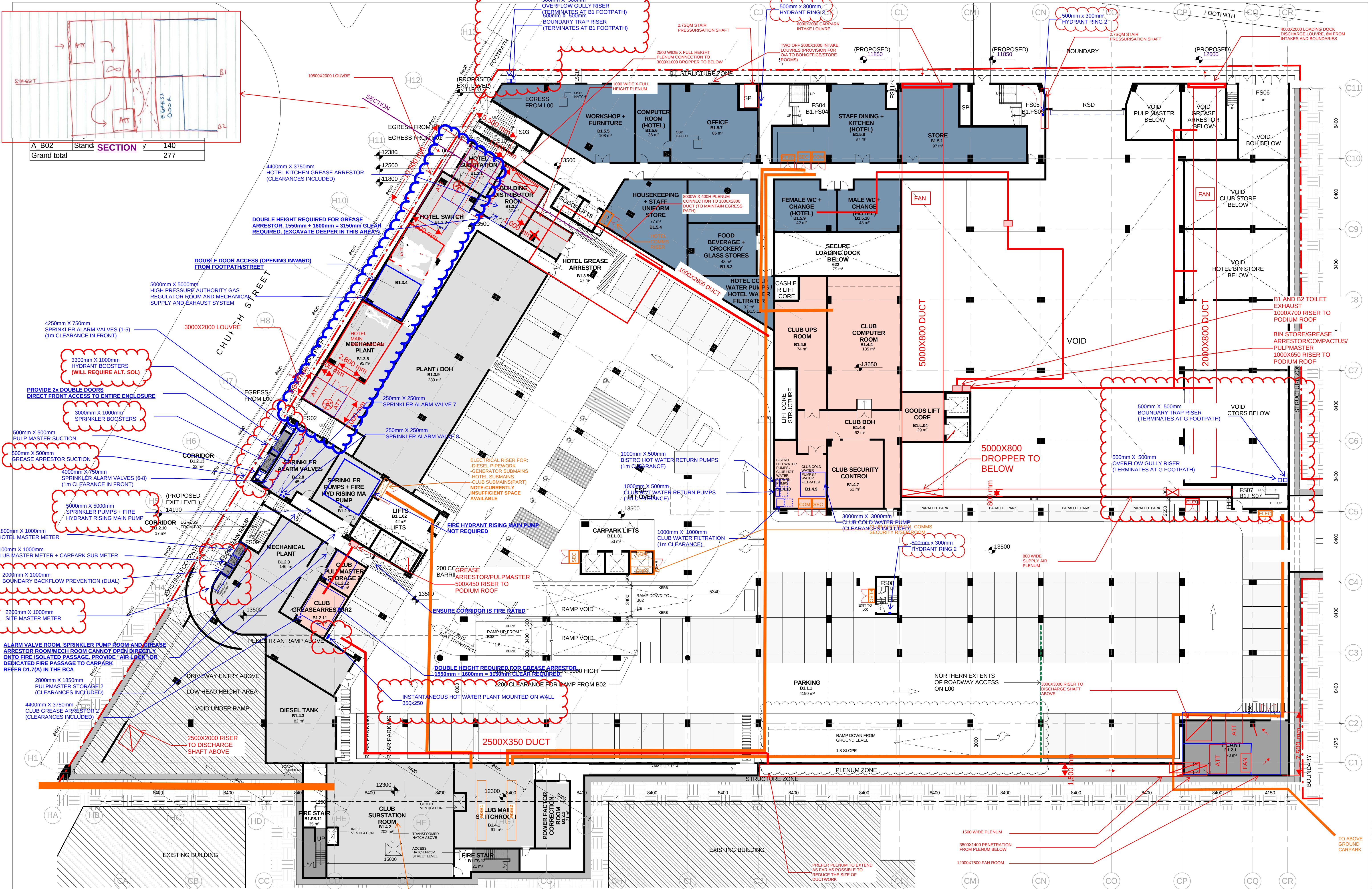
DOOLEYS LIDCOMBE CATHOLIC CLUB

JOHN STREET, LIDCOMBE, NSW 2141

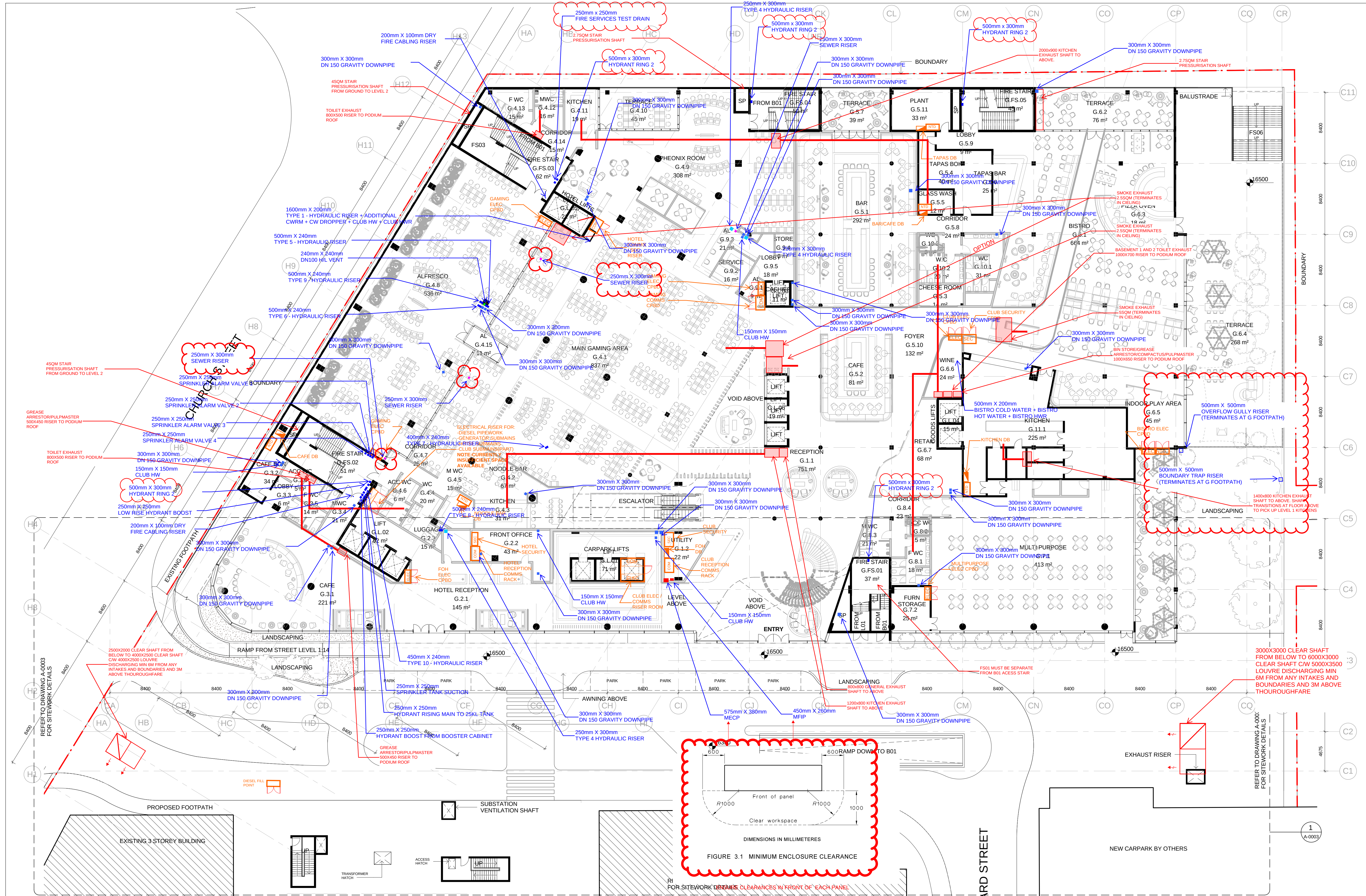
Title:

CLUB/HOTEL - BASEMENT PLAN B2

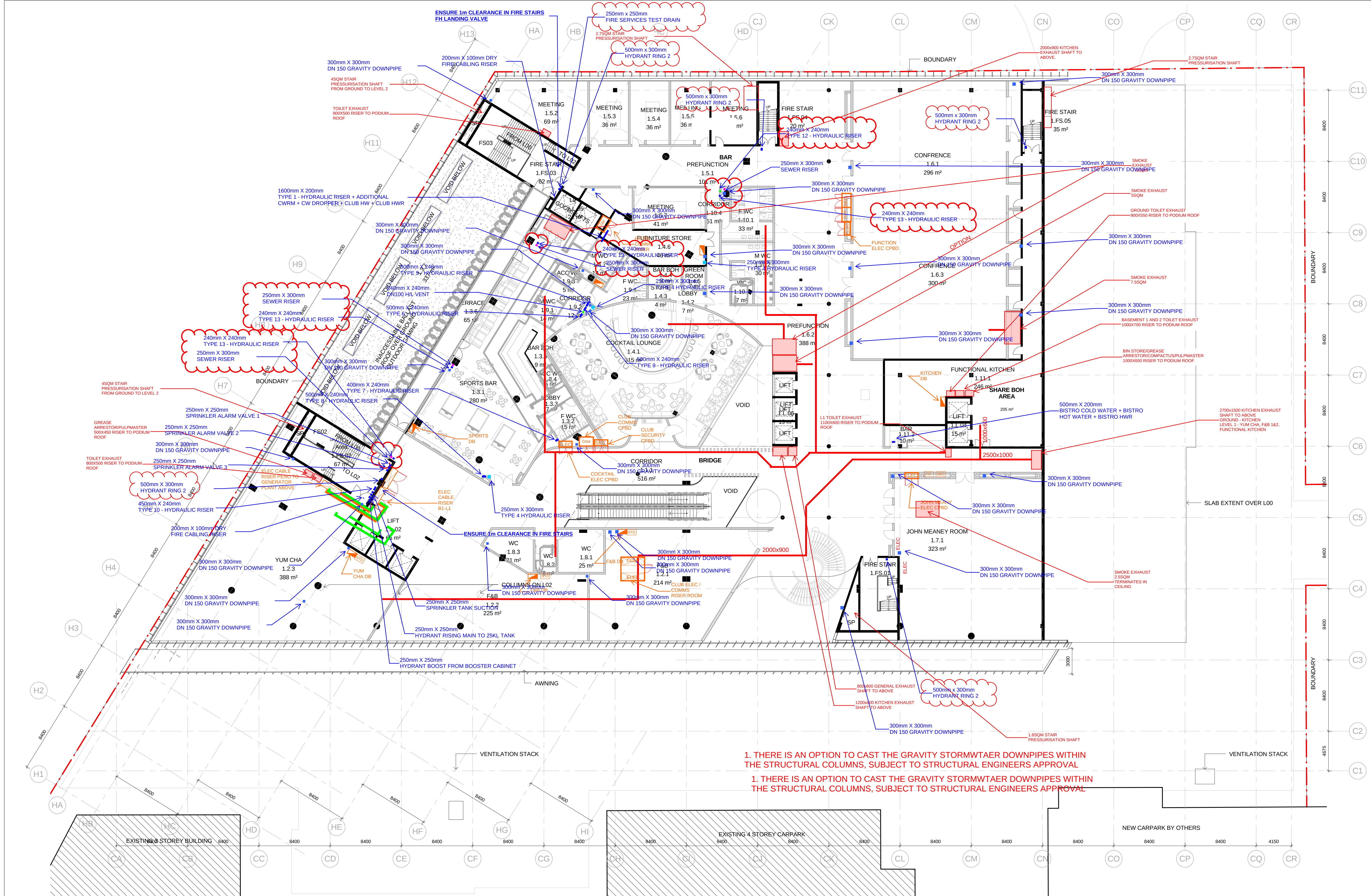
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Status:	SCHEME DESIGN					



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S4B STUDIO

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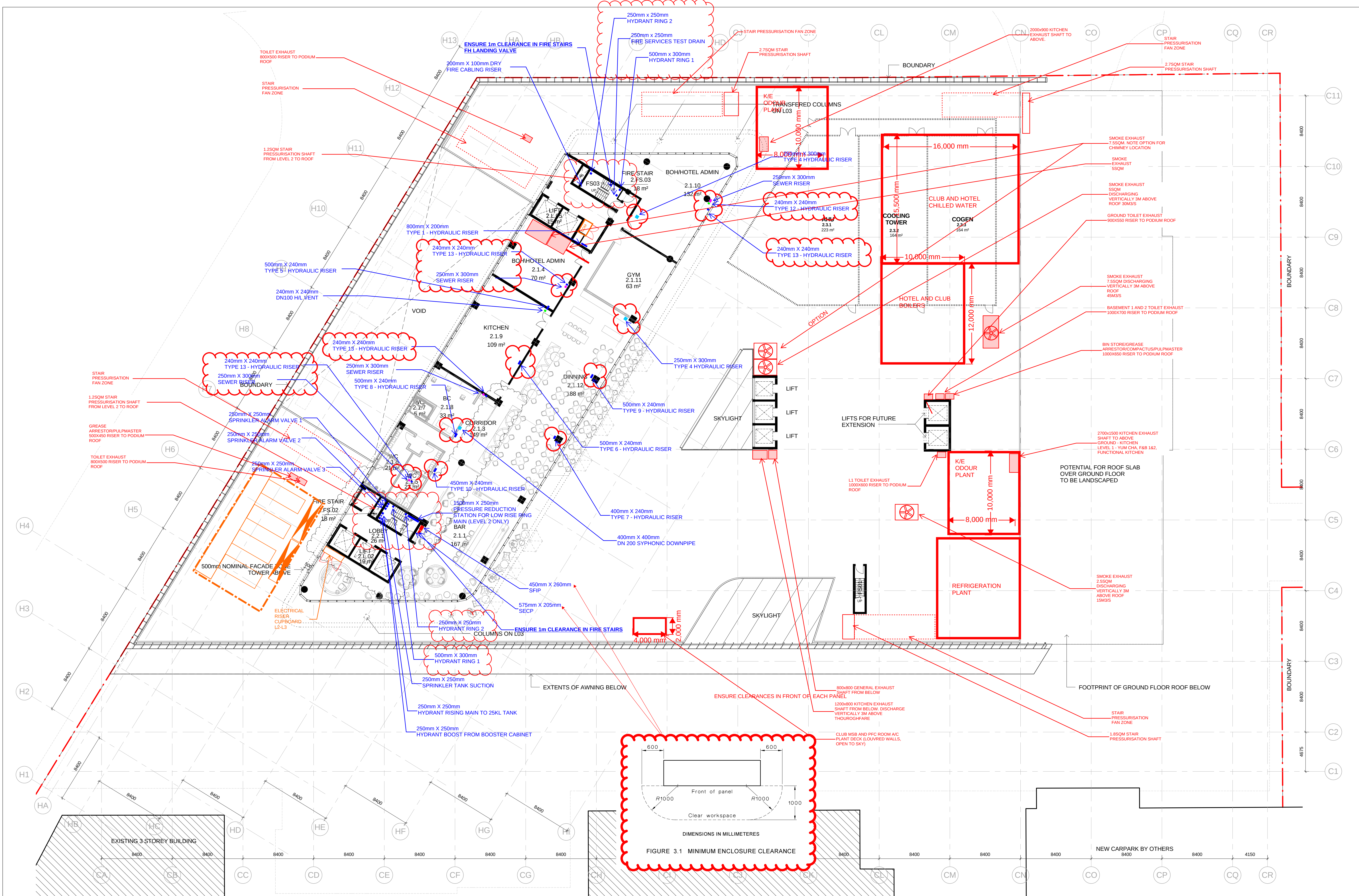
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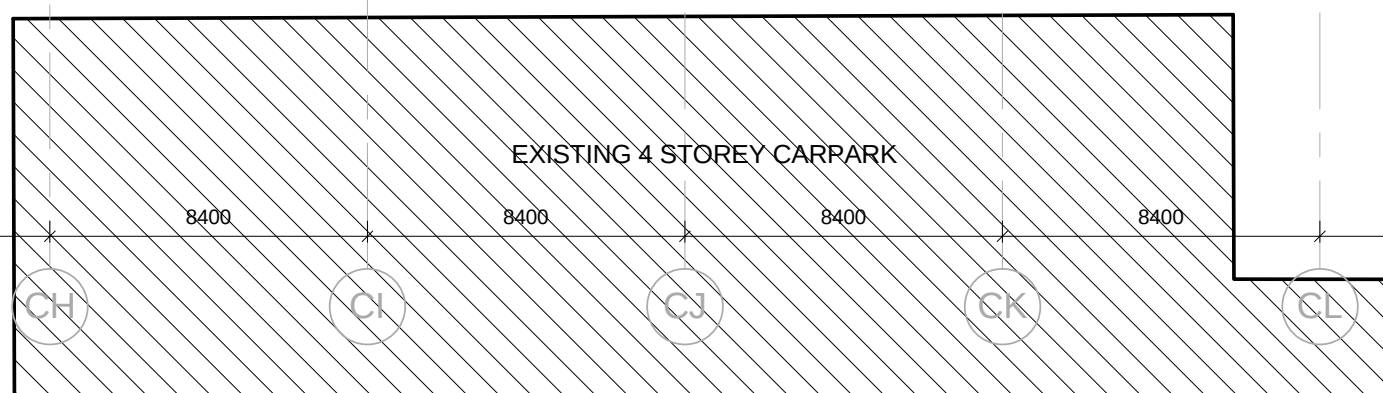
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Status:	SCHEME DESIGN				

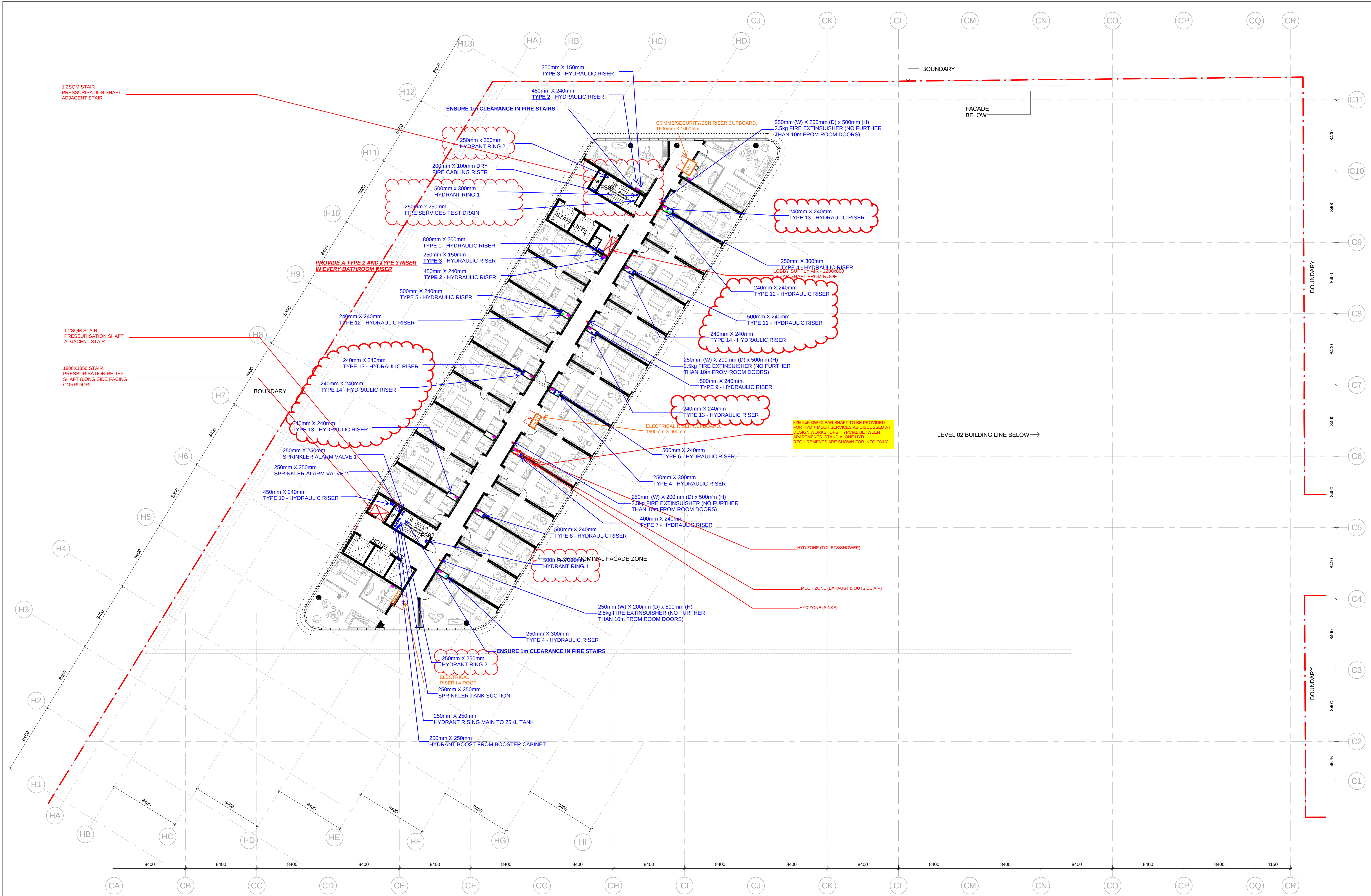
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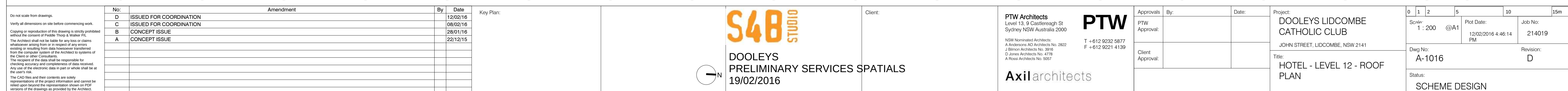
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APPENDIX F EXTERNAL GLAZING REVIEW

Project:	Dooleys Lidcombe	Document No.:	DA 03 r01
To:	Bouygues Constructions	Date:	24 March 2016
Attention:	Duncan Swift	Cross Reference:	
Delivery:	Email	Project No.:	2015562SY
From:	Aaron James	No. Pages:	12 Attachments: No
Subject	Preliminary Facade Acoustic Performance Requirements		

OVERVIEW

The following outlines recommended façade acoustic performance requirements and example glazing systems that may be suitable to assist in development of the schematic design (suitability of the glazing will depend on the framing system).

This review is based on general arrangement and façade drawings received 15 February 2016, with updated façade type A sketch detail dated 4/3/2016.

To minimise vision glazing performance requirements, calculations are on the basis noise ingress via non-vision elements is minimised. This requires the sound isolation performance of the non-vision element to be sufficiently in excess of the vision element.

Preliminary performance requirements for the non-vision element to achieve this requirement are presented as an overall system performance, i.e. shadow box, back-panel, internal lining, ceiling etc. Performance requirements and suitable construction for individual elements will need to be confirmed as the design progresses.

Glazing performance requirements are nominated as minimum octave band levels for an installed facade system performance, including glazing and frame. For comparison an overall R_w value is nominated, noting that achieving the R_w performance only does not guarantee all octave band performance values are achieved.

Incident external noise levels are presented for comparative information only. Glazing performance requirements have been calculated by octave band from on-site noise measurements.

For the review façade elements have been divided according to minimum performance requirements. It is understood some elements may be combined. In these instances it is recommended that the higher acoustic performance requirement is achieved.

Future Design Considerations

The following will need to be considered as the design progresses;

- Façade floor to floor sound isolation
- Demarcation of the façade package elements (where performance requirements are required) and co-ordination with façade internal lining / walls
- Ceiling design

FAÇADE PERFORMANCE REQUIREMENTS - HOTEL ROOMS

Performance requirements for glazing systems are provided in Table 1 in reference to attached markups. Example glazing systems have been provided on the basis of;

- Preference for the DGU outer pane to be 6mm float (inner pane can be laminated where required)



- Preference for air cavity to be either nominal 12mm or 24mm
- Type A Glazed vision element is 2100mm high as per sketch drawing A-4102 dated 4/3/2016

Design internal noise levels are presented in the basis below.

Sound Isolation to Adjacent Rooms

The façade system must achieve the following sound isolation;

- Adjacent hotel rooms (vertically): $R_w + C_{tr} > 50$
- Adjacent hotel rooms (horizontally): $R_w + C_{tr} > 50$

Figure 1 and Figure 2 provide some examples of the type of acoustic detailing that is likely to be required for a curtain wall system. Specific details will need to be confirmed that ensure that the nominated performance requirements are achieved.

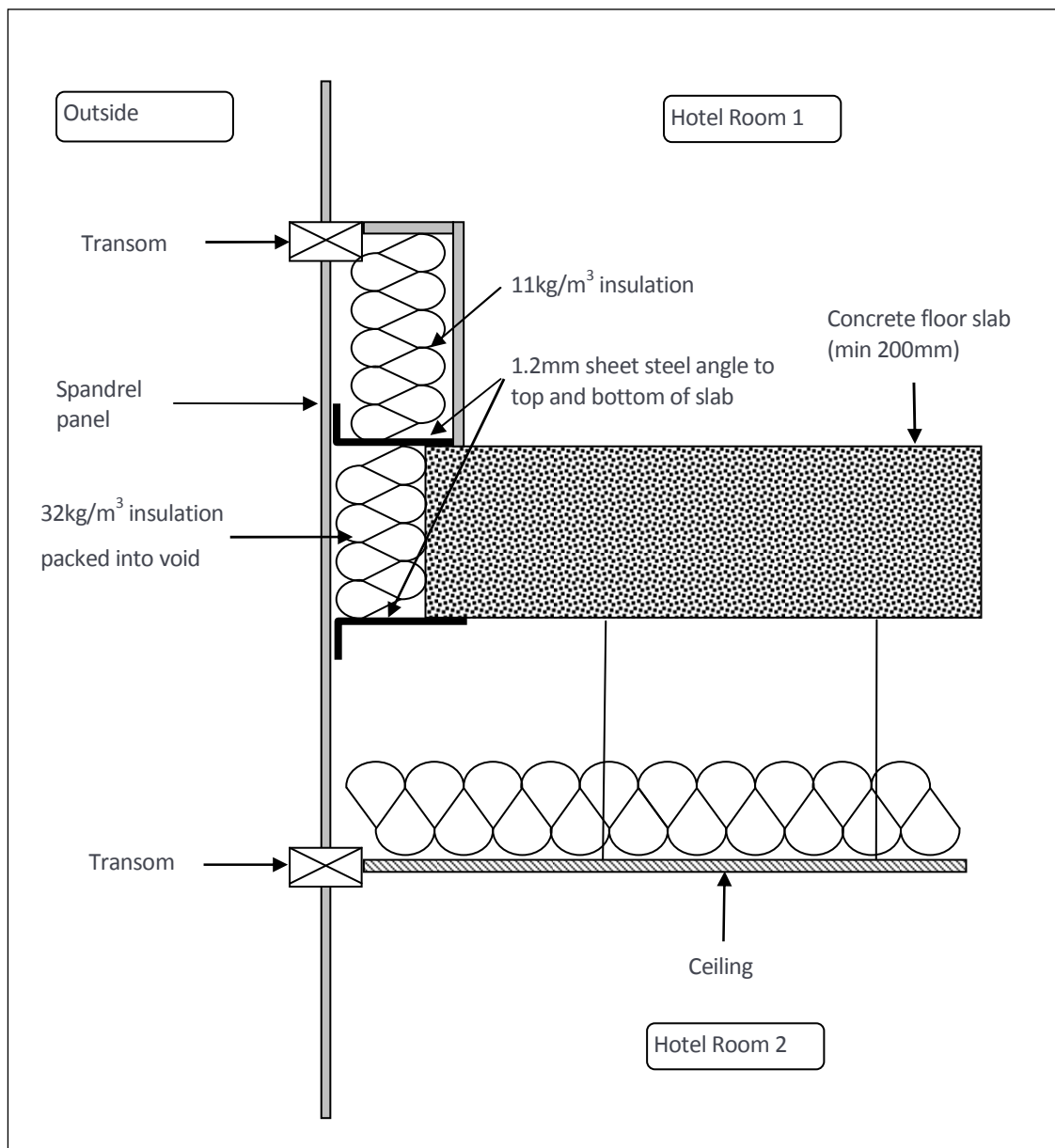


Figure 1: Conceptual detail for slab edge to facade acoustic treatment for hotel suite curtain wall (section)

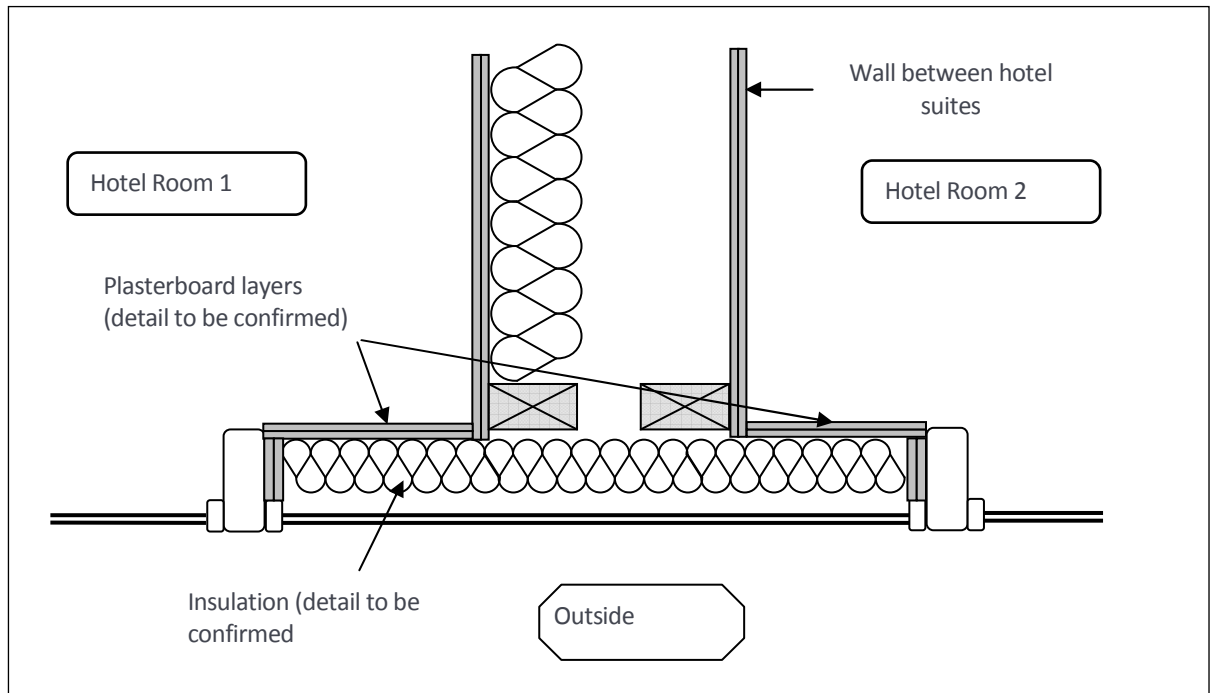


Figure 2: Conceptual detail for acoustic treatment for the junction between a façade utilising single mullions, and the hotel suite partition connection to the facade (plan view)

Table 1: Preliminary curtain wall façade recommendations, hotel rooms

#	Room	Traffic Incident Level L_{Aeq} / L_{Amax}	Design Target	Glazing Octave Band Performance Requirement							R_w ¹	Example Glazing Systems	Non-Vision Element	Comment / Assumptions
				63	125	250	500	1k	2k	4k				
1	Hotel Room	64 / 80	See basis, below	22	27	30	33	38	41	41	38	Double Glazed Unit; 8mm float, 12mm air-gap, 10.76mm laminated 6mm float, 24mm air-gap, 10.76mm laminated	Allow for system performance requirement of $R_w + C_{tr} > 45$	Reduction in glazing requirements possible to non-hotel rooms
2	Hotel Room	70 / 85	See basis, below	28	32	36	43	44	47	50	45	Alternative #1: Double Glazed Unit; 10mm float, 24mm air-gap, 14.76mm laminated <i>Not expected to be possible to achieve with 12mm cavity and commercial glazing panels</i> Alternative #2: Jockey sash system; - Double glazed unit achieving minimum performance for Type 1 façade (above) with additional internal jockey sash. Jockey sash to be min. 10.76mm laminated glass, offset 150mm from the inner pane of the DGU. Where required to be openable, to be awning type with acoustic rated compressible rubber perimeter seals.	Allow for system performance requirement of $R_w + C_{tr} > 50$	Reduction in glazing requirements possible to non-hotel rooms
3	Hotel Room	63 / 78	See basis, below	19	24	26	30	35	37	37	34	Double Glazed Unit; 6mm float, 12mm air-gap, 10.76mm laminated 6mm float, 24mm air-gap, 8.76mm laminated	Allow for system performance requirement of $R_w + C_{tr} > 40$	Reduction in glazing requirements possible to non-hotel rooms

¹ Indicative only, each octave band performance requirement is required to be achieved

FAÇADE PERFORMANCE REQUIREMENTS – DOOLEYS CLUB AND HOTEL COMMON AREAS

Recommendations are provided in Table 2 (ground), Table 3 (level 1) and Table 5 (level 2) in reference to attached mark-ups.

Façade performance requirements are based on the understanding;

- Level 1 west facing meeting rooms and conference room vision glazing is 4000mm high
- Vision glazing to ground level hotel café is 4000mm high
- Vision glazing to level 1 Yum Cha is 4000mm high

Non-sensitive locations that are not exposed to road traffic are noted in the attached mark-up. Acceptable internal noise levels are achieved with a sealed façade with glazing that meets minimum structural requirements.

Internal noise level targets are presented as the overall room design target level, which includes external noise ingress and noise from building services.

Where required, minimum performance requirements are nominated for façade elements with doors.

Façade elements facing north and east include consideration for external noise breakout to nearby noise sensitive receivers.

Plantrooms to the Façade

Where plantrooms are located adjacent to the façade, minimum façade performance requirements will depend on plant and equipment in the room. In lieu of a potentially high performance façade, the recommendation is to allow for an internal masonry wall to the plantroom to provide the bulk of the sound isolation. Details will need to be confirmed as the design progresses.

Performance requirements for external louvres will need to be confirmed as the design progresses with identification of plant and equipment and whether the intent is for intake / discharge attenuators. The expectation is acoustic louvres may be required (order 600mm deep), potentially in combination with a lined plenum.

Table 2: Preliminary curtain wall façade recommendations for club and non-hotel rooms, ground

#	Location	Traffic Nominal Incident Level L_{Aeq}	Design Target	Glazing Octave Band Performance Requirement							R_w	Example Glazing Systems	Comment / Assumptions
				63	125	250	500	1k	2k	4k			
1	Alfresco / Outdoor Gaming	64	50	16	21	23	26	28	30	30	30	6mm laminated 10mm toughened	- Expect glazing selection will be controlled by structural requirements - On basis 25% roof opening and roof with minimum 10kg/m² density solid construction
2	Hotel Café	63	45	16	21	23	26	28	30	30	30	6mm float, 12mm air-gap, 6mm float 6mm laminated	Internal finishes assumed to achieve nominated target room reverberation levels
3	Phoenix Room / Bar / Bistro	70	45	16	21	23	26	28	30	30	30	6mm float, 12mm air-gap, 6mm float 6mm laminated	R_w 30 door, requires perimeter and threshold acoustic seals - Glazing assumed to be 2.7m high - Non-Vision element required to achieve $R_w + C_{tr} > 30$
4	Multi-purpose room	-	45	18	22	24	28	30	32	32	31	6mm float, 12mm air-gap, 6mm laminated 6mm laminated 10mm toughened	- Assumes internal noise levels are limited to 75-80dBA, i.e. no loud amplified music, with no substantial noise after 12PM R_w 30 door, requires perimeter and threshold acoustic seals - Screening to the north to neighbouring residences assumed from the terrace
5	Bistro / Indoor Play Area	-	-	18	22	24	28	30	32	32	31	6mm float, 12mm air-gap, 6mm laminated 6mm laminated 10mm toughened	- Vision glazing assumed to be 4m high - Assumed internal noise levels are up to 75dBA up to 10PM, limited occupancy / noise after R_w 30 door, requires perimeter and threshold acoustic seals
6	Phoenix Room / Stairs	70	45	-	-	-	-	-	-	-	40	n/a (solid wall)	90mm hollow blockwork sufficient

Table 3: Façade performance recommendations for club and non-hotel rooms, Level 1

#	Location	Traffic Nominal Incident Level L_{Aeq} / L_{Amax}	Design Target	Octave Band Performance Requirement							R_w	Example Glazing Systems	Comment / Assumptions
				63	125	250	500	1k	2k	4k			
1	Meeting Room / Conference Room	70 / 85	Meeting 40 Conference Room 35	25	28	33	36	42	45	45	41	Double Glazed Unit; 8mm float, 24mm air-gap, 10.76mm laminated <i>Not expected to be possible to achieve with 12mm cavity and commercial glazing panels</i>	- Require additional internal absorptive surfaces to the most exposed south west corner meeting room, overall room reverberation time 0.6s - Façade system to not limit the room to room acoustic separation of the partitions - Glazing performance to the pre-function area can be downgraded - See basis below, internal noise generation up to 85dBA maximum
2	Sports Bar	64	45	16	21	23	26	28	30	30	30	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm float	- Assume 4m high glazed façade to the sports bar R_w 30 door, requires perimeter and threshold acoustic seals - Assume no loud amplified music in the sports bar
3	Yum Cha	62	45	16	21	23	26	28	30	30	30	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm float	Assume internal absorptive finishes to achieve nominated room reverberation target
4	John Meany Room	-	35	18	22	24	28	30	32	32	31	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm laminated	- Solid Awning - See basis below, internal noise levels up to 85dBA maximum

Table 4: Façade performance recommendations for club and non-hotel rooms, Level 2

#	Location	Traffic Nominal Incident Level L_{Aeq} / L_{Amax}	Design Target	Octave Band Performance Requirement								R_w	Example Glazing Systems	Comment / Assumptions
				63	125	250	500	1k	2k	4k				
1	BOH / Admin	70	45	20	25	27	31	36	38	38	35	Double Glazed Unit; 6mm float, 12mm air-gap, 10.76mm laminated 6mm float, 24mm air-gap, 8.76mm laminated	- Allow for system performance requirement of $R_w + C_{tr} > 40$ - Assume vision glazing to 2700mm - Assume open office layout, no private offices - Assumes noise emission controls for external plant to be 10dB less than traffic	
2	Gym	63	45	16	21	23	26	28	30	30	30	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm float	- Assume limited music (not sufficient to disturb conversation) - Connection of façade to the slab with floating floor will be required - Façade connection to ensure the sound isolation of the R_w 50 internal partitions are not compromised - Assumes noise emission controls for external plant to be 10dB less than traffic	
3	BOH / Hotel Admin	64	45	18	22	24	28	30	32	32	31	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm laminated	- Assume vision glazing to 2700mm - Assume open office layout, no private offices - Allow for system performance requirement of $R_w + C_{tr} > 35$	
4	Café / Business centre	63	45	18	22	24	28	30	32	32	31	Double Glazed Unit; 6mm float, 12mm air-gap, 6mm laminated	Assumes noise emission controls for external plant to be 10dB less than traffic	
5	Kitchen / Amenities	63	50								40	n/a	90mm hollow blockwork sufficient	

BASIS OF OPINION - NOISE SOURCES

The following noise sources have been considered;

- Passenger and Freight Rail traffic parallel to Church Street, including raised rail overpass at intersection to Olympic Drive
- Vehicle traffic on Olympic Drive (including heavy vehicles)
- Vehicle traffic on Church Street
- Internal vehicle traffic on Dooleys Lidcombe site

Noise exposure from road and rail traffic has been quantified from unattended logging and attended measurements on Church Street and Olympic Drive.

Noise breakout has been considered for;

- Activity noise in the conference rooms and John Meaney Room (see comments below)
- Patron noise in the multi-purpose room and bistro

Internal noise levels in food and beverage tenancies are assumed to be controlled within the space with no loud amplified music.

Internal Noise Levels in Conference Rooms / John Meaney Room

On the basis rooms will not have acoustic floating floors, previous MDA advice was that it will be necessary to limit the allowable internal noise levels to control the risk of structure borne noise transfer into sensitive spaces. It was recommended that internal noise levels in the Conference rooms and the John Meaney Room should be limited to a maximum sound level of 85dBA.

To provide context with regard to the internal noise level limits, previous acoustic testing has been carried out by Marshall Day Acoustics in various licensed and music venues, with average results shown in Table 5.

Table 5: Typical internal music noise levels

Description	L _{Aeq} dB
Typical upper levels in live “heavy” rock band/nightclub	107
Typical average levels in live “heavy” rock band/nightclub	98
Wedding band (loud)	94
Amplified music in bar (moderate)	87
3 piece jazz band (up tempo loud song)	89
3 piece jazz band (ballad – low)	80

BASIS OF OPINION – INTERNAL NOISE LEVEL DESIGN TARGETS

Hotel Rooms

Noise criteria for hotel rooms are presented for;

- External noise intrusion from traffic noise via the façade
- Building services noise levels

External Noise Intrusion

External noise intrusion criteria are informed by;

- Australian Standard AS/NZS 2107:2000 – recommendations for overall noise levels, including external noise ingress and building services
- AAAC star rating system, recommended for external noise ingress
- State Environmental Planning Policy (SEPP) (Infrastructure) 2007, mandatory requirements for residential developments near rail and major roadways
- Office of Liquor Gaming and Racing (OLGR) – mandatory criteria that apply to licensed venues
- Sleep disturbance criteria

Details are provided in the concept acoustic report.

For constant external noises (e.g. road noise) compliance with AS/NZS 2107:2000 ‘satisfactory’ levels and a “3-star” acoustic rating under the AAAC star rating system is considered appropriate for the quality objectives outlined in the design basis, shown in Table 6.

Table 6: Recommended criteria, external noise intrusion for amenity

Dominant Noise Source	Application	Overall Target
Road and rail traffic	Hotel room, day (0700-2200hrs)	40dB $L_{Aeq, 15hr}$
	Hotel room, night (2200-0700hrs)	35dB $L_{Aeq, 9hr}$
	Hotel room, anytime	55 $L_{Amax, 15min}$ (90th percentile)

Overall these design targets are consistent with SEPP requirements for a residential development. Where the design achieves the above nominated constant noise level targets, typical night-time maximum internal noise level events are unlikely to cause sleep awakenings. It must be noted that at this level, peak road and rail traffic noise will still be audible and apparent.

Building services noise levels

Building services noise level targets are informed by;

- AS/NZS 2107:2000, recommended overall noise levels
- AAAC Star rating system, recommended levels for amenity

Overall recommendations for building services noise levels are shown in Table 7. Recommendations are generally compliant with AS/NZS 2107:2000, however suggested criteria allow for tolerance to higher noise levels for building services operated by the Hotel guest.

Table 7: Recommended Overall Noise Level Criteria, Hotel Rooms

Source	Value
Air-conditioning noise - wall mounted unit at medium speed	NR40 / 45dBA
Fan coil unit noise in Hotel rooms:	
Low speed	NR30 / 36dBA
Medium speed	NR35 / 40dBA
Noise from a switched exhaust fan in a wet area	45dBA
Noise from any central building services (exhaust fans, chillers, lifts, etc) in a wet area	$L_{max} \leq 30dBA$
Noise from any central building services (exhaust fans, chillers, lifts, etc) in a hotel bedroom or living room	$L_{max} \leq 25dBA$
Noise in a wet area from any waste pipes serving any other hotel room	$L_{max} \leq 35dBA$
Noise in a bedroom or living area from any waste pipes serving any other hotel room	$L_{max} \leq 25dBA$

Dooleys Club and Hotel Common Areas

Overall noise level targets for Dooleys Club and hotel common areas are listed in Table 8 and Table 9 respectively. Design targets are the overall level, combining noise from building services and external sources (road traffic, train pass-by and entertainment noise break-in).

Recommended design criteria for internal spaces take into consideration the recommendations in AS/NZS 2107:2000, adapted for the various commercial public spaces.

Criteria are listed as both a noise rating and overall noise level. Building services are to achieve both nominated criteria with external road / rail traffic noise intrusion.

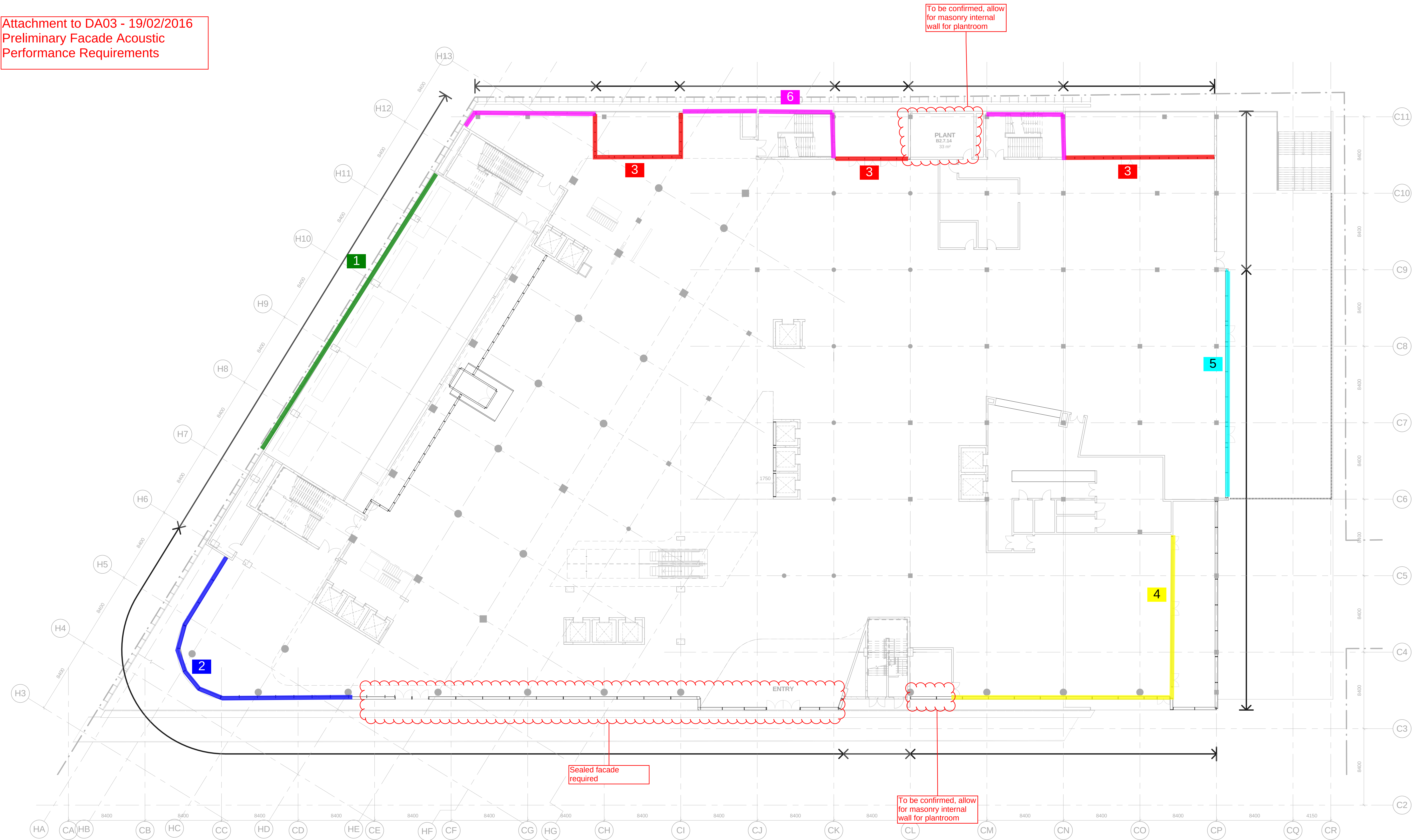
Table 8: Overall noise level criteria, club areas

Room	Overall Noise Level, L_{Aeq}	Building Services Noise Rating (NR)
Gaming (indoor)	45	NR40
Restaurants/Bars/Bistro	45	NR40
Conference Room / John Meaney Room	35	NR30
Meeting Rooms / Business Centre	40	NR35
Offices	45	NR40
Kitchens	50	NR40
Lobbies	50	NR40
Toilets	50	NR45
Basement carparks	60	NR50

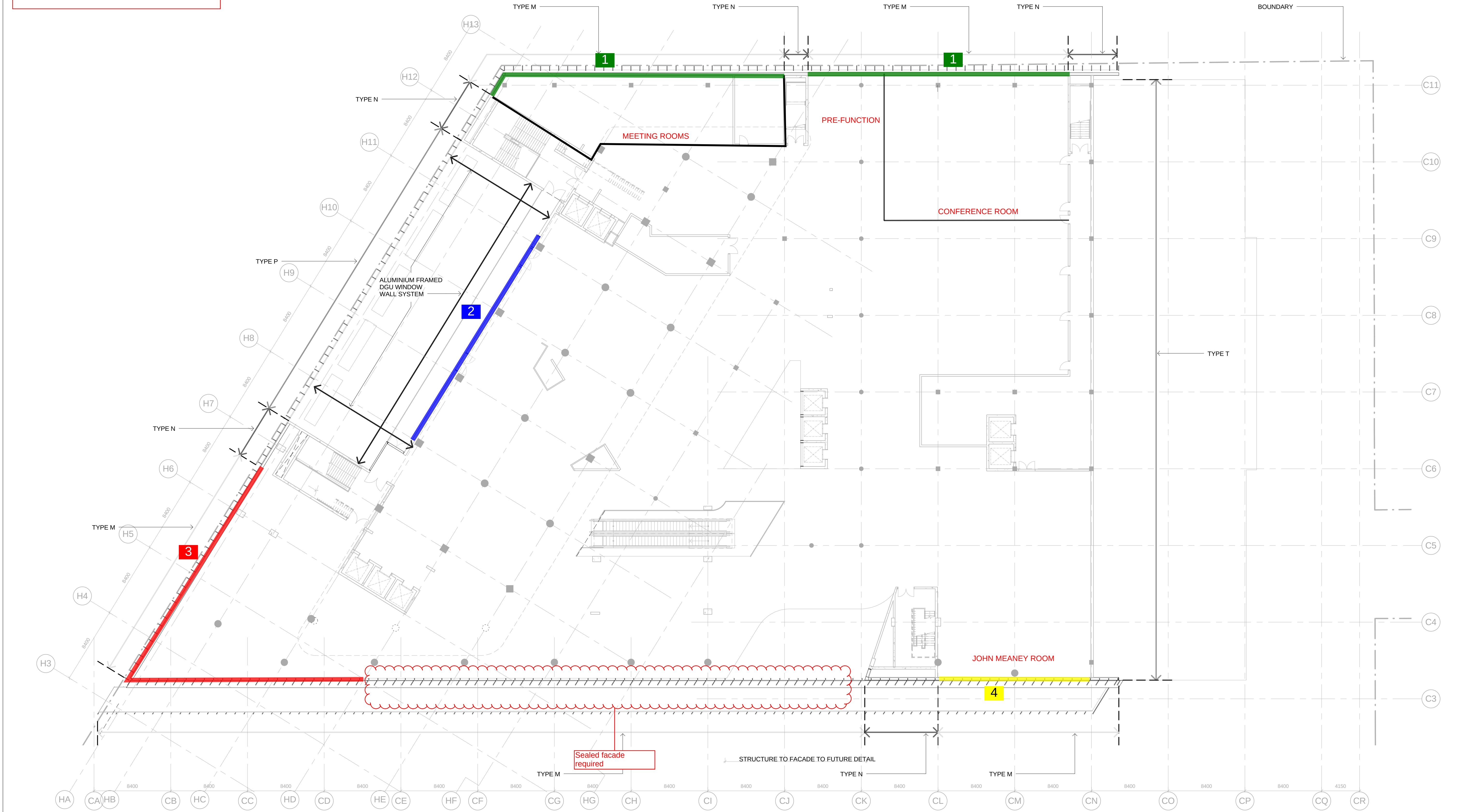
Table 9: Overall noise level criteria, Hotel common areas

Room	Overall Noise Level, L_{Aeq}	Building Services Noise Rating (NR)
Hotel Reception	45	NR40
Terrace Lounge	45	NR40
Hotel Gym Health Facility	45	NR40
Restaurants/Bars	45	NR40
Kitchens	50	NR40
Hotel corridors	45	NR40
Toilets	50	NR45
Business Centre, Meeting Rooms	40	NR35
BOH offices	45	NR40

Attachment to DA03 - 19/02/2016
Preliminary Facade Acoustic
Performance Requirements



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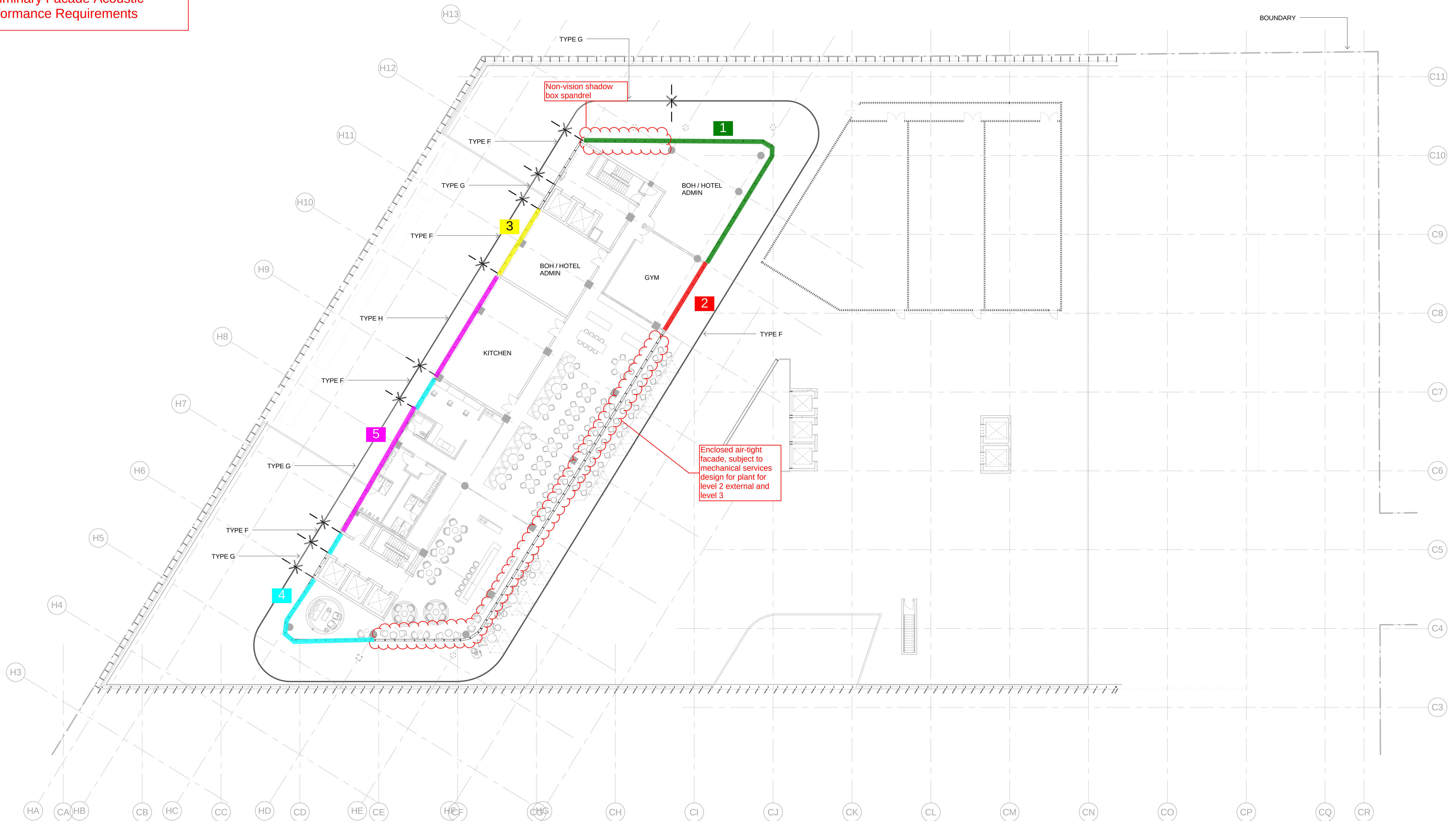


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														A-1211		A				
										Status:										
										SCHEME DESIGN										

Attachment to DA03 - 19/02/2016
Preliminary Facade Acoustic
Performance Requirements



LEGEND:

TYPE A REFER TO A-4102	TYPE F FLOOR TO CEILING ALUMINIUM FRAMED CURTAIN WALL SYSTEM WITH DGU VISION PANELS FULL HEIGHT @ 1050 MILLIONS CTRS APPROX TO ALIGN WITH HOTEL ROOM ABOVE (TYPE A)	TYPE G AS PER TYPE F BUT WITH FULL HEIGHT SHADOW BOX SPANDREL IN LIEU OF VISION GLASS PANELS	TYPE H AS PER TYPE 'F' BUT WITH SHADOW BOX SPANDREL TO 2100 AFL WITH DGU VISION GLASS PANEL ABOVE TO CEILING LEVEL
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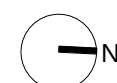
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Key Plan:



Consultants:	
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Client:

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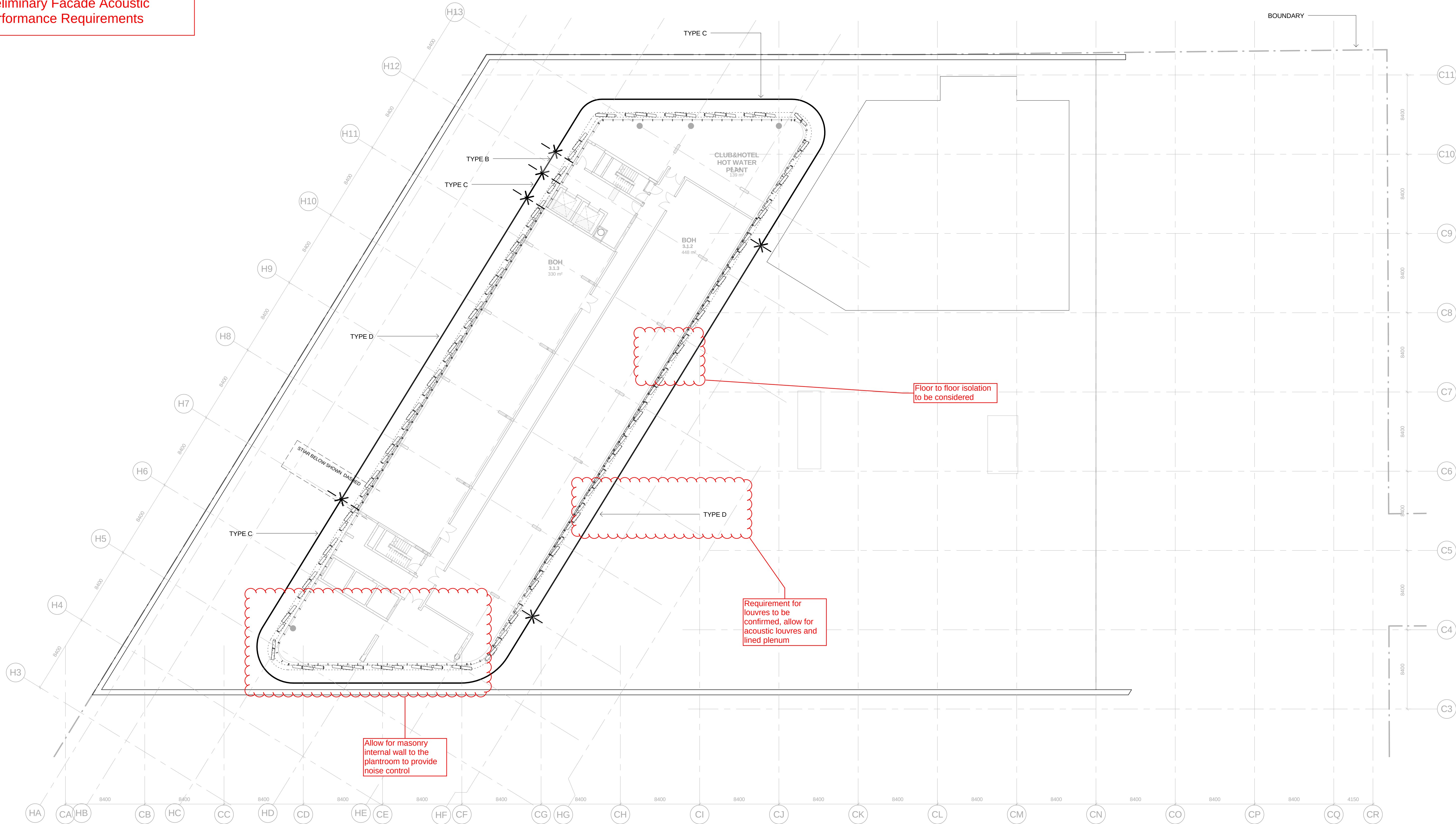
Approvals	By:	Date:
PTW Approval:		
Client Approval:		

Project:
DOOLEYS LIDCOMBE
CATHOLIC CLUB
JOHN STREET, LIDCOMBE, NSW 2141

Title: FACADE SCOPE
TOWER - LEVEL 2

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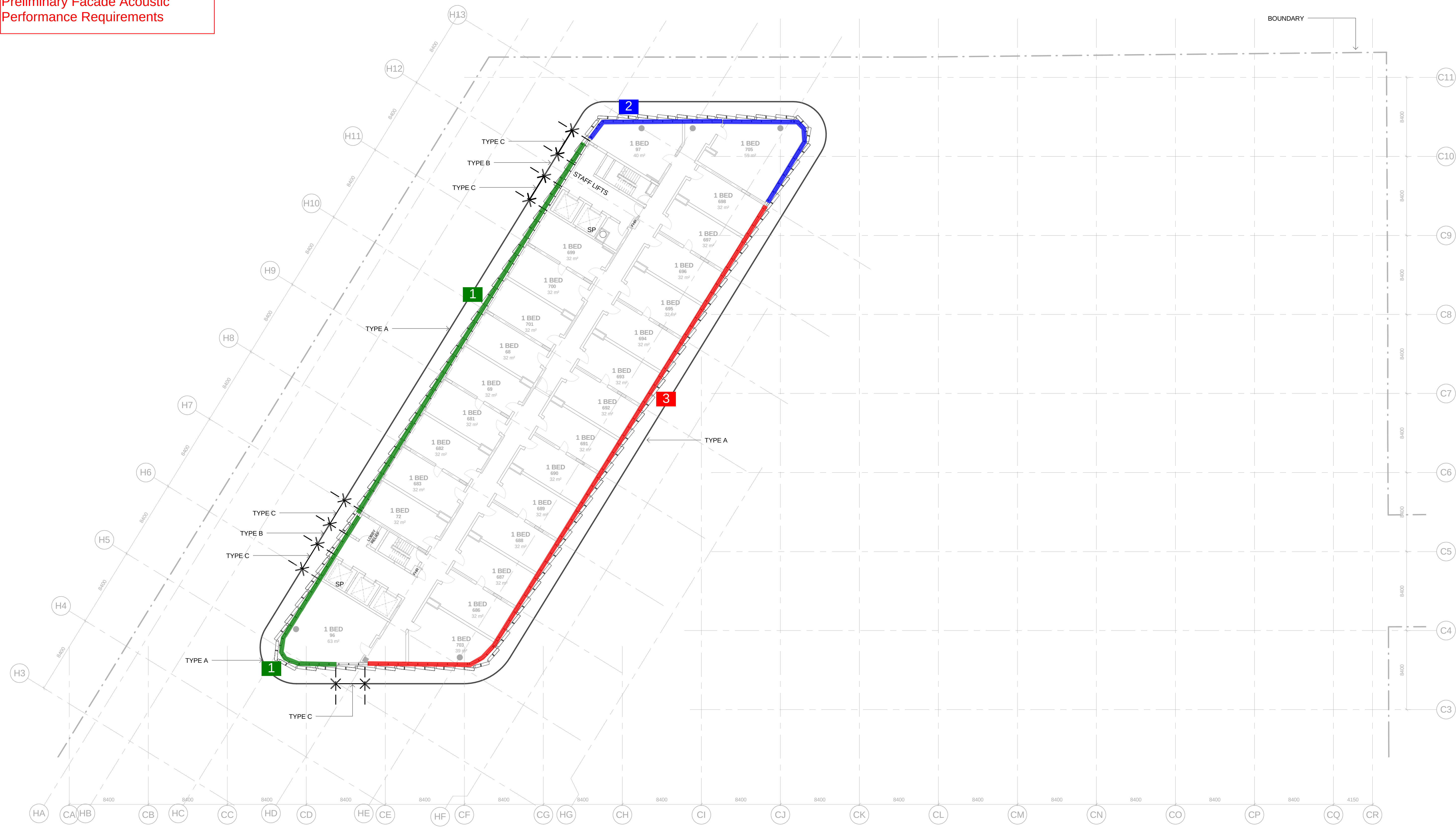
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LEGEND:

TYPE A	TYPE B	TYPE C
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APPENDIX G ABOVE GROUND CARPARK NOISE IMPACT ASSESSMENT