

Foreground Architecture
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Carlton North Primary School

BQSH Acoustic Assessment

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1. Introduction

Octave Acoustics was engaged by Foreground Architecture to review project documentation for the proposed modernisation and upgrade works for Carlton North Primary School, located at 60 Lee Street, Carlton North. 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:

- The delivery of a new Multipurpose Hall building, which will include a Multipurpose Hall / After Care space, a Canteen/Food Science space, a music classroom and associated amenities and store rooms;
- Internal refurbishment of the existing “Infant” building, and;
- Internal refurbishment of the existing “Upper” building.

Note that any existing walls, ceilings and doors that will be retained after the refurbishment works are considered to be outside of scope with respect to the BQSH requirements. Nevertheless, recommendations have been made for acoustic treatment in spaces to be refurbished as to maximise acoustic separation and minimise reverberation time, whilst noting budgetary and heritage-related constraints.

This assessment was carried out with reference to project plans prepared by Foreground Architecture as attached in Appendix A.

2. BQSH Criteria

2.1. 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)”.

2.1.1. 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.

2.1.2. 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 1 below.

Table 1 – EPR 2021 Noise Criteria for Plant Noise Emissions based on a Neutral Zoning Level

Period	Zoning Level ₄ , L _{Aeq}
Day ₁	51
Evening ₂	45
Night ₃	40

- Notes:
1. Day period is:
 - 07:00 – 18:00 Monday – Saturday (except public holidays)
 2. Evening period is:
 - 18:00 – 22:00 Monday – Saturday
 - 07:00 – 22:00 Sunday and public holidays
 3. Night period is:
 - 22:00 – 07:00 Monday – Sunday
 4. 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.

2.1.3. 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.

2.2. 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.

2.3. Internal Sound Insulation

2.3.1. 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 2 provides activity noise levels and noise tolerance levels for typical educational spaces. Table 3 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 3 is provided in terms of $D_{nT,w}$ which is a metric that can be verified on-site.

Table 2 – Sound Insulation Ratings

Type of Room	Activity Noise (Source Room)	Noise Tolerance (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

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 3 – 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

2.3.2. Doors

Table 4 provides details of the applicable acoustic performance requirements which relate to doors and associated glazing.

Table 4 – 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 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.

2.3.3. 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 ($D_{nT,w}$ 35). Octave Acoustics has therefore designed fixed walls to achieve R_w 40 ($D_{nT,w}$ 35) where they incorporate a R_w 30 door-set.

2.4. 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 5.

Table 5 - 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

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.
-

2.5. 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.

2.6. 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.

3. Design Assessment

3.1. AS/NZS 2107

Refer to sections 3.2, 3.5 and 3.5.1 below.

3.2. 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 3.5.

3.3. Sound Insulation between Spaces

Appendix A presents marked-up and tagged floor plans that when read with reference to Table 6 will result in design compliance with BQSH requirements for sound insulation between spaces. Detail drawings of the specified wall constructions are provided in Appendix B.

Table 6 – Project Specific Wall Constructions to Satisfy BQSH

Minimum Acoustic Rating	Building Element	Solution
D _{nT,w} 30	Wall construction	Simple 64mm-wide steel or 90mm-wide timber stud 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	Simple 64mm-wide steel or 90mm-wide timber stud with a single layer of 13mm plasterboard applied to each side.

(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 ceilings are constructed)	Wall construction	Simple 64mm-wide steel or 90mm-wide timber stud 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 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	Single 64mm steel or 120mm timber stud system 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 .

	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	Single 64mm-wide steel or 120mm-wide timber stud system 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.
D _{nT,w} 50 – 55	Wall construction	Two rows of 64mm steel or 90mm timber stud separated by not less than 70mm and lined with 2 x 16mm plasterboard on both sides.
	Wall Extent	All plasterboard layers to interrupt the ceiling and divide the ceiling cavity.
	Cavity Insulation	Acoustic grade, 75mm thick with a minimum density of 14kg/m ³ installed to each row of studs.
	End Terminations of Other Walls	Not to form junctions with any lightweight wall or facade system unless the structure of the abutting wall/facade is physically interrupted by the dividing wall.
	Glazing	Not permitted.
	Ceiling	No specific requirement relating to sound transmission.
	<p>Plumbing Noise Attenuation Measures.</p> <p>(As shown by the dashed line)</p>	<p>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 3.3.3). 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/</p>

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.

3.3.1. Doors

Examples of door types which are expected to achieve the BQSH performance requirements described in Section 2.3.2 are provided in Table 7 and shall apply as shown in the tagged floor plans in Appendix A of this document.

Table 7 – Examples of Door Systems Expected to Achieve the BQSH Performance Requirement

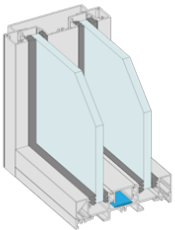
Door Label	Room Type	Acoustic rating	Door Type	Door Thickness	Acoustic Seals
Unlabelled	<ul style="list-style-type: none"> ▪ Toilets and washrooms ▪ Kitchens and kitchenettes ▪ Store rooms 	N/A	Timber Hinged Door	32mm (Solid core)	Nil.
			Glazed Hinged Door	6.38mm laminated glass	
			Sliding Door	32mm (Solid core)	
DT1	<ul style="list-style-type: none"> ▪ All acoustically significant spaces except music rooms 	R _w 30	Timber Hinged Door	35mm (Solid core)	Head & Jambs: Equivalent to Raven RPI20 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	
DT2	<ul style="list-style-type: none"> ▪ Music rooms 	R _w 33	Solid Sliding Door	Proprietary acoustic door, e.g., Lotus or Glyde which achieves a minimum performance requirement of R _w 33	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 33
			Glazed sliding door	Proprietary acoustic door, e.g., Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35

			minimum performance requirement of R_w 35		
DT3	<ul style="list-style-type: none"> Interconnecting doors separating enclosed rooms such as teaching spaces 	R_w 35	Solid sliding door	Proprietary acoustic door, e.g., Lotus or Glyde which achieves a minimum performance requirement of R_w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R_w 35
			Glazed sliding door	Proprietary acoustic door, e.g., Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R_w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R_w 35

3.3.2. Internal Glazing

Glazing types as shown in Table 8 shall apply as shown in the tagged floor plans in Appendix A of this document.

Table 8 - Glazing Types

Wall Type / Line Colour (Refer Appendix A)	Glass Type
$D_{nT,w}$ 30 - Orange	Fixed glazing at least 6mm thick
$D_{nT,w}$ 35 - Light Blue	Fixed glazing incorporating sealed 10.38mm thick laminated glass
$D_{nT,w}$ 40 - Red	<p>Performance requirement for glazing suite is $R_w \geq 45$.</p> <p>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.</p> <p>https://www.awsaustralia.com.au/specifyaws/office-partitioning-system</p> 

3.3.3. 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.

3.3.4. 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.

3.3.5. Acoustic Separation of Library Space from Adjacent Spaces (Infant Building)

An assessment of the acoustic performance of the existing partitions is outside the scope of this assessment. As such, any additional acoustic treatment proposed may be compromised by noise flanking through the existing partitions. For this reason, recommendations to reduce noise transmission between the Library and adjacent spaces are presented below in expected order of cost effectiveness.

3.3.5.1. Installation of Door Seals on Existing Doors

It is recommended that the following face-fixed drop seals and perimeter seals are installed to the existing pair hinged doors separating the Library space from WCs / Entry to the west.

Face-fixed drop seals: Equivalent to Raven RP128Si

Meeting stile seals: Equivalent to Raven RP71Si

Head and jambs: Equivalent to Raven RP10Si

It is recommended that the following face-fixed drop seals and perimeter seals are installed to the existing hinged doors separating the Library space from the Sci / Art spaces to the north.

Face-fixed drop seals: Equivalent to Raven RP99Si

Head and jambs: Equivalent to Raven RP10Si

3.3.5.2. Construction of an Acoustic Enclosure behind Glazing Separating Library from WCs

It is understood that stained-glass windows are to be installed into existing frames separating the Library from the adjacent WCs, with LED lighting to be installed behind the glass panes.

It is recommended that acoustic enclosures are constructed behind these windows (on the WC side), consisting of at least one layer of 13mm thick moisture rated plasterboard or one layer of 9mm thick fibre cement sheet with 50mm thick, 32kg/m³ fibrous insulation installed the cavity.

3.4. Reverberation Control

Table 9 provides details of acoustic absorption treatments required to achieve design compliance with BQSH requirements for reverberation control in key spaces.

At this stage, it is understood that:

- In the Upper Building, all spaces listed below are expected to retain their existing ceilings under the base scheme:
 - Prep Classroom U01 and Prep classroom U04 (with a proposed tender option to replace the ceiling)
 - Library U.02 (with a proposed tender option to replace the ceiling)
 - Consult / Teacher U.02 (with a proposed tender option to replace the ceiling)
 - Foyer U.05
 - All circulation spaces
- For reasons relating to heritage, installation of absorptive treatment in the Library Space (Infant Building) is limited. Namely, it is understood that:
 - the existing ceiling is to be retained, and that acoustic treatment (e.g., acoustic panels) cannot be directly fixed to or suspended from the ceiling
 - wall coverage of acoustic treatment is limited (e.g., cannot be installed above existing internal windows).

Achieving the BQSH requirement in regard to reverberation time for these spaces will be largely dependent on the performance of the existing ceiling(s) which have not been verified. These spaces are therefore considered outside of scope with respect to the BQSH reverberation time requirement, and it is recommended that departures with the applicable BQSH reverberation time criteria are sought for these spaces. Refer to Section 3.6.1.

Nevertheless, recommendations have been made for acoustic treatment in spaces to be refurbished as to minimise reverberation time, whilst noting budgetary and heritage-related constraints.

Table 9 – Recommended Reverberation Control Treatments

Room	Criteria for Reverb Time (s)	Treatment	
		Surface	Recommendation
Upper Building			
Prep Classroom U.01 and U.04	< 0.6	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Install approximately 50% coverage of the total wall area with acoustic pinboard having an NRC rating of $\geq 0.45_2$. Ideally, coverage is evenly distributed between at least two perpendicular walls.
		Ceiling	<p>Base option: Existing ceiling is to be retained and a departure for compliance with BQSH reverberation time criteria is sought for this space. Note that it is calculated that at least 70% coverage of the existing ceiling area with acoustic panel equivalent to 25mm Autex Quietspace with NRC ≥ 0.85 would be required to comply with the applicable reverberation time criteria.</p> <p>Tender option: Replace entire ceiling with an acoustically absorptive ceiling, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70.</p>
Library U.02	< 0.6	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Install approximately 50% coverage of the total wall area with acoustic pinboard having an NRC rating of $\geq 0.45_2$. Ideally, coverage is evenly distributed between at least two perpendicular walls.
		Ceiling	<p>Base option: Existing ceiling is to be retained and a departure for compliance with BQSH reverberation time criteria is sought for this space. Note that it is calculated that at least 70% coverage of the existing ceiling area with acoustic panel equivalent to 25mm Autex Quietspace with NRC ≥ 0.85 would be required to comply with the applicable reverberation time criteria.</p> <p>Tender option: Replace entire ceiling with an acoustically absorptive ceiling, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70.</p>
Consult / Teacher U.03	0.3 – 0.6	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Install approximately 50% coverage of the total wall area with acoustic pinboard having an NRC rating of $\geq 0.45_2$. Ideally, coverage is evenly distributed between at least two perpendicular walls.
		Ceiling	<p>Base option: Existing ceiling is to be retained and a departure for compliance with BQSH reverberation time criteria is sought for this space. Note that it is calculated that at least 70% coverage of the existing ceiling area with acoustic panel equivalent to</p>

			<p>25mm Autex Quietspace with NRC \geq 0.85 would be required to comply with the applicable reverberation time criteria.</p> <p>Tender option: Replace entire ceiling with an acoustically absorptive ceiling, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70.</p>
Foyer U.05	< 0.8	Floor	Resilient floor surface (e.g., vinyl) (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>Base option: Existing ceiling is to be retained and a departure for compliance with BQSH reverberation time criteria is sought for this space.</p> <p>Note that it is calculated that at least 70% coverage of the existing ceiling area with acoustic panel equivalent to 25mm Autex Quietspace with NRC \geq 0.85 would be required to comply with the applicable reverberation time criteria.</p> <p>Tender option: Replace entire ceiling with an acoustically absorptive ceiling, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70.</p>
Reception U.06 and Office U.07	< 0.8	Floor	Resilient floor surface (e.g., vinyl) (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).</p>
Bus. Mng	0.4 – 0.7	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).</p>
A / Principals	0.4 – 0.7	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).</p>
Principal	0.4 – 0.7	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated</p>

			plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).
Meeting	0.4 – 0.7	Floor	Carpet or carpet tile (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	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).</p>
Sickbay	0.4 – 0.7	Floor	Resilient floor surface (e.g., vinyl) (100% floor coverage).
		Walls	Nil.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive, hygiene rated ceiling is installed, such as hygiene rated acoustic ceiling tiles, rated to at least NRC 0.70 (100% ceiling coverage).</p>
Planning U.12	0.6 – 0.7	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	Install approximately 50% coverage of the total wall area with acoustic pinboard having an NRC rating of $\geq 0.45_2$. Ideally, coverage is evenly distributed between at least two perpendicular walls.
		Ceiling	<p>It is understood that a new ceiling is proposed for this space.</p> <p>It is recommended that an acoustically absorptive ceiling is installed, such as acoustic ceiling tiles or perforated plasterboard, rated to at least NRC 0.70 (100% ceiling coverage).</p>
Staff / PLC U.13, Staff Kitchen U.14 and Storage U.15	< 0.8	Floor	Existing floor surface.
		Walls	Nil.
		Ceiling	<p>Base option: Existing ceiling is to be retained. It is recommended to install at least 70% coverage of the ceiling area with acoustic panel equivalent to 25mm Autex Quietspace with NRC ≥ 0.85.</p> <p>Proposed tender option: Install a suspended acoustic baffle system, rated to at least NRC 0.70 (at least 80m² coverage). e.g., Autex Frontier Axis 12mm (150mm deep, 300mm centres).</p>
Infant Building			
Library L.01	< 0.8	Floor	Existing flooring surface.
		Walls	Maximise coverage of acoustic panel equivalent to 24mm thick Autex Cube (NRC 0.70) where space and heritage conditions allow.

		Ceiling	It is understood the existing ceiling is to be retained and cannot be modified for reasons relating to heritage. It is recommended that a departure for compliance with BQSH reverberation time criteria is sought for this space.
Multipurpose Hall Building			
Multi-Purpose Hall / After Care M.04	< 1.0	Floor	Resilient floor surface (e.g., vinyl) (100% floor coverage).
		Walls	Heavy velour curtains (at least 610g/m ³ when draped to half area) (at least 30m ² wall coverage).
		Ceiling	Suspended perforated plasterboard with an open area of not less than 15% and having an NRC rating of $\geq 0.70_2$. Perforated plasterboard should be overlaid with 50mm thick fibrous insulation having a density of not less than 32kg/m ³ . (100% ceiling coverage).
Canteen, Food, Science / OSHC M.10	0.6 – 0.8	Floor	Resilient floor surface (e.g., vinyl) (100% floor coverage).
		Walls	Nil.
		Ceiling	Suspended, hygiene rated acoustic ceiling tiles with an NRC rating of at least NRC 0.70 and a CAC rating of at least 35 (100% ceiling coverage).
Music M.01	0.7 – 0.9	Floor	Carpet or carpet tile (100% floor coverage).
		Walls	It is recommended that at least 15m ² wall coverage of acoustic pinboard with an NRC rating of at least 0.40 ₂ is installed. Ideally, coverage is evenly distributed on at least 2 perpendicular walls.
		Ceiling	Suspended perforated plasterboard with an open area of not less than 15% and having an NRC rating of $\geq 0.70_2$. Perforated plasterboard should be overlaid with 50mm thick fibrous insulation having a density of not less than 32kg/m ³ .

- Notes:
- 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.
 - The following are examples of products providing the required NRC levels referenced in this report:
 - NRC = 0.45: Acoustic Pinboard – 12mm thick Autex Cube
 - NRC = 0.70: Gyprock Rigitone Matrix 8mm Round overlaid with 50mm thick, 32kg/m³ insulation with a ceiling cavity depth of at least 200mm
 - NRC = 0.85: Acoustic Panel – 25mm thick Autex QuietSpace

3.5. Internal Noise Criteria

Table 10 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 10.

Table 10 – 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
Upper Building		
Prep Classroom U.01 and U.04	35-40	50
Library U.02	40-45	50
Consult / Teacher U.03	35-40	50
Foyer U.05	< 50	55
Reception U.06 and Office U.07	< 50	55
Bus. Mng	35-40	50
A / Principals	35-40	50
Principal	35-40	50
Meeting	35-40	50
Sickbay	40-45	50
Planning U.12	35-40	50
Staff / PLC U.13, Staff Kitchen U.14 and Storage U.15	40-45	50
Infant Building		
Library L.01	40-45	50
Multipurpose Hall Building		
Multi-Purpose Hall / After Care M.04	40-45	50
Canteen, Food, Science / OSHC M.10	40-45	50
Music M.01	35-40	50

Notes: 1. As defined in Section 2.6.

3.5.1. External Noise Intrusion

The Subject Site is located near roads with relatively low volumes of traffic. The Subject Site is not located near any railway lines and is not located within the ANEF contours of major airports. As such, the assessment of the proposed modernisation and upgrade works for Carlton North Primary School, with respect to potential noise sources, indicates that associated external noise intrusion will comfortably comply with BQSH requirements for the proposed façade and roof construction.

3.5.2. Rain Noise

Table 11 presents a design for a build-up of roof/ceiling construction for the proposed modernisation and upgrade works for Carlton North Primary School as required to satisfy BQSH requirements for rain noise control in all spaces apart from where the existing roof is to be retained.

Where existing sections of the roof are retained, rain noise mitigation is considered to be outside of scope as there is no opportunity to install an insulation blanket between the roof sheeting and purlins in order to provide damping.

Table 11 – 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">Standard plasterboard not less than 10mm thick; orAcoustic ceiling tile with a ceiling attenuation class (CAC) of at least 35; orPerforated plasterboard overlaid with 50mm thick fibrous insulation having a density not less than 32kg/m³.

3.6. Summary of Proposed Departures from BQSH Criteria

3.6.1. BQSH Reverberation Time Criteria Departures

It is understood that under the proposed base scheme, the existing ceilings are to be retained in the following spaces, and as such, it is proposed that departures for BQSH reverberation time criteria are sought.

- Prep Classroom U.01 and U.03
- Library U.02
- Consult / Teacher U.03
- Foyer U.05
- Library L.01
- Staff / PLC U.13, Staff Kitchen U.14 and Storage U.15

3.6.2. BQSH Sound Insulation Criteria Departures

It is understood that existing internal walls (in full, or partially) surrounding the following spaces, and/or existing ceilings are to be retained in the following spaces, and as such, it is proposed that departures for BQSH airborne sound insulation criteria are sought.

- All spaces in the Upper Building except for A / Principals U.09
- Library L.01

3.6.3. BQSH Rain Noise Control Criteria

Where existing sections of the roof are retained, rain noise mitigation is considered to be outside of scope as there is no opportunity to install an insulation blanket between the roof sheeting and purlins in order to provide damping.

3.7. 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.

3.7.1. 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.

4. Conclusion

Octave Acoustics has carried out an acoustic BQSH assessment of the documentation for the proposed modernisation and upgrade works for Carlton North Primary School. 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 within the scope of assessment).

For detailed recommendations, refer to:

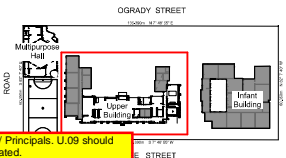
- Appendix A – Acoustic Internal Partition Markup
- Appendix B – BQSH wall type drawings.
- Appendix C – Acoustic Reverberation Treatment Markup

Appendix A: Acoustic Internal Partition Markup

Note that:

- Walls and doors have been specified in accordance with BQSH. However, where existing ceilings / walls / doors are being retained proximate to new ceilings / walls / doors, the composite sound insulation performance of partitions may not meet the airborne sound insulation requirements in BQSH due to sound flanking through retained components.
- Unmarked walls and doors are understood to be existing and retained.
- This markup is to be read in conjunction with Section 3.3 of the acoustic report and Appendix B.

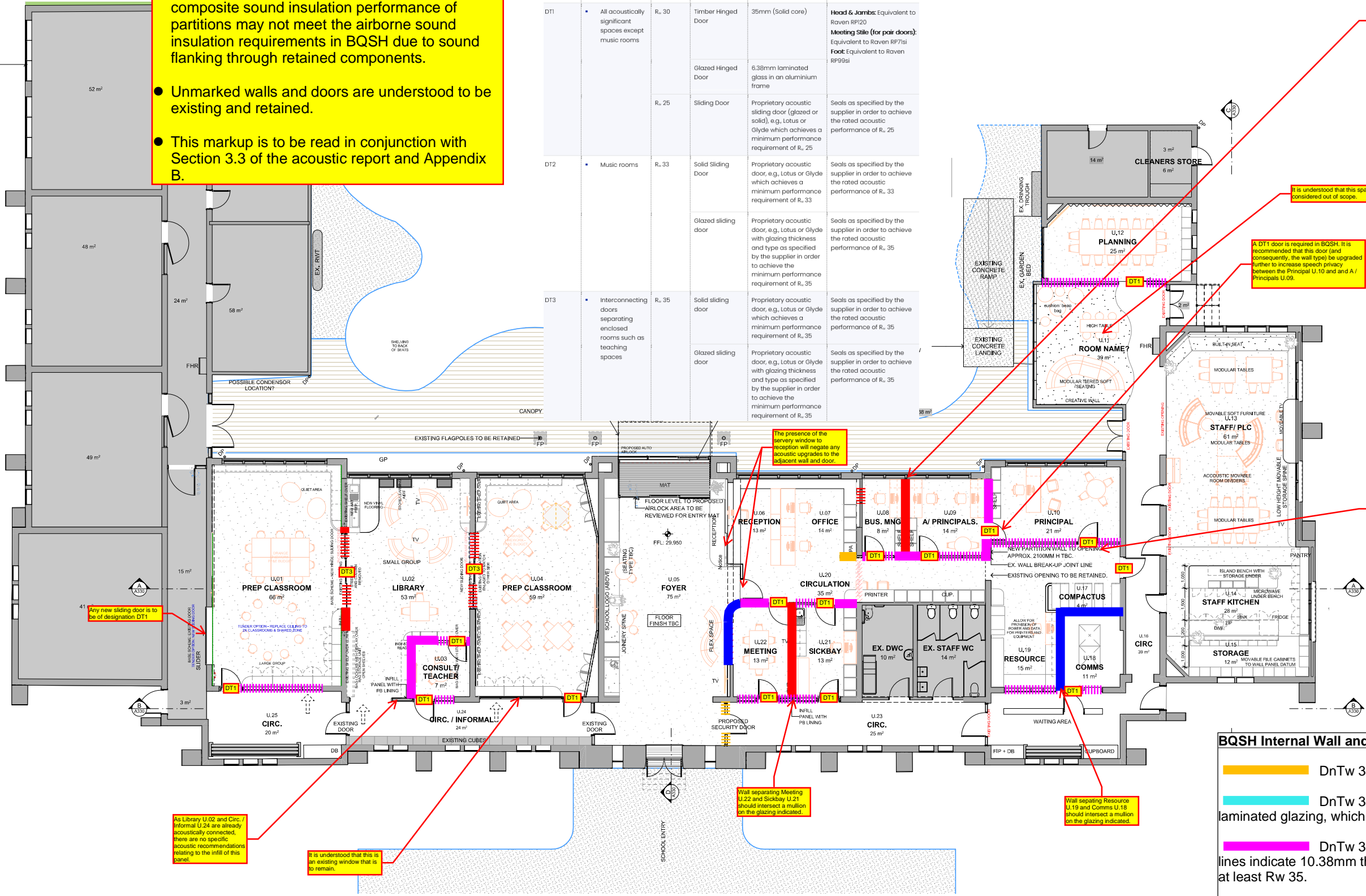
Door Label	Room Type	Acoustic rating	Door Type	Door Thickness	Acoustic Seals
Unlabelled	Toilets and washrooms Kitchens and kitchenettes Store rooms	N/A	Timber Hinged Door	32mm (Solid core)	Nil.
			Glazed Hinged Door	6.38mm laminated glass	
			Sliding Door	32mm (Solid core)	
DT1	All acoustically significant spaces except music rooms	R. 30	Timber Hinged Door	35mm (Solid core)	Head & Jamb: Equivalent to Raven RP20 Meeting Stile (for pair doors): Equivalent to Raven RP71s Foot: Equivalent to Raven RP99s
			Glazed Hinged Door	6.38mm laminated glass in an aluminium frame	
DT2	Music rooms	R. 25	Sliding Door	Proprietary acoustic sliding door (glazed or solid), e.g. Lotus or Glyde which achieves a minimum performance requirement of R. 25	Seals as specified by the supplier in order to achieve the rated acoustic performance of R. 25
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R. 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R. 35
DT3	Interconnecting doors separating enclosed rooms such as teaching spaces	R. 35	Solid sliding door	Proprietary acoustic door, e.g. Lotus or Glyde which achieves a minimum performance requirement of R. 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R. 35
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R. 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R. 35



Wall separating Bus. Mng U.08 and A / Principals, U.09 should intersect a mullion on the glazing indicated.

It is understood that a glass fin connection the existing mullion is required (for reasons relating to heritage), and that the system must have a timber frame. It is recommended that a glazing system with a minimum acoustic rating of Rw 40 is used.

At this stage, it is expected that a double glazed system with two panes of 10.38mm thick laminated glass with a minimum airgap of 40mm will be required to achieve this minimum acoustic rating of Rw 40.



It is understood that this space is considered out of scope.

A DT1 door is required in BQSH. It is recommended that this door (and consequently, the wall type) be upgraded further to increase speech privacy between the Principal U.10 and A / Principals U.09.

If the proposed opening to the new partition is implemented, this will negate any acoustic upgrades (as marked up here) to the partition elements (walls, doors and internal glazing).

The presence of the service window to reception will negate any acoustic upgrades to the adjacent wall and door.

Any new sliding door is to be of designation DT1

As Library U.02 and Circ. Informal U.24 are already acoustically connected, there are no specific acoustic recommendations relating to the infill of this panel.

It is understood that this is an existing window that is to remain.

Wall separating Meeting U.22 and Sickbay U.21 should intersect a mullion on the glazing indicated.

Wall separating Resource U.19 and Comms U.18 should intersect a mullion on the glazing indicated.

BQSH Internal Wall and Glazing Types

- DnTw 30 wall.
- DnTw 35 wall. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 35 wall adjacent to perforated ceilings. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 40 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 40.
- DnTw 45 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 45.
- DnTw 50-55 wall.

NOTES

- DO NOT SCALE DRAWINGS.
- FIGURED DIMENSIONS TAKE PRECEDENCE.
- DIMENSIONS ARE IN MILLIMETRES
- ANY DISCREPANCY IN THE DRAWINGS OR SPECIFICATIONS SHALL BE REFERRED TO FOREGROUND ARCHITECTURE.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH SECONDARY CONSULTANT'S DRAWINGS, DETAILS AND SPECIFICATIONS, AND ANY OTHER WRITTEN INSTRUCTIONS ISSUED DURING THE COURSE OF THE CONTRACT.
- THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO COMMENCING ANY SHOP DRAWINGS OR WORKS ON SITE.

REV	DATE	BY	CH	DESCRIPTION
M00	19/09/2023		LC	START OF AMP STAGE
D00	10/09/2024		LC	START DESIGN DEVELOPMENT
D01	10/09/2024		LC	Consultant Coordinations
D02	18/09/2024		LC	Consultant Coordinations - Demolition & SSU Review

ID	CHANGE DESCRIPTION
CH400 2	DD - SSU Review Issue

Foreground
architecture

Swanston Central Tenancy 3, Upper Mezzanine Level
180 Victoria Street, Carlton VIC 3053
Wurundjeri Waa Wurrundj Country

foregrundarchitecture.com.au
info@foregrundarchitecture.com.au
ABN 44 005 690 859 ARBV 50053 +61 (03) 9329 8555

DESIGN DEVELOPMENT

NOT FOR CONSTRUCTION

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CHECKED LC
PLOT DATE 23/09/2024

DRAWING TITLE
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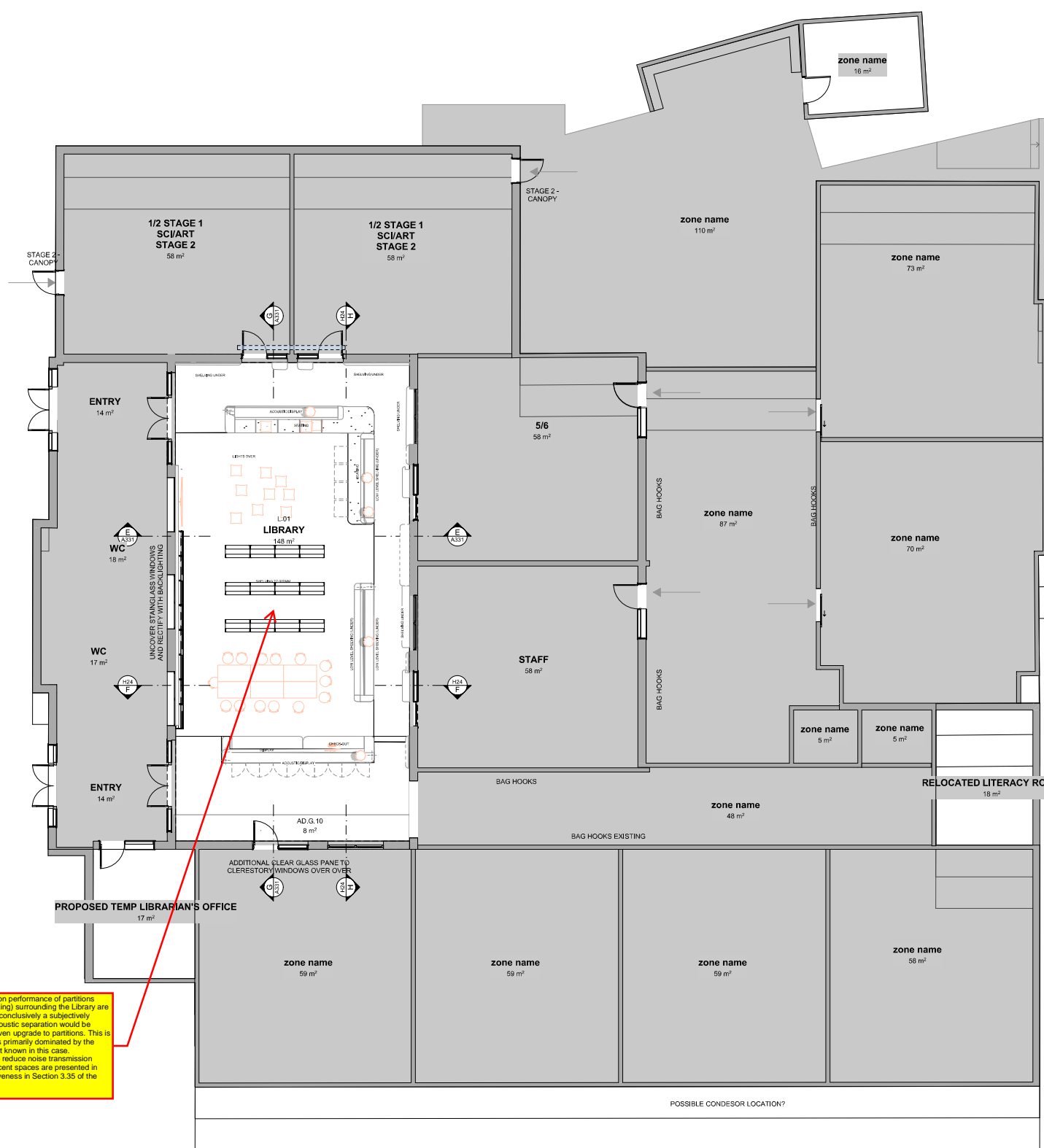
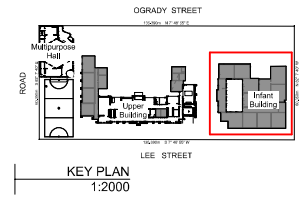
PROJECT
Carlton North Primary School
60 Lee St, Carlton north, VIC 3054
Wurundjeri Country

FOR
VSBA

PROJECT
2357

DWG NO.
A131

REVISION
D02



BQSH Internal Wall and Glazing Types

- DnTw 30 wall.
- DnTw 35 wall. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 35 wall adjacent to perforated ceilings. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 40 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 40.
- DnTw 45 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 45.
- DnTw 50-55 wall.

Note that:

- Walls and doors have been specified in accordance with BQSH. However, where existing ceilings / walls / doors are being retained proximate to new ceilings / walls / doors, the composite sound insulation performance of partitions may not meet the airborne sound insulation requirements in BQSH due to sound flanking through retained components.
- Unmarked walls and doors are understood to be existing and retained.
- This markup is to be read in conjunction with Section 3.3 of the acoustic report and Appendix B.

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	<ul style="list-style-type: none"> • All acoustically significant spaces except music rooms 	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	
			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
DT2	<ul style="list-style-type: none"> • Music rooms 	R _w 33	Solid Sliding Door	Proprietary acoustic door, e.g. Lotus or Glyde which achieves a minimum performance requirement of R _w 33	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 33
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35
DT3	<ul style="list-style-type: none"> • Interconnecting doors separating enclosed rooms such as teaching spaces 	R _w 35	Solid sliding door	Proprietary acoustic door, e.g. Lotus or Glyde which achieves a minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35

As the existing sound insulation performance of partitions (walls, doors and internal glazing) surrounding the Library are unknown, it is not possible to conclusively a subjectively noticeable improvement in acoustic separation would be achieved as a result of any given upgrade to partitions. This is because noise transmission is primarily dominated by the weakest pathway, which is not known in this case. As such, recommendations to reduce noise transmission between the Library and adjacent spaces are presented in expected order of cost effectiveness in Section 3.35 of the acoustic report.

REV	DATE	BY	CH	DESCRIPTION	ID	CHANGE DESCRIPTION
D00	10/09/2024			START DESIGN DEVELOPMENT	CH400 2	DD - SSU Review Issue
D01	10/09/2024			Consultant Coordinations		
D02	16/09/2024			Consultant Coordinations - Demolition & SSU Review		

- NOTES**
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 6. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO COMMENCING ANY SHOP DRAWINGS OR WORKS ON SITE.

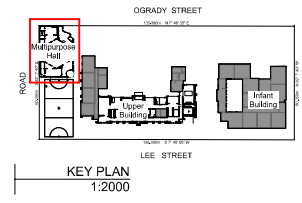
GA PLAN - Infant Building

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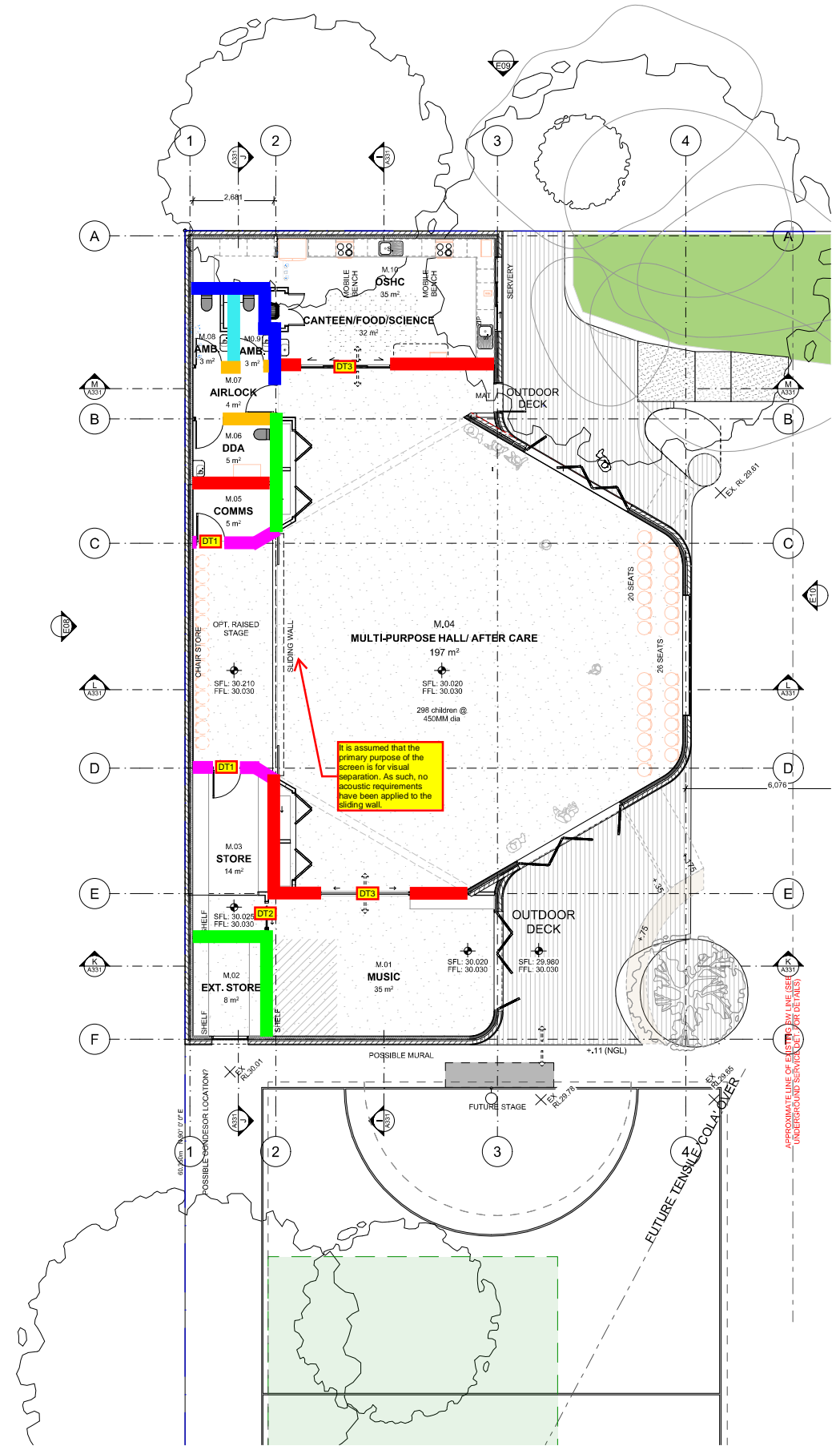


Note that:

- Walls and doors have been specified in accordance with BQSH. However, where existing ceilings / walls / doors are being retained proximate to new ceilings / walls / doors, the composite sound insulation performance of partitions may not meet the airborne sound insulation requirements in BQSH due to sound flanking through retained components.
- Unmarked walls and doors are understood to be existing and retained.
- This markup is to be read in conjunction with Section 3.3 of the acoustic report and Appendix B.

BQSH Internal Wall and Glazing Types

- DnTw 30 wall.
- DnTw 35 wall. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 35 wall adjacent to perforated ceilings. Dashed lines indicate 10.38mm thick laminated glazing, which is to be rated to at least Rw 35.
- DnTw 40 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 40.
- DnTw 45 wall. Dashed lines indicate glazing, which is to be rated to at least Rw 45.
- DnTw 50-55 wall.



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	<ul style="list-style-type: none"> All acoustically significant spaces except music rooms 	R _w 30	Timber Hinged Door	35mm (Solid core)	Head & Jamb: 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	
DT2	<ul style="list-style-type: none"> Music rooms 	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 R _w 25
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35
DT3	<ul style="list-style-type: none"> Interconnecting doors separating enclosed rooms such as teaching spaces 	R _w 35	Solid sliding door	Proprietary acoustic door, e.g. Lotus or Glyde which achieves a minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35
			Glazed sliding door	Proprietary acoustic door, e.g. Lotus or Glyde with glazing thickness and type as specified by the supplier in order to achieve the minimum performance requirement of R _w 35	Seals as specified by the supplier in order to achieve the rated acoustic performance of R _w 35

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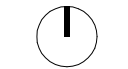
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 GA Plan - Multipurpose Hall

PROJECT
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 60 Lee St, Carlton north, VIC 3054
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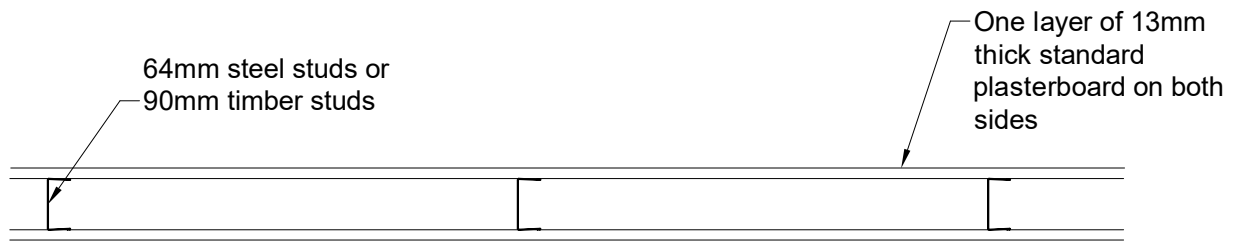
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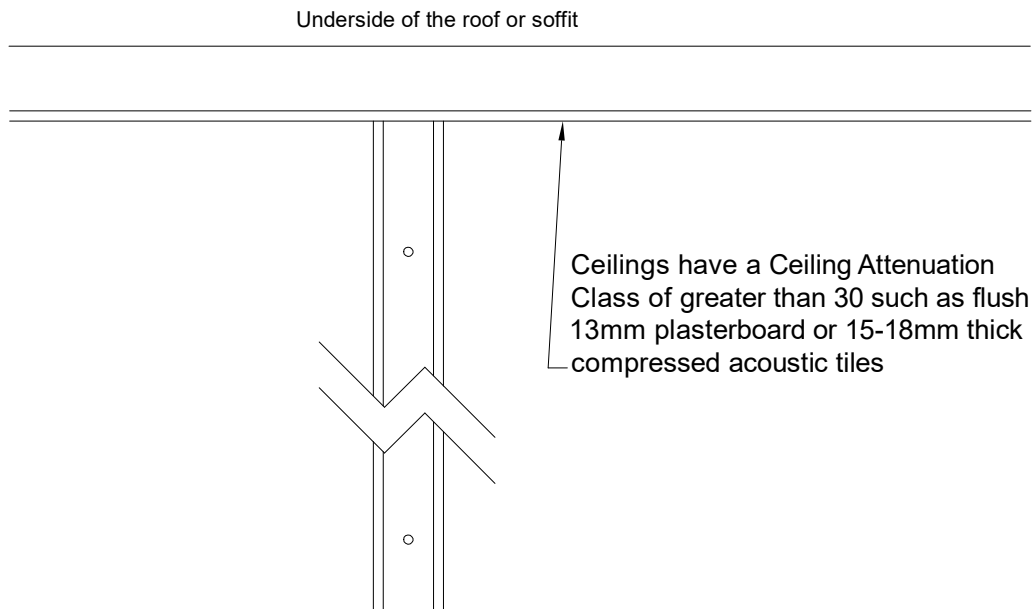
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Appendix B: BQSH Wall Type Drawings

DnTw 30 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: Permitted but must be sealed and should be at least 6mm thick.



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TITLE:

DnTw 30 Wall

PROJECT NO.

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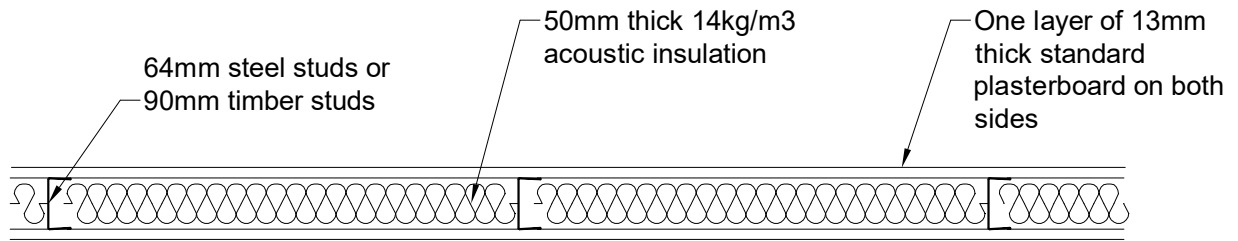
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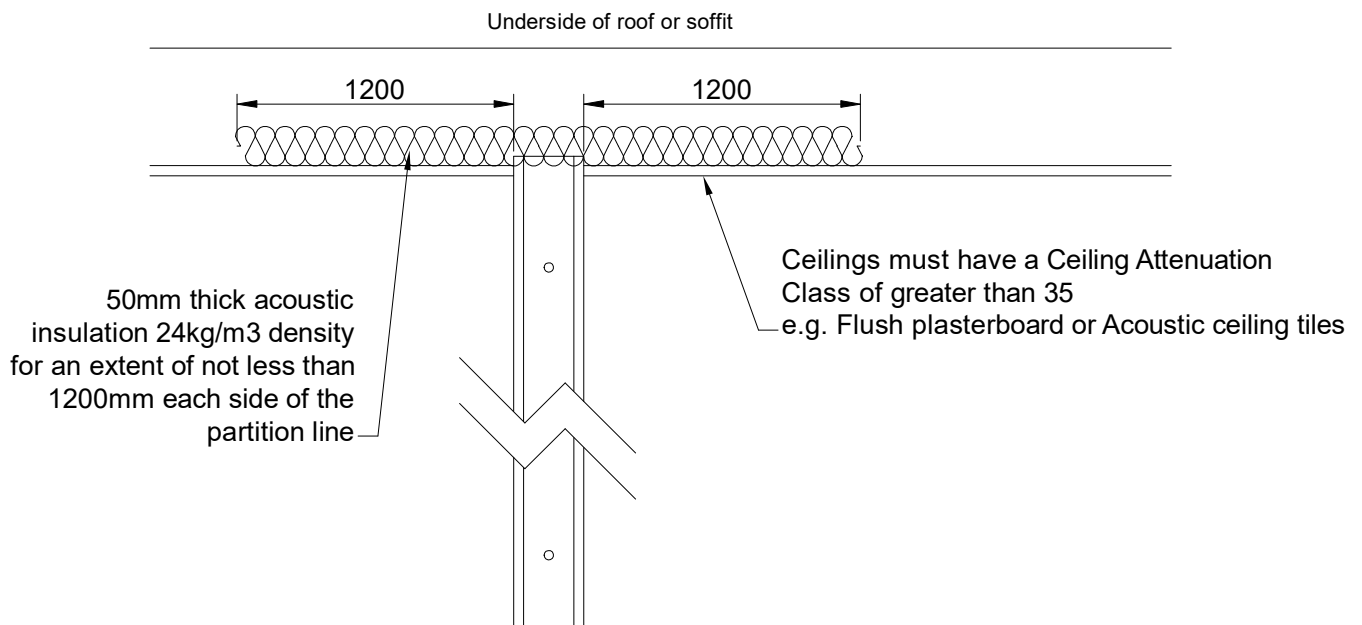
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DnTw 35 Wall



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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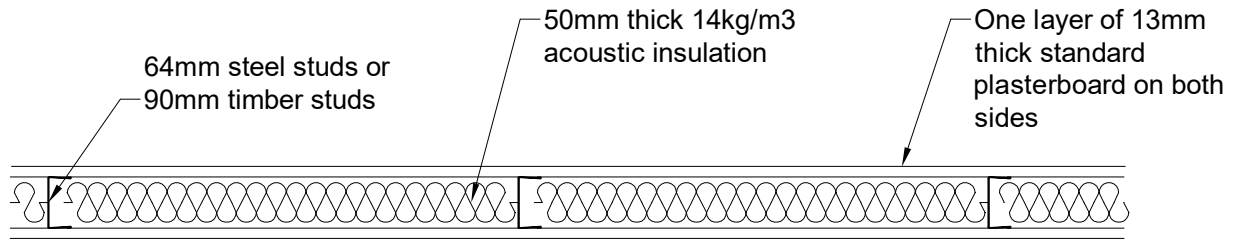
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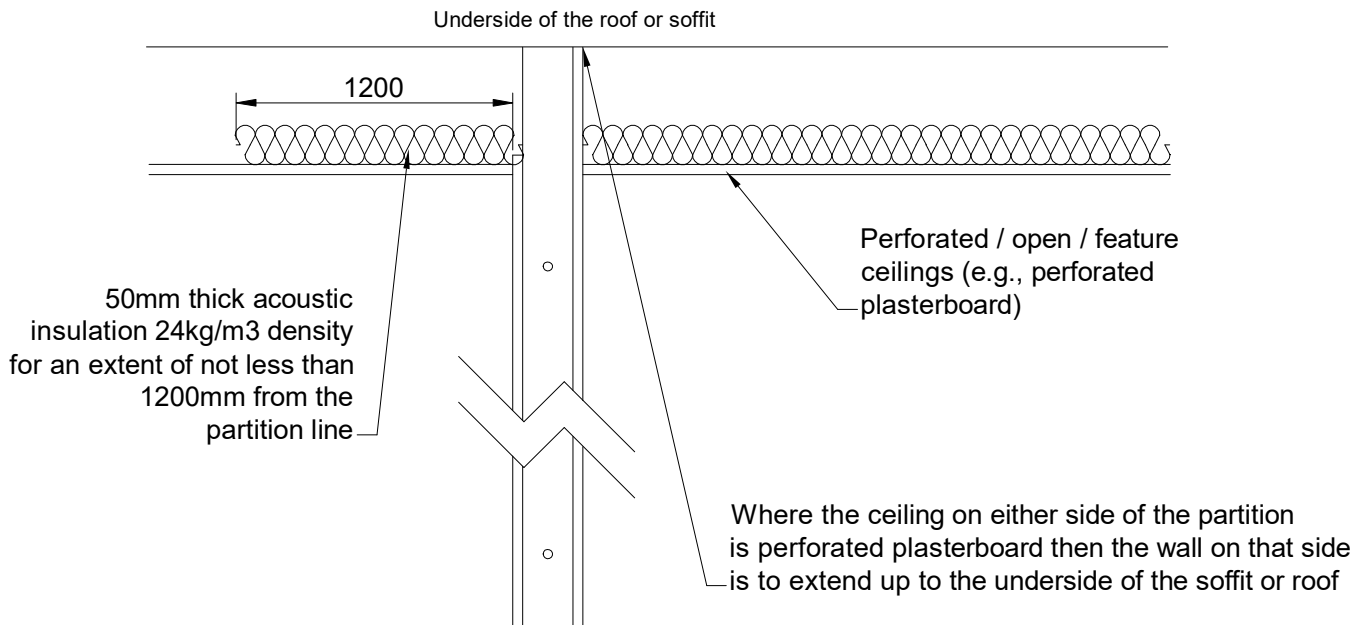
DnTw 35 Wall - Light Blue

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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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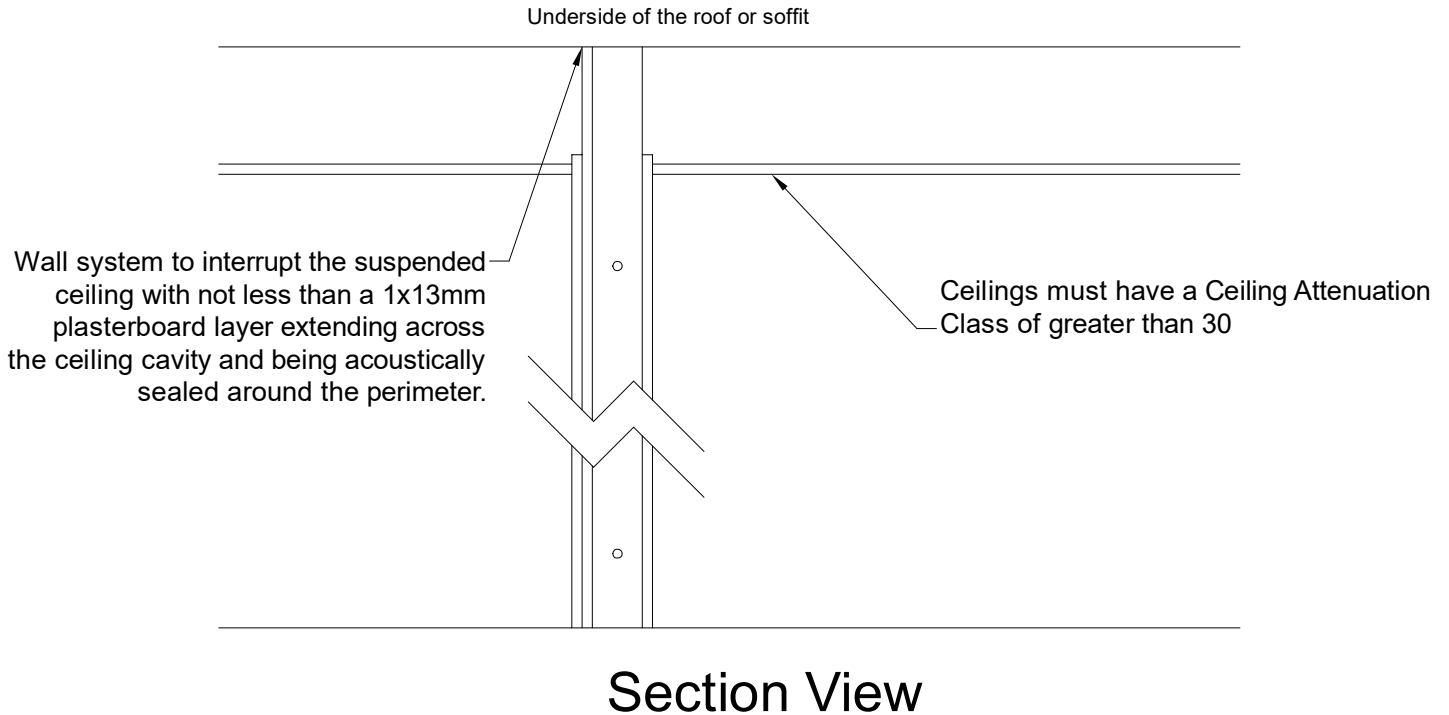
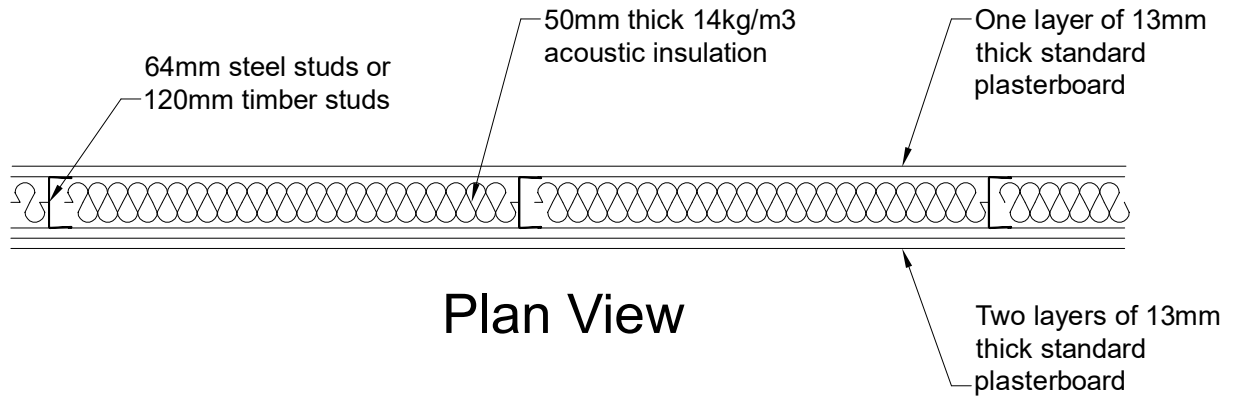
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DnTw 35 Wall - Pink

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DnTw 40 Wall



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



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DnTw 40 Wall

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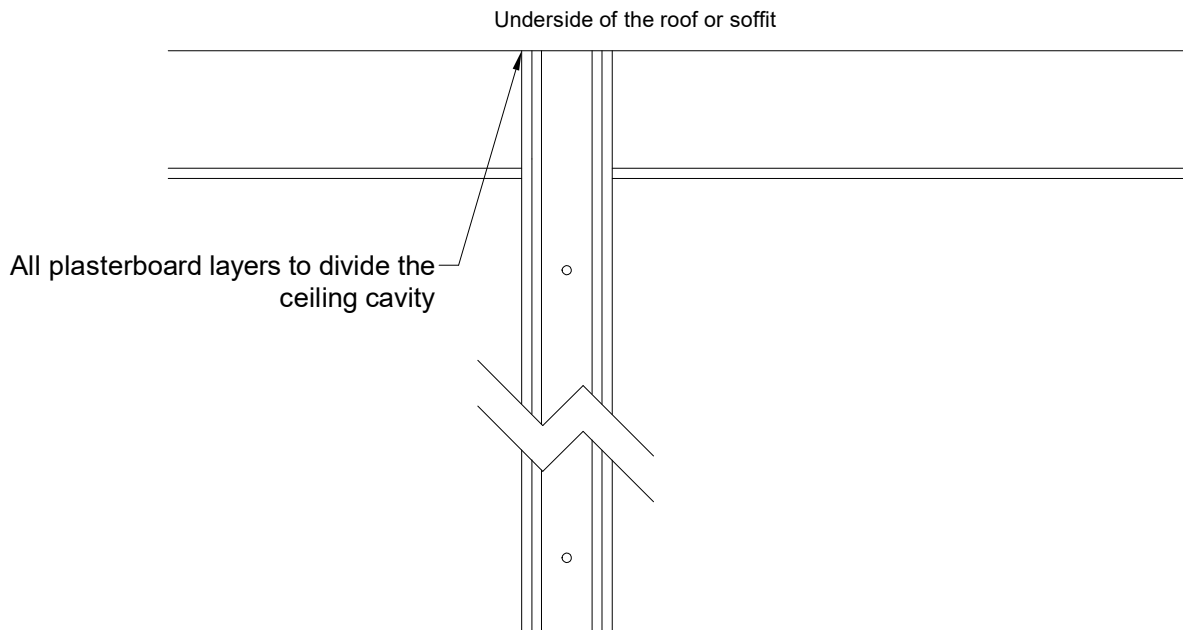
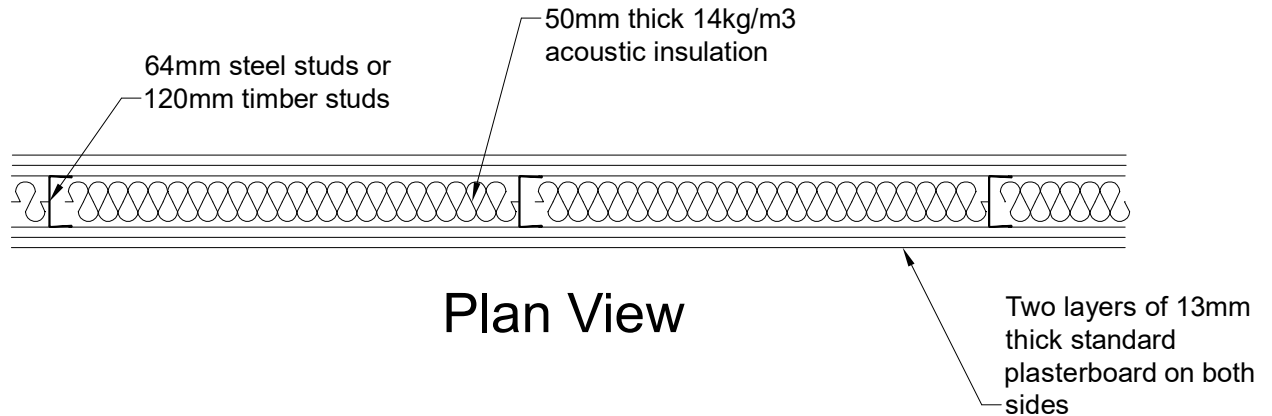
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DnTw 45 Wall



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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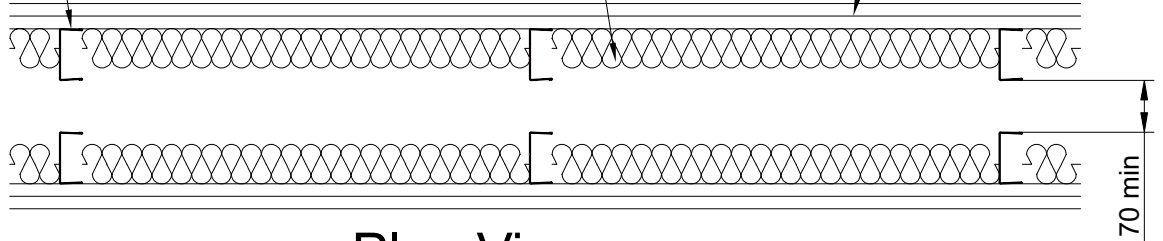
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DnTw 50-55 Wall

64mm steel studs
or 90mm timber
studs both sides

50mm thick x 14kg/m³ glasswool
installed between studs both sides

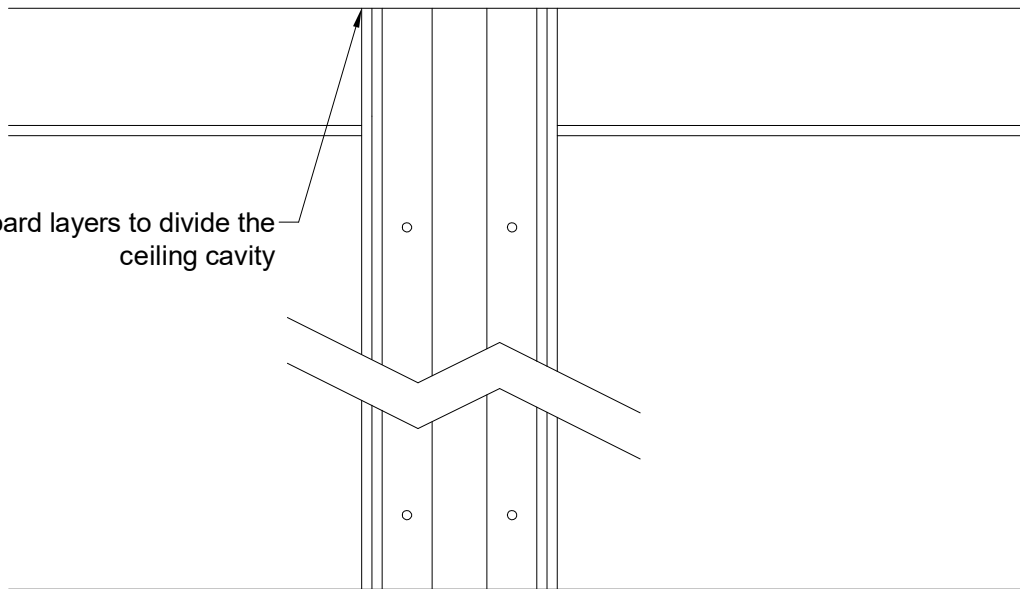
Two layers of 16mm thick
plasterboard both sides



Plan View

Underside of the roof or soffit

All plasterboard layers to divide the
ceiling cavity



Section View

End terminations of other walls: Not to form junctions with any
lightweight wall or facade system unless the structure of the
abutting wall / facade is physically interrupted by the dividing wall.
Glazing: Not permitted.



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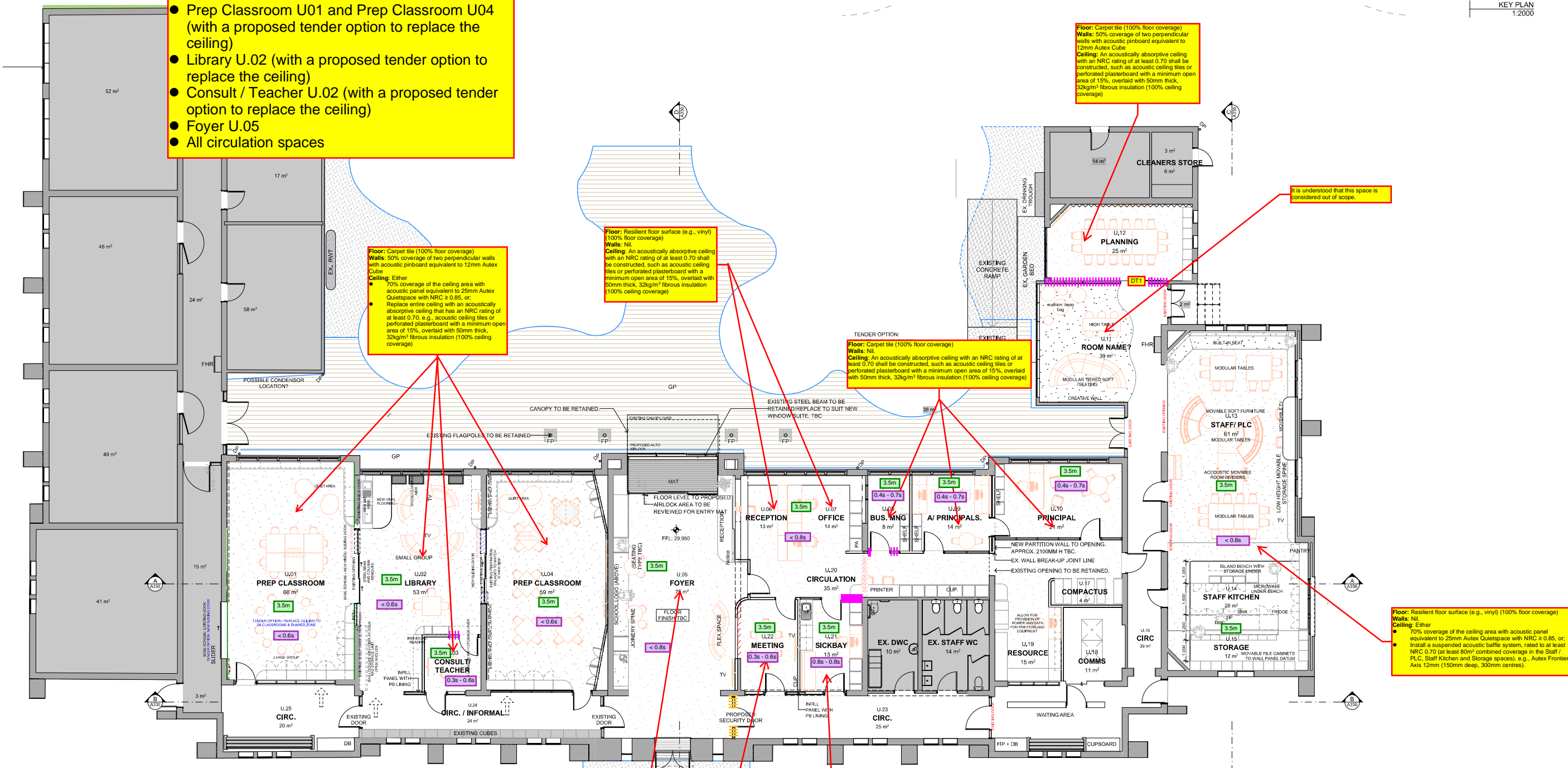
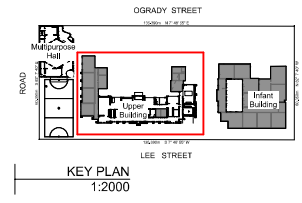
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Appendix C: Acoustic Reverberation Treatment Markup

This markup is to be read in conjunction with Section 3.4 of the acoustic report.

At this stage, it is understood that all spaces listed below are expected to retain their existing ceilings under the base scheme:

- Prep Classroom U01 and Prep Classroom U04 (with a proposed tender option to replace the ceiling)
- Library U.02 (with a proposed tender option to replace the ceiling)
- Consult / Teacher U.02 (with a proposed tender option to replace the ceiling)
- Foyer U.05
- All circulation spaces



Floor: Carpet tile (100% floor coverage)
Walls: 50% coverage of two perpendicular walls with acoustic pinboard equivalent to 12mm Autex Cube
Ceiling: Either
 ● 70% coverage of the ceiling area with acoustic panel equivalent to 25mm Autex Quiespace with NRC > 0.85, or
 ● Replace entire ceiling with an acoustically absorptive ceiling that has an NRC rating of at least 0.70 e.g., acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Floor: Resilient floor surface (e.g., vinyl) (100% floor coverage)
Walls: Nil
Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Floor: Carpet tile (100% floor coverage)
Walls: 50% coverage of two perpendicular walls with acoustic pinboard equivalent to 12mm Autex Cube
Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

TENDER OPTION:
Floor: Carpet tile (100% floor coverage)
Walls: Nil
Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

It is understood that this space is considered out of scope.

Floor: Resilient floor surface (e.g., vinyl) (100% floor coverage)
Walls: Nil
Ceiling: Either
 ● 70% coverage of the ceiling area with acoustic panel equivalent to 25mm Autex Quiespace with NRC > 0.85, or
 ● Install a suspended acoustic baffle system, rated to at least NRC 0.70 (at least 80m² combined coverage in the Staff / PLC, Staff Kitchen and Storage spaces) e.g., Autex Frontier Axis 12mm (150mm deep, 300mm centres).

Floor: Resilient floor surface (e.g., vinyl) (100% floor coverage)
Walls: Nil
Ceiling: Either
 ● 60% coverage of the ceiling area with acoustic panel equivalent to 25mm Autex Quiespace with NRC > 0.85, or
 ● Replace entire ceiling with an acoustically absorptive ceiling that has an NRC rating of at least 0.70, e.g., acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Floor: Carpet tile (100% floor coverage)
Walls: 50% coverage of two perpendicular walls with acoustic pinboard equivalent to 12mm Autex Cube
Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Floor: Nil - Resilient floor surface (e.g., vinyl) (100% floor coverage)
Walls: Nil
Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Ceiling Tag Legend

3.5m Ceiling height

<0.8s BQSH reverberation time criteria

NOTES

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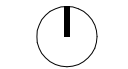
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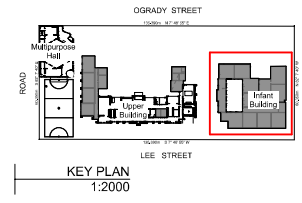
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 60 Lee St, Carlton north, VIC 3054
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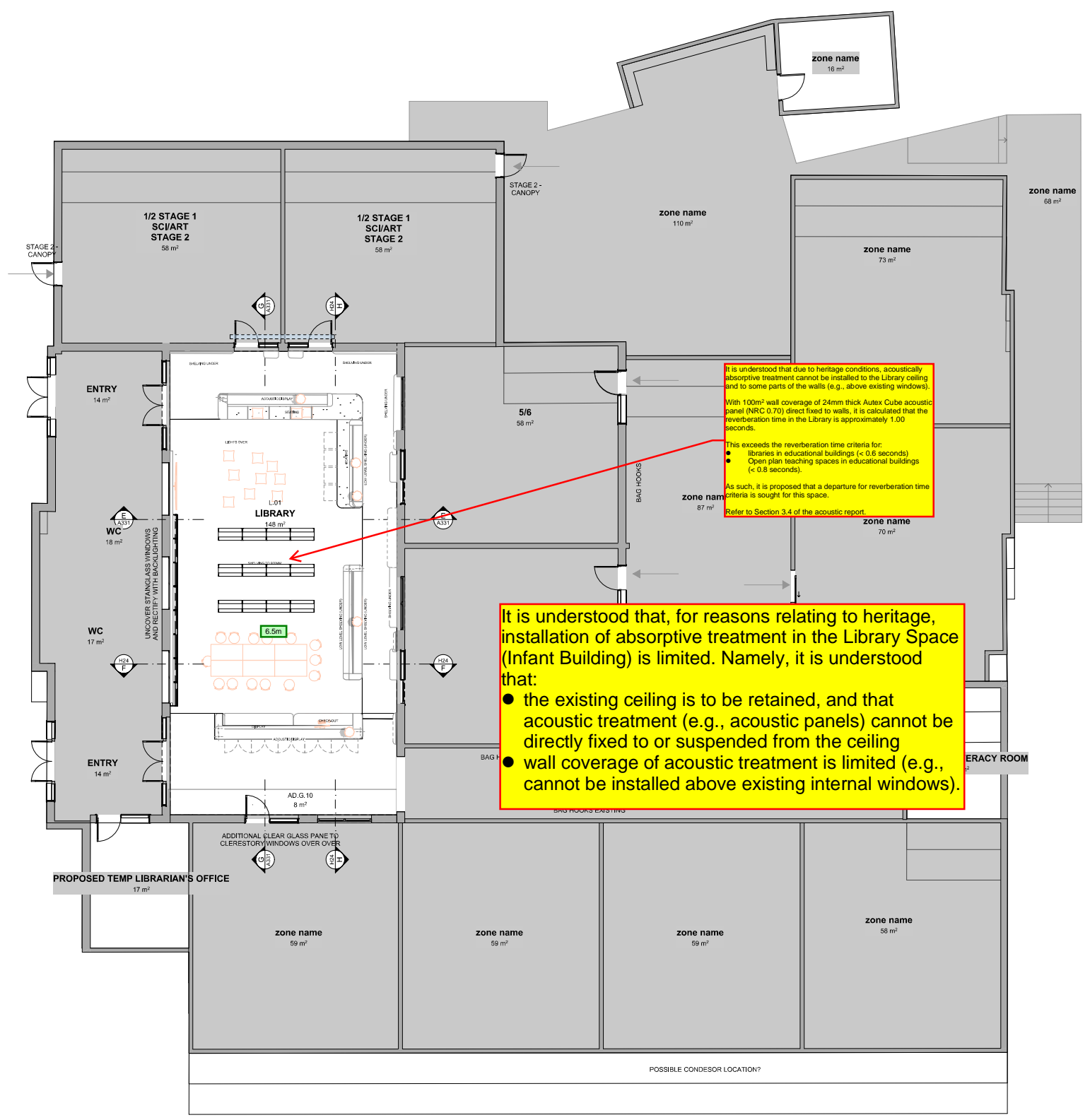
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Ceiling Tag Legend

- 3.5m Ceiling height
- <0.6s BQSH reverberation time criteria



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Wurundjeri Country

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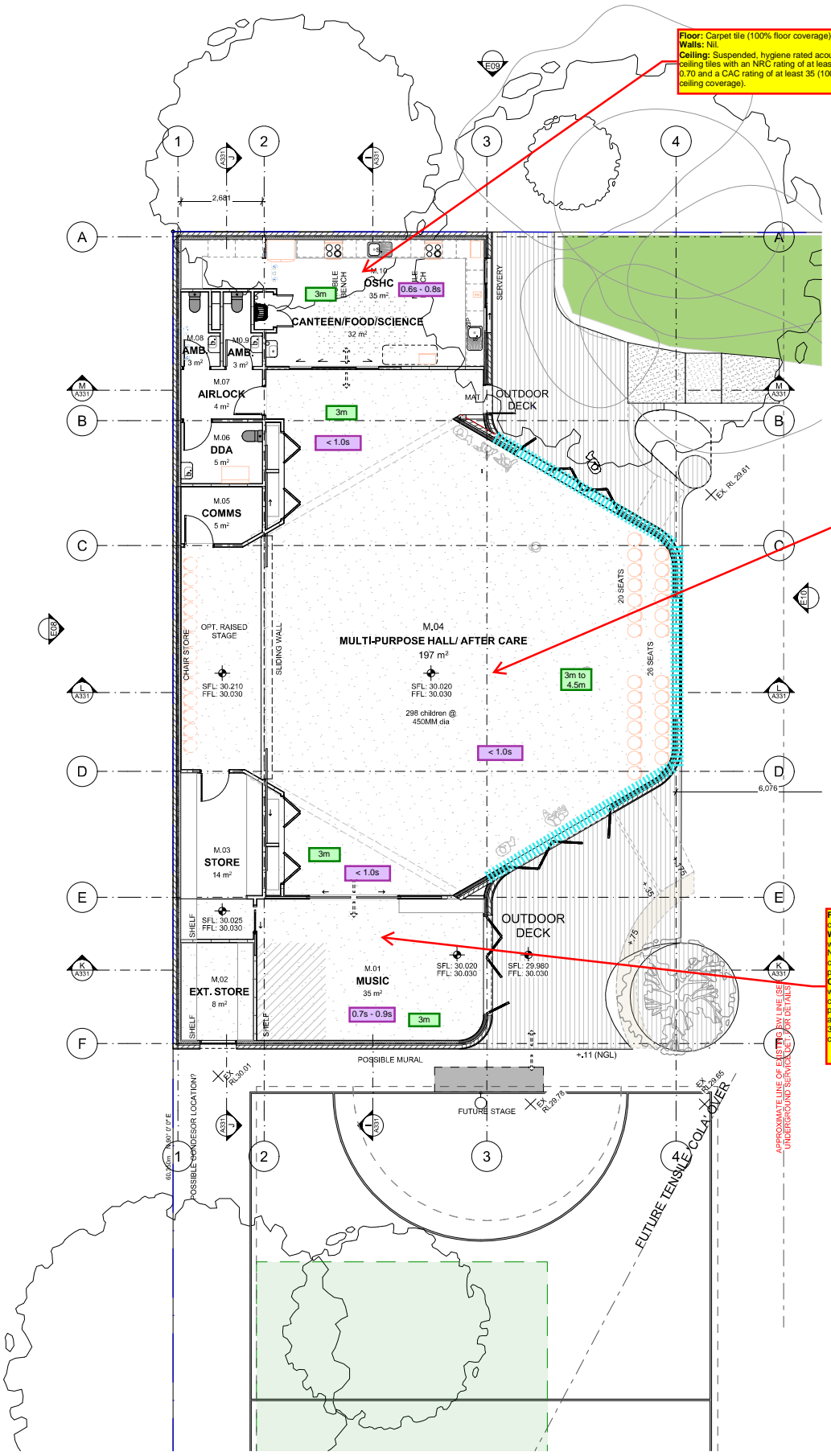
Floor: Carpet tile (100% floor coverage)
 Walls: Nil
 Ceiling: Suspended, hygiene rated acoustic ceiling tiles with an NRC rating of at least 0.70 and a CAC rating of at least 35 (100% ceiling coverage)

Ceiling Tag Legend

3.5m Ceiling height
 < 0.6s BQSH reverberation time criteria

Floor: Resilient floor surface (e.g., vinyl) (100% floor coverage)
 Walls: Heavy velour curtains (at least 610g/m² when draped to half area) (at least 30m² wall coverage, installed on the wall surfaces marked up in light blue hashed lines)
 Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)

Floor: Carpet or carpet tile (100% floor coverage)
 Walls: It is recommended that at least 15m² wall coverage of acoustic paneling with an NRC rating of at least 0.40 is installed. Ideally, coverage is evenly distributed on at least 2 perpendicular walls.
 Ceiling: An acoustically absorptive ceiling with an NRC rating of at least 0.70 shall be constructed, such as acoustic ceiling tiles or perforated plasterboard with a minimum open area of 15%, overlaid with 50mm thick, 32kg/m³ fibrous insulation (100% ceiling coverage)



GA PLAN - Multipurpose Hall

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DESIGN DEVELOPMENT

NOT FOR CONSTRUCTION

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SCALE
 @A1
 DRAWN
 CHECKED
 PLOT DATE 23/09/2024

DRAWING TITLE
GA Plan - Multipurpose Hall

PROJECT
 Carlton North Primary School
 60 Lee St, Carlton north, VIC 3054
 Wurundjeri Country

FOR
 VSBA

PROJECT
2357

DWG NO.
A133

REVISION
D02