

Kneeler Design Architects
27 June 2024

Nunawading Christian College – Early Learning Centre

BQSH Acoustic Assessment

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Client Kneeler Design Architects
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1. Introduction

Octave Acoustics was engaged by Kneeler Design Architects to review project documentation for the Nunawading Christian College – Early Learning Centre project. This assessment has been conducted in accordance with the acoustic requirements set out in the May 2023 version of the Department of Education and Training Building Quality Standards Handbook (BQSH).

The project consists of the following:

- Demolition of an existing residential dwelling, carpark and driveway, fence, concrete paving;
- Relocation of an existing portable classroom building, and;
- Construction of a new single storey early learning centre building, as well as associated carpark and driveway.

This assessment was carried out with reference to project drawings prepared by Kneeler Design Architects as attached in Appendix A, B, C, D and E.

It is understood that the proposed operating hours of the early learning centre are Monday to Friday, from 7:00am to 6:30pm.

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2. Site Context



Figure 1 - Site Context

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3. Noise Measurements

Octave Acoustics carried out unattended noise monitoring between Thursday the 11th April and Wednesday the 17th of April 2021. Measurements were carried out using an NTi XL2 meter which was calibrated before and after all measurements using a Bruel Kjaer 4320 calibrator. No drift in calibration was detected. The NTi XL2 complies with the requirements of IEC 61672-1:2013 Sound Level Meters and is classified as a Class 1 instrument. The calibrator complies with the requirements of IEC 60942:2004 Sound Calibrators. Both the XL2 and calibrator carry current NATA certification or manufacturer’s certification if less than two years old.

Noise monitoring was conducted at a height of 1.5 m above the rooftop of the existing single storey portable classroom located adjacent the proposed early learning centre building (refer to Noise Logging Location in Figure 1). The noise monitor microphone was installed in free field conditions and had direct line of sight to the Belgrave and Lilydale rail corridor.

3.1. Results of Noise Measurements

3.1.1. Rail Noise

Data from unattended noise monitoring in Noise Logging Location (refer to Figure 1) was analysed and the highest measured equivalent continuous sound level over a thirty-minute period that was attributed to noise from the Belgrave and Lilydale rail corridor was identified and is presented below in Table 1. This measured sound level was used to conduct an assessment of rail noise intrusion (refer to Section 5.6).

Table 1 – Highest Measured Equivalent Continuous Sound Level Due to Rail Noise

Measurement Location	Measurement Period	Metric	Highest Measured Equivalent Continuous Sound Level, dB(A)
Noise Logging Location (refer to Figure 1)	7:30am to 8:00am on Friday the 12 th of April 2024	L _{Aeq,30min}	60

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4. BQSH Criteria

4.1. Statutory Requirements and Standards

Acoustic design requirements must be addressed in accordance with the following statutory requirements and best practice standards:

- "Occupational Health and Safety Regulations 2017" which specifies allowable noise levels in the workplace.
- Environment Protection Regulations 2021 Part 5.3 Division 3 – Unreasonable and Aggravated Noise from Commercial, Industrial and Trade Premises (EPR 2021) and EPA Victoria Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues, Publication 1826.4 (Publication 1826.4).
- Australian Standard AS/NZS 2107 "Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors". Within this Standard, Table 1, Section 1 provides recommendations for design sound levels in education buildings.
- Australian Standard AS 2021 "Acoustics – Aircraft noise intrusion – Building siting and construction".
- Australian Standard AS/NZS/ISO 717.1 "Acoustics – Rating of sound insulation in buildings and of building elements – Airborne Sound Insulation".
- Australian Standard AS/ISO 2631.2 "Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)".

4.1.1. Occupational Health & Safety Regulations

These regulations specify the allowable noise levels and noise exposure standards in the workplace. The allowable noise levels and exposure standards are applicable to all areas of the building that could constitute a workplace; however, they are most commonly relevant in workshops, technology classrooms, material preparation rooms and plant rooms.

A workplace must be designed to meet the following standards:

- peak noise levels no greater than 140dB(C); and
- an equivalent continuous noise level not exceeding 85dB(A) over 8 hours of a workday.

These are mandatory requirements.

Expert advice is generally required to determine if the above standards are likely to be exceeded. In most cases a noise exposure control strategy will be required to ensure compliance with the statutory standards. Noise exposure control strategies must be strictly in accordance with the requirement of the Regulations.

In practice, detailed advice with respect to the above is typically only required for high noise areas such as shop classes and plant rooms which would dictate use of personal hearing protection.

4.1.2. Environment Protection Regulations 2021

Noise associated with base building plant and services is required to comply with Part 5.3 of the Environment Protection Regulations 2021 (EPR 2021). EPA Victoria Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues Publication 1826.4 (Publication 1826.4) provides a protocol for determining EPR 2021 noise limits and carrying out subsequent assessment of noise impacts to a neighbouring noise sensitive area. A noise sensitive area can be a residence, motel, hospital, school classroom or similar.

Noise sources that can lead to non-compliance include (but are not limited to) air-conditioning equipment, exhaust fans, pumps and compressors.

EPR 2021 noise limits have been calculated assuming a neutral zoning level and are provided in Table 2 below.

Table 2 – EPR 2021 Noise Criteria for Plant Noise Emissions based on a Neutral Zoning Level

Period	Zoning Level ₄ , L _{Aeq}
Day ₁	56
Evening ₂	49
Night ₃	44

- Notes:
- Day period is:
 - 07:00 – 18:00 Monday – Saturday (except public holidays)
 - Evening period is:
 - 18:00 – 22:00 Monday – Saturday
 - 07:00 – 22:00 Sunday and public holidays
 - Night period is:
 - 22:00 – 07:00 Monday – Sunday
 - Where the noise source under consideration is equipment used solely in relation to emergencies (such as fire pumps, standby generators, stair pressurisation and smoke spill fans), the relevant noise limit applying to the testing or maintenance of such equipment is increased by 10dB for the day period and 5dB for the evening and night periods.

4.1.3. AS/NZS 2107

Australian / New Zealand Standard AS/NZS 2107 provides recommended design sound levels for a wide range of occupancies and includes recommendations for many room types that occur in educational buildings.

It should be noted that the noise levels recommended in the standard apply to an unoccupied space and are not intended to cover noise from room occupants (i.e. voices or active use).

This standard also provides recommended design reverberation times for a range of occupancies and includes recommendations for many room types that occur in educational buildings.

4.2. Acoustic Floor Planning

From the outset, floor planning must consider acoustic performance and whether the spaces are fit-for-purpose.

Spaces with incompatible acoustic requirements should be located as far apart as practicable. Where open-plan teaching spaces are proposed, dedicated quiet rooms or pods should also be included to cater for small groups needing acoustic separation from the main group. For special schools and special development schools, there are greater requirements, reflecting the increased acoustic sensitivity of some users.

4.3. Internal Sound Insulation

4.3.1. Airborne Sound Insulation between Rooms

The BQSH provides performance standards for the control of sound transfer between spaces via walls not containing a door.

Table 3 provides activity noise levels and noise tolerance levels for typical educational spaces. Table 4 provides recommended minimum sound insulation rating for partitions not including doors based on the applicable source room activity noise and the receiver room tolerance to that noise. The recommended sound insulation rating in Table 4 is provided in terms of $D_{nT,w}$ which is a metric that can be verified on-site.

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Table 3 – Sound Insulation Ratings

Type of Room	Activity Noise (Source Room)	Noise Level (Receiving Room)
Classrooms, shared learning spaces, seminar rooms, tutorial rooms, language laboratories, small group rooms, library/learning resource centre	Average	Medium
Open-plan and learning community areas, teaching areas, resource/breakout areas	Average	Medium
Music classroom Small and large practice/group room/dance Performance/recital room Ensemble room/recording studio	Very High	Low
Control room – for recording	High	Low
Control room – not for recording	Average	Medium
Lecture room	Average	Medium
Shared learning spaces specifically for students with special hearing and communication needs	Average	Low
Shared learning spaces for special needs students in special schools and special development school	High	Low
Study room (individual learning space, withdrawal, remedial work, teacher preparation)	Low	Medium
Quiet study areas	Low	Medium
Resource intensive learning areas	Average	Medium
Science laboratories	Average	Medium
Materials technology	High	High
Electronics/control, textiles, food, graphics, design/resource areas, ICT rooms, art	Average	Medium
Drama studios, assembly halls, multi-purpose halls (drama, physical education, dance, audio/visual presentations, assembly, occasional music)	High	Low
Atria, circulation spaces used for circulation and socialising (but not teaching and learning)	Average	Medium
Sports halls (for sport use only)	High	Medium
Hydrotherapy swimming pool (if required)	High	High
Meeting rooms, interviewing/counselling rooms, video conference rooms	Low	Medium
Canteens, food preparation, dining rooms or laundries	High	High
Kitchens, laundries	High	High
Offices, medical rooms, staff work areas	Low	Medium

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Corridors, stairwells, circulation, coats and locker areas	Average	High
Changing room areas	Average	High
Toilets	Average	High
Definition:	The $D_{nT,w}$ rating is determined using Australian Standards AS ISO 140.4 and AS/NZS ISO 717.1. It involves assessment at site by measuring the noise reduction between rooms over a range of sound frequencies and then standardising the result.	
Notes:	<ol style="list-style-type: none"> The $D_{nT,w}$ performance is to be achieved taking account of all sound paths, including the ceiling void, floor, ductwork or ventilation openings, windows, perimeter wall junctions etc. The location of toilet and amenity spaces must minimise the impact of hydraulic noise transfer to teaching and administration spaces. In locations where teaching and administration spaces are adjacent to walls containing in-wall cisterns or noisy pipework, or where noisy appliances are on the opposite side of the wall, the walls must be constructed and insulated to prevent noise intruding on adjacent spaces. 	

Table 4 – Sound Insulation Requirements for Noise Tolerance

Minimum $D_{nT,w}$	Activity Noise in Source Room			
	Low	Average	High	Very High
Noise Tolerance in Receiving Room				
High	N/A	35	45	50
Medium	40	45	50	55
Low	45	50	55	55

4.3.2. Doors

Table 5 provides details of the applicable acoustic performance requirements which relate to doors and associated glazing.

Table 5 – Doors Suitable for Different Room Types

Type of space	Minimum R_w	
	Glazing	Door Set
All spaces except music rooms	35	30
Music rooms	45	33
Spaces separated by sliding doors	35	25
Operable walls	45	45
Bounding walls beside / above an operable wall	50	50

An exception to the above table is where it is essential to link a teaching space with another occupied room via an interconnecting door for operational or safety purposes. In such cases a door set must be used with a rating of at least 35 dB R_w . The surrounding wall (including any glazing) should have a composite sound insulation rating of at least 45 dB R_w .

The design of dedicated music areas, especially where they form part of a group of practice rooms, may require higher acoustic door ratings. In these situations, sound locks and or separating central

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corridors are recommended. An acoustic rating higher than R_w 50 can effectively be achieved with two R_w 30 doors and a space between them, designed to suit the site.

4.3.3. Airborne Sound Insulation of Walls which incorporate Doors

The BQSH does not prescribe the sound insulation rating for a wall which incorporates a door. Where a door is installed within a wall which has a relatively small area, only minor improvement in overall partition performance is expected once the performance of the wall is more than about 10dB higher than the rating of the door. Therefore, for a door-set which has an R_w 30 rating there is no additional benefit to be gained by designing the performance of the wall containing the door higher than R_w 40 (D_{nTW} 35). Octave Acoustics has therefore designed fixed walls to achieve R_w 40 (D_{nTW} 35) where they incorporate a R_w 30 door-set.

4.4. Reverberation Control & Ambient Noise Level

Spaces must be designed to achieve the reverberation time below the maximum stated in the 'recommended reverberation time' as well as internal ambient noise levels no more than 5dB(A) above the lower figure in the range recommended in AS/NZS 2107.

Appropriate reverberation time and ambient noise level criteria as recommended by AS/NZS 2107:2016 are presented in Table 6.

Table 6 - AS2107:2016 Recommended Design Sound Levels & Reverberation Times

Room	Design sound level ($L_{Aeq,t}$) range	Design reverberation time (T) range, s
EDUCATIONAL BUILDINGS		
Art/craft studios	40 to 45	< 0.8
Assembly halls up to 250 seats	30 to 40	0.6 to 0.8
Assembly halls over 250 seats	30 to 35	Curve 1 ²
Audio-visual areas	35 to 45	0.6 to 0.8
Computer Rooms – Teaching	40 to 45	0.4 to 0.6 ⁶
Computer Rooms – Laboratories	45 to 50	0.4 to 0.6
Conference rooms	35 to 40	0.6 to 0.7
Corridors and lobbies	< 50	< 0.8
Drama Studios	35 to 40	Curve 1 ²
Engineering Workshops - Teaching	< 45	Minimised ¹
Engineering Workshops - Non-teaching	< 60	Minimised ¹
Weight training/fitness room	< 50	< 1.0
Interview/counselling rooms	40 to 45	0.3 to 0.6
Laboratories – Teaching	35 to 45	0.5 to 0.8 ⁶
Laboratories – Working	40 to 50	0.5 to 0.8

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Lecture rooms up to 50 seats	30 to 35	Curve 3 ⁴
Lecture Theatres – Without speech reinforcement	30 to 35	Curve 3 ⁴
Lecture Theatres – With speech reinforcement	30 to 40	Curve 3 ⁴
Libraries – General areas	40 to 50	< 0.6
Libraries – Reading areas	40 to 45	< 0.6
Manual arts workshops	< 45	< 0.8
Medical rooms (first aid)	40 to 45	0.6 to 0.8
Music practice rooms	40 to 45	0.7 to 0.9
Music studios	30 to 35	Curve 2 ³
Office areas	40 to 45	0.4 to 0.7
Professional and administrative offices	35 to 40	0.6 to 0.8
Teaching spaces/single classroom – Open plan	35 to 45	Minimised ¹
Teaching spaces/single classroom – Primary schools	35 to 45	Curve 3 ^{4, 6}
Teaching spaces/single classroom – Secondary schools	35 to 45	Curve 3 ^{4, 6}
Staff common rooms	40 to 45	< 0.6
Staff studies/collegiate	40 to 45	0.4 to 0.6
Sports hall	< 50	Curve 4 ⁵
Toilet/change/showers	< 55	-

- Notes:
1. Reverberation time should be minimized for noise control. Where minimisation is recommended the BQSH states that acoustic absorption should be installed in the noise-sensitive space, applied in locations appropriate to the function of the space, and located to maximise the acoustic performance of materials selected. The resulting performance of the installed acoustic absorption must result in a reverberation time equivalent to or lower than the reverberation time predicted for treating at least 50% of the combined floor and ceiling area with a material having a noise reduction coefficient (NRC) of at least 0.5. Alternatively, compliance may be demonstrated by treating 50% of the combined floor and ceiling area with a material with an NRC of at least 0.5.
 2. Reverberation time is dependent on room volume in accordance with Curve 1 for speech and lecture (refer AS 2107, Figure A1).
 3. Specialist advice should be sought for these spaces. Reverberation time is dependent on room volume in accordance with Curve 2 for music (refer AS 2107, Figure A1).
 4. Reverberation time is dependent on room volume in accordance with Curve 3 for teaching and communication (refer AS 2107, Figure A1).
 5. Reverberation time is dependent on room volume in accordance with Curve 4 for sport (refer AS 2107, Figure A1).

-
6. BQSH states that dedicated teaching space must have reverberation times in the lower half of the range specified in AS/NZS 2107.
-

4.5. External Noise

The design of the school building façade should meet the recommended ambient noise levels within AS/NZS 2107 with windows and doors closed. External noise must be planned for and addressed during the design phase, to ensure internal spaces are functional and fit-for-purpose.

School sites should be positioned to mitigate the effect of noise associated with traffic, rail activity, commercial/industrial noise and/or aircraft noise must be evaluated according to the proposed design solution. The results of the evaluation should be used for the façade designs. Appropriate treatments can include double or triple-glazing, if required.

4.6. Rain Noise

The roof design should control excessive noise from rain in learning and speech-use areas. The noise effect from rain on a roof should not exceed the ambient noise levels within AS/NZS 2107 by more than 5dB(A) during a moderately heavy rain event (up to 10mm/hr rate).

As a minimum requirement (notwithstanding the AS/NZS 2107), metal roofing should have a thermal/acoustic insulation blanket at least 75mm thick between roof purlins/battens and the roofing.

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5. Design Assessment

5.1. AS/NZS 2107

Refer to sections 5.2, 5.5 and 5.6 below.

5.2. Environment Protection Regulations 2021 Requirements for the Mechanical Contractor

It is recommended that words to the effect of the following be included in the construction contract:

- All mechanical equipment including but not limited to fans and condensers shall be selected, installed and commissioned such that resulting external noise levels comply with the requirements of the *Environment Protection Regulations 2021, Part 5.3 Division 3 – Unreasonable and Aggravated Noise from Commercial, Industrial and Trade Premises* at all noise sensitive areas.
- All mechanical equipment, including but not limited to fans and air-conditioners shall be selected, installed (including the use of appropriate vibration isolation mounts) and commissioned such that resultant noise levels are no more than 5dB(A) above the lower figure in the range set out in *Australian Standard 2107 Recommended Design Sound Levels and Reverberation Times for Building Interiors* when operating at design duty/speed as prescribed in Section 5.5.

5.3. Sound Insulation between Spaces

Appendix A presents marked-up floor plans that when read with reference to Table 7 will result in design compliance with BQSH requirements for sound insulation between spaces. Detail drawings of the specified wall constructions are provided in Appendix F.

Table 7 – Project Specific Wall Constructions to Satisfy BQSH

Minimum Acoustic Rating	Building Element	Solution
D _{nT,w} 30	Wall construction	92mm-wide or 150mm-wide steel studs with a single layer of 13mm plasterboard applied to each side.
	Wall extent	Wall may extend to the underside of any ceilings having a Ceiling Attenuation Class (CAC) of greater than 30 (examples include flush 13mm plasterboard and 15-18mm thick compressed acoustic tiles).
	Cavity insulation	Not required.
	End termination of other walls	Standard building construction only. Termination to window mullions permitted but should be acoustically sealed.
	Glazing	Permitted but must be sealed and should be at least 6mm thick. Composite R _w value of wall and glazing should be at least 35.
D _{nT,w} 35	Wall construction	92mm-wide or 150mm-wide steel studs with a single layer of 13mm plasterboard applied to each side.

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(Where acoustic ceiling tile or flush plasterboard ceilings are constructed)	Wall Extent	The wall structure should project through the suspended ceiling but framing and plasterboard layers need not extend to divide the ceiling cavity.
	Cavity Insulation	Acoustic grade, 50mm thick with a minimum density of 14kg/m ³ .
	End Terminations of Other Walls	Standard building construction only. Termination to window mullions permitted but should be acoustically sealed.
	Glazing	Not to make up more than 15% of the wall area, and must be sealed, 10mm laminated glass. Composite R _w value of wall and glazing should be at least 40.
	Ceiling	Must have a CAC rating not less than 35. Must be overlaid with a 50mm thick, 24kg/m ³ (minimum) density acoustic grade insulation for an extent of not less than 1200mm each side of the partition line.
D _{nT,w} 35 (Where perforated or wood wool ceilings are constructed)	Wall construction	92mm-wide or 150mm-wide steel studs with a single layer of 13mm plasterboard applied to each side.
	Wall Extent	Wall system to interrupt the suspended ceiling with not less than a 1 x 13mm plasterboard layer extending across the ceiling cavity on each side adjacent to a perforated plasterboard or wood wool ceiling and being acoustically sealed around the perimeter.
	Cavity Insulation	Acoustic grade, 50mm thick with a minimum density of 14kg/m ³ .
	End Terminations of Other Walls	Standard building construction only. Termination to window mullions permitted but should be acoustically sealed.
	Glazing	Not to make up more than 15% of the wall area, and must be sealed, 10mm laminated glass. Composite R _w value of wall and glazing should be at least 40
D _{nT,w} 40	Wall construction	92mm-wide or 150mm-wide steel studs lined with 2 x 13mm plasterboard on one side with 1 x 13mm plasterboard on the other side. Acoustic insulation is to be placed in the wall cavity.
	Wall Extent	Wall system to interrupt the suspended ceiling with not less than a 1 x 13mm plasterboard layer extending across the ceiling cavity and being acoustically sealed around the perimeter.
	Cavity Insulation	Acoustic grade, 50mm thick with a minimum density of 14kg/m ³ .

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	End Terminations of Other Walls	Walls should not abut window mullions, window glazing or simple lightweight partitions.
	Glazing	Not recommended in these partitions.
	Ceiling	Must have a CAC rating of not less than 30.
D _{Nt,w} 45	Wall construction	92mm-wide or 150mm-wide steel studs with 2 x 13mm plasterboard applied to each side.
	Wall Extent	All plasterboard layers to interrupt the ceiling and divide the ceiling cavity.
	Cavity Insulation	Acoustic grade, 50mm thick with a minimum density of 14kg/m ³ .
	End Terminations of Other Walls	Wall structure should interrupt the flow of the lining of any flanking wall (e.g. sheets of plasterboard must not be permitted to pass uninterrupted past the end of the wall).
	Glazing	Not Recommended.
	Ceiling	No specific requirement relating to sound transmission.
	Plumbing Noise Attenuation Measures. (As shown by the dashed line)	Any walls dividing wet areas from teaching and administration spaces shall incorporate plumbing noise attenuation measures. Water supply pipes shall be Rehau RAUTITAN or an equivalent PEX system (refer Section 5.3.3). Waste pipes shall not be in direct contact with or directly fixed to studwork. Where fixing is required use an acoustically isolated connection clamp such as Flexistrut Acoustic 'S' Series Pipe Clips http://www.flexistrut.com.au/acoustic-pipe-clips/

Notes: As a general recommendation for all acoustically rated walls:

1. Wall perimeters to be fully stopped and sealed.
2. Walls are not to be degraded acoustically by penetrations for electrical or plumbing fixings or fixtures.
3. Heads of walls terminating at the underside of suspended ceiling are to be sealed using compressible acoustic foam and/or flexible acoustic sealant beads.
4. Walls dividing the ceiling cavity are to be sealed at the head, sides and at any and all services penetrations.
5. Air-conditioning and or ventilation openings in ceilings must not compromise the sound insulation between rooms and should be treated/modified accordingly. Where a duct penetrates an acoustically rated wall, it should be of steel walled construction and internally acoustically lined for not less than 1200mm each side of the penetration. The penetrating duct must be acoustically sealed into the wall penetration using a flexible non-hardening acoustic sealant.

5.3.1. Doors

Examples of door types which are expected to achieve the BQSH performance requirements described in Section 4.3.2 are provided in Table 8 and shall apply as shown in the marked up floor plans in Appendix A of this document.

Table 8 – Examples of Door Systems Expected to Achieve the BQSH Performance Requirement

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Door Label	Room Type	Acoustic rating	Door Type	Door Thickness	Acoustic Seals
Unlabelled	<ul style="list-style-type: none"> Toilets and washrooms Kitchens and kitchenettes Store rooms 	N/A	Timber Hinged Door	32mm (Solid core)	Nil.
			Glazed Hinged Door	6.38mm laminated glass	
			Sliding Door	32mm (Solid core)	
DT1	All acoustically significant spaces	R _w 30	Timber Hinged Door	35mm (Solid core)	Head & Jambs: Equivalent to Raven RP120 Meeting Stile (for pair doors): Equivalent to Raven RP71si Foot: Equivalent to Raven RP99si
			Glazed Hinged Door	6.38mm laminated glass in an aluminium frame	
		R _w 25	Sliding Door	Proprietary acoustic sliding door (glazed or solid), e.g., Lotus or Glyde which achieves a minimum performance requirement of R _w 25	

5.3.2. Internal Glazing

Glazing types as shown in Table 9 shall apply as shown in the tagged floor plans in Appendix A of this document.

Table 9 - Glazing Types

Wall Type / Line Colour (Refer Appendix A)	Glass Type
D _{nT,w} 33 - Light Blue	Performance requirement for glazing suite is R _w ≥ 35. Fixed glazing incorporating sealed 10.38mm thick laminated glass
D _{nT,w} 40 - Red	Performance requirement for glazing suite is R _w ≥ 45. An example of a system that satisfies this requirement is the AWS Series 105 Office Partitioning System; consisting of two panes of laminated glass (each 10.38mm thick) separated by an airgap of approximately 40mm. https://www.awsaustralia.com.au/specifyaws/office-partitioning-system



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5.3.3. Plumbing

To satisfy the requirements of the BQSH all water supply pipes installed within sound rated walls shall be equivalent to Rehau RAUTITAN or an equivalent PEX system. Copper pipes and toilet waste pipe and cisterns shall not be installed within sound rated walls.

5.3.4. Hand Dryers

In order to minimise noise impacts to adjoining rooms, hand dryers shall not be installed to walls separating amenities from sensitive rooms such as teaching or administration spaces. Hand dryers shall only be installed to WC and change room intra-tenancy walls (those walls which separate WC's or change rooms from each other) or external walls.

5.4. Reverberation Control

details of acoustic absorption treatments required to achieve design compliance with BQSH requirements for reverberation control in key spaces for the Nunawading Christian College – Early Learning Centre project. Refer to Appendix C.

Table 10 provides details of acoustic absorption treatments required to achieve design compliance with BQSH requirements for reverberation control in key spaces for the Nunawading Christian College – Early Learning Centre project. Refer to Appendix C.

Table 10 – Recommended Reverberation Control Treatments

Room	Criteria for Reverb Time (s)	Treatment	
		Surface	Recommendation
Foyer	< 0.8	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Nil – Flush plasterboard
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and an R_w rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m ³ density acoustic grade insulation).
Reception	< 0.8	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Nil – Flush plasterboard
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and an R_w rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m ³ density acoustic grade insulation).
Office Manager	0.4 - 0.7	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and an R_w rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m ³ density acoustic grade insulation).
Meeting Room (adjacent to the foyer and reception area)	0.3 - 0.6	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.

		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and an R_w rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m ³ density acoustic grade insulation).
Meeting Room (adjacent to the Kitchen + Dining area)	0.3 - 0.6	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).
Staff Room	0.4 - 0.7	Floor	Carpet or carpet tiles (100% coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).
Kitchen + Dining	< 0.8	Floor	Nil – Timber flooring (100% floor coverage).
		Walls	Nil – Flush plasterboard
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).
Children's Rooms 1, 2, and 3	< 0.6	Floor	Nil – Timber flooring (100% floor coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).
Corridors	< 0.8	Floor	Nil – Timber flooring (100% floor coverage).
		Walls	Nil – Flush plasterboard
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).
Pods 1 & 2	< 0.6	Floor	Nil – Timber flooring (100% floor coverage).
		Walls	Install approximately 25% coverage of acoustic pinboard having an NRC rating of $\geq 0.40_2$ to at least two perpendicular walls.
		Ceiling	Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles).

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- Notes:
1. Acoustic absorption comes in many forms, from basic polyester panels such as Autex QuietSpace to slotted/perforated timber panels (with high density insulation installed behind) of the style manufactured by Atkar. All such products can be acceptable; however, it is important that the selected product satisfies the specified performance requirement for acoustic absorption 'Noise Reduction Coefficient' or NRC. NRC is a ratio indicating the amount of incident noise that is absorbed by a panel. A panel having an NRC of 1 absorbs 100% of the incident noise, whereas a panel having an NRC of 0 would absorb 0% of incident noise.
 2. The following are examples of products providing the required NRC levels referenced in this report:
 - NRC = 0.40: Acoustic Pinboard – 10-12mm thick Autex Composition Acoustic Fabric
 - NRC = 0.40: Acoustic Pinboard – 12mm thick Autex Symphony
 - NRC = 0.45: Acoustic Pinboard – 12mm thick Autex Cube
 - NRC ≥ 0.70: 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation
 - NRC ≥ 0.70 and CAC ≥ 40: 19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles

5.5. Internal Noise Criteria

Table 11 sets out performance requirements for internal ambient noise within spaces. Note that ambient criteria apply to HVAC noise but do not apply to noise associated with activities in these spaces, such as teaching or AV presentations.

The mechanical contractor shall ensure that all new or upgraded mechanical equipment including, but not limited to fans and air-conditioners shall be selected, installed and commissioned such that resultant internal noise levels do not exceed the maximum ambient noise levels as prescribed in Table 11.

Table 11 – Performance Requirements for Ambient & Rain Noise Within Spaces

Room	Recommended Maximum Ambient Noise Level, L _{Aeq} (dB)	Recommended Maximum Rain Noise Level L _{Aeq} (dB) ₁
Foyer / corridors	< 50	55
Meeting rooms	40-45	50
Reception	< 50	55
Office Manager	35-40	45
Kitchen + Dining	< 50	55
Staff	40-45	50
Children's Rooms 1, 2 & 3	35-40	45
WC	< 55	60
Pod 1 & 2	35-40	45

- Notes:
1. As defined in Section 4.6.

5.6. External Noise Intrusion

The Subject Site is located near roads with relatively low volumes of traffic. The Subject Site is not located within the ANEF contours of major airports.

The Subject Site is located adjacent the Belgrave and Lilydale rail corridor. As such, a rail noise intrusion assessment has been conducted below in Section 5.6.1.

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5.6.1. Façade & Glazing

A 3-D computer model of the proposed development was developed in CadnaA software implementing the ISO9613 environmental noise prediction algorithms. The noise model was validated using results of on-site noise measurements. The model was run to calculate traffic induced sound pressure levels across the façades with rail noise intrusion to internal areas calculated using standard transmission loss algorithms.

Performance requirements for the glazing specification were developed as required for design compliance with AS2107. The resulting performance requirement is presented in Table 12 below. It was assumed that all opaque sections of the building façade labelled BK-01 in Appendix D have the following construction:

Minimum 70mm thick brick veneer wall or minimum 100mm thick precast concrete wall with a minimum 20mm airgap to a row of 64mm wide steel studs with one layer of 13mm thick standard plasterboard affixed on the inside.

Table 12 – Minimum Performance Requirement for Façade Glazing Systems, R_w

Façade	Performance Requirement for Glazing Assembly including Frame and Seals	Indicative Glazing ¹
Refer to markup in Appendix D for extent of acoustic glazing requirements to internal rooms	$R_w \geq 36$	Double-glazed system incorporating at least one pane of 10.76mm thick laminated glass. (e.g. 6mm glass pane / 12mm airgap / 10.76mm thick laminated glass pane). Sliding doors to include full perimeter seals equivalent to Schlegel Q-Lon. All operable elements including awning windows to include full perimeter EPDM seals.
	$R_w \geq 32$	Double glaze system incorporating two panes of 6mm thick glass pane in a commercial aluminium frame (e.g. 6mm thick glass pane / 12mm airgap / 6mm thick glass pane) All operable elements including awning windows to include full perimeter EPDM seals.

Notes:

- Indicative glazing is not provided as a specification but rather to inform the Contractor as to the types of glazing that may satisfy the R_w performance requirements. It is the responsibility of the Contractor to ensure that the nominated glazing assemblies satisfy the performance requirement. This is best done by obtaining a laboratory test report from the nominated glazing system supplier and installer during design and construction.

5.6.2. Skylights

The minimum performance rating for all skylights is presented in Table 13 below. Refer to Appendix E.

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Table 13 – Minimum Performance Requirements for Skylight Glazing Systems.

Location	Performance Requirement for Glazing Assembly including Frame and Seals	Indicative Glazing ¹
Refer to markup in Appendix E	$R_w \geq 31$	Double glazed skylight equivalent to Velux Curb-mounted Operable Double-glazed skylight VCM4646 2004A. (e.g. 3.9mm toughened glass pane / 9mm Argon gap / 5.36mm laminated glass pane).

Notes:

- Indicative glazing is not provided as a specification but rather to inform the Contractor as to the types of glazing that may satisfy the R_w performance requirements. It is the responsibility of the Contractor to ensure that the nominated glazing assemblies satisfy the performance requirement. This is best done by obtaining a laboratory test report from the nominated glazing system supplier and installer during design and construction.

5.6.3. Ceilings

As part of the rail noise intrusion assessment, noise transmission into internal spaces via the roof/ceiling system was calculated using standard transmission loss algorithms.

Performance requirements for the ceiling specification were developed as required for design compliance with AS2107 (refer to Section 4.4). The resulting performance requirement is presented in Table 14 below. Refer to Appendix C.

Table 14 – Minimum Performance Requirements for Ceilings.

Ceiling designation (refer to Appendix C)	Performance Requirement	Indicative Ceiling Type ¹
CT1	$NRC \geq 0.70$ $CAC \geq 40$ dB	19mm thick Armstrong Ultima OP acoustic mineral fibre ceiling tiles.
CT2	$NRC \geq 0.70$ $R_w \geq 6$ dB	25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m ³ density acoustic grade insulation.

Notes:

- Indicative ceiling type is not provided as a specification but rather to inform the Contractor as to the types of ceiling that may satisfy the performance requirements. It is the responsibility of the Contractor to ensure that the nominated ceiling assemblies satisfy the performance requirement.

5.6.4. Rain Noise

Table 15 presents a design for a build-up of roof/ceiling construction for the Nunawading Christian College – Early Learning Centre as required to satisfy BQSH requirements for rain noise control in all spaces.

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Table 15 – Recommended Rain Noise Control

Treatment
Metal deck roof with insulated sarking equivalent to 100mm thick Bradford Anticon sandwiched between the roof sheeting and purlins.
Suspended ceiling either:
<ul style="list-style-type: none">▪ Wood wool acoustic ceiling panel with a surface density of not less than 12kg/m²; or▪ Standard plasterboard not less than 10mm thick▪ Acoustic ceiling tile with a ceiling attenuation class (CAC) of at least 35; or▪ Wood wool ceilings overlaid with 50mm thick fibrous insulation having a density not less than 32kg/m³;

5.7. Acoustic Sealing

All gaps and joints in and with acoustically rated forms of construction shall be acoustically sealed as follows.

1. Joints between adjacent plasterboard sheets shall be taped and filled.
2. Joints between differing forms of construction and not greater than 10mm in width shall be filled with a flexible caulk having a specific gravity not less than 1.3.
3. Joints between differing forms of construction between 10mm and 20mm wide shall be packed with insulation and sealed with a flexible caulk having a specific gravity not less than 1.3.
4. Joints between differing forms of construction between 20mm – 50mm wide shall be packed with insulation, covered over with a steel plate or angle not less than 3mm thick and caulked.
5. Advice should be sought from Octave Acoustics for sealing methodologies of gaps greater than 50mm wide.
6. Approval should be sought from Octave Acoustics for acoustic sealing details varying from the above.
7. In all instances the depth of any caulk shall be no less than the width of the caulked joint.

5.7.1. Penetrations

Service penetrations in all acoustically rated forms of construction shall be fully caulked and sealed. Pipes, ducts, and conduits that penetrate acoustically rated walls, ceilings, or floors should be acoustically treated. This requires a 10 - 20mm gap around the penetrating element which shall be filled with rockwool or polyester insulation having a density not less than 60kg/m³. The penetration is then sealed airtight with flexible caulking compound having a specific gravity not less than 1.3.

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6. Conclusion

Octave Acoustics has carried out an acoustic BQSH assessment of the documentation for the Nunawading Christian College – Early Learning Centre. The recommendations contained within this document provide recommendations that when implemented will result in design compliance with the acoustic provisions of the BQSH (where considered applicable).

For detailed recommendations, refer to:

- Appendix A – Application of Walls, Doors and Internal Glazing.
- Appendix B – Reverberation Treatment Markup
- Appendix C – Acoustic Ceiling Sound Insulation Treatment Markup
- Appendix D – External Walls and Glazing Markup
- Appendix E – Skylight Markup
- Appendix F – BQSH Wall Type Drawings.

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Appendix A: Application of walls, doors and internal glazing

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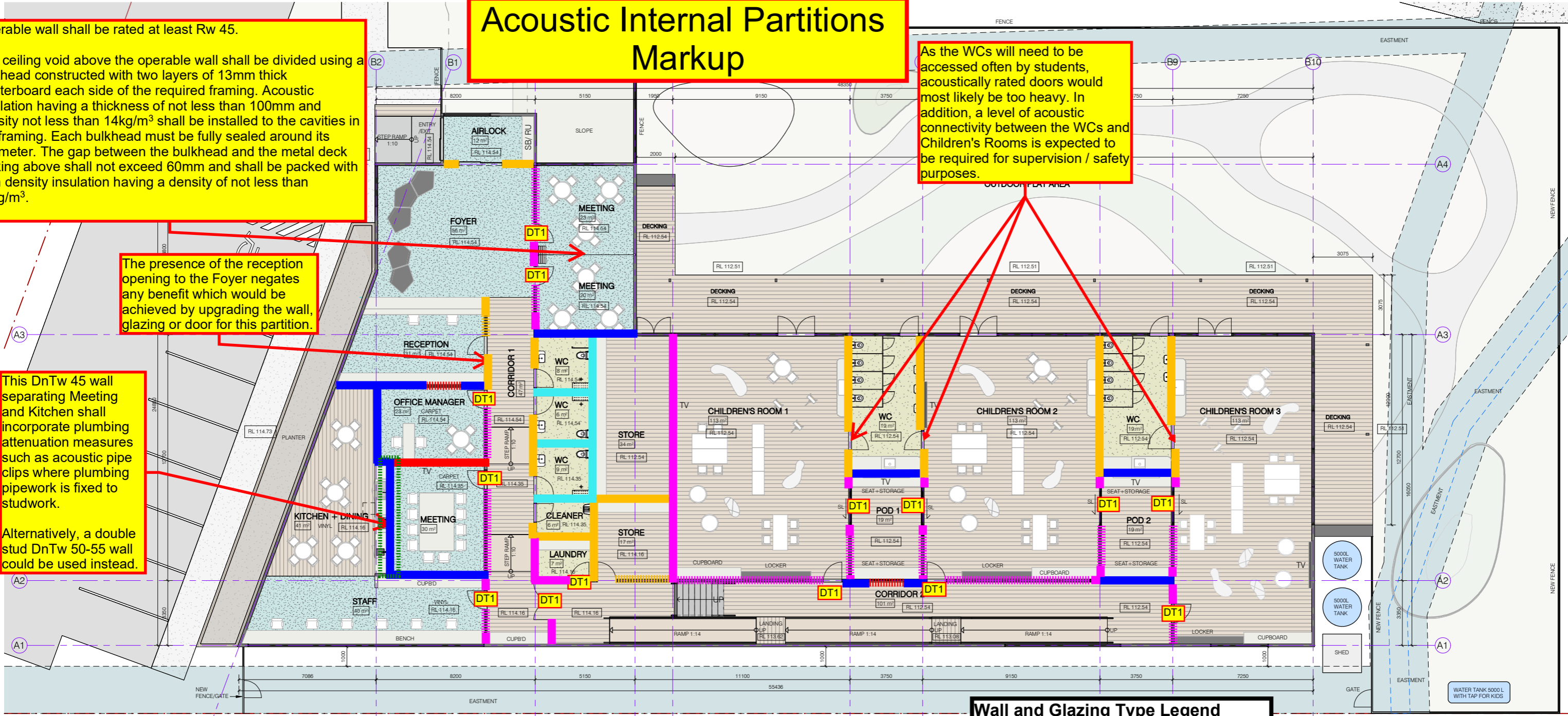
Acoustic Internal Partitions Markup

Operable wall shall be rated at least Rw 45.
 The ceiling void above the operable wall shall be divided using a bulkhead constructed with two layers of 13mm thick plasterboard each side of the required framing. Acoustic insulation having a thickness of not less than 100mm and density not less than 14kg/m³ shall be installed to the cavities in the framing. Each bulkhead must be fully sealed around its perimeter. The gap between the bulkhead and the metal deck sarking above shall not exceed 60mm and shall be packed with high density insulation having a density of not less than 60kg/m³.

As the WCs will need to be accessed often by students, acoustically rated doors would most likely be too heavy. In addition, a level of acoustic connectivity between the WCs and Children's Rooms is expected to be required for supervision / safety purposes.

The presence of the reception opening to the Foyer negates any benefit which would be achieved by upgrading the wall, glazing or door for this partition.

This DnTw 45 wall separating Meeting and Kitchen shall incorporate plumbing attenuation measures such as acoustic pipe clips where plumbing pipework is fixed to studwork.
 Alternatively, a double stud DnTw 50-55 wall can be used instead.



Wall and Glazing Type Legend

- █ DnTw 30 Wall
- ▤▤▤▤▤▤ Fixed glazing that is at least 6mm thick
- █ DnTw 35 Wall (adjacent to flush plasterboard ceilings)
- █ DnTw 35 Wall (adjacent to wood wool ceilings)
- ▤▤▤▤▤▤ Fixed glazing system incorporating 10.38mm thick laminated glazing that is rated to at least Rw 35
- █ DnTw 40 Wall
- ▤▤▤▤▤▤ Glazing system rated at least Rw 45 e.g., AWS Series 105 Office Partitioning System; consisting of two panes of laminated glass (each 10.38mm thick) separated by an air-gap of approximately 40mm.
- █ DnTw 45 Wall

Door Label	Room Type	Acoustic rating	Door Type	Door Thickness	Acoustic Seals
Unlabelled	<ul style="list-style-type: none"> Toilets and washrooms Store rooms 	N/A	Timber Hinged Door	32mm (Solid core)	Nil.
			Glazed Hinged Door	6.38mm laminated glass	
			Sliding Door	32mm (Solid core)	
DT1	<ul style="list-style-type: none"> All acoustically significant spaces 	R _w 30	Timber Hinged Door	35mm (Solid core)	Head & Jamb: Equivalent to Raven RPI20 Meeting Stile (for pair doors): Equivalent to Raven RP7Isi Foot: Equivalent to Raven RP99si
			Glazed Hinged Door	6.38mm laminated glass in an aluminium frame	
			Sliding Door	Proprietary acoustic sliding door (glazed or solid), e.g., Lotus or Glyde which achieves a minimum performance requirement of R _w 25	Seals as specified by the supplier in order to achieve the rated acoustic performance of at least R _w 25
		R _w 25	Sliding Door	Proprietary acoustic sliding door (glazed or solid), e.g., Lotus or Glyde which achieves a minimum performance requirement of R _w 25	Seals as specified by the supplier in order to achieve the rated acoustic performance of at least R _w 25

Student per room = 33 max.
 Total student = 99
 Outdoor play area = min. 693m²

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TOWN PLANNING
 NOT FOR CONSTRUCTION

NUMBER	REVISIONS	DATE
A0	ISSUED FOR DISCUSSION & COST ESTIMATE	29-11-2024
A1	ISSUED FOR DISCUSSION	23-04-2024
A2	ISSUED FOR DISCUSSION	28-05-2024

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 PROPOSED FLOOR PLANS
 DRAWN BY: KDA DATE: MAY 2024
 SCALE: 1:100 DRAWING NUMBER: WD2110/201/A2

Appendix B: Reverberation Treatment Markup

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Reverberation Treatment Markup

Foyer

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Nil - Flush plasterboard

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and an Rw rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation).

Reception

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Nil - Flush plasterboard

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and an Rw rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation).

Kitchen + Dining

Floor: Nil – Vinyl floor cover (100% floor coverage)

Walls: Nil - Flush plasterboard

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).

Meeting Room

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).

Corridor 1

Floor: Nil – Vinyl floor cover (100% floor coverage)

Walls: Nil - Flush plasterboard

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).

Office Manager

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and an Rw rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation).

Student per room = 33 max.
Total student = 99
Outdoor Staff

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).

Meeting Rooms

Floor: Carpet or carpet tiles (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and an Rw rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation).

Childrens Rooms 1, 2 & 3

Floor: Nil – Timber flooring (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).

Corridor 2

Floor: Nil – Vinyl floor cover (100% floor coverage)

Walls: Nil - Flush plasterboard

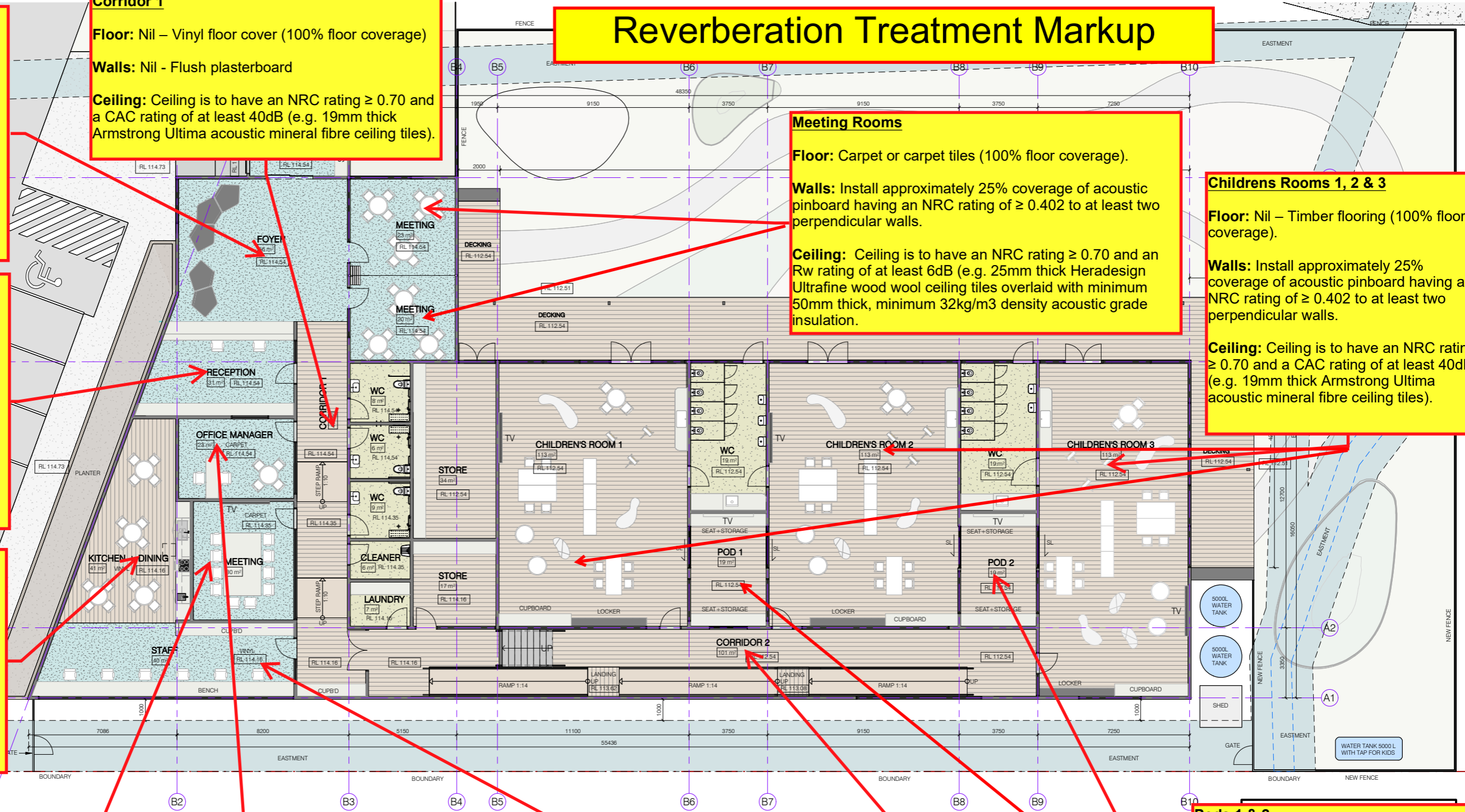
Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and an Rw rating of at least 6dB (e.g. 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32kg/m³ density acoustic grade insulation).

Pods 1 & 2

Floor: Nil – Vinyl floor cover (100% floor coverage).

Walls: Install approximately 25% coverage of acoustic pinboard having an NRC rating of ≥ 0.402 to at least two perpendicular walls.

Ceiling: Ceiling is to have an NRC rating ≥ 0.70 and a CAC rating of at least 40dB (e.g. 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles).



GROUND FLOOR PLAN

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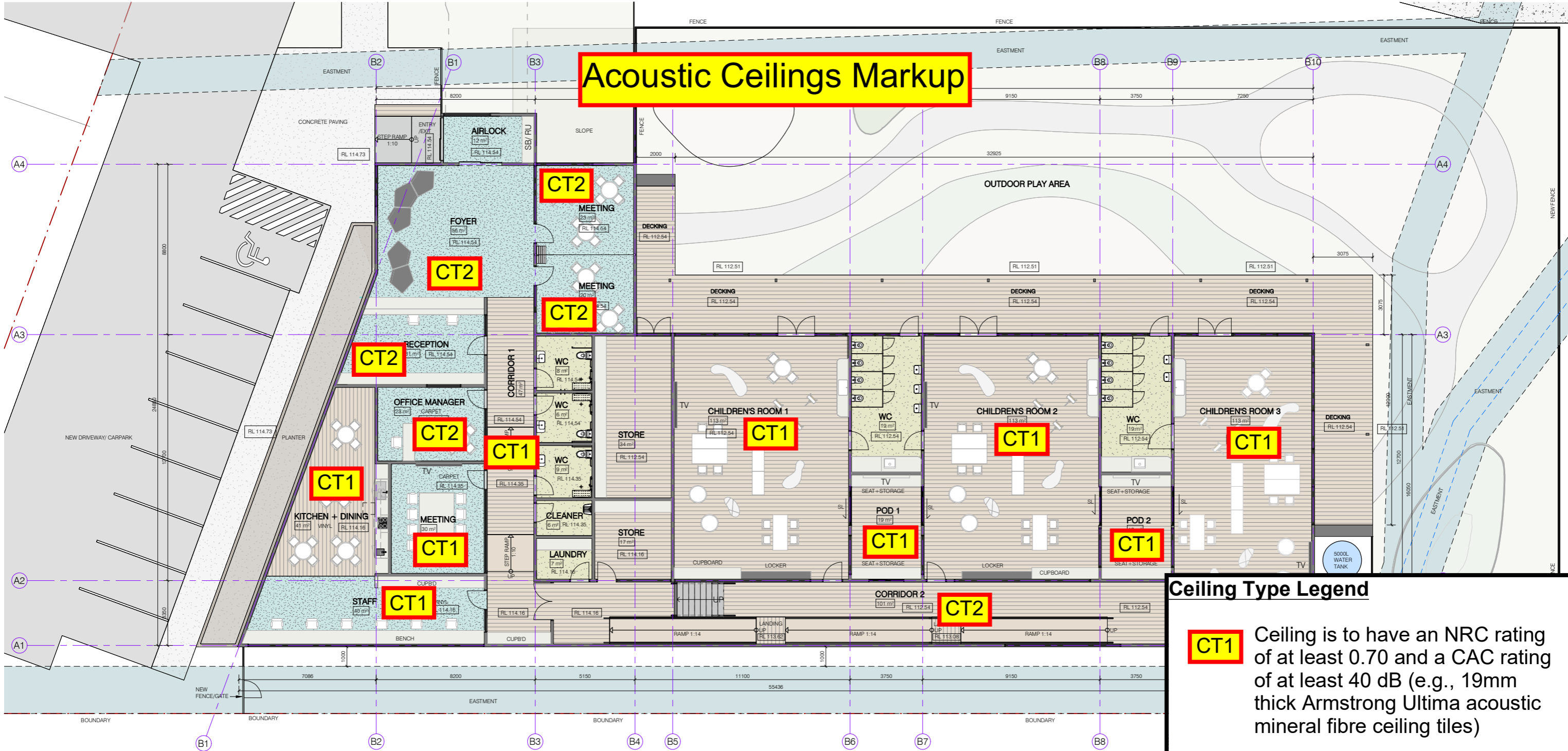
NUNAWADING CHRISTIAN COLLEGE
100 CENTRAL ROAD, NUNAWADING 3131
KDA
MAY 2024
1 : 100
WD211/201/A2

Appendix C: Acoustic Ceiling Sound Insulation Treatment Markup

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Acoustic Ceilings Markup



GROUND FLOOR PLAN
SCALE 1 : 100

Student per room = 33 max.
Total student = 99
Outdoor play area = min. 693m²

Ceiling Type Legend

- CT1** Ceiling is to have an NRC rating of at least 0.70 and a CAC rating of at least 40 dB (e.g., 19mm thick Armstrong Ultima acoustic mineral fibre ceiling tiles)
- CT2** Ceiling is to have an NRC rating of at least 0.70 and an Rw rating of at least 6 dB (e.g., 25mm thick Heradesign Ultrafine wood wool ceiling tiles overlaid with minimum 50mm thick, minimum 32 kg/m³ density acoustic grade insulation)

Spaces which do not have a ceiling type tag have no specific acoustic requirements, unless otherwise stated in acoustic wall type schedule.

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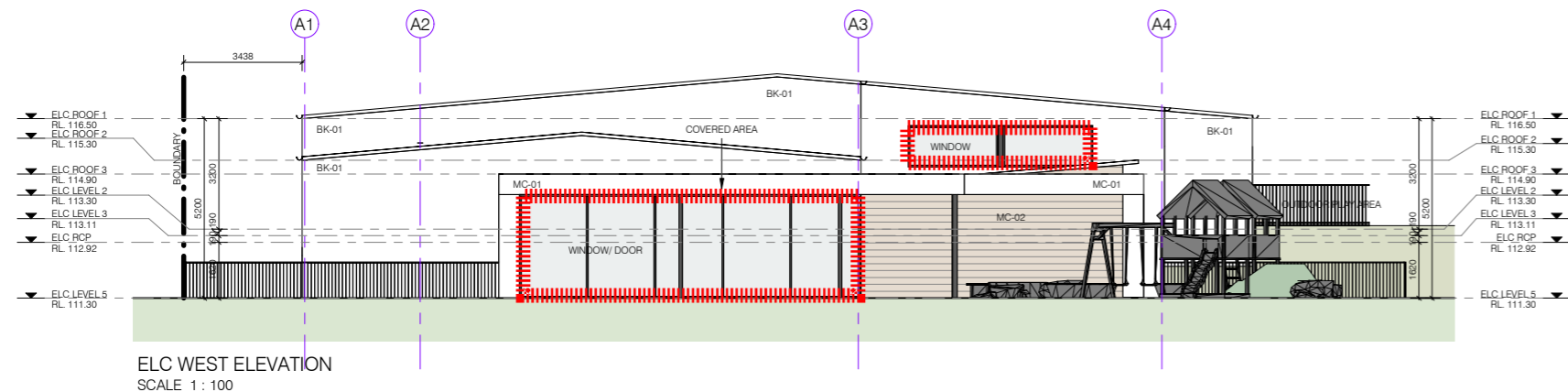
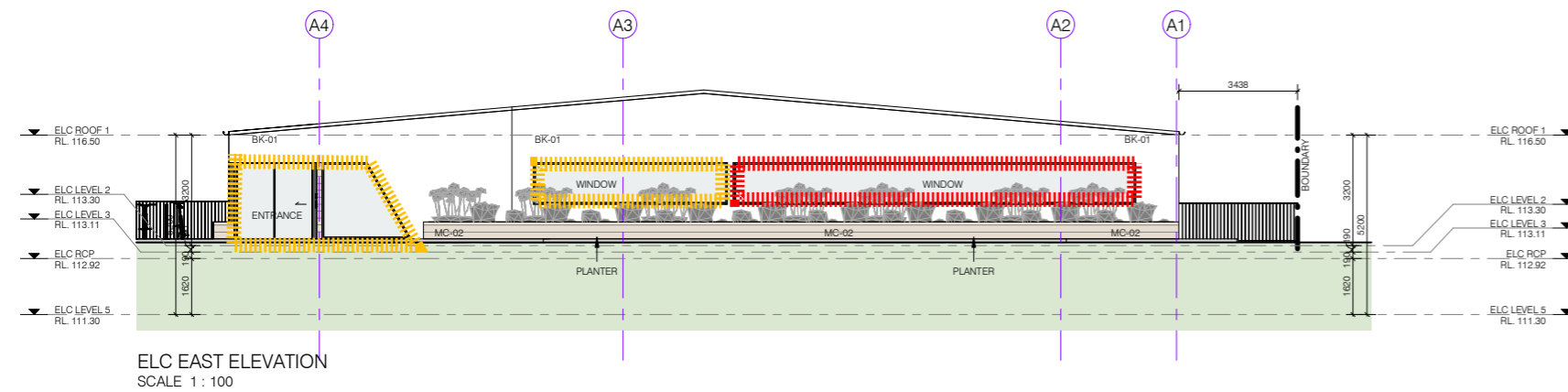
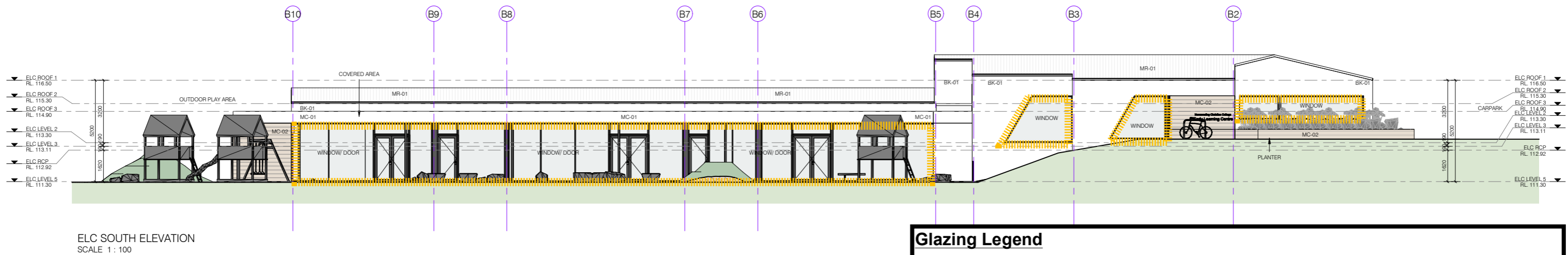
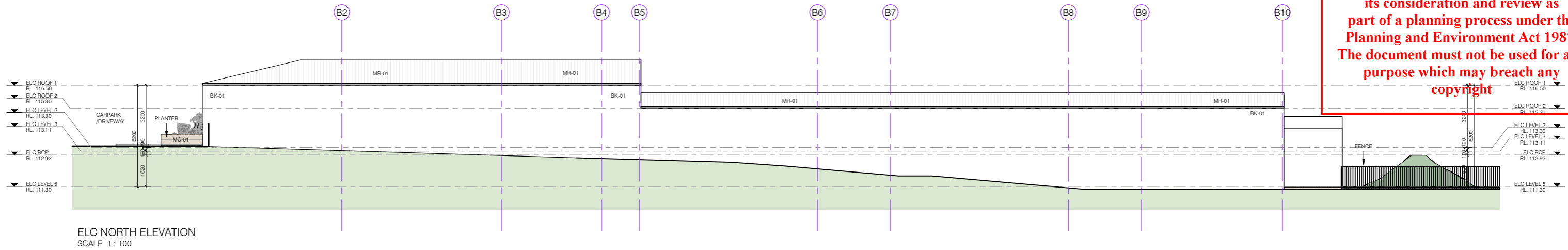
Appendix D: External Walls and Glazing Markup

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External Walls and Glazing Markup

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Glazing Legend

- All glazing enclosed by this marked up shape is to be rated at least Rw 32. An indicative glazing system which may meet this performance requirement is a double glazed unit incorporating two panes of 6mm thick glass in a good quality commercial aluminium frame (e.g., 6mm thick glass pane / 12mm air-gap / 6mm thick glass pane). All operable elements including awning windows to include full perimeter EPDM seals.
- All glazing enclosed by this marked up shape is to be rated at least Rw 36. An indicative glazing system which may meet this performance requirement is a double glazed unit incorporating at least one pane of 10.76mm thick laminated glass in a good quality commercial aluminium frame (e.g., 6mm glass pane / 12mm air-gap / 10.76mm thick laminated glass pane). All operable elements including awning windows to include full perimeter EPDM seals. All sliding doors to include full perimeter seals equivalent to Schlegel Q-Lon.

All opaque sections of the building facade labelled BK-01 have been assumed to have the following construction:
Minimum 70mm thick brick veneer wall or minimum 100mm thick precast concrete wall with a minimum 20mm air-gap to a row of 64mm wide steel studs with one layer of 13mm thick standard plasterboard affixed on the inside. Wall cavity filled with 90mm thick, 14kg/m³ glasswool insulation.

ADVERTISED PLAN

KNEELER DESIGN ARCHITECTS
2163 Hyde Street
Yarraville Victoria 3013
r.biervenu@kneelerdesign.com.au
T 61 3 9416 4544

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PROJECT: NUNAWADING CHRISTIAN COLLEGE

EARLY LEARNING CENTRE
161 CENTRAL ROAD, NUNAWADING 3131

DATE: MAY 2024
DRAWING NUMBER: WD2110/301/A2
SCALE: 1 : 100

Appendix E: Skylight Markup

ADVERTISED PLAN

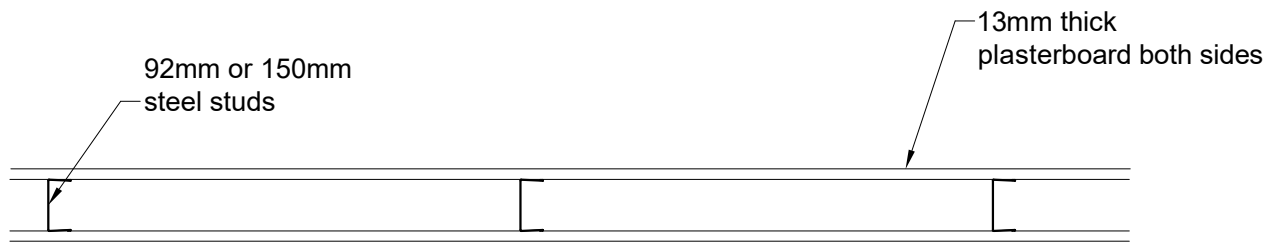
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Appendix F: BQSH Wall Type Drawings

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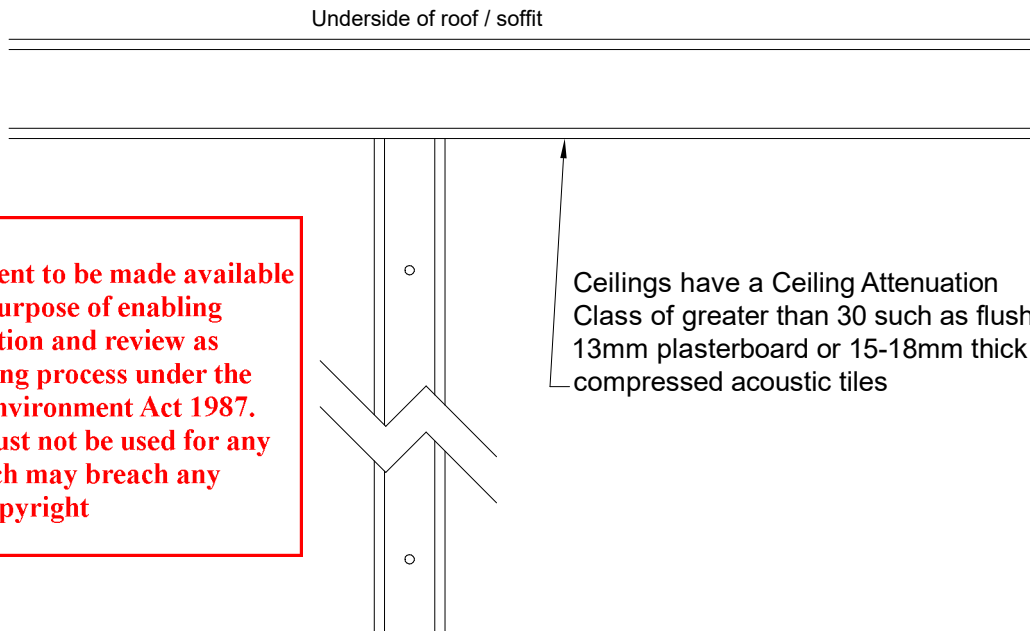
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DnTw 30 Wall



Plan View

**ADVERTISED
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Section View

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Ceilings have a Ceiling Attenuation Class of greater than 30 such as flush 13mm plasterboard or 15-18mm thick compressed acoustic tiles

End terminations of other walls: Standard building construction only.
Termination to window mullions is permitted but should be acoustically sealed.
Glazing: Permitted but must be sealed and should be at least 6mm thick.



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40/131 Hyde Street, Footscray
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www.octaveacoustics.com.au

Sydney:
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Sydney NSW 2000
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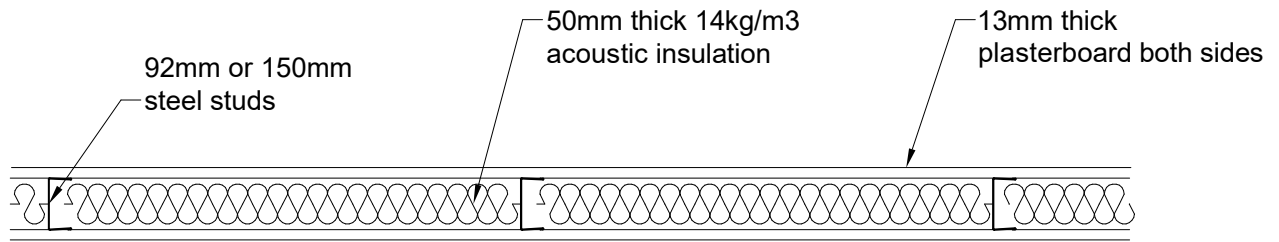
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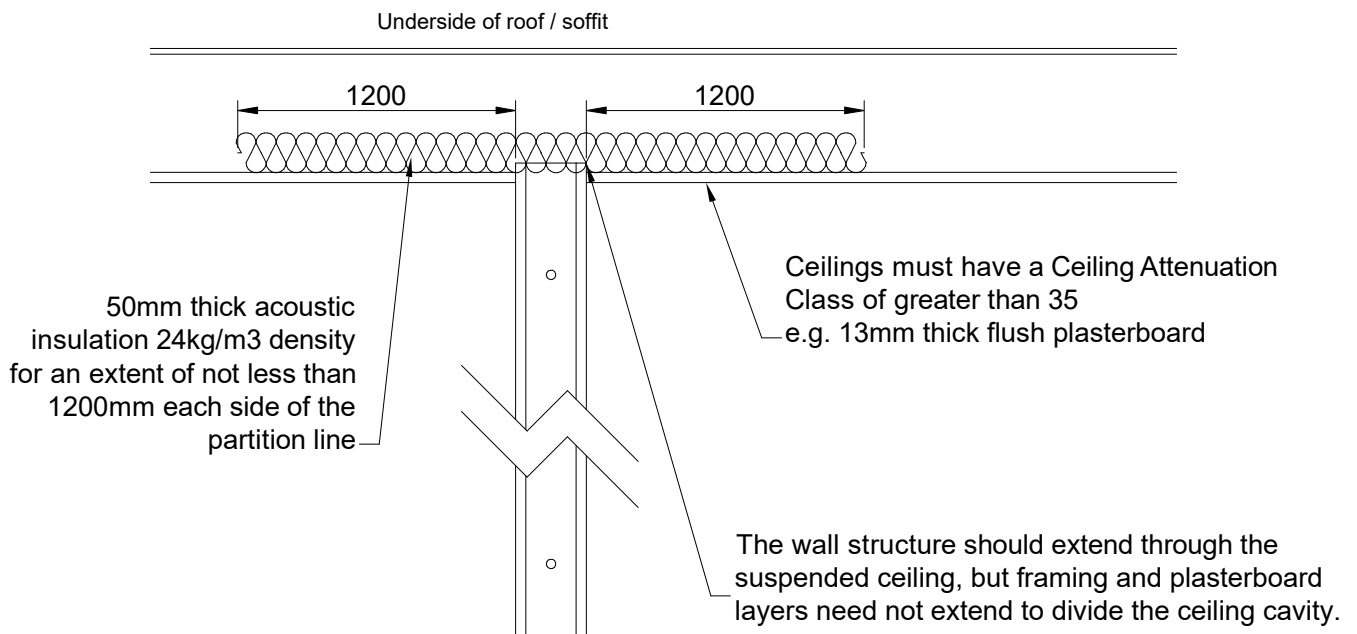
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DnTw 35 Wall



Plan View



Section View

End terminations of other walls: Standard building construction only.
Termination to window mullions is permitted but should be acoustically sealed.
Glazing: Not to make up more than 15% of the wall area, and must be sealed 10mm laminated glass

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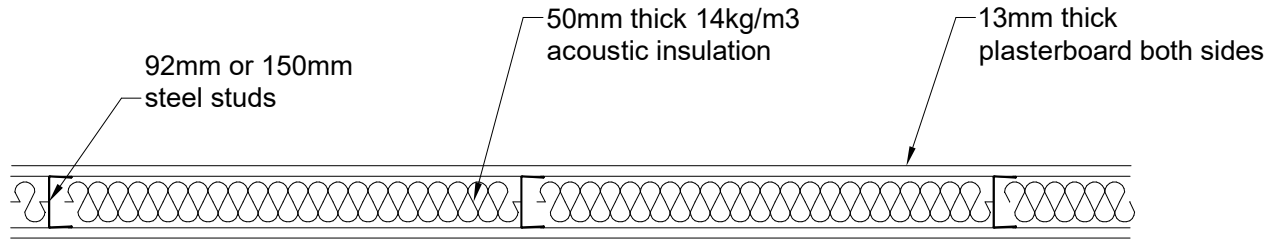
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DATE 03/05/2024

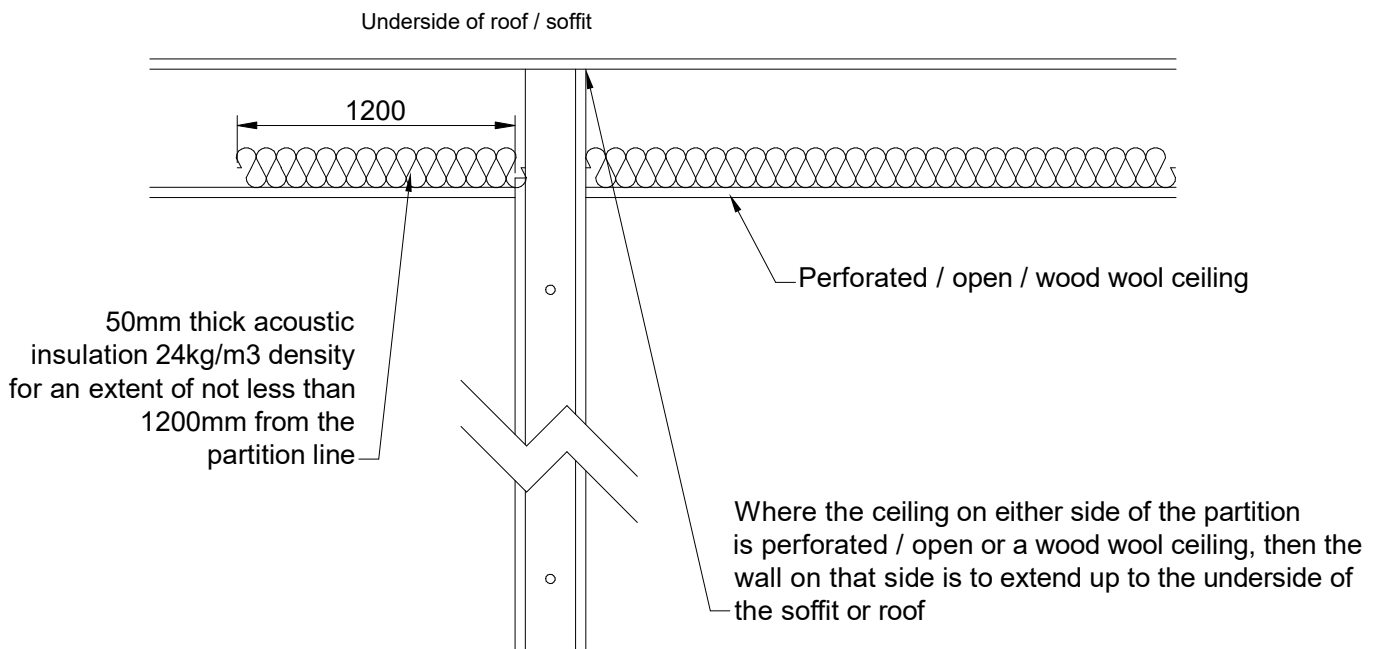
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DnTw 35 Wall



Plan View

**ADVERTISED
PLAN**



Section View

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End terminations of other walls: Standard building construction only.
Termination to window mullions is permitted but should be acoustically sealed.
Glazing: Not to make up more than 15% of the wall area, and must be sealed 10mm laminated glass



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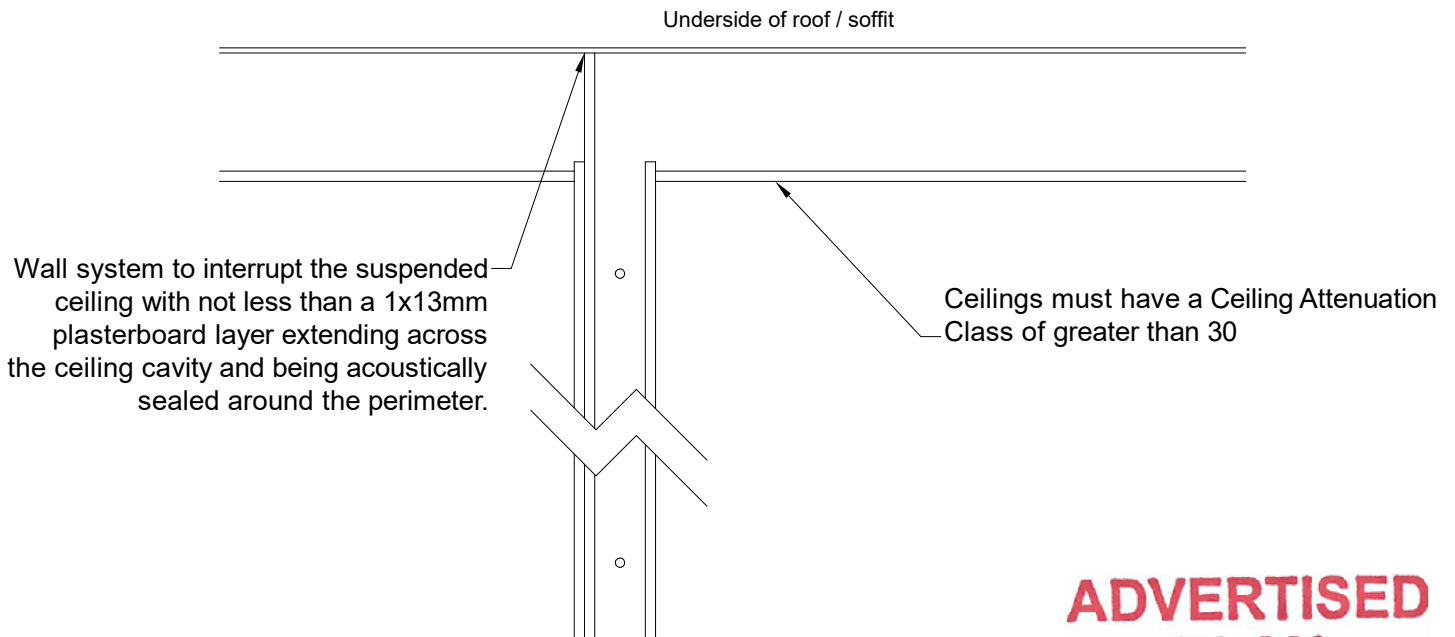
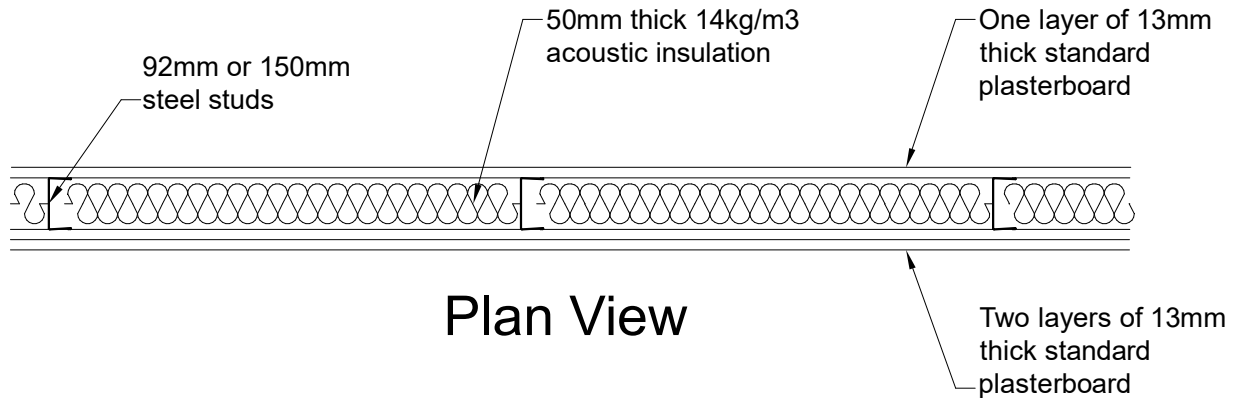
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DnTw 40 Wall



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End terminations of other walls: Walls should not abut window mullions, window glazing or simple lightweight partitions.
Glazing: Not recommended.



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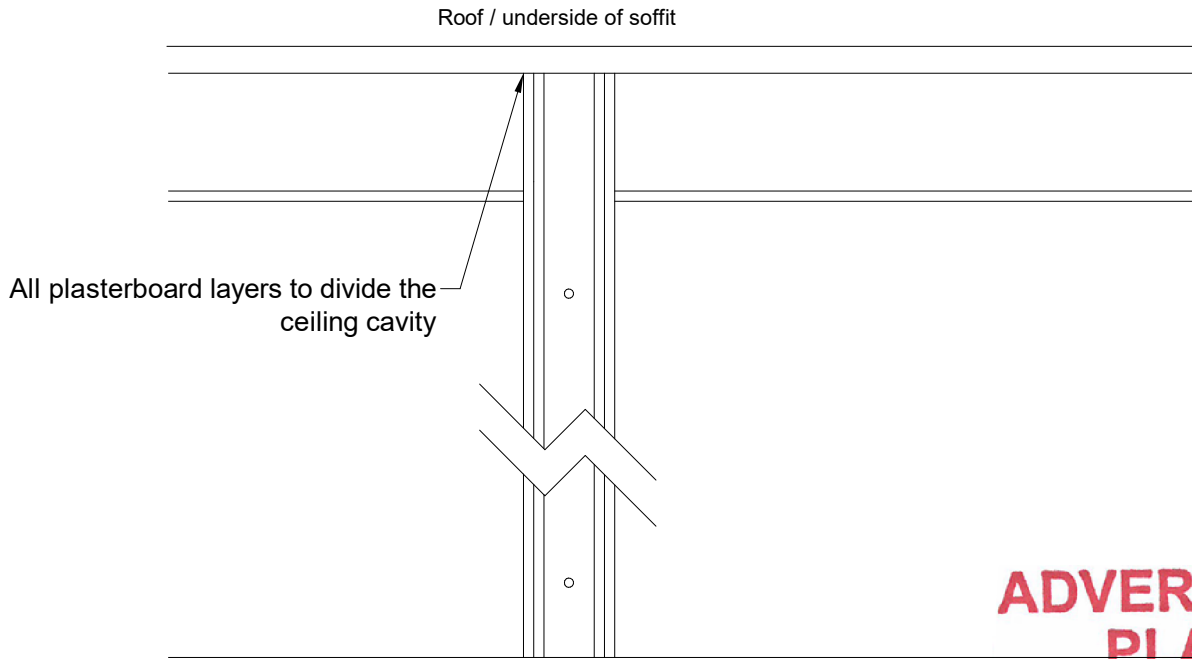
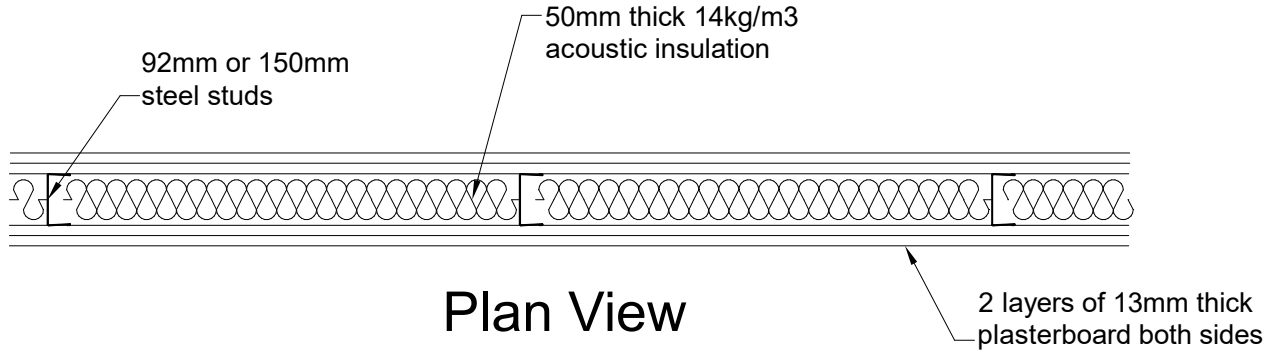
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DnTw 45 Wall



Section View

End terminations of other walls: Wall structure should interrupt the flow of the lining of any flanking wall (e.g. sheets of plasterboard must not be permitted to pass uninterrupted past the end of the wall).
Glazing: Not permitted.

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DnTw 45 Wall

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