Warringah Mall

Proposed Gym

Noise Impact Assessment

Scentre Group

Report number: 220498-Warringah Mall - Gym Noise Assessment - R0
Date: 10 February 2023
Version: For Information

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DOCUMENT CONTROL

Project Name	Warringah Mall
Project Number	220498
Report Reference	220498-Warringah Mall - Gym Noise Assessment - R0
Client:	Scentre Group

Revision	Description	Reference	Date	Prepared	Checked	Authorised
0	For Information	220498-Warringah Mall - Gym Noise Assessment - R0	10 February 2023	Ben White	Matthew Furlong	Ben White

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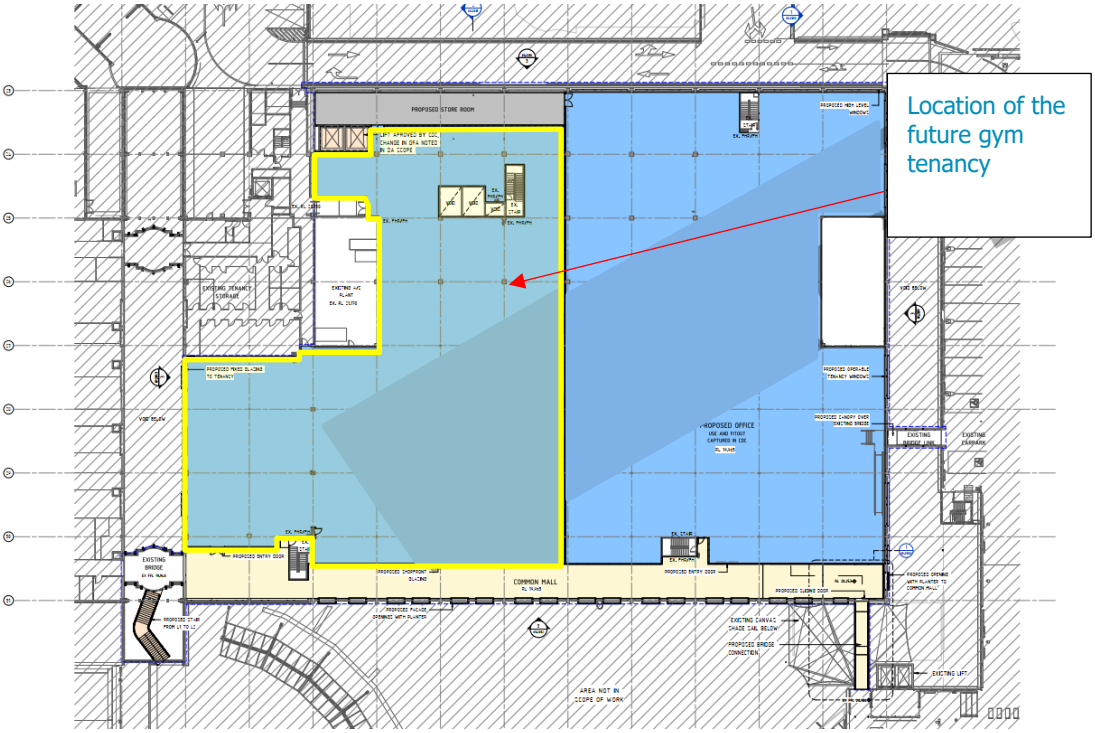
1 INTRODUCTION

Pulse White Noise Acoustics has been engaged to undertake the Noise Impact Assessment of the proposed future gym tenancy to be located within the exiting Warringah Mall.

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of gym on surrounding receivers external to the centre as well as noise impacts within the retail centre.

The proposed gym is to be included within the existing Warringah Mall shopping centre including a tenancy which is located within the building envelope. The location of the gym include a tenancy on level 2 of the shopping centre as detailed in the figure below.

Figure 1 Proposed Gym Tenancy



1.1 Development Description

The proposed gym is to be located within the existing Warringah Mall shopping centre on level 2 of the exiting building. The site is located with Old Pittwater Road to the south of the site as well as Pittwater road to the east of the site.

The location of the gym within the exiting shopping centre results in significant distant separation to the surrounding residential receivers including approximate distances as follow:

1. To the south of the proposed gym – Residence on Old Pittwater Road, approximately 250 metres from the proposed gym. Existing noise levels include traffic noise levels from Old Pittwater Road and Pittwater Road which carry significant traffic volumes during all times of the day, evening and night.

2. To the east of the proposed gym – Residence on Pittwater Road, approximately 250 metres from the proposed gym. Existing noise levels include traffic noise levels from Pittwater Road which carry significant traffic volumes during all times of the day, evening and night.

Details of the proposed gym location are included in the figure below.

Figure 2 Site Location

2 PROPOSED DEVELOPMENT

The proposed Gym is to be located within the existing Warringah Mall building which is located with an industrial and retail area with no residential receivers neighbouring the site. The closest residential receiver is located to the south and east of the site of approximately 250m from the proposed tenancy as detailed in the figure above.

The site is located within the Northern Beaches Council local government jurisdiction.

3 EXISTING ACOUSTIC ENVIRONMENT

The existing environmental noise levels at the site are predominantly as a result from existing facilities within proximity of the site and traffic noise on Showground Road. Existing receivers within the vicinity of the site include industrial and retail receivers. The closest residential receiver is located 250m to the south of the site and 250m to the east of the site and detailed in Figure 2 above.

As part of this assessment an acoustic survey of the existing acoustic environment at the site was undertaken. The survey included attended noise level measurements at the site, during various times of the day on the 21st September, 2022. During the testing periods of inclement weather have not been included in the assessment.

Attended noise level testing was conducted using a Rion NL-42EX type meter with Serial number 396932 and calibration number C19465. The meter was calibrated before and after testing and no significant drift was recorded.

3.1 Noise Survey Results

The attended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\ (t)}$) as well as the impact from traffic movements ($Leq_{(t)}$). The results of the acoustic survey are detailed in the tables below which have been used as the basis of this assessment.

Table 1 Results of the Attended Noise Survey at the Site

Measurement Location	Time of Measurement	$L_{Aeq,\ 15min}$ dB(A)	$L_{A90,\ 15min}$ dB(A)	Comments
Corner Green Road and Showground Road	6.30am to 6.45 am	64	44	Noise level at the site dominated by vehicle movements on surrounding roadways

4 EXTERNAL NOISE EMISSION ASSESSMENT

This section of the report details the relevant noise level criteria for noise emissions generated on the site once completed.

The relevant authority which provides the required noise level criteria for noise levels generated on the site includes the NSW Environmental Protection Authority's (EPA) Noise Policy for Industry (NPfI).

4.1 NSW Environmental Protection Authority, Noise Policy for Industry

The NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI), previously Industrial Noise Policy, details noise criteria for the control of noise generated from the operation of developments and the potential for impact on surrounding receivers.

The NPI includes both intrusive and amenity criteria which are summarised below.

1. Intrusive noise level criteria, The NPfI states the following:

   'The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the LAeq descriptor), measured over a 15minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.'

2. Amenity noise level criteria, The NPfI states the following:

   'To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.'

   Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

   Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

   The LAeq is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the LAeq, period + 3 decibels (dB), unless robust evidence is provided for an alternative approach for the particular project being considered.

   Project amenity noise level (ANL) is urban ANL (Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level (dB = decibel; dB[A] = decibel [A-weighted]; RBL = rating background noise level).

Noise level used in the assessment of noise emission from the site have been based on the noise level survey conducted at the site and detailed in this section of the report.

Consequently, the resulting noise level criteria are summarised in the table below. The criteria are nominated for the purpose of determining the operational noise limits for the operation of the site including mechanical plant associated with the development which can potentially affect noise sensitive receivers and operational noise levels from the future tenancies. For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. The calculated *Project Amenity Noise Level* includes either the Recommended Amenity Noise Level minus 5 dB(A) plus 3 dB(A) (for a 15 minimum period) or the measured existing Leq noise level – 10 dB if this is greater as determined by the NPfI.

Table 2 Project Noise Emission Requirements

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)
Residence (Suburban)	Day	50	44	64	**49**
	Evening	**40**	44	64	49
	Night	**35**	44	64	49
Commercial Receivers	When in Operation	**65**	52	64	N/A
Industrial Receivers	When in Operation	**70**	52	65	N/A

Note 1: LA90 Background Noise or Rating Background Level including façade corrections
Note 2: Project Noise Trigger Levels are shown in bold

4.2 Noise Impact Assessment

An assessment of noise generated on the site has been undertaken on this section of the report. The assessment of noise levels generated on the site are summaries below:

1. Mechanical Services Equipment –Detailed selections of the proposed mechanical plant and equipment to be used on the site are not available at this time. All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicated that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:
    a. Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
    b. General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flex ducting or internal lined ducting.

    Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

2. Operation of the Gym – Providing the following treatments and controls are included in the design and construction of the gym noise level at all surrounding receivers will comply with the relevant noise level criteria:
    a. All windows within the gyn are to be fixed closed during operation.
    b. All door openings are to include self-closing devices.
    c. No playing of music or the like externally to the building.

    Providing the acoustic treatments and controls detailed in the points above are included as part of the operation of the proposed gym compliance with all relevant noise level emission criteria will be achieved.

Based on the assessment of the proposed noise emissions from the proposed gym providing the recommendations detailed in this section of the report are included in the project the resulting noise levels at all surrounding residential receivers will generally be inaudible and compliance with the required intrusive and amenity requirement of the EPA NPfI will be achieved.

4.2.1 Noise Impact on the Commercial Centre

A detailed assessment of the potential for noise and vibration impact on the adjoining commercial areas of the Warringah Mall has been undertaken and is detailed within the *Westfield Warringah Mall – David Jones Conversion, Acoustic Design Report* with reference 220498_Westfield WM_David Jones Converstion_Acoustic Design Rprt_3.0 which is included in Appendix B of this report.

Providing the details include within the Acoustic Design Report are included in the construction and operation of the proposed gym the resulting noise and vibration impacts to the surrounding commercial areas of the Warringah Mall shopping will comply with the relevant standards.

5 CONCLUSION

This report details the Noise Impact Assessment of the proposed gym tenancy to be located on level 2 of the exiting Warringah Shopping mall.

This report details the required acoustic treatments and controls to be included within the construction and operation of the proposed gym such that compliance with the relevant noise emission criteria based on the NSW Environmental Protection Authorities Noise Policy for Industry are complied with and to mitigate noise impacts on the surrounding areas of the Hills Super Centre.

Proving all recommendations detailed in this report are included in the future design and operation of the gym all noise emissions from the site comply with the EPA NPfI criteria and ensure an acceptable noise impact on the surrounding retail areas of Warringah Mall.

For any additional information please do not hesitate to contact the person below.

Regards

Ben White
Director

Pulse White Noise Acoustics

6 APPENDIX A – GLOSSARY OF TERMS

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L_{A90} value

Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
dB (A)	'A' Weighted overall sound pressure level
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
NR Noise Rating	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
R_w	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data".
R'_w	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, L_P dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, L_W dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Transmission Loss	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

7 APPENDIX B – ACOSUTIC DESIGN REPORT

Westfield Warringah Mall – David Jones Conversion

Acoustic Design Report

Scentre Group
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Sydney NSW 2000

Report number: 220498_Westfield WM_David Jones Conversion_Acoustic Design Rprt_3.0.docx
Date: 26 October 2022
Version: For Issue

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DOCUMENT CONTROL

Project Name	Westfield Warringah Mall – David Jones Conversion
Project Number	220498
Report Reference	220498_Westfield Warringah Mall_David Jones Conversion
Client:	Scentre Group 85 Castlereagh Street Sydney NSW 2000

Revision	Description	Reference	Date	Prepared	Checked	Authorised
1.0	Draft	220498_Westfield Warringah Mall_David Jones Conversion	20 September 2022	Renzo Arango	Ben White	Ben White
1.1	Draft	220498_Westfield Warringah Mall_David Jones Conversion	21 September 2022	Renzo Arango	Ben White	Ben White
2.0	Draft	220498_Westfield Warringah Mall_David Jones Conversion	18 October 2022	Renzo Arango	Ben White	Ben White
3.0	For Issue	220498_Westfield Warringah Mall_David Jones Conversion	26 October 2022	Renzo Arango	Ben White	Ben White

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1 INTRODUCTION

As part of the Stage 2D redevelopment at Westfield Warringah Mall (located at 145 Old Pittwater Road, Brookvale, NSW); it is proposed to undertake refurbishment works at the existing David Jones Tenancy.

These works are aimed at undertaking the following modifications within and around the David Jones Tenancy:

- At Ground Level:
    - Close down entry to David Jones Tenancy at this level, and backfill with new retail tenancy.
    - Implement new fire corridor adjacent to this new tenancy
- On Level 2:
    - Refurbishing existing retail floor into two new tenancies: one new mini major designated as a gym tenancy (approximately 2480 m^2); and a new co-working office tenancy (approximately 2890 m^2).
    - Terrace link adjacent to new tenancies.
    - Existing façade upgrade to include new windows and planting.
    - Building services to suit new spaces.
- New skylights to existing roof structure.
- New bridge connection to adjacent southern carpark.
- New weather roof protection to existing eastern bridge connection to carpark.
- Replace and upgrade existing good lifts to retail passenger lift on north-west corner of new tenancies.

Therefore, this report discusses the acoustic design criteria for the new retail spaces which are part of Stage 2D redevelopment works; as well as relevant acoustic recommendations provided to achieve compliance with the aforementioned criteria.

A glossary of terminology used in this report is provided in Appendix A.

2 ACOUSTIC DESIGN CRITERIA

2.1 External Noise Emissions Criteria

The external noise emissions criteria should be determined in accordance with the relevant acoustic assessment report issued as part of the development application submission for the refurbishment works (i.e. referred herein as the *DA Acoustic Report*)

2.2 Internal Noise Level Criteria

2.2.1 Typical Operating Conditions

Internal ambient noise levels within office and retail areas, are primarily a result of the following:

- Noise emission from the operation of mechanical services (i.e. base building and fit out plant items).
- Environmental noise intrusion via the external façade construction.

It is important that an appropriate ambient noise level is established within the development. For instance, a reduced level of ambient noise is required in certain spaces (e.g. meeting rooms) to achieve good communication throughout the space. A higher level of ambient noise is generally preferable in open plan and retail spaces to ensure a moderate level of acoustic privacy. Too loud a background noise level may, however, lead to communication difficulties and fatigue.

Recommended ambient noise levels and reverberation times for office spaces are detailed within the Australian / New Zealand Standard 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors*". Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this standard.

The projects required internal noise levels from the operation of fit out plant and equipment are detailed in Table 1. Noise levels criteria detailed below are for plant and equipment operating at 'normal maximum operating conditions.

Section 6.18 of AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance.

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met.

The recommended noise levels for different areas of the development are given in terms of equivalent continuous A-weighted noise levels (L_{Aeq}) measured over a 1 minute period.

Table 1 Internal noise level criteria

Type of Occupancy/Activity	Maximum Design Sound Level ($L_{Aeq,t}$)
Check-in/Waiting Areas	45
General Office Areas	45
Gym	50

Notes:

1. *All noise levels are to be free of tonal or annoying characteristics*
2. *Internal noise levels to include the combined noise from environmental noise intrusion as well as building services operations.*

2.2.2 Emergency Operation

According to standard AS/NZS 1668.1:2015, internal noise levels generated by smoke control systems should comply with the following:

> *The noise level in occupied spaces during operation of the smoke control systems (including smoke exhaust fans and air pressurization fans) shall not exceed 65 dBA. Where the internal occupied ambient noise levels exceed 60 dBA, the smoke control systems shall not exceed 5 dBA above the internal occupied ambient noise levels, to a maximum level of 80 dBA.*
>
> *Noise levels in fire-isolated exits and car parks, as well as and smoke control zones served by hot layer smoke control systems shall not exceed 80 dBA.*

2.2.3 Regenerated Noise Levels For Short Term Events

Regenerated (structure-borne) noise from various impacts within the gymnasium (such as weight drops) is likely to result in the largest potential noise impacts on the receivers located above.

Noise arising from the vibration of building structures is typically characterized by low-frequency noise in the spectral region below about 100 Hz. Structure-borne noise should be measured at the location in the room where its effect is considered to be most disturbing. It might often be masked by ambient noise from other sources, making its unambiguous determination difficult or impossible.

A specific set of criteria relating to regenerated noise from gymnasiums are not currently available. The sensitivity of humans with respect to potential annoyance from regenerated noise, however, has been well researched. This is particularly true regarding regenerated noise from underground railways and construction works. Whilst these sources may differ from those associated with this project, the mechanisms are similar. The suggested noise targets for regenerated noise typically take the form of a maximum A-weighted noise level that should not be exceeded during the relevant period of assessment.

Experience with gymnasium developments suggest that assessing the maximum regenerated noise level from impacts caused by dropping weights against the background noise level for the night-time period most accurately quantifies potential impacts. The following criterion results in acceptable outcomes and minimises the risk of adversely affecting receiver amenity:

Commercial: $L_{Amax\ (Fast)} \leq$ Minimum $L_{A90\ (Fast)}$ + 5 dB

Note: In some assessments of regenerated noise, such as railway activity in tunnels below residences, where there is build-up and prolongation of the noise level, the "slow" time weighting is used to assess the regenerated noise level. For the relatively infrequent and sudden impacts associated with the dropping of weights, the "fast" time weighting is thought to be a more conservative and appropriate time weighting for the assessment of this potential noise source.

Given that the nearest affected premises below and adjacent to the proposed gymnasium are commercial tenancies, then the regenerated noise criterion is defined as follows:

Commercial: $L_{Amax\ (Fast)} \leq 45 - 50$ dBA

2.3 Reverberation Times

Reverberation time refers to the amount of time required for the sound field in a space to decay by 60 dB and is given the abbreviation of RT60. In simple terms this means the amount of time it takes for sound energy to travel around a room before being absorbed by the surface finishes and air. Closed spaces that have little sound absorbent material have long reverberation times (such as sports halls), and very absorbent rooms have short reverberation times (such as movie theatres)

Reverberation time is important because it affects how well speech is understood and influences the acoustic ambience. In a reverberant space, once a person is a relatively short distance away from the speaking person, the reverberant sound level is as loud as the direct sound from their voice and, because of the time delay in the reflected sound, speech intelligibility is compromised. In extreme cases it may be necessary to talk more slowly in order to be understood.

Reverberation control is necessary for two important reasons:

- Excessive reverberation makes speech more difficult to follow as the sounds of one word are blurred into the next.
- A noise source, such as air-conditioning equipment or even people talking, will generate greater sound pressure levels in a reverberant space because the sound energy takes longer to decay.

A noise source in a "lively" room can be, in practice, up to approximately 5-7 dBA louder than in an acoustically "dead" room. Therefore, it is important when designing "quiet" office spaces that the surface area of sound absorptive finishes is maximised. The table below details the required reverberation times for the different areas in the fit out based on the recommendations given in standard AS/NZS 2107:2016.

Table 2 Recommended reverberation times

Type of Occupancy/Activity	Project Design Reverberation Times (s)
Check in/ Waiting Areas	Refer to Note 1 Target of 1.4
General Office Areas	Refer to Note 1 Target of 0.9
Gym	N/A

Notes:
1. Reverberation times in open plan offices should be minimised where possible for noise control.

2.4 Sound Insulation Requirements – Partitions

This section of the report details the minimum sound insulation requirements for partitions.

The following factors are considered when determining the required sound insulation performance of partitions:

- Proposed activities to be undertaken within the refurbished spaces.
- Areas which are separated by a partition and the required privacy of each space.
- The base building constructions, including services reticulation.
- The construction of ceilings within adjacent spaces. Where ceilings are perforated, a slab-to-slab or slab-to-roof partition construction is advised.

- Determination of privacy between spaces. This can be undertaken using the recommendations given in standard BS 8233:1999, and includes recommendations for various levels of voice. When confidential privacy is required rather than normal privacy, the RW rating of the wall is increased. The design methodology is summarised in Table 3

Table 3 Calculations of speech requirements

Design Vocal Effort within the Source Room	Speech Privacy Level to be Achieved in the Adjoining Space	Privacy rating required = Dw + LA[1] = R'w - 10 log (S/V) +LA where RT is approx. 0.5s
Normal	Normal	75
	Confidential	81
Raised	Normal	81
	Confidential	88
Loud	Normal	88
	Confidential	94

Notes:

1. *LA is the ambient noise level in the receiving room, and for the purposes of establishing the weighted noise reduction (Dw) between adjoining spaces, is that recommended by standard AS/NZ 2107:2016, provided in Table 1 of this Standard, and Table 1 of this report.*

Based on the table above a summary suitable partitions performance includes the following:

- Rw 35 partition will provide a separation which results in noise from normal conversations being audible between spaces but does not generally include information. That is conversations will be 'muffled'. This is a generally a suitable separation between office and corridor areas.

- Rw 40 partition will provide a separation which results in noise from normal levels of speech being confidential between spaces. That is conversations may just be audible but will contain no information.

- Rw 45 partitions will provide a separation which results in noise from normal levels of speech not been generally audible as well as noise from loud levels of speech being audible between spaces but does not generally include information. This separation is generally used for the separation of general private offices.

- Rw 50 partitions will provide a separation which results in noise from normal levels of speech being inaudible between spaces as well as noise from loud levels of speech being 'muffled' between spaces but does not generally include information. This level of separation is typically used for executive offices.

- Rw 55 partitions will provide a separation which results in noise from all levels of speech being inaudible other than the loudest noise levels which may be muffled but there will be information. This level of separation can be used for audio visual rooms and the like.

Based on the discussions above the projects required acoustic performance for partitions within the refurbished spaces are detailed in Table 4. Additionally, sound insulation requirements for individual partitions have been designated in Appendix B.

Table 4 Recommended partition performances

Type of Occupancy/Activity	Required Acoustic Separation
Check-in/Waiting Areas	Rw 40
General Office Areas	-
Gym	Rw 50

Notes:
1. *Partitions with a rating of Rw 50 or greater are required to be constructed slab to slab or slab to roof.*
2. *Recommended partition constructions are included in Appendix B.*
3. *Operable walls to include an above ceiling bulkhead.*

2.5 Sound Insulation Requirements – Glazed Partitions

Where there is an architectural requirement to include glazed partitions, or an element of a partition to be glazed, the acoustic performance of the partition can be compromised. In these areas it is practical to accept a reduction in the overall acoustic performance of a partition such that the architectural performance of the space can be achieved.

Where glazing is proposed for a partition the following acoustic performances can be expected:

- 6.38mm laminated glass – Rw 30
- 10.38mm laminated glass – Rw 35
- Double glazed systems – Rw greater than 35.

Based on the discussions above the recommended glass partition constructions for the project are detailed in the table below.

Table 5 Recommended glass partitions

Type of Occupancy/Activity	Glass Type	Acoustic Performance
Glass to common Mall Area	10.38 mm Laminated	Rw 35

2.6 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"* (AVTG). By considering typical vibration events related to gym activities, this type of impact can be further categorised and assessed as follows:

- Impulsive vibration - up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 6).
- Intermittent vibration - such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 7).

Regarding the VDV criteria summarised in Table 7, these criteria are "dose" based criteria which are determined by both vibration level and duration. They are therefore dependent on the level of patronage of the gymnasium and the predominate use of the space. The VDV criteria are more applicable to complaint-based compliance assessments and can be assessed by longer term vibration monitoring. The practical considerations of how to exclude vibration in the building caused by doors slamming, building occupant activity in their apartments, etc. would however need to be overcome before a VDV assessment could be carried out.

Table 6 Impulsive RMS weighted acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Offices, schools, educational institutions, and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 7 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

For feasible simplicity, vibration from typical activities will be assessed against criteria for impulsive vibration, which is assessed on the basis of acceleration levels. Such an assessment procedure is inherently conservative, since the criteria for impulsive vibration is more stringent than that for intermittent vibration and assumes essentially continuous exposure to the vibration level. The levels appropriate for this development are given in Table 7.

Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2. The weighting used is Wb. A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02 m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 s.

The assessment criteria for impulsive vibration, presented in different units, are shown below in Table 8 below.

Table 8 Criteria for exposure to impulsive vibration, presented in different units (Z axis only) [1]

Location	Assessment period	[2] RMS acceleration (m/s^2) & vib. accel. value (dB re 10^{-6} m/s^2)		[3]RMS velocity (mm/s) & vib. velocity value (dB re 10^{-9} mm/s)		[4] Peak velocity (mm/s)	
		Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Offices, schools, educational institutions and places of worship	Day or night-time	**0.64 (116 dB)**	**1.28 (122 dB)**	**13.0 (142 dB)**	**26.0 (148 dB)**	**18.0**	**36.0**
Workshops	Day or night-time	0.64 (116 dB)	1.28 (122 dB)	13.0 (142 dB)	26.0 (148 dB)	18.0	36.0

Note 1: From "Assessing Vibration – A Technical Guideline" (AVTG)
Note 2: Values derived from z-axis critical frequency range 4–8 Hz. Where required, a more detailed analysis can be conducted as per BS 6472–1992.
Note 3: Values given for the most critical frequency range >8 Hz assuming sinusoidal motion. Where required, a more detailed analysis can be conducted as per AS 2670.2–1990.
*Note 4: Sufficient justification should accompany the use of a peak velocity approach if used in an assessment. Note that the crest factor of the source vibration **must** be considered – and for impulsive sources can be 10 or higher.*
Note 5: Specific values depend on social and cultural factors, psychological attitudes and expected degree of intrusion.

3 ACOUSTIC RECOMMENDATIONS

3.1 Electrical Skirting

Where electrical skirting penetrates a partition with a design performance of Rw 40 or higher, the skirting should be filled/packed with insulation material (with 15 kg/m^3 minimum density when uncompressed) for a minimum distance of 600 mm either side of the partition.

3.1.1 Internal Surface Finishes

3.1.1.1 General Recommendations

To control the reverberation times within areas of the fit-out, sound absorptive surface finishes are required. This can include the walls, floors and or ceiling finishes.

Details of the recommended surface finishes within various areas of the project are summarised in Table 9.

Table 9 Recommended sound absorptive surface finishes

Internal Area	Recommended Surface Finishes
Servery	No additional acoustic surface finishes recommended.
General Office Areas	Recommended to include a carpet floor finish. In the event ceiling tiles are to be included to the office areas ceiling tiles should include an NRC of 0.65 and a CAC of no less than 36.
Gym	No additional acoustic surface finishes recommended.

Notes:
1. *If sound absorptive ceiling tiles are to be installed, these should also achieve a minimum CAC rating of 38.*

Where wall surface finishes are nominated, the following list of products may be used:

- Sontext products
- Acoufelt products
- CSR Martini products
- Eco board
- Eco panel
- Ecoustic panels by Instyle.
- Other products with a minimum NRC of 0.65

3.1.1.2 Workstations

Construction of internal partitions separating workstations will have the greatest impact on privacy between users. The recommended design and construction of partitions separating users within the open plan office areas includes the following;

- Partitions between workstations to be constructed to a height of approximately 1.2m, such that there is a line of sight barrier between uses when seated.
- Partitions to be constructed from an absorptive material (or absorptive surface finish) with a minimum NRC rating of 0.6. Products which can be used include (but is not limited to) the following:
    - Ecosorb
    - Acoufelt products
    - CSR Martini products
    - Echo board
    - Others with a minimum NRC of 0.6.
- Details of the required work station design would be undertaken by the future tenant as part of the office fit out design.

3.2 Building Services

3.2.1 Internal Noise Emissions

To achieve compliance with the internal noise level criteria discussed in Section 2.2, it is advised that the building contractor should implement acoustic treatments to all building services. This applies to typical operational conditions as well as emergency operation.

For mechanical services, details of the required acoustic treatments to supplementary plant and equipment is to be provided once selections are finalised. Treatments may include internal lining of ductwork, installation of insulated flexible ductwork, acoustic silencers and the like.

For hydraulic services, it is advised that any wastewater (stormwater or wastewater) pipes located within the ceiling cavity of the fit out (all areas) are required to be acoustically lagged using a 4kg/m^2 loaded vinyl and open cell foam. Suitable external lagging products include:

- Pyrotek Soundlag 4525C.
- Acoustic Supplies Vibralag.

3.2.2 External Noise Emissions

Furthermore, acoustic treatments should also be implemented for external noise emissions by building services (including mechanical services). These treatments should aim at achieving compliance with the external noise level criteria discussed in the relevant DA Acoustic Report (refer to Section 2.1).

3.2.3 Treatments For Wall Penetrations

Acoustic seals shall be provided where any pipes, ducts and conduits penetrate plantrooms or critical floor and ceiling slabs or acoustic walls.

At penetrations where mechanical fixing of the pipe or duct to the building structure is not required, allow clearance between the pipe (or duct wall) and the structure penetration of approximately 10% of the pipe diameter (or smallest duct cross-sectional dimension) - in the case of ductwork this clearance should not exceed 20 mm.

Seal the clearance gap with one of the following materials where appropriate (subject to fire rating requirements) and caulk with a non-hardening mastic or synthetic rubber sealant.

Gap filling materials:

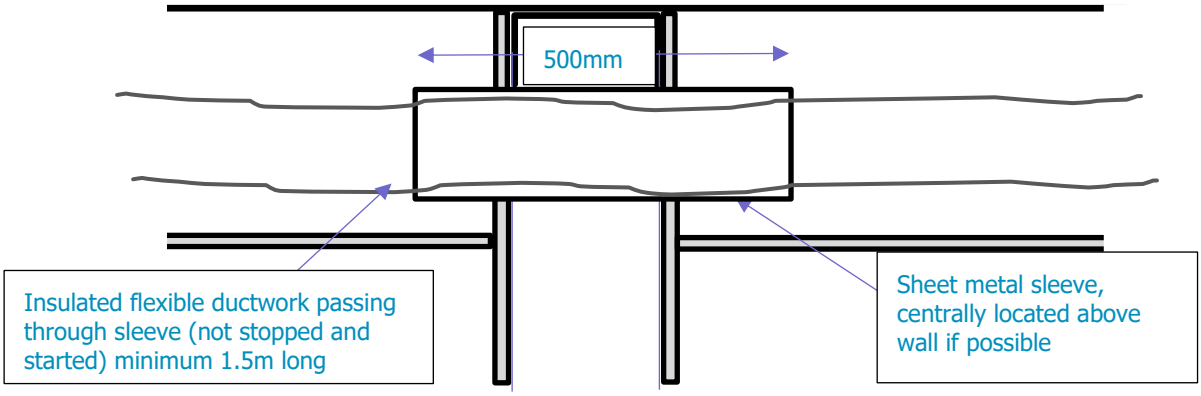
- Closed cell flexible foam
- Fibreglass or rock wool

Any gaps between ductwork, fire dampers and wall penetrations should be packed with mineral wool of appropriate service temperature and sealed off with vermiculite plaster or other approved sealant. Details of penetrations of fire or smoke rated partitions must be checked with the Fire Consultant.

3.2.4 Flexible Duct Penetrations

No flexible ducts shall penetrate full height acoustic walls as these cannot be sealed effectively. Where penetrations of full height walls are unavoidable, the following penetration detail in Figure 1 shall include as part of the mechanical services installation.

Figure 1 Flexible duct penetrations through full height walls



3.2.5 Transfer Ducts

Any transfer ducts are to be acoustically insulated with a minimum of 50mm. Location of the transfer ducts should be above the door, being the weakest component of the door.

Transfer ducts should comprise the following duct components:

- Minimum of two internally lined bends
- Minimum of 2 m of straight internally lined ductwork

Also, transfer duct outlets should not face each other and should be installed at least 4 m apart.

3.2.6 Vibration Isolation

Mechanical contractor to ensure all plant and equipment to be installed is required to be vibration / resiliently isolated from the building structure, such that internal noise levels recommended in this report are complied with.

3.3 Façade Windows

It is our understanding that the existing solid façade on Level 2 will be retained. This comprises brickwork. However, openings will be implemented to accommodate façade windows.

Therefore, it is advised that these windows achieve a minimum sound insulation performance of Rw 35. Example of glazing element that achieve this performance is 10.38mm laminated glass. Additionally, these windows should comprise the following:

- Solid non-hollow frames: Either metal frames fully packed with insulation or grout; or solid timber frames.
- Rubber acoustic seals implemented to window/door frames (such as Q-Lon seals), or fin rubber seals with deep C channels as part of the window track.

3.4 Gym Tenancy

Table 10 below summarises the floor treatments required for the gym tenancy. The treatments are classified in accordance with typical gym activities.

No weight drops are permitted unless otherwise noted in Table 10. For lifting platforms, weights up to 100 Kg can be dropped at maximum heights of 150mm. However, such activities should be discouraged by management and noted in the Plan of Management.

For lifting platforms, and areas designated for the use of dumbbells, two floor treatment options are recommended: a lightweight floating floor system and a jack up raised concrete floor system. Details for the lightweight floating floor system are provided in Appendix D. This system can be implemented in individual floor modules for each weight rack and weight drop area. Alternatively, a jack up raised concrete floor system can be installed for the whole floor area which requires treatment. An example of such raised concrete floor construction is shown in Figure 2.

Table 10 Overall Flooring Requirements

Activity or Space	Recommended Flooring Systems	Associated Management Controls
Lobby, Reception and General Walking Areas	Standard flooring	No weight drops permitted
Amenities (Change Rooms, Showers and Toilets)	Standard flooring	No weight drops permitted
Pilates	8mm rubber flooring tile or 10mm rubber underlay beneath hard floor finish	No weight drops permitted
Aerobic / Cardio Exercises (without free weights)	8mm rubber flooring tile or 10mm rubber underlay beneath hard floor finish	No weight drops permitted
Aerobic / Cardio Exercises (with free weights), including battle ropes	Regupol 4080	No more than 20kg drop, from 300mm height.
Boxing	Standard flooring	No weight drops permitted

Activity or Space	Recommended Flooring Systems	Associated Management Controls
Lifting platforms (including squats)	Option 1: Lightweight floating floor system Option 2: Jack-up raised concrete floor (refer to Figure 2)	Weight drop limited as per restrictions discussed in Section 3.4.
Stationary Cardio Equipment Spin Exercise Bikes	8mm rubber flooring tile or 10mm rubber underlay beneath hard floor finish	No weight drops permitted
Pin and Plate Loaded Machines	Machines should be installed on 15mm rubber flooring Machines should also be internally sprung with Embelton NXS-14 springs. Refer to Figure 3.	No weight drops permitted
Indoor Athletic Track	10mm rubber flooring underneath synthetic grass	No weight drops permitted
Areas for Use of Dumbbells	Option 1: Getzner G-Fit Shock Absorb Extreme 75mm + 15mm Topping Tile. Option 2: Lightweight floating floor system. However, it is not required to divide the floating floor into modules. Option 3: Jack-up raised concrete floor (refer to Figure 2)	No more than 30kg drop, from 300mm height.

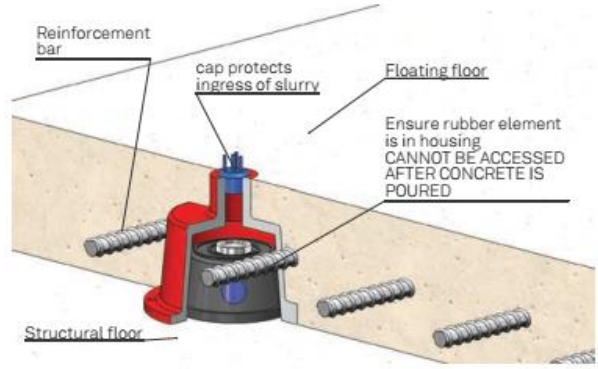
Pin and plate loaded machines should be internally sprung as shown in Figure 3. Additionally, machines should be installed on 15mm rubber flooring.

Only the following areas do not require specific floor treatments:

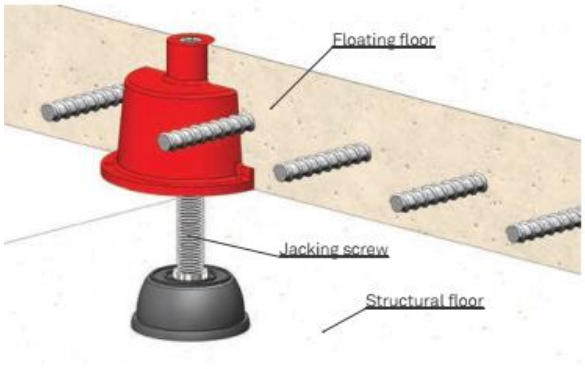
- Lobby, reception and general transit areas.
- Amenities (change rooms, showers and toilets).
- Boxing area.

Finally, please note it is the responsibility of the contractor to confirm number and location of spring mounts. As a result, contractor should confirm with structural consultant that resonance frequency of floating floor is within acceptable margins with respect to resonance frequency of floor slab.

Figure 2 Example of jack up floating floor system

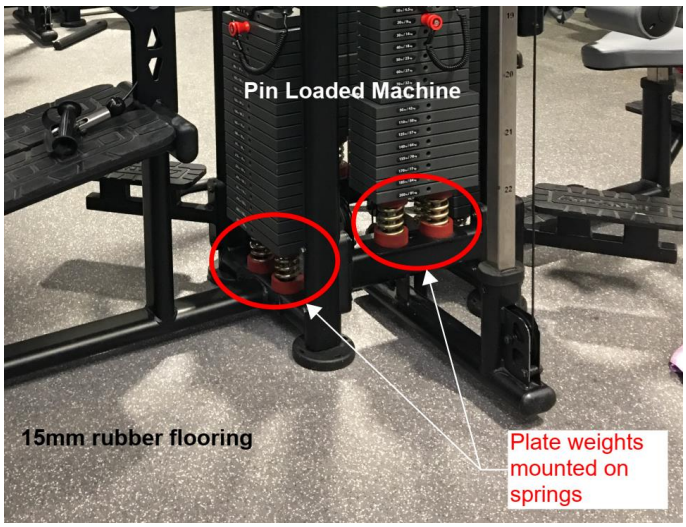


CEFM2 JACK-UP FLOATING FLOOR LOWERED



CEFM2 JACK-UP FLOATING FLOOR RAISED

Figure 3 Recommended treatments for pin and plate loaded machines



APPENDIX A: ACOUSTIC TERMINOLOGY

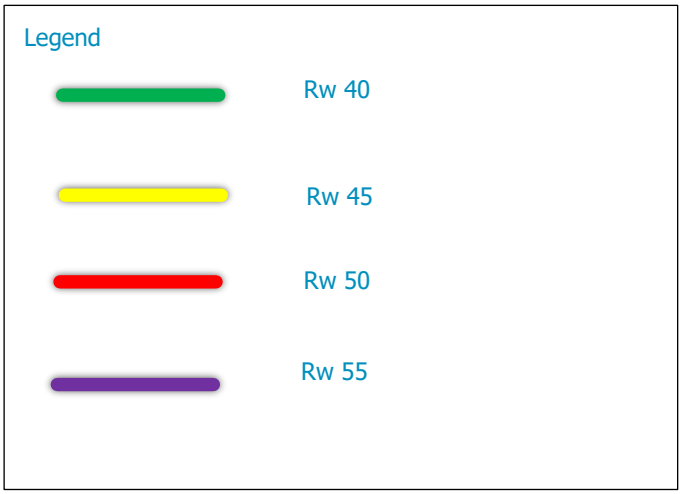
The following is a brief description of the acoustic terminology used in this report.

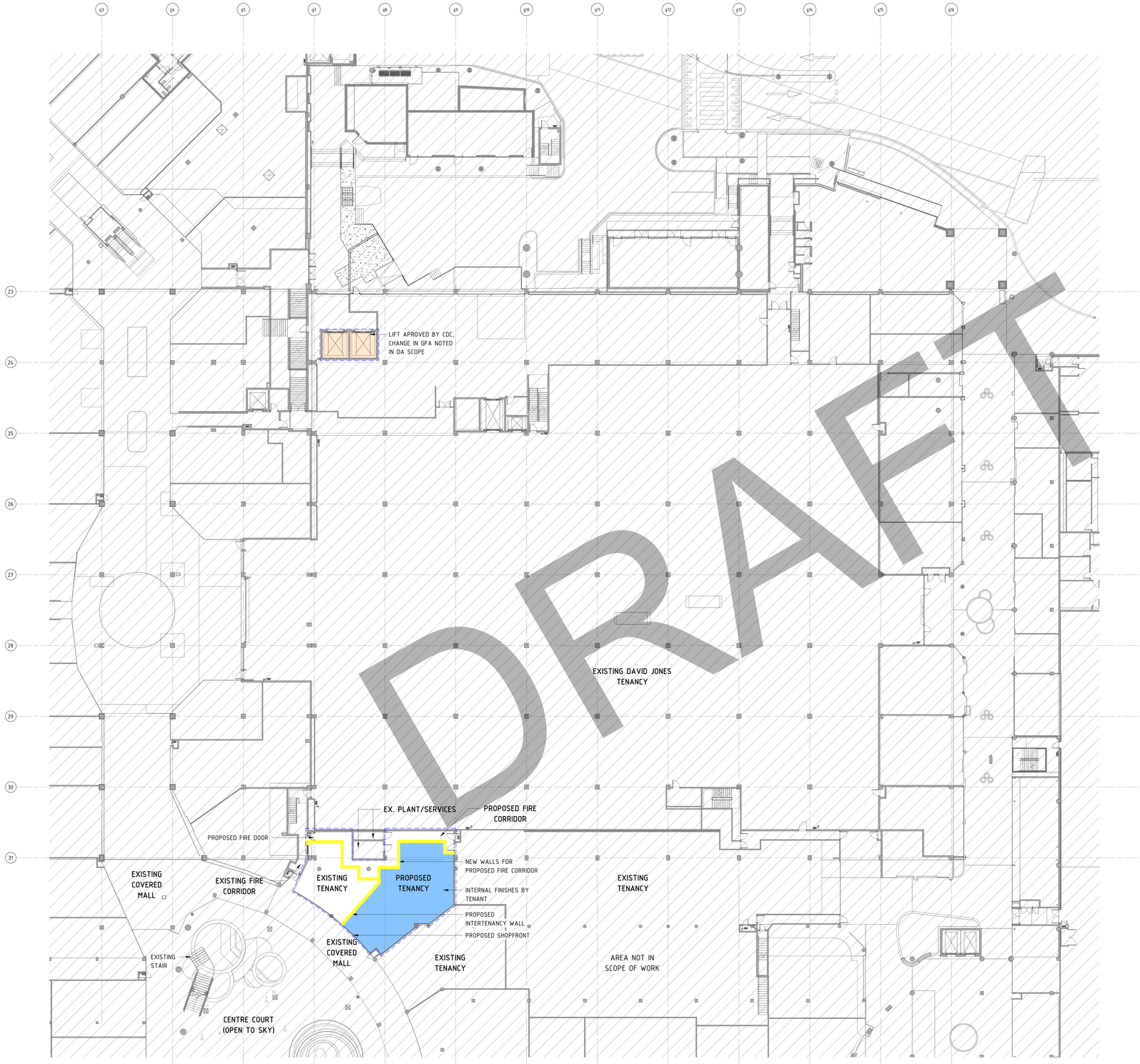
Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

APPENDIX B: MARK-UP OF INTERNAL SOUND INSULATION REQUIREMENTS





1 STAGE 2D PROPOSED PLAN - GROUND LEVEL
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SDC-01.0811 [A]

SCOPE LEGEND

- AREA NOT IN SCOPE
- PROPOSED TENANCY AREA
- PROPOSED COMMON MALL AREA
- PROPOSED ROOF
- PROPOSED VERTICAL CIRCULATION

STAGE 2D GFA MODIFICATIONS

LEVEL	LOST AREA	GAINED AREA	TOTAL INCREMENTAL
GROUND	-24.15 m²		-24.15 m²
LEVEL 1	-24.15 m²		-24.15 m²
LEVEL 2	-561.29 m²		-561.29 m²
TOTAL	-609.59 m²		-609.59 m²

Rev	Date	By	Chk	Description
A	25/08/2022	PS	LC	ISSUE FOR DA REVIEW

SITE ADDRESS : 145 OLD PITTWATER ROAD, BROOKVALE NSW 2100

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WARRINGAH

STAGE 2B DEVELOPMENT APPLICATION

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Phone (02) 9358 7000 Fax (02) 9028 8500
GPO Box 4004 Sydney NSW 2001
ACN 000 267 265

Title

STAGE 2D PROPOSED PLAN - GROUND LEVEL

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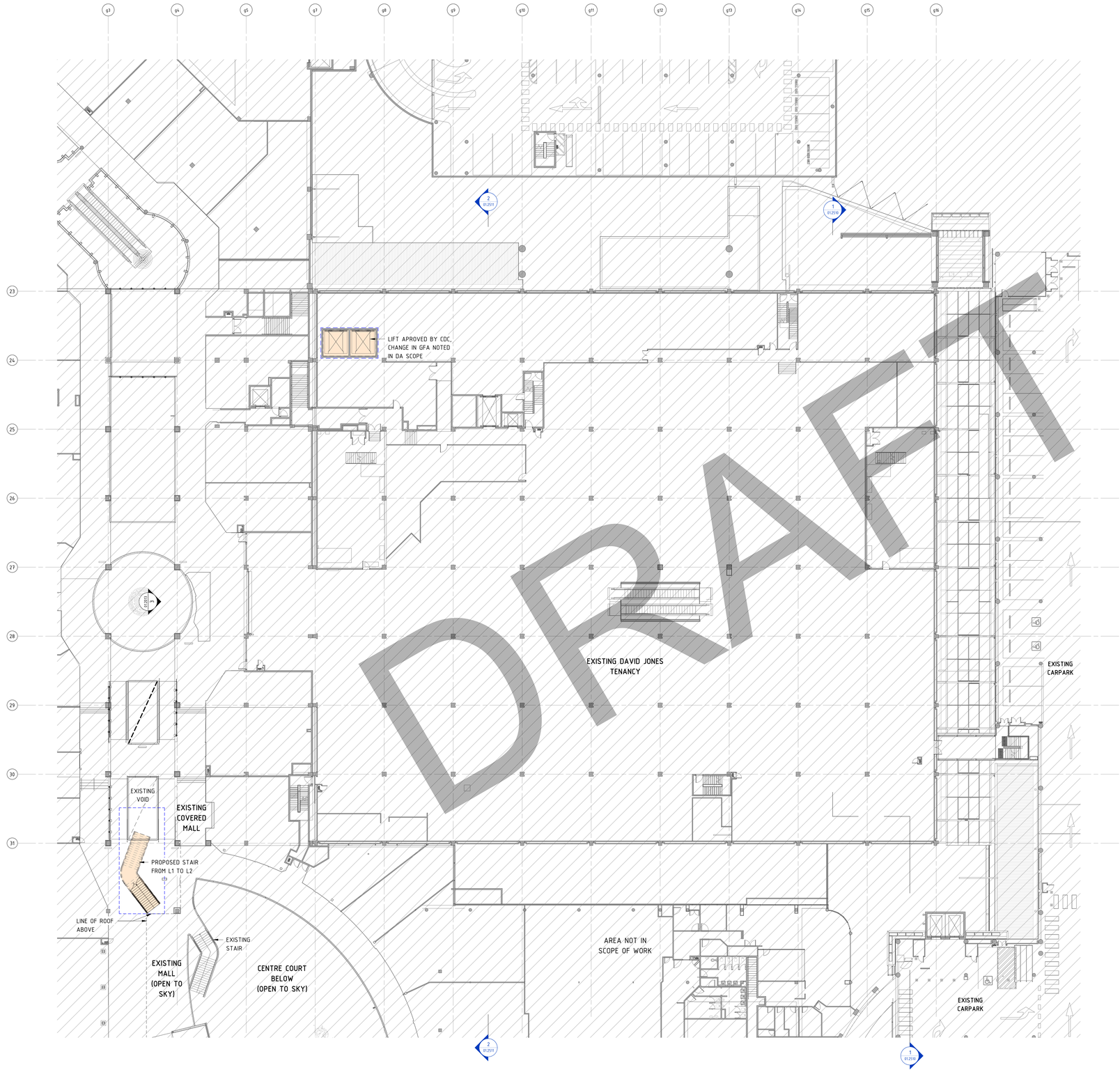

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1 : 200

SDC-01.0812 [A]

SCOPE LEGEND
AREA NOT IN SCOPE
PROPOSED TENANCY AREA
PROPOSED COMMON MALL AREA
PROPOSED ROOF
PROPOSED VERTICAL CIRCULATION

STAGE 2D GFA MODIFICATIONS			
LEVEL	LOST AREA	GAINED AREA	TOTAL INCREMENTAL
GROUND	-24.15 m²		-24.15 m²
LEVEL 1	-24.15 m²		-24.15 m²
LEVEL 2	-561.29 m²		-561.29 m²
TOTAL	-609.59 m²		-609.59 m²

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STAGE 2D PROPOSED PLAN - LEVEL 01

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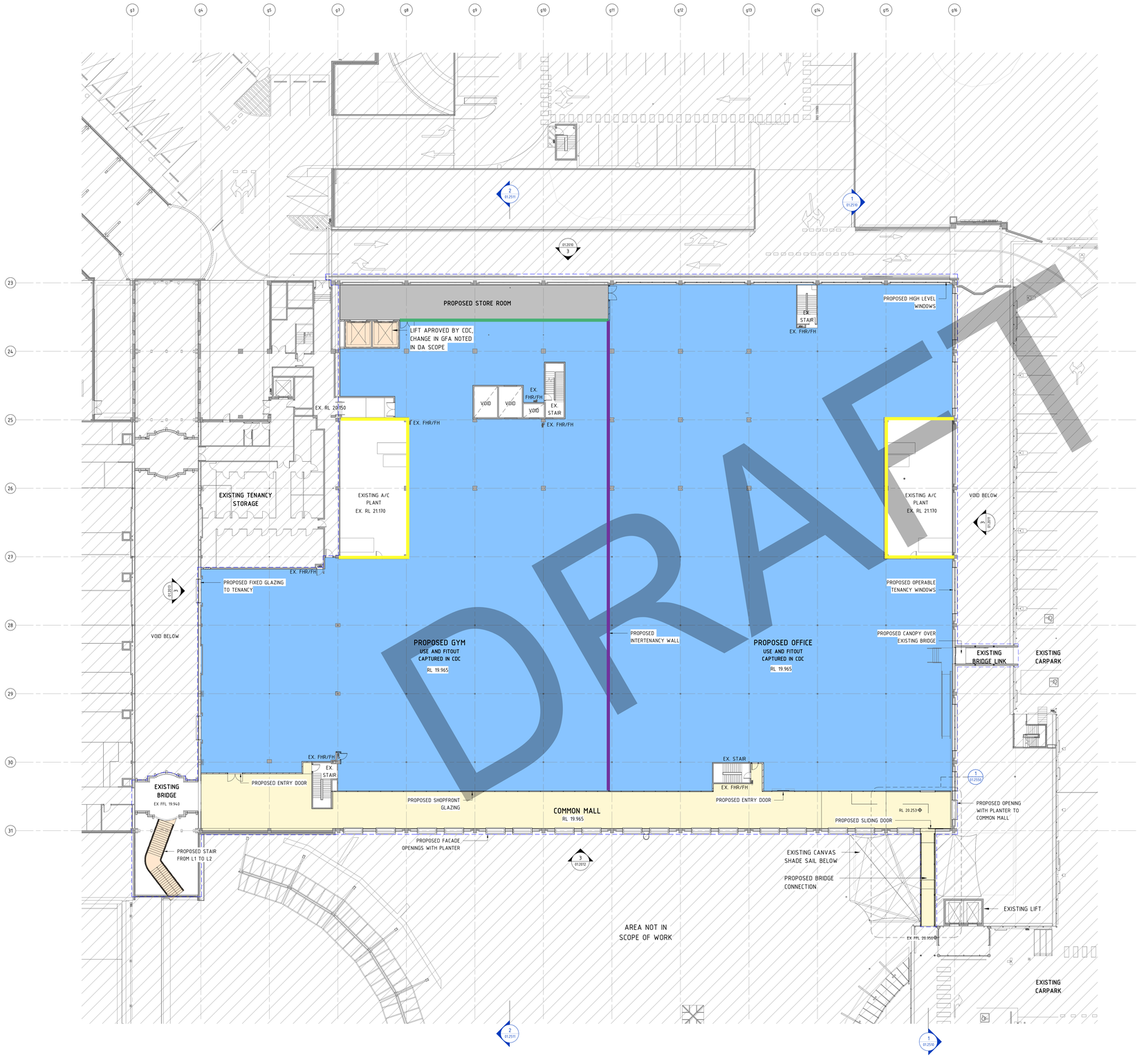

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SDC-01.0813 [A]

SCOPE LEGEND

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- PROPOSED TENANCY AREA
- PROPOSED COMMON MALL AREA
- PROPOSED ROOF
- PROPOSED VERTICAL CIRCULATION

STAGE 2D GFA MODIFICATIONS

LEVEL	LOST AREA	GAINED AREA	TOTAL INCREMENTAL
GROUND	-24.15 m²		-24.15 m²
LEVEL 1	-24.15 m²		-24.15 m²
LEVEL 2	-561.29 m²		-561.29 m²
TOTAL	-609.59 m²		-609.59 m²

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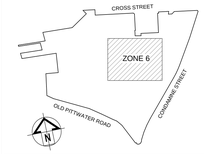

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APPENDIX C: TYPICAL WALL TYPE CONSTRUCTIONS

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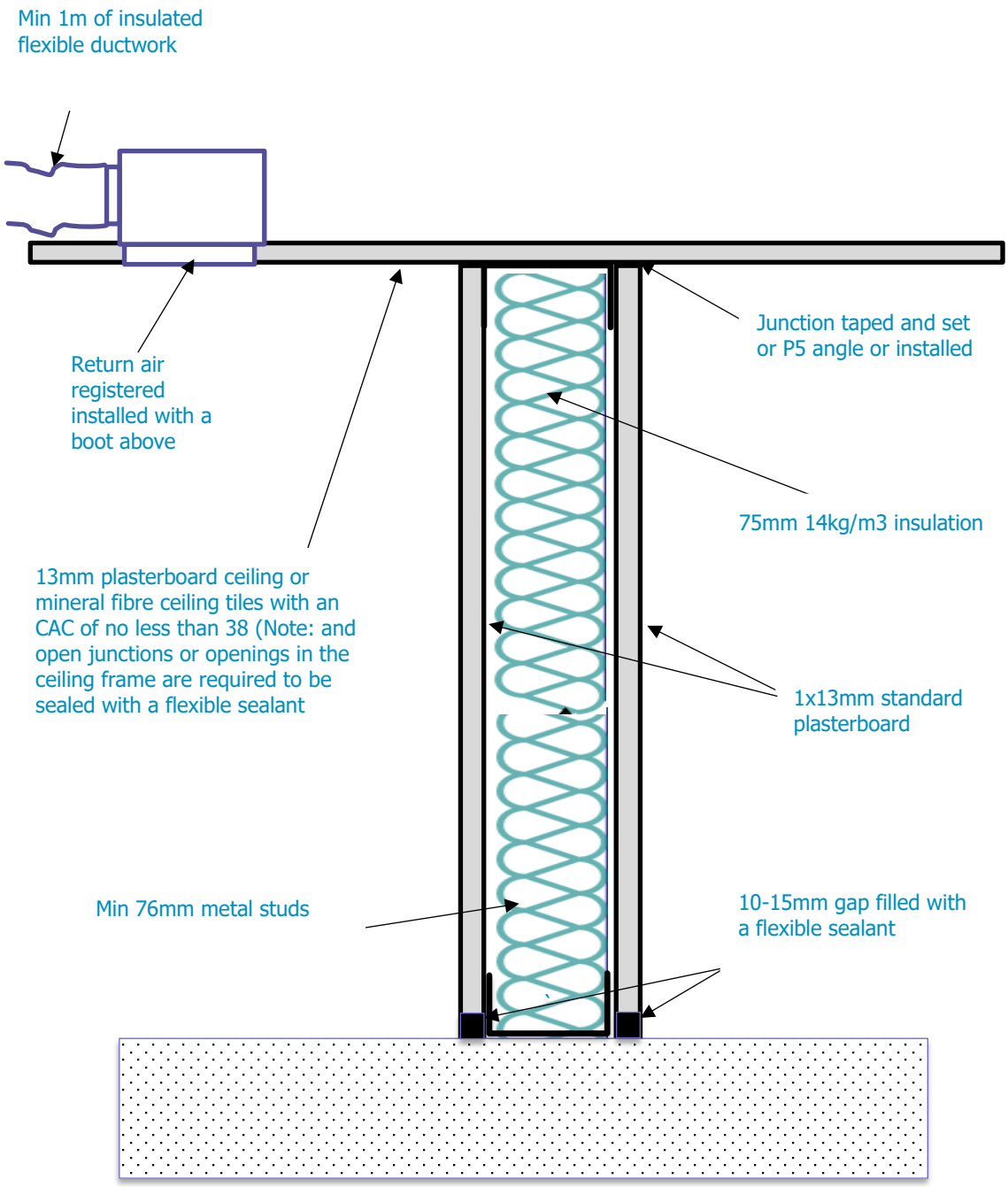

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Date: September 2022

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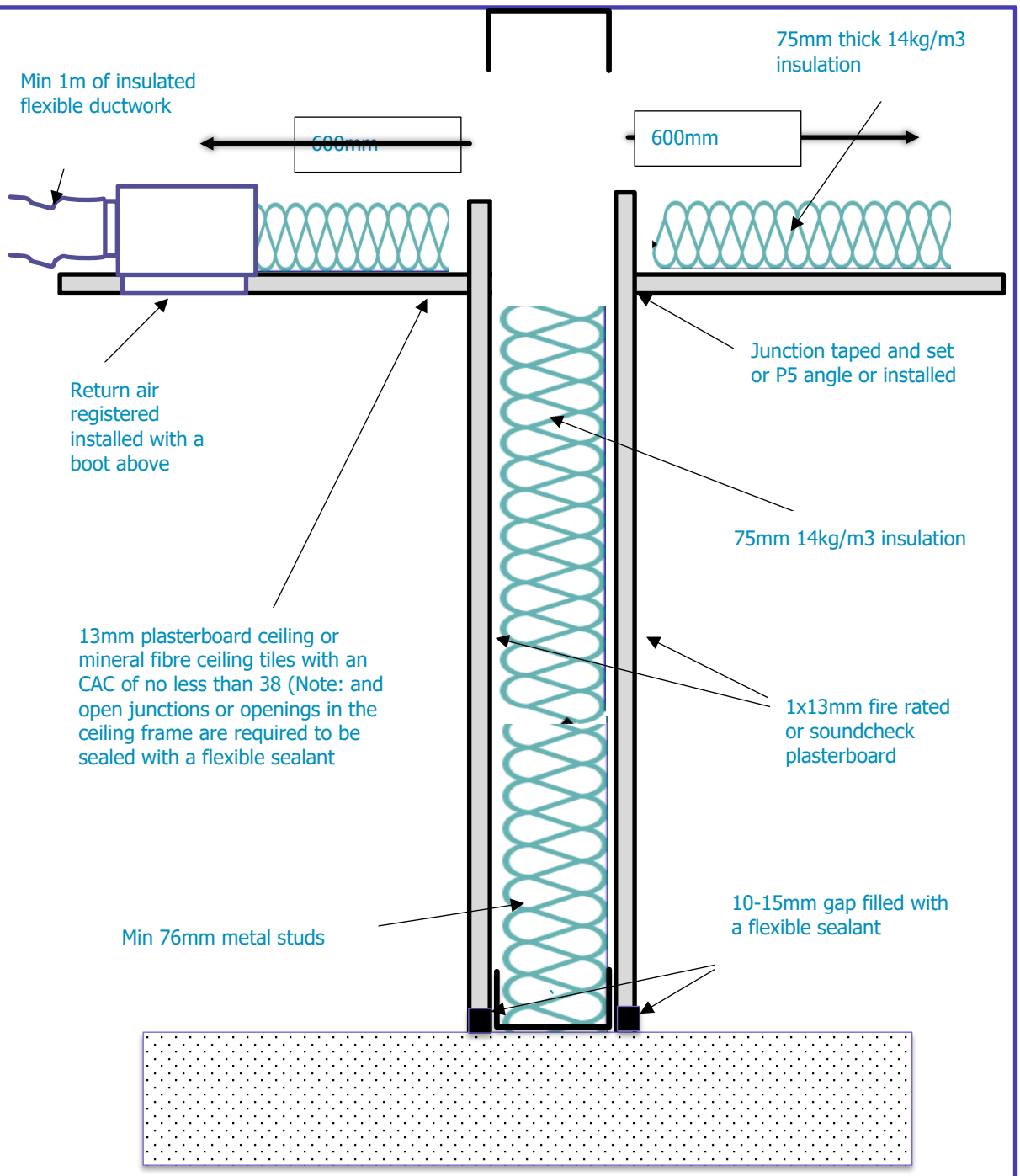
85 Castlereagh Street
Sydney NSW 2000



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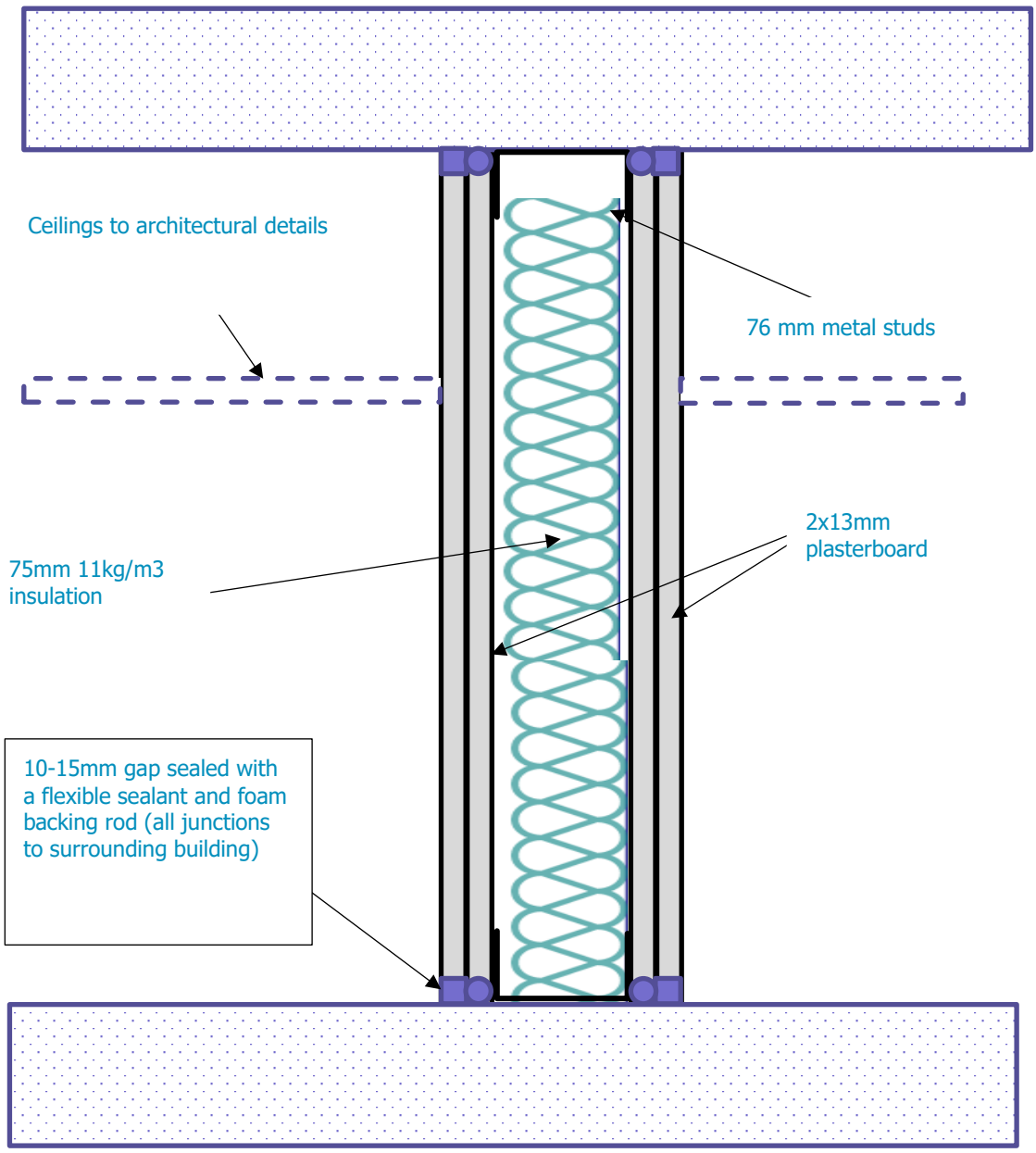

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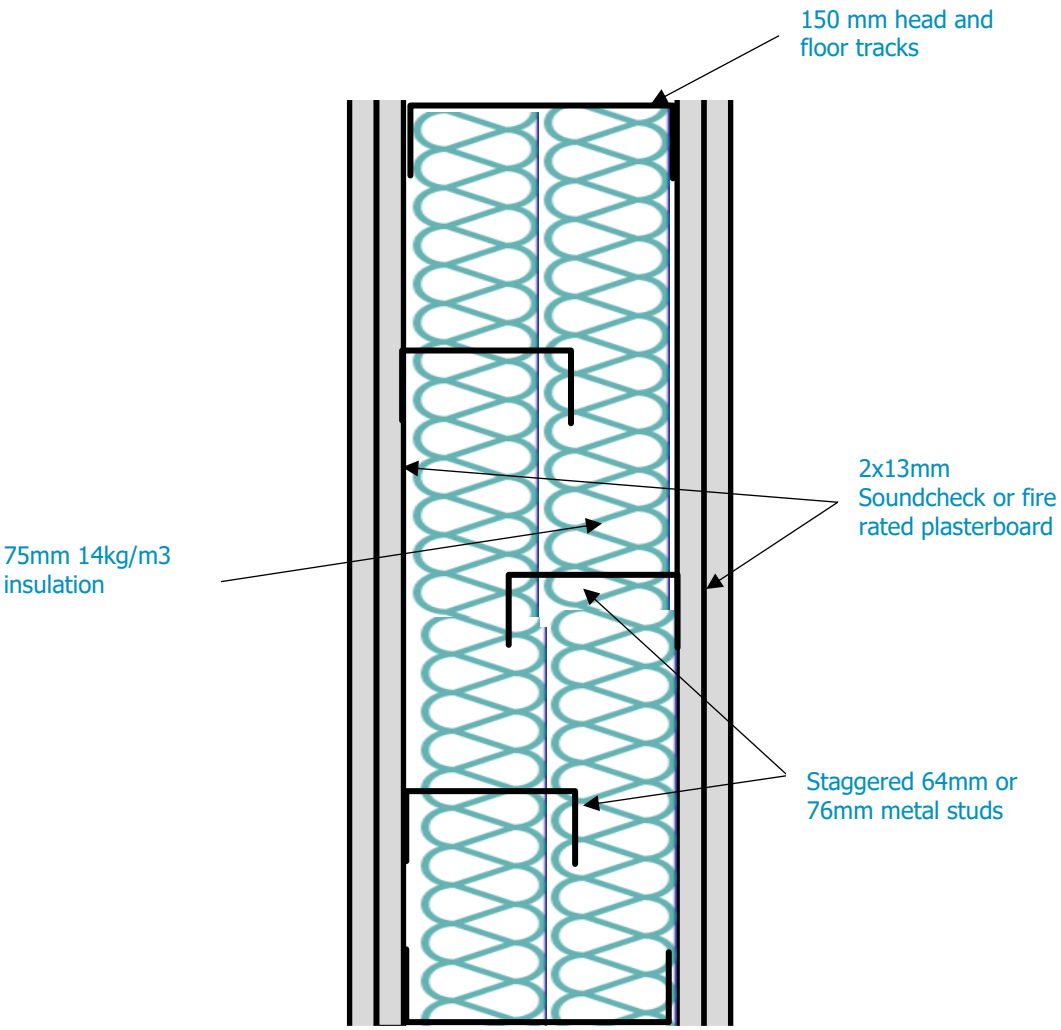
85 Castlereagh Street
Sydney NSW 2000

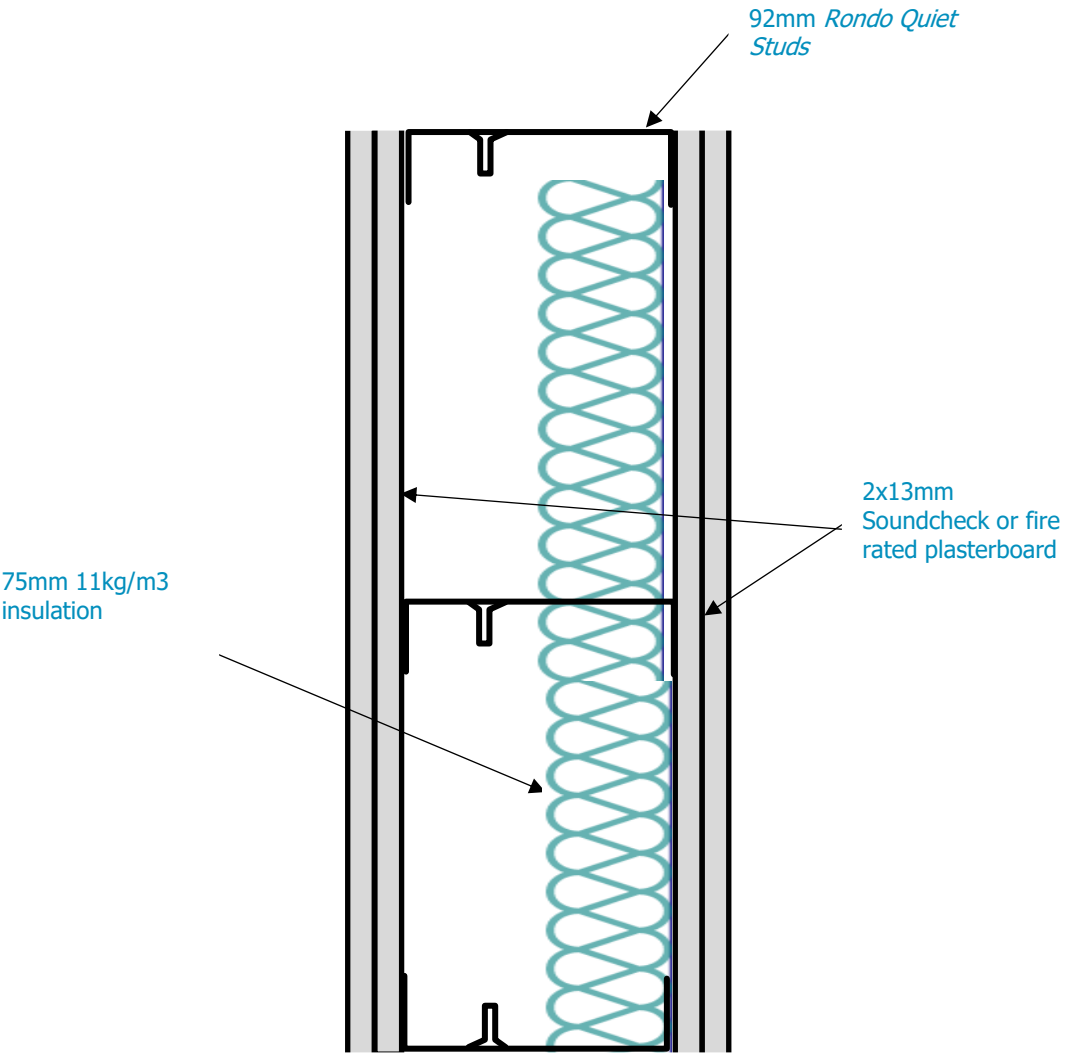


Rw 55 Partitions with Impact Rating (option 1) (Section Plan)

Project:	Drawing Number
220498	PWNA004

Date: September 2022	Drawn: BW

Scentre Group
85 Castlereagh Street
Sydney NSW 2000



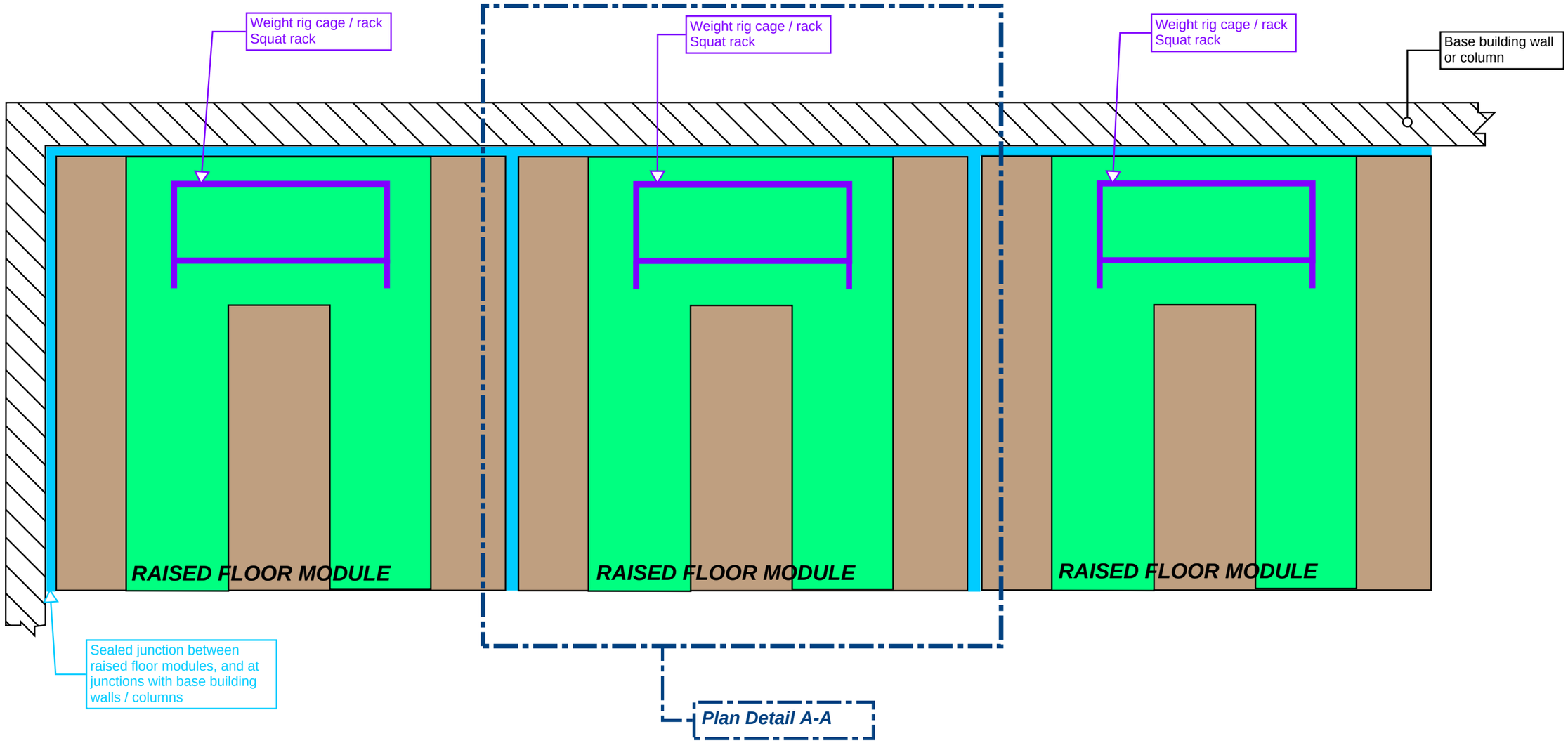
Rw 50 Partitions with Impact Rating (option 1) (Section Plan)

Project:	Drawing Number
220498	PWNA005

Date: September 2022	Drawn: BW

APPENDIX D: DETAILS FOR LIGHTWEIGHT FLOATING FLOOR SYSTEM

DETAILS FOR LIGHTWEIGHT FLOATING FLOOR CONSTRUCTION



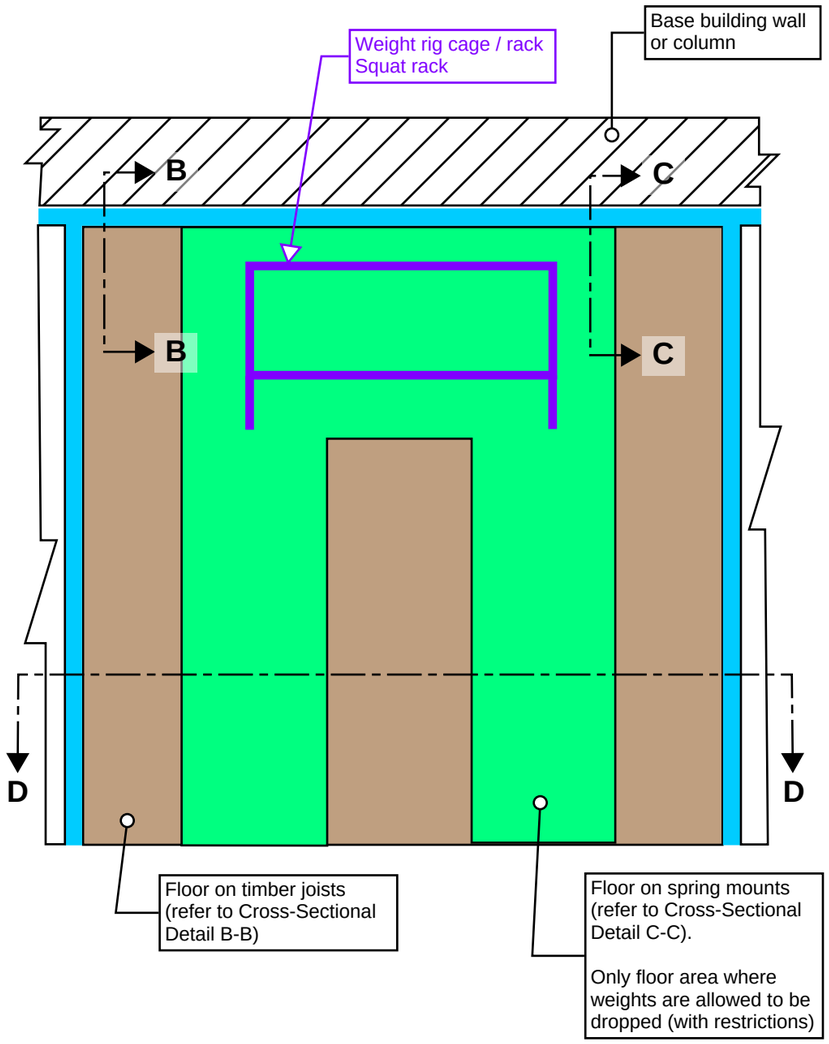
Notes

1.- Contractor to confirm number and location of spring mounts. As a result, contractor should confirm with structural consultant that resonance frequency of floating floor is within acceptable margins with respect to resonance frequency of floor slab.

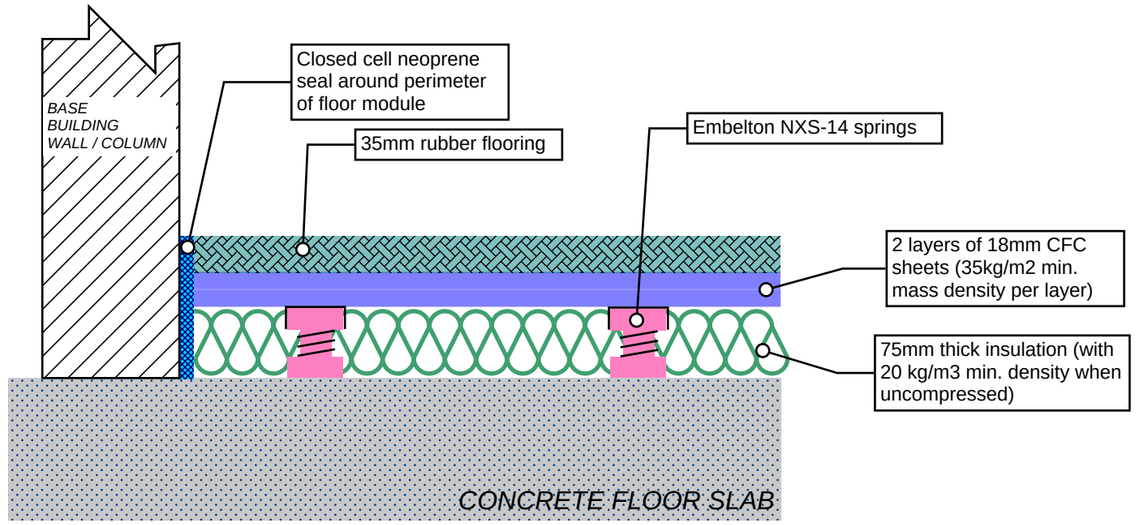
2.- Weight rig cage / rack should only be installed on floating floor area mounted on springs.

3.- Weights should only be dropped (with restrictions) within floating floor area mounted on springs

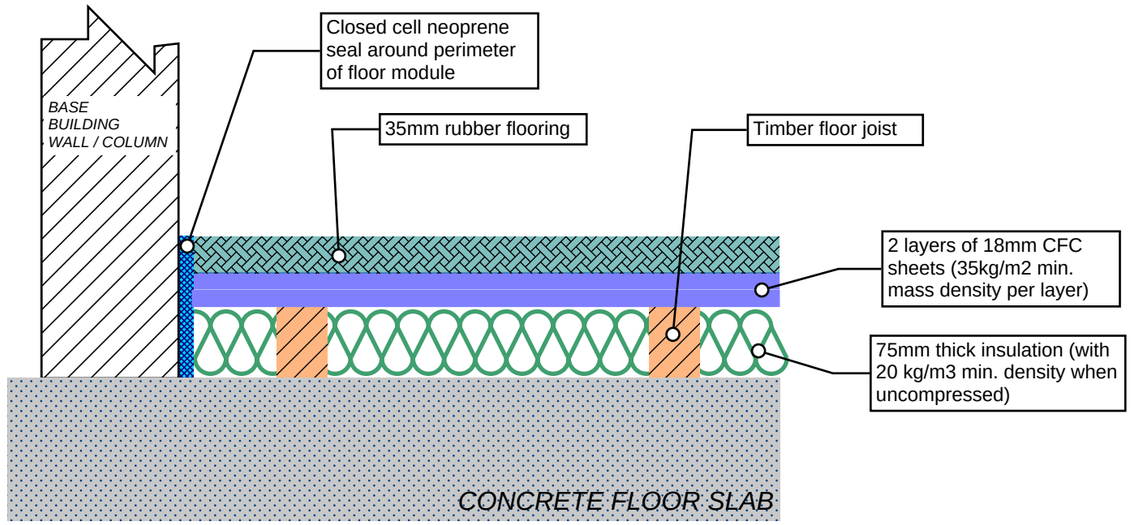
PLAN DETAIL A-A



CROSS-SECTIONAL DETAIL C-C



CROSS-SECTIONAL DETAIL B-B



CROSS-SECTIONAL DETAIL D-D