



Performance-Based Design Brief / Fire Engineering Brief Questionnaire (FEBQ)

1 Document control

Applicant reference number P00700

FRNSW reference number FRN23/3144

Ver.	Author	Organisation	Status	Date
01	Lloyd Wilkinson	E-LAB Consulting	Initial submission	20/09/2023
02	Fabio Perri	FRNSW (BFS23/5376 #30920)	Response to V01	3/10/2023
03	Lloyd Wilkinson	E-LAB Consulting	Response to V02	30/10/2023

2 Applicant

2.1 Agreement

As the applicant, I confirm the following:

- I agree to pay Fire and Rescue NSW (FRNSW) the charges set out in [Clause 46](#) of the *Fire Brigades Regulation 2014* (see Section 10).
- I agree to forward with this application the following documentation for FRNSW to review and provide advice on the assessment methods and acceptance criteria proposed for the given performance solution:

- Copy of proposed building plans and specifications (e.g. relevant floor plans, elevations, site plan, section views, hydrant plan and schematic)

FRNSW Comment: FRNSW notes that no hydrant plans or schematics were provided.

- BCA report or letter from an accredited certifier that identifies all non-compliances (if available)
- CFD/zone modelling inputs form (if applicable) (available on FRNSW website)
- Performance solution summary table (available on FRNSW website)

Name of fire engineer	Lloyd Wilkinson	Registration number	3284
Company name	E-LAB Consulting		
Fire engineer's phone no.	0447 343 458		
Fire engineer's email	Lloyd.wilkinson@e-lab.com.au		

2.2 Remittance advice information

Invoices will be issued based on the information provided below:

ASIC company name	ADCO Constructions Pty Ltd		
Australian business number	46 001 044 391	Trading name	ADCO Constructions
Remittance contact name	Andrew Roman		
Remittance street address	Level 2, 7-9 West Street, North Sydney 2066.		
Remittance email address	aroman@adcoconstruct.com.au		
Remittance phone number	0422 025 788	Remittance fax number	N/A
Purchase order ref. no.	If applicable	Project code ref. no.	If applicable
Project leader contact name	Andrew Roman		

Fire and Rescue NSW ABN 12 593 473 110 firesafety.fire.nsw.gov.au
Community Safety Directorate Locked Mail Bag 12 T (02) 9742 7434
Fire Safety Branch Greenacre NSW 2190 F (02) 9742 7483

Version 18

Issued 2 August 2023

Efiresafety@fire.nsw.gov.au

Project leader contact email aroman@adcoconstruct.com.au

3 Consultation

3.1 Stakeholders

Role	Name and BPB number	Organisation and phone	Email address
BCA consultant	Seb Howe BDC2420	Modern Building Consultants Pty Ltd (02)9939 1530	showe@mbc-group.com.au
Certifier	Jake Hofner BDC2309	Blackett Maguire + Goldsmith Pty Ltd 02 9211 7777	jake@bplusg.com.au
Senior Associate Planner	Penny Smith	EPM Projects 02 9452 8300	psmith@epmprojects.com.au
Senior Project Director	Martyn Charlett	School Infrastructure NSW 0412 135 517	martyn.charlett@det.nsw.edu.au
Project Director	Beau Travers	School Infrastructure NSW 0460 037 377	Beau.Travers@det.nsw.edu.au
Builder	Andrew Roman	ADCO Construction 02 8437 5000	aroman@adcoconstruct.com.au
Planner	Amy Cropley	EPM 02 9452 8300	-
Fire Services Designer	Patrock Ilagan	JHA Consulting Engineers 02 9437 1000	patrick.ilagan@jhaengineers.com.au
Structural Engineer	Pushpa Ratnayake	H&H Consulting 02 9417 8400	pratnayake@hhconsult.com.au
FRNSW reviewers	A/Insp John Marzol Engineer Fabio Perri	Fire and Rescue NSW 02 9742 7434	firesafety@fire.nsw.gov.au

3.2 Meeting details

Record the details of any meetings undertaken with FRNSW on the project.

Meetings undertaken	Type of Meeting	Meeting Date	Attendees
Description of Meeting	Select	Meeting date	Enter names
Description of Meeting	Select	Meeting date	Enter names
Description of Meeting	Select	Meeting date	Enter names

4 Project details

4.1 Premises

Premises name	Broadwater Public School
Primary street address	9 Byrnes Street

Secondary street address	Secondary street address (if applicable)
Premises suburb	Broadwater NSW 2472
Lot and DP numbers	Lot 4&5, DP1043232 and Lot 501, DP755624
Is the premises considered a significant development or a unique building (e.g. Sydney Football Stadium, Sydney Opera House, Crown Towers, etc.)?	No

4.2 Proposed works

- New building
- Refurbishment of an existing building
- Extension of an existing building
- Change in use within an existing building
- Other: (provide details)

Applicable NCC: NCC 2019 Amdt 1

For existing buildings:

Approximate year of construction: **Year**
 Building code when constructed: **Select**

What is the proposed approval pathway?:

- Complying Development Certificate (CDC)
- Construction Certificate (CC)
- Crown works
- Voluntary upgrade
- Other: (provide details)

How many performance solution issues are proposed in this FEBQ? 7

How many Performance Requirements are being assessed? 4

Do any of the Performance Solutions proposed pertain to works already constructed on site? No
 N/A

Are any of the solutions proposed as a result of:

An issue of a notice of intention to issue a fire order on the subject premise	No
An issue of a fire order on the subject premise	No
An audit of the existing building that has identified an existing non-compliance	No
Not being able to sign off an annual fire safety statement	No
(provide details)	

Additional Questions

Does the proposal include a reduction in water supply to the fire hydrant or sprinkler system?	No
Does the proposal relate to fire hydrant system flows and/or pressures?	No
Would the DtS provisions require the provision of an active fire safety system that is not proposed as part of the performance solution (i.e. is the performance solution deleting an active fire safety system)?	Yes
If the proposal includes a waste management facility, does it comply with the current FRNSW Fire Safety in Waste Facilities Fire safety guideline?	No
Has there been any previous IFSR submission(s) under Part 3 Division 3 of the <i>Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021</i> pertaining to this development? (If yes, provide details and appropriate references)	No

Will the premises likely be subject to a fire safety study, risk assessment or dangerous goods study? No

Note: Any study/risk assessment should be completed prior to submitting this FEBQ and should be attached to this application.

Have all departures from the deemed-to-satisfy (DtS) provisions of the *National Construction Code (NCC)* been identified for this proposed design (i.e. a BCA report or letter from an accredited certifier)? Yes

Note: Any advice given is subject to all non-compliances being identified. Any new DtS departures identified, including any from the certifier determining the application for construction certificate, may affect FRNSW advice in respect to this performance solution.

Identify if any previous performance solution applies to the building:

N/A

Identify if any application has been/will be submitted for a fire safety exemption under Clause 188 of the *Environmental Planning and Assessment Regulation 2000* or under Section 111 of the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021*:

N/A

Identify if the premises is or will be subject to any development application (DA) conditions or special regulatory approvals (e.g. BPB conditions, ministerial conditions, crown building works):

Note: FRNSW will not comment on existing buildings subject to voluntary upgrade or change of use prior to the issuing of any DA conditions of consent, or conditions of an existing consent have been modified (i.e section 4.55 of *Environmental Planning and Assessment Act 1979*). Comment will also not be provided if an order has been issued unless the Council agrees. The Council may seek advice during the DA review.

N/A

4.3 Description of building

Main occupancy class	9b	Largest fire compartment (within the building)	Area (m ²)	1,029
Other occupancy classes	5, 7b		Volume (m ³)	4,425
Type of construction	B		Height (m)	4.3
Effective height (m)	3.3	Ground floor area (m ²)	1,029	
Rise in storeys	2	Total floor area (m ²)	2,058	
Levels contained	2	Total volume (m ³)	7,512	
Does the building contain an early childhood centre?	No	Is the building or does the building contain a Data Centre?	No	
Is the development a major hazard facility?	No			

Outline any additional building characteristics:

The development consists of a modular classroom design elevated off of the ground on top of a gantry structure to minimise the impact of flooding on the school building.

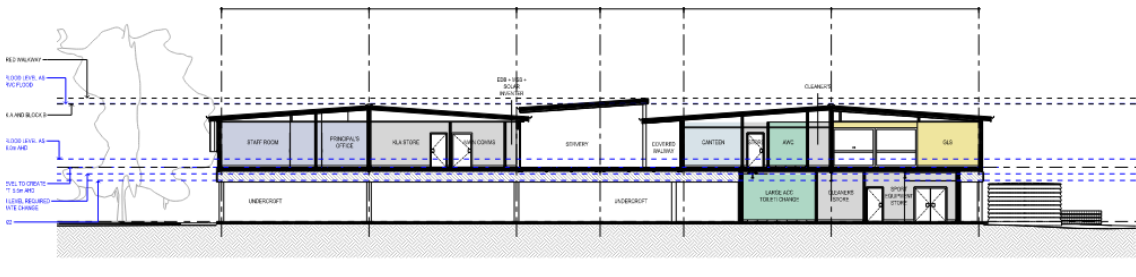


Figure 1: Development Section

The primary footprint of the undercroft shall be empty and will not be permitted to be used as a storage space. With the exception of the storeroom which shall be separated from the remainder of the building by 30 minute fire rated construction. The larger undercroft space will occasionally be used as a class 9b cola space to hold impromptu assemblies or be used as a recreational space for students during inclement weather under teacher supervision. The undercroft space is open on all sides and allows for rapid egress in multiple directions.

It should be noted that the Type B requirements are triggered due to the storeroom, it is considered appropriate to apply fire resistance levels akin to that of a Type C construction requirements to the development due to the functionality and use of the space.

Outline the services provided for fire brigade / fire services intervention:

Location of hydrant booster, and dual hydrant are shown in the figure below.



Figure 2: Location of the Dual Hydrant and Hydrant booster.

List key occupant characteristics for the building:

The expected building occupant have been described using Table 2 – ‘Occupancy Characteristics’ from BS 9999.

Table 1: Occupancy characteristics

OCCUPANT DESCRIPTION	CHARACTERISTICS	DISCUSSION
Students	Awake and Familiar	Students/users of the tenancy. Aware of exit locations. Students are expected to be supervised and under the care of Teachers.
Staff/Trainers	Awake and Familiar	Physically fit and aware of exit locations.
Maintenance/Cleaners	Awake and Familiar	Service the site cleanliness and maintenance of the building
Visitors	Awake and Unfamiliar	Parents or other visitors to the site. Visitors are expected to be supervised/accompanied by staff.

5 Hazards

Outline any hazards unique to the building:

- Combustible external cladding
- Combustible waste (i.e. waste facility)
- Electricity supply system (e.g. substations)
- Battery system (e.g. BSS, BESS, ESS)
- Alternative electrical generation (e.g. solar, tri-gen)
- Electric vehicle charging
- Automatic storage and retrieval system (ASRS)
- Insulated sandwich panels**
- Podium type building
- A basement level
- An atrium (Part G3 of BCA)
- Car stacker
- Green wall

Hazardous chemicals / dangerous goods (provide details)

Other: (provide details)

Note: Clauses E1.10 / E1D17 and E2.3 / E2D21 of the NCC should be addressed when special hazards exist (e.g. car stacker, hazardous chemicals/dangerous goods).

FRNSW comment: FRNSW note Insulated Sandwich Panels are proposed to be utilised as presented in issue 6. Clarification is required as to why the relevant tick box above has not been checked.

Please refer FRNSW comments in issue 6.

E-LAB: Tick box has been amended.

6 Preventative and protective measures

Identify fire safety measures that are, or will be, provided throughout the building, including anything undecided, which should be mentioned as part of the FEBQ review. Additional information may be added to the comments section below to better describe any systems or indicate systems that may be subject to a performance solution.

Suppression system	Detection system	Facilities for emergency services
<input type="checkbox"/> CA16 (existing building)	<input type="checkbox"/> AS 3786:2014	<input type="checkbox"/> Emergency lifts
<input type="checkbox"/> AS 2118.1-2017	<input type="checkbox"/> AS 3786-1993 (existing building)	<input type="checkbox"/> Fire control centre
<input type="checkbox"/> AS 2118.1-2006	<input checked="" type="checkbox"/> AS 1670.1:2018	<input type="checkbox"/> Fire control room
<input type="checkbox"/> AS 2118.1-1999 (existing building)	<input type="checkbox"/> AS 1670.1:2015 (existing building)	<input type="checkbox"/> Perimeter vehicular access
<input type="checkbox"/> AS 2118.2-2021 (wall-wetting)	<input checked="" type="checkbox"/> AS 1668.1:2015	<input type="checkbox"/> Standby power supply system
<input type="checkbox"/> AS 2118.2-2010 (wall-wetting)	<input type="checkbox"/> AS 1670.3-2018 (monitored)	Occupant warning system
<input type="checkbox"/> AS 2118.3-2010 (deluge)	<input type="checkbox"/> AS 1670.3-2004 (existing building)	<input type="checkbox"/> Building occupant warning
<input type="checkbox"/> AS 2118.4-2012 (residential)	<input type="checkbox"/> Smoke alarms	<input type="checkbox"/> EWIS
<input type="checkbox"/> AS 2118.5-2006 (domestic)	<input type="checkbox"/> Heat alarms	<input type="checkbox"/> SSISEP
<input type="checkbox"/> AS 2118.6-2012 (combined)	<input type="checkbox"/> Smoke detectors	<input type="checkbox"/> Break glass unit
<input type="checkbox"/> FPAA101D	<input type="checkbox"/> Heat detectors	<input type="checkbox"/> Visual / tactile alarm devices
<input type="checkbox"/> FPAA101H	<input type="checkbox"/> Flame detectors	Signage
<input type="checkbox"/> Fast response heads	<input type="checkbox"/> CO detectors	<input checked="" type="checkbox"/> Emergency lighting
<input type="checkbox"/> ESFR	<input type="checkbox"/> Multi-criteria fire detectors	<input checked="" type="checkbox"/> Exit and direction signs
<input type="checkbox"/> Storage mode sprinklers	<input type="checkbox"/> Aspirated smoke detection	<input checked="" type="checkbox"/> Warning and operational signs
<input type="checkbox"/> Gaseous suppression system	<input type="checkbox"/> Beam detection	Protection of openings
<input type="checkbox"/> Water mist system	Water supply	<input checked="" type="checkbox"/> Fire doors
Hydrant system	<input checked="" type="checkbox"/> Reticulated town main	<input type="checkbox"/> Smoke doors
<input type="checkbox"/> AS 2419.1-2021	<input type="checkbox"/> Private water main	<input type="checkbox"/> Solid core doors
<input type="checkbox"/> AS 2419.1-2017	<input type="checkbox"/> Onsite storage tank	<input type="checkbox"/> Fire windows
<input checked="" type="checkbox"/> AS 2419.1-2005	<input type="checkbox"/> Gravity tank/reservoir	<input type="checkbox"/> Fire shutters
<input type="checkbox"/> AS 2419.1-1994 (existing building)	<input type="checkbox"/> Dual supply (sprinklers)	<input type="checkbox"/> Wall-wetting sprinklers
<input type="checkbox"/> Ordinance 70 (existing building)	<input type="checkbox"/> Dual supply (hydrants)	<input type="checkbox"/> Fire curtain
<input type="checkbox"/> Dry fire hydrant system	Smoke hazard management	<input type="checkbox"/> Smoke curtain
<input checked="" type="checkbox"/> External hydrants	<input type="checkbox"/> Zone smoke control	<input type="checkbox"/> Safety curtain for openings
<input type="checkbox"/> Internal hydrants	<input type="checkbox"/> Purge system (existing building)	<input type="checkbox"/> Fire dampers
<input type="checkbox"/> Street hydrant coverage only	<input type="checkbox"/> Smoke and heat vents	<input type="checkbox"/> Smoke dampers
<input checked="" type="checkbox"/> Hydrant booster assembly	<input type="checkbox"/> Smoke exhaust	<input type="checkbox"/> Fire seals (intumescent)
<input type="checkbox"/> Pumpset	<input type="checkbox"/> Smoke baffles	<input type="checkbox"/> Medium temp. smoke seals
Firefighting equipment	<input type="checkbox"/> Ridge vents	<input checked="" type="checkbox"/> Fire collars
<input checked="" type="checkbox"/> Portable fire extinguishers	<input type="checkbox"/> Stair pressurisation	<input type="checkbox"/> Attenuation screens
<input type="checkbox"/> Fire hose reels	<input type="checkbox"/> Impulse / jet fans (in carpark)	

Additional information:

6.1 Construction

6.1.1	<p>The undercroft storage shall be enclosed in (30)/30/30 fire rated construction. The door's leading to the undercroft from the storage shall be fire doors with FRL's of -/60/30.</p> <p>Or</p> <p>60-minute separation for the storage ceiling and 30 minute separation for the bounding walls of the storage area.</p>
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Figure 3: Storage area fire rating requirement

6.2 Detection and Smoke Hazard Management

6.1.1	A mechanical air handling system shall be provided to the development in accordance with AS1668.1-2015, NCC Clause E2.2 and NSW Table E2.2b. The mechanical air handling system shall automatically shutdown upon detection of a fire.
6.1.2	The building shall be provided with an automatic detection system in accordance with AS1670.1 and NCC Clause E2.2 with 15 m x 15 m detector spacing for the purpose of automatic shutdown of the air handling system upon detection of a fire.

6.3 Fire Hose Reels

6.1.1	Fire hose reels have been omitted from non-teaching areas in line with the egress strategy of the development.
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6.4 Portable Fire Extinguisher

6.1.1	Portable fire extinguishers shall be provided to the development in accordance with AS2444-2001 and NCC Clause E1.6.
6.1.2	Where fire hose reels have been omitted from the development, additional portable fire extinguishers shall be provided where not already required by AS2444-2001 and NCC Clause E1.6. On the undercroft level, PFE's shall only be provided to the storerooms.

6.5 Fire Hydrant System

6.1.1	A fire hydrant system shall be provided to the development in accordance with AS2419.1-2005 and NCC Clause E1.3.
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6.6 Emergency Lighting and Exit Signage

6.1.1	Emergency lighting and exit signage shall be provided in accordance with AS2293.1-2018 and NCC Clauses E4.2, E4.5, NSW E4.6 and NSW E4.8.
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6.7 Maintenance and Management in Use

6.1.1	The following management requirements are placed on the eventual building owners and operators and are to be included in any management documentation.
6.1.2	Regular evacuation drills are to be conducted annually (minimum) within the building.
6.1.3	General housekeeping must be undertaken to maintain egress paths and ensure exits are operable to allow unobstructed travel.
6.1.4	A no smoking policy is to be implemented in all public areas.
6.1.5	The following maintenance requirements are to be placed on the eventual building managers.
6.1.6	<p>The undercroft space shall be designated as a no storage space as shown below. Signage shall be provided to the area prohibiting the storage in this area. This shall be included in the buildings management in use plan and shall be listed as an essential fire safety measure.</p>
<p>Figure 4: Undercroft area</p>	
6.1.7	The undercroft storerooms shall not be used for the storage of flammable liquids or combustible materials. Signage shall be provided to the double doors leading into the storerooms which read

'STORAGE OF FLAMMABLE AND COMBUSTIBLE MATERIALS ARE PROHIBITED'. This shall be in the buildings management in use plan and shall be listed as an essential fire safety measure.



Figure 5: Indicative signage to double doors prohibiting the storage of flammable liquids or combustible goods in the undercroft storerooms.

6.1.8	Where services are modified as part of a performance solution, these must be included in the maintenance and annual certification.
6.1.9	Maintenance on all active Fire Safety Systems is to be in accordance with the relevant AS1851-2012 section.
6.1.10	Evacuation diagrams are to be provided in accordance with AS3745-2010.

7 Departures from the Deemed-to-Satisfy provisions

Issue number: 1 Title: Rationalise Fire Resistance Levels

Details of departures from DtS provisions:

The development contains a rise in storeys of 2 as a Class 9b assembly building and therefore is required to be of Type B Construction. It is proposed to meet the FRL requirements of Type C construction in lieu of Type B Construction. This is inclusive of the Class 7b storage space within the undercroft. **It should be noted that the class 7b storage space is less than 10% of the floor area as calculated to the perimeter of the construction edge above.**

E-LAB: It is proposed to rationalise the FRL requirements of the load-bearing elements for the 9b school portion as follows:

- External walls -/-
- Internal columns -/-

Applicable DtS provisions (including clause excerpt):	C1.1 – Type of construction required Specification C1.1 – Fire-resisting construction	Applicable Performance Requirements:	CP1– Structural stability during a fire CP2 – Spread of fire
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List key fire safety measures:

The undercroft storage shall be enclosed in (30)/30/30 fire rated construction. **The door’s leading to the undercroft from the storage shall be fire doors with FRL’s of -/60/30.**

Or
60-minute separation for the storage ceiling and 30 minute separation for the bounding walls of the storage area.



Figure 6: Storage area fire rating requirement

Additionally, the storerooms shall not be used for the storage of flammable liquids or combustible materials. Signage shall be provided to the double doors leading into the storerooms which read ‘STORAGE OF FLAMMABLE AND COMBUSTIBLE MATERIALS ARE PROHIBITED’. This shall be listed in the buildings management in use plan and shall be listed as an essential fire safety measure.

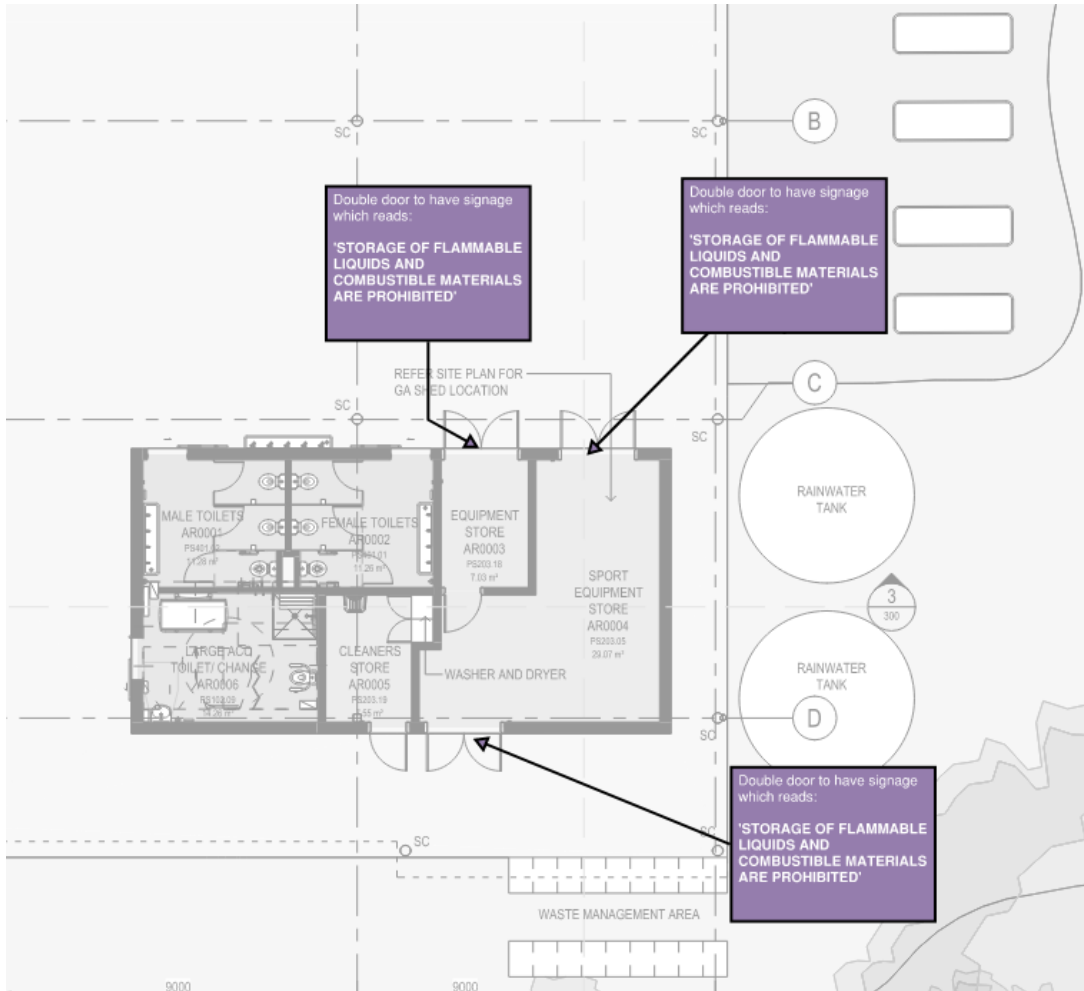


Figure 7: Indicative signage to double doors prohibiting the storage of flammable liquids or combustibles goods in the undercroft storerooms.

Egress from the undercroft area to open space is readily available in multiple directions. Egress from the gantry above the undercroft is within DtS compliant distances and is available from multiple stairways.

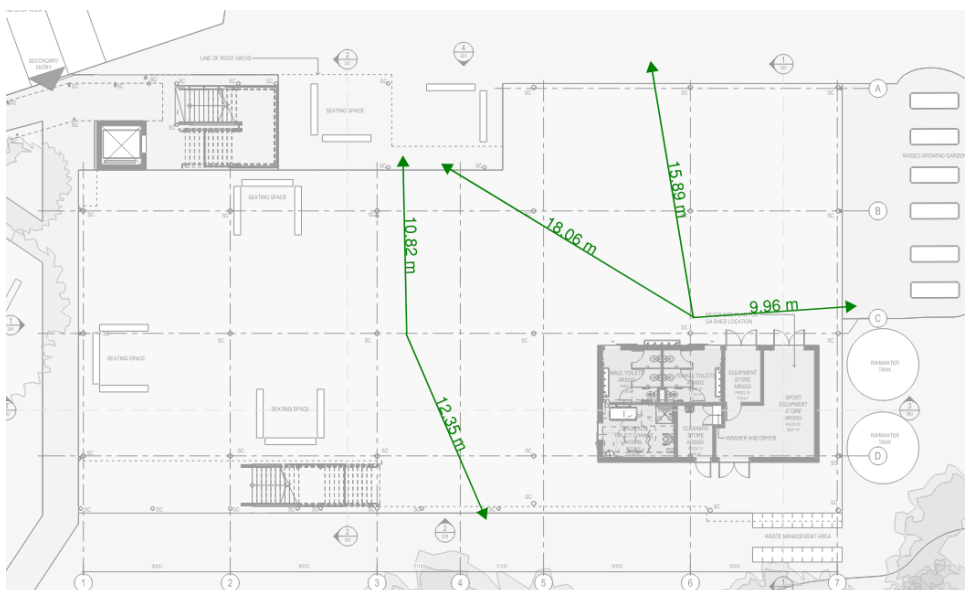


Figure 8: Example paths to outdoor space from the undercroft. Undercroft is open on all sides.

The undercroft space shall be designated as a no storage space as shown below. Signage shall be provided to the area prohibiting the storage in this area. This shall be included in the buildings management in use plan and shall be listed as an essential fire safety measure.

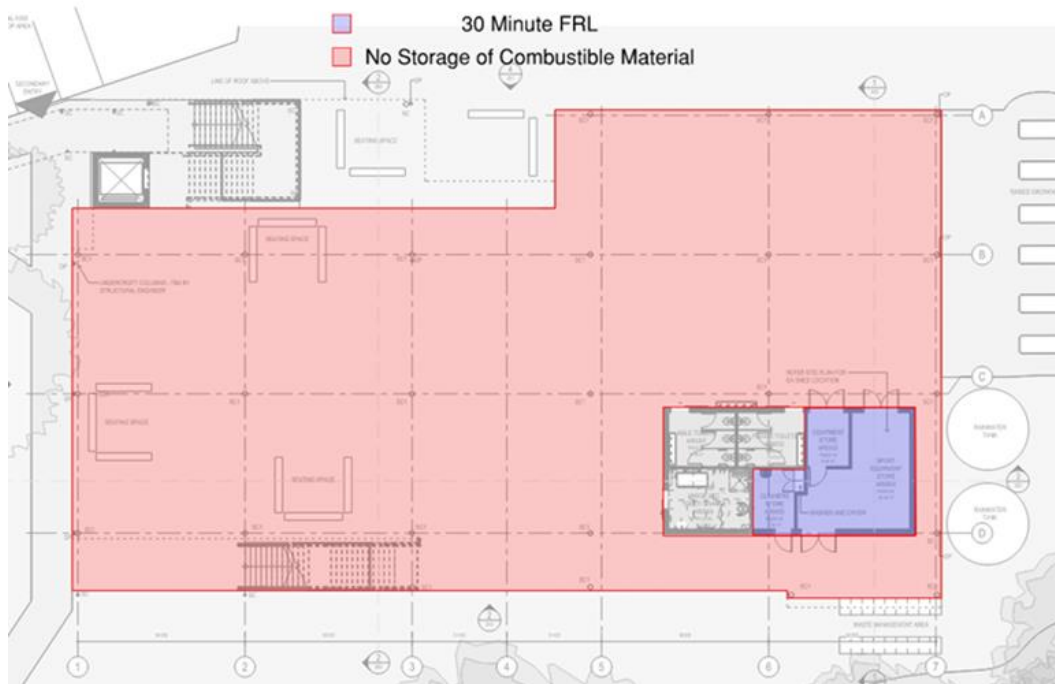


Figure 9: Undercroft area

Proposed performance solution:

BCA Intent

The Guide to the BCA states that the type of construction is based on the risk levels associated with the Class of building as well as the building's height indicated by the rise in storeys. The height (rise in storeys) of the building is relevant as a measure of likely evacuation times and evacuation difficulty.

BCA Clause C1.1 sets the requirements for the minimum Type of fire-resisting construction of a building.

Addressing C1.1, the Guide to the BCA states that the

'The Class of building is measure of the building's likely:

- *Use;*
- *fire load;*
- *population; and*
- *mobility of the occupants, such as whether they are sleeping or alert.*

And further, *'... the required type of construction of a building depends on risk levels as indicated by the Class of the building and the Building's height **as indicated** by the rise in storeys.'*

The BCA guide states that the intent of Clause C1.2 is to establish a method of the calculation of the rise in storeys of a building, as a means of helping determine a building's required type of construction. The guide states that the rise in storeys has an impact on:

- *The risk of exposure to radiant heat from a fire in another building;*
- *The risk of emitting radiant heat to another building; and*
- *The risk to occupants who may need to travel down a stairway to safely evacuate the building.*

The intent of Performance requirement CP1 is to ensure building elements maintain structural stability during a fire.

The intent of CP2 is to minimise the risk of fire spread from a point of origin to another location, appropriate to the fire risk.

Analysis

It is proposed for the development to be constructed under the FRL requirements of a Type C Construction as it will be shown that the additional storey of this development does not significantly increase the fuel load of the building as well as not significantly increase the difficulty of evacuation.

Type C construction would not require fire rating to the equipment storage space however, as an additional safety measure the sports storage shall be enclosed in 30 minute fire rated construction.

Fuel Load Assessment

Due to the subject tenancy containing a small ancillary room below the Ground Floor, it is considered an additional storey under the BCA and therefore triggers the requirement for the development to have Type B Construction. However, it is considered that due to the ancillary nature and small floor area of this storage space, the increased fuel load is not significant. It should be noted that the amenities block below does not trigger an additional storey and as such it is the presence of the store room adjacent to the amenities within the building footprint that triggers the rise in storey of 2.

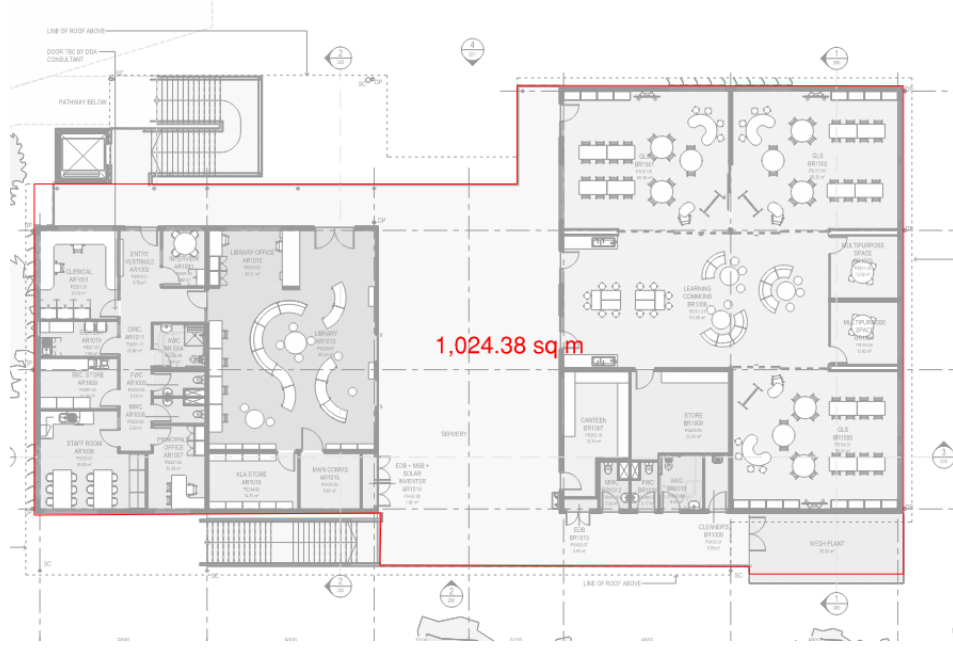


Figure 10: Raised Level Floor Plan



Figure 11: Undercroft and storeroom

Furthermore, a general design principle providing a minimum of 5m setback from the boundary will ensure that no boundary fire source feature will impact the building. As an additional fire safety measure the storage room shall be fire separated from the remainder of the building by way of 30 minute fire rated construction.

Population and Evacuation Assessment

The BCA also classifies the Type of Construction based on the difficulty of evacuation of the development and concludes that a two-storey class 9b building to be a significantly higher risk than a one-storey class 9b building, resulting the change in Type from C to B. However, it is noted that undercroft storage is small and not used as a Class 9b space as it is only for staff and is anticipated to be used to store sporting equipment. Occupant densities

and activities associated with Class 9b areas will not occur ~~en~~ in the undercroft storage areas with only a limited number of persons occupying the storage area at one time. It should be noted that the non-storage areas of the undercroft may be used as a Class 9b cola area for impromptu assemblies or as a recreational area during inclement weather. However, during these use cases, students are expected to be under the direct supervision of staff. Additionally, egress from the undercroft area to open space is immediately accessible in multiple directions, allowing for rapid egress to safety in the rare event of a fire during the aforementioned uses.

It should be noted that the storage areas present in the undercroft space constitute less than 10% of the floor area of the undercroft space, which is expected to be used as a 9b space on occasion. Due to this, the proposed fire separation is considered to be an improvement on a DtS design, which would not require the storage area to be separated from the remainder of the undercroft.

Therefore, the additional of storage space within the undercroft is considered to not increase the difficulty of evacuation of the development due to its small space, location, and occupant type. As such, it is considered appropriate to adopt the FRL requirements of Type C construction in lieu of Type B for the development.

Conclusion

It has been demonstrated that the additional storey created due to the storage in the undercroft of the development does not significantly increase the fuel load and difficulty of evacuation of the development, as such it is appropriate to apply the Type C Construction FRL requirements in lieu of the Type B requirements. Therefore, Performance Requirements CP1 and CP2 are considered to still be maintained to an acceptable level.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
 A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
 A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
 A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
 A2G2(2)(c) or A2.2(2)(c) - Expert judgement
 A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- Comparative Qualitative Deterministic
 Absolute Quantitative Probabilistic

AFEG sub-systems used in the analysis:

- A – Fire initiation and development and control D – Fire detection, warning and suppression
 B – Smoke development and spread and control E – Occupant evacuation and control
 C – Fire spread and impact and control F – Fire services intervention

Acceptance criteria and factor of safety:

The solution is considered acceptable if it can be demonstrated that the undercroft storage does not result in a fire safety risk which would practically affect the buildings Type of Construction required.

Fire scenarios and design fire parameters:

A fire occurring generally in the building is considered.

Describe how fire brigade intervention will be addressed or considered:

Fire brigade intervention is considered to not be impacted due to the fuel load and difficulty in evacuation not significantly increased due to the addition of the undercroft storage.

Verification/validation analyses:

- Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

E-LAB: Noted. Compliance shall be demonstrated in the FER.

Issue number: 2 **Title: Omission of Fire Rated Floor and Storage Room requirements**

Details of departures from DtS provisions:

It is proposed to omit the fire rated floor requirements and associated column requirements from the non-habitable undercroft area outlined below.

Applicable DtS provisions (including clause excerpt):	C1.1 – Type of construction required Specification C1.1 – Fire-resisting construction	Applicable Performance Requirements:	CP1 – Structural stability during a fire CP2 – Spread of fire
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List key fire safety measures:

The undercroft space shall be designated as a no storage space as shown below. Signage shall be provided to the area prohibiting the storage in this area. This shall be included in the buildings management in use plan and shall be listed as an essential fire safety measure.

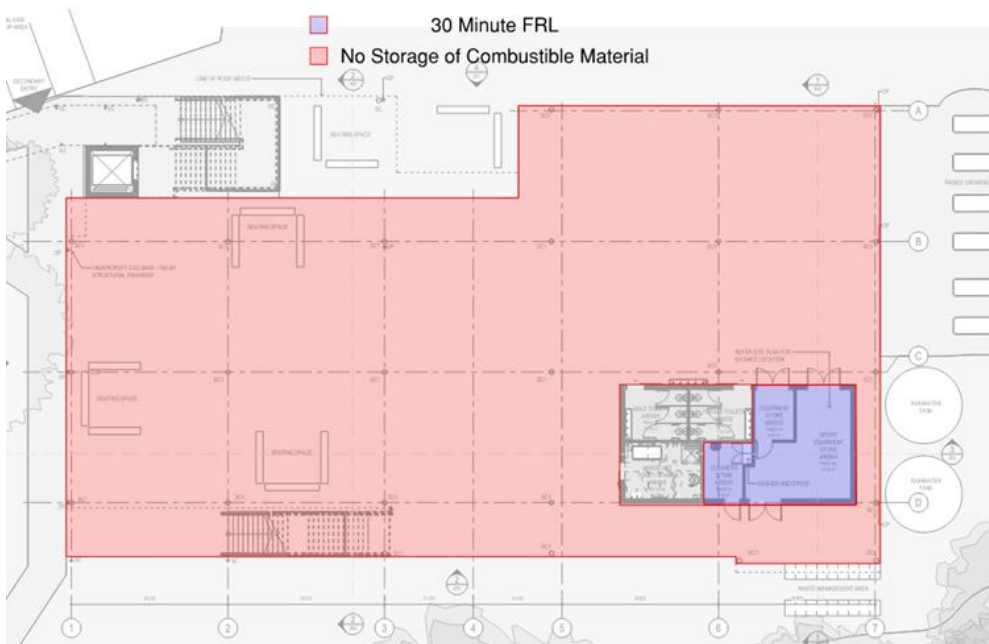


Figure 12: Undercroft area

Additionally, the storerooms shall not be used for the storage of flammable liquids or combustible materials. Signage shall be provided to the double doors leading into the storerooms which read 'STORAGE OF FLAMMABLE AND COMBUSTIBLE MATERIALS ARE PROHIBITED'. This shall be listed in the buildings management in use plan and shall be listed as an essential fire safety measure.



Figure 13: Indicative signage to double doors prohibiting the storage of flammable liquids or combustible goods in the undercroft storerooms.

Egress from the undercroft area to open space is readily available in multiple directions. Egress from the gantry above the undercroft is within DtS compliant distances and is available from multiple stairways.

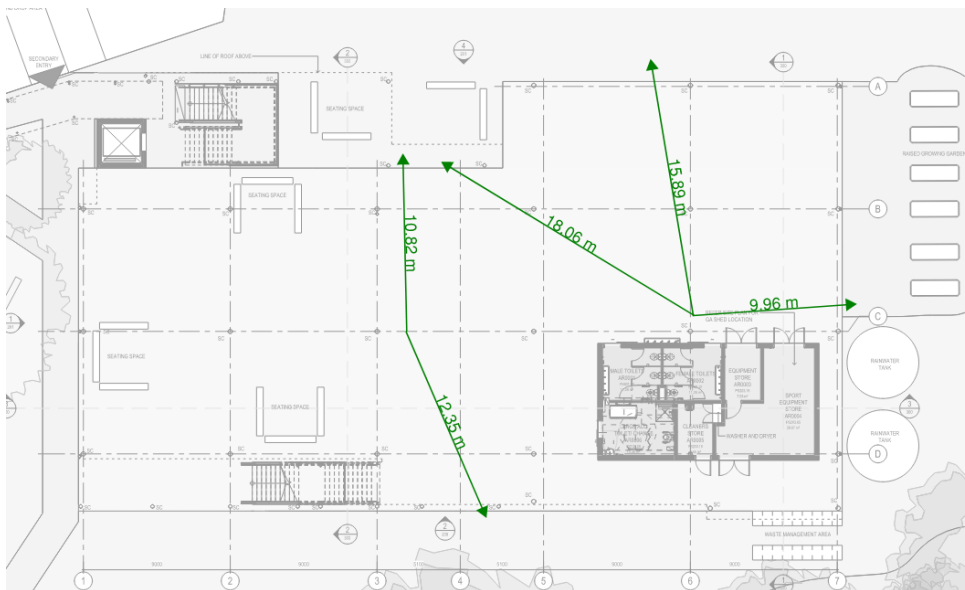


Figure 14: Example paths to outdoor space from the undercroft. Undercroft is open on all sides.

FRNSW Comment: FRNSW recommend management in use procedures be implemented to ensure the sterile requirements of the space are maintained accordingly.

E-LAB: Noted, see above.

Proposed performance solution:

BCA Intent

The Guide to the BCA states that the type of construction is based on the risk levels associated with the Class of building as well as the building’s height indicated by the rise in storeys. The height (rise in storeys) of the building is relevant as a measure of likely evacuation times and evacuation difficulty.

BCA Clause C1.1 sets the requirements for the minimum Type of fire-resisting construction of a building.

Addressing C1.1, the Guide to the BCA states that the

‘The Class of building is measure of the building’s likely:

- Use;
- fire load;
- population; and
- mobility of the occupants, such as whether they are sleeping or alert.

And further, ‘... the required type of construction of a building depends on risk levels as indicated by the Class of the building and the Building’s height **as indicated** by the rise in storeys.’

Specification C1.1 Part (1)(f)(ii) states in a Class 9b building, a floor separating storeys or above a space for the accommodation of motor vehicles or used for storage or any other ancillary purpose, must have an FRL of at least 30/30/30.

FRNSW Comment: FRNSW recommend the above referenced clause be clarified, noting it does not appear as though the above clause exists.

E-LAB: The above clause is actually Specification C1.1 Part 4.1 (i)(ii). The previous reference was made in error.

The intent of Performance requirement CP1 is to ensure building elements maintain structural stability during a fire.

The intent of CP2 is to minimise the risk of fire spread from a point of origin to another location, appropriate to the fire risk.

Analysis

Fire Rated Floor

It is proposed to omit the fire rated floor requirements with the exception of providing a 30 minute fire rating to the undercroft storage room. Additionally, a no storage outside of the store room shall be implemented to minimise the fuel load within this space.



Figure 15: Undercroft area

As shown above the undercroft is primarily empty reducing the risk of a fire initiating within this space due to the lack of fuel load and limited ignition sources. It should be noted that the non-storage areas of the undercroft may be used as a Class 9b cola area for impromptu assemblies or as a recreational area during inclement weather. However, during these use cases, students are expected to be under the direct supervision of staff. The most credible ignition source within this space would be the electrical fixtures and any cabling associated with the undercroft amenities and store room. The highest risk of fire initiation is within the storeroom. As such, it is proposed to enclose the storeroom within 30 minute fire rated construction.

The DtS requirement for a fire separated floor is to separate between storeys within a building. However, due to the aforementioned low fuel load and limited ignition sources the risk of a fire initiating and growing to a size though may affect occupants is highly unlikely to occur. Furthermore, the building is set back from the allotment boundary and as such the risk of a fire at the boundary impacting the floor and columns is highly unlikely to occur.

The columns supporting the floor structure are proposed to be lightweight steel. The limiting steel temperature T_l is a function of the ratio of load to capacity; this is diagrammatically represented in Figure 16 and calculated to AS 4100 as follows:

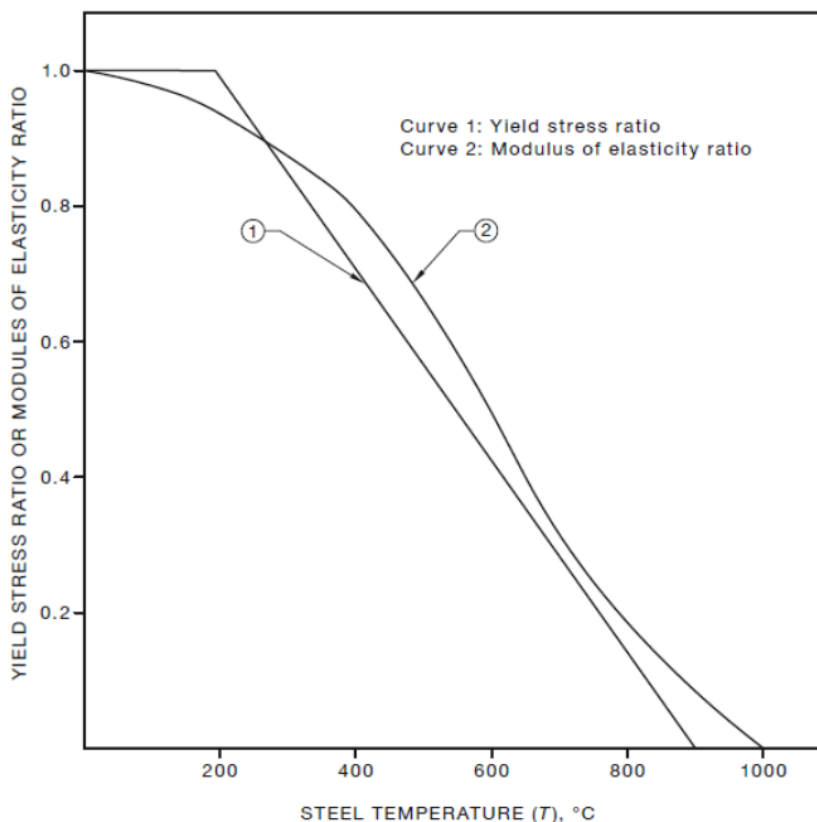


Figure 16: Variation of Mechanical Properties of Steel with Temperature

As shown above steel starts to lose its mechanical properties after 200°C as there is no fuel load or ignition sources in the undercroft the only credible scenario that would impact the columns supporting the floor structure would be a fire in the store room or a fire on the adjacent allotment.

As mentioned, the store room shall be boxed out in 30 minute fire rated construction minimising the risk of a fire impacting the floor system and associated columns. Additionally, the building is greater than 5m away from the boundary line significantly reducing the risk of radiant heat impacting the columns and floor system.

Furthermore, the building provides equivalent egress to that of a one storey building elevated off of the ground. As such, egress from the occupied areas are considered to be quick and simple. As such, evacuation times are expected to occur faster than the time it would take a fire to impact the floor system.

Conclusion

It has been qualitatively shown that the omission of fire rating to the floor system and supporting columns is not expected to impact occupant egress. The most credible fire initiation location shall be separated from the remainder of the development by way of 30 minute fire rated construction providing an additional level of safety.

As such, performance requirement CP1 and CP2 has been met.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
 A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
 A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
 A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
 A2G2(2)(c) or A2.2(2)(c) - Expert judgement
 A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- Comparative Qualitative Deterministic
 Absolute Quantitative Probabilistic

AFEG sub-systems used in the analysis:

- A – Fire initiation and development and control D – Fire detection, warning and suppression
 B – Smoke development and spread and control E – Occupant evacuation and control
 C – Fire spread and impact and control F – Fire services intervention

Acceptance criteria and factor of safety:

The performance solution is considered acceptable if it is shown the omission of fire rating to the floor system does not increase the risk of fire spread.

Fire scenarios and design fire parameters:

A fire within the undercroft space and at the boundary line has been considered for this assessment.

Describe how fire brigade intervention will be addressed or considered:

Fire brigade intervention is not considered to be impacted by this assessment.

Verification/validation analyses:

- Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: In principle support is provided subject to:

- the analysis in the FER demonstrating compliance with the performance requirements of the NCC.
- FRNSW Comments being adequately addressed.

E-LAB: Noted. Compliance shall be demonstrated in the FER. See comments above.

Issue number: 3 Title: Omission of fire hose reels

Details of departures from DtS provisions:

It is proposed to remove the fire hose reel requirement from the non-classroom and staff office areas such as storage rooms, canteen, undercroft spaces (including amenities), admin/staff room and library.

Applicable DtS provisions (including clause excerpt):	E1.4	Applicable Performance Requirements:	EP1.1
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List key fire safety measures:

Portable fire extinguishers shall be provided to the development to afford occupants with suitable first hand fire fighting capabilities.

Where fire hose reels have been omitted from the development, additional portable fire extinguishers shall be provided where not already required by AS2444-2001 and NCC Clause E1.6. On the undercroft level, PFE's shall only be provided to the storerooms.

Proposed performance solution:

BCA Intent

Clause E1.4 states E1.4 does not apply to a Class 2, 3 or 5 or Class 4 part of a building, or a Class 8 electricity network substation, or a Class 9c building or classrooms and associated corridors in a primary or secondary school. A fire hose reel must be provided to serve the whole building where one or more internal fire hydrants are installed or where internal fire hydrants are not installed, to serve any fire compartment with a floor area greater than 500m².

Performance requirement EP1.1 states a fire hose reel system must be installed to the degree necessary to allow occupants to safely undertake initial attack on a fire appropriate to the size of the fire compartment, and the function or use of the building, any other fire safety systems installed in the building, and the fire hazard.

The intent of providing fire hose reels as per the Guide to the BCA is to enable, when appropriate, a building's occupants to undertake initial attack on a fire. It should be noted that a similar intent is given to portable extinguishers.

Analysis

In order to qualify the risk to occupants, it is important to acknowledge how occupants respond to a fire. Occupants having responded to a fire cue or alarm signal may either decide to evacuate or attempt to fight a fire.

Based on research as discussed by Bryan a correlation is drawn upon for various occupancy types and the percentage of occupancies in which fire-fighting was utilized. It is evident from the figure below that the use of fire-fighting equipment in buildings other than dwellings and smaller apartments is limited, accounting for less than 5% of incidents.

It should be noted that the figure below represents a total of 64 incidents across all occupancy types listed.

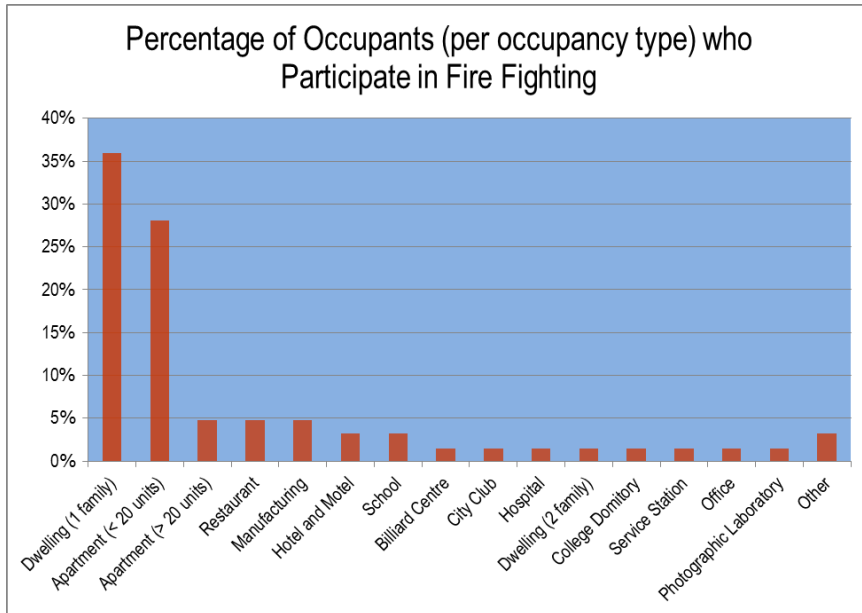


Figure 17 - Occupants who participate in firefighting

Occupants are expected to use fire hose reels when they consider it is safe to do so, in the early stage of a fire development. Therefore, heat and smoke from the fire are expected to be limited when occupants are trying to fight the fire.

If the fire is noticed at an early stage both fire hoses and fire extinguishers provide sufficient means for undertaking an initial attack. If the fire is noticed at a later stage, it could have developed to a size where it is beyond the capabilities of a fire extinguisher. Whilst a fire hose reel might still be sufficient, due to the larger fire size the risk to occupants will have increased as well.

It is not considered appropriate under such conditions for occupants to attempt to extinguish such a fire. If the fire is too large to extinguish with a portable extinguisher it is growing at an increasing rate. Due to the fact that occupants are not experienced setting up a fire hose reel there will likely be a time delay before the use can be undertaken; allowing the fire to grow even larger. Even if the amount of water during use is indefinite, occupants will have to fight the fire without any personal protective equipment or breathing apparatus. In addition to heat from the fire and toxic gas, occupants could also be harmed by the steam produced when applying water to the fire.

Therefore, if the fire is too large to extinguish with a portable fire extinguisher, occupants should evacuate the building instead of undertaking an initial attack.

Fire extinguishers complying with Australian Standards are marked with a classification and rating, determined in accordance with the relevant hazard that is likely to be present within the space. These are classified according to Class A through Class F as shown in the table below.

Table 2 - Categories of fire extinguishers

Fire Extinguisher Type	Type of Fire, Class and Suitability
Class A	Wood, paper, plastics, etc.
Class B	Flammable liquids
Class C	Flammable gases
Class D	Metal fires
Class E	Energized electrical equipment
Class F	Cooking oils and fats

Given the nature and use of the Class 9b space as a school, it is reasonable to assume that building staff should prioritise the evacuation of students/occupants from the compartment of fire origin to adjacent safe compartments or out of the building rather than undertaking initial fire-fighting.

For those occupants who deem it appropriate to undertake initial firefighting measure compliant fire extinguishers and extinguishants in accordance with the Australian Standard AS2444-2001 are provided. Extinguishers have the benefit of being considerably lighter than fire hose reels, meaning that they can be used by a wider range of building occupants.

It is further noted that if an occupant does not manage to control the fire, he/she may flee with the risk of leaving the hose edged against a door, leaving it open and allowing the fire to spread into other areas of the building. This compromises the fire compartmentation within a building and creates a path for fire and smoke to readily spread to the egress path as well as to be trained in the use of fire hose reels and therefore would likely put themselves at a higher risk of injury than simply evacuating. The same risk is not applicable to Fire Extinguishers.

FRNSW Comment: FRNSW recommend that PFEs be provided in locations where FHRs are proposed to be omitted.

E-LAB: Noted, a requirement for the placement of additional PFEs in areas where FHRs have been omitted has been added above. Additional PFEs shall not be provided to the non-storage area of the undercroft as this space will see use as a class 9b cola area for impromptu assemblies or student recreation during inclement weather and as such, is considered to be closer in use to a classroom space. Additionally, the wider undercroft space is open on all sides and mostly empty, with a management in use plan in place prohibiting storage within the area, further reducing the fuel load present. Students and teachers in this area have direct and immediate egress to open space in any direction from within the wider undercroft, and as such would not be expected to conduct firsthand firefighting using hose reels in the mostly open space. As such, it is considered appropriate to omit FHRs from the non-storage areas of the undercroft without providing PFEs to this area in particular.

Conclusion

Based on the qualitative assessment of the general egress strategy it has been demonstrated that the omission of fire hose reels in non-education spaces does not impact occupant egress or their ability to undertake fire hand fire-fighting operations. Therefore, performance requirement EP1.1 has been satisfied.

Performance solution:

- [x] A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
[] A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- [] A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
[] A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
[x] A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
[] A2G2(2)(c) or A2.2(2)(c) - Expert judgement
[] A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- [] Comparative [x] Qualitative [x] Deterministic
[x] Absolute [] Quantitative [] Probabilistic

AFEG sub-systems used in the analysis:

- [x] A - Fire initiation and development and control [x] D - Fire detection, warning and suppression
[] B - Smoke development and spread and control [x] E - Occupant evacuation and control
[x] C - Fire spread and impact and control [] F - Fire services intervention

Acceptance criteria and factor of safety:

The building occupants are provided with suitable firefighting equipment should early intervention be required. However, the building egress strategy is to prioritise evacuation over standing and fighting.

Fire scenarios and design fire parameters:

A fire in an auxiliary space has been considered for this assessment.

Describe how fire brigade intervention will be addressed or considered:

Fire brigade intervention is not considered impacted by this solution.

Verification/validation analyses:

- [] Sensitivity studies [] Redundancy studies [] Uncertainty studies [x] None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: FRNSW comments above to be adequately addressed.

E-LAB: See above. Further, it should be noted that the areas where fire hose reels are proposed to be omitted are staff areas such as canteens, library, small storage or office spaces within the school. These areas are considered to be more akin in risk to a class 5 office area, which would not be required to possess FHRs under BCA Clause E1.4.

Issue number: 4 **Title: Fire Hydrant System Simultaneous Flow Requirement**

Details of departures from DtS provisions:

It is proposed to permit the hydrant simultaneous flow requirement to be based on a fire compartment with 1000m² in lieu of 1029m² as shown below.

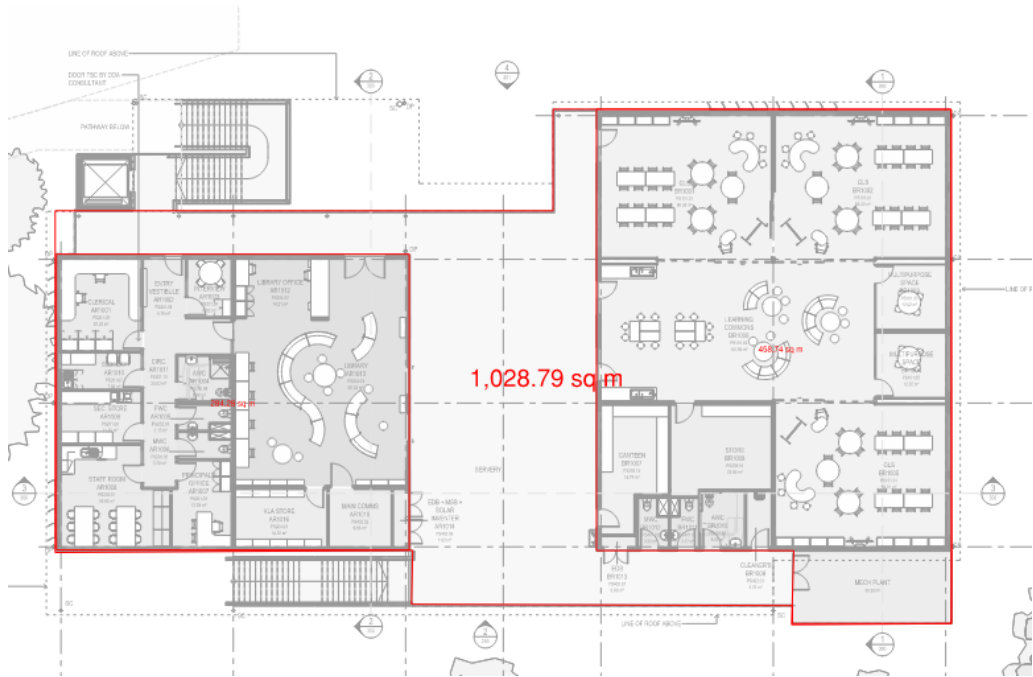


Figure 18: Floor Area Calculation

Applicable DtS provisions (including clause excerpt):	E1.3	Applicable Performance Requirements:	EP1.3
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List key fire safety measures:

A fire hydrant system shall be provided to the development in accordance with AS2419.1-2005 and NCC Clause E1.3.

Proposed performance solution:

BCA Intent

Clause E1.3 states a fire hydrant system must be installed in accordance with AS2419.1. The intent of clause E1.3 as per the Guide to the BCA is to require the installation of suitable fire hydrant system to facilitate the fire brigade’s firefighting operations.

Performance requirement EP1.3 states a hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to fire-fighting operations and the floor area of the building and the associated fire hazard of the building.

Analysis

The additional 29m² of floor area is not expected to significantly increase the fuel load or the rate of spread throughout the building as the circulation and plant space accounts for approximately 286 m² of the total floor area. As this space is used primarily for the use of occupant movement large quantum of fuel load storage is highly unlikely to occur. The increased floor area is approximately 3% over the 1000m² limit however approximately 29% of the compartment is circulation and plant space and as such is not considered reflective of a fire compartment with a fuel load density spread across the entire 1000m² floor area.

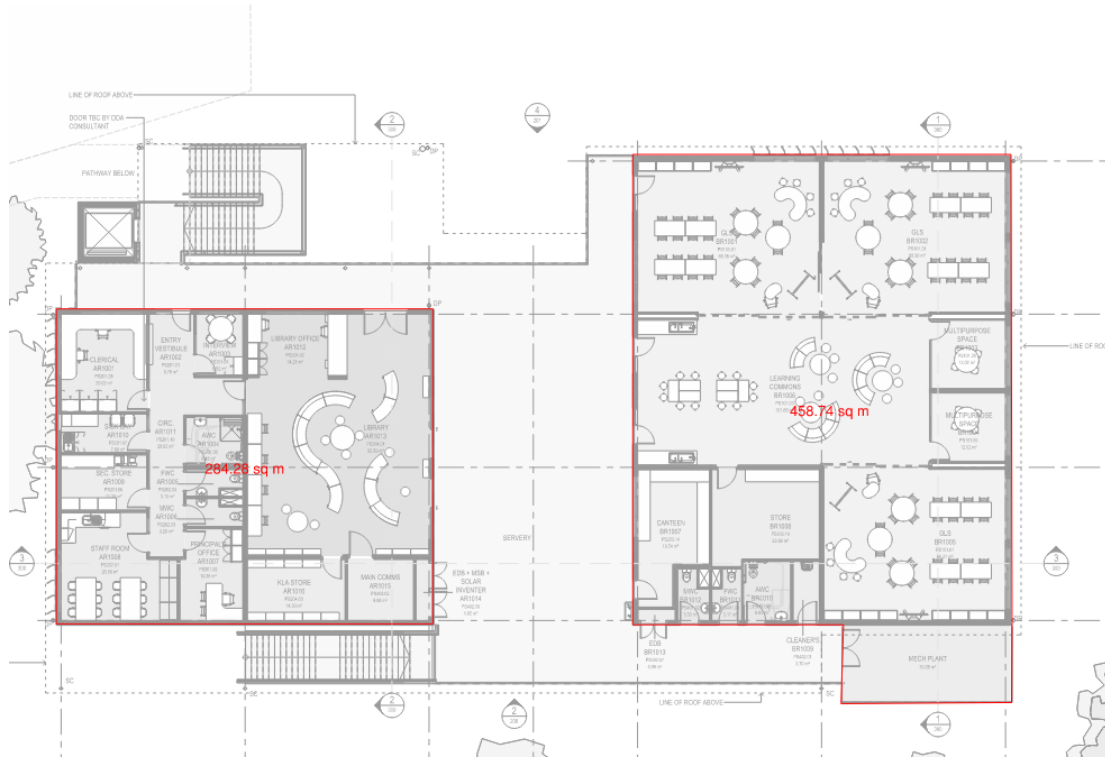


Figure 19: Floor area of classrooms and staff rooms – 743.82 m²

As shown below a building with 1 or 2 storeys contained and has a floor area of less than or equal to 1000m² is only required to have a single fire hydrant operating at any one time. A single hydrant has an extinguishing capacity of 16MW as per FBIM V2.2, a singular hydrant should be sufficient when fighting a Class 9b fire. The 29m² area above the 1000m² is not expected to increase the risk of fire spread throughout the entirety of the building as the circulation space separated the two main learning spaces/ staffrooms.

Table 2.1 — Number of fire hydrant outlets required to discharge simultaneously according to building classification and floor area

Building classification (see BCA)	Fire compartment floor area m ²	No. of fire hydrant outlets required to flow simultaneously (Note 1)
2, 3, 5 and 9 (1 or 2 storeys contained)	≤1 000	1
2, 3, 5 and 9 (1 or 2 storeys contained)	>1 000 ≤5 000	2
2,3,5 and 9 (3 or more storeys contained)	≤500	1
2,3,5 and 9 (3 or more storeys contained)	>500 ≤5 000	2
6, 7 and 8 (Note 2)	≤500	1
6, 7 and 8	>500 ≤5 000	2
All classes sprinklered	>5 000 ≤10 000	2
All classes sprinklered	>10 000	3
All classes unsprinklered	>5 000 ≤10 000	3
All classes unsprinklered	>10 000	3 plus one additional fire hydrant for each additional 5 000 m ² or part thereof

Figure 20: AS2419.1 - 2005 Simultaneous Flow Requirements

Conclusion

Hence, the applicable number of fire hydrants required to flow simultaneously shall meet the requirements for a compartment that is 1000m². Therefore, Performance Requirement EP1.3 has been met as it has been qualitatively demonstrated the minor increase in floor area above 1000m² is not expected to significantly increase the risk of fire spread.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
 A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
 A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
 A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
 A2G2(2)(c) or A2.2(2)(c) - Expert judgement
 A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- Comparative Qualitative Deterministic
 Absolute Quantitative Probabilistic

AFEG sub-systems used in the analysis:

- A – Fire initiation and development and control D – Fire detection, warning and suppression
 B – Smoke development and spread and control E – Occupant evacuation and control
 C – Fire spread and impact and control F – Fire services intervention

Acceptance criteria and factor of safety:

The performance solution is considered acceptable if it is shown that the proposed hydrant system meets the intent of performance requirement EP1.3 and that the compartment size is sufficiently close to 1000m² to meet the intent of AS2419.1-2005.

Fire scenarios and design fire parameters:

A fire within the school portion of the development has been considered for this assessment.

Describe how fire brigade intervention will be addressed or considered:

The impact on the brigade has been discussed in the above assessment.

Verification/validation analyses:

- Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: In principle support is provided subject:

- to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.
- Full hydrant coverage being achieved.

E-LAB: Full hydrant coverage is assumed to be achieved. Compliance shall be demonstrated in the FER.

Issue number: 5 Title: Permit Ancillary Elements

Details of departures from DtS provisions:

It is proposed to permit external signage to be made from combustible materials such as acrylic, PVC or polycarbonate.

AC units are proposed to be fixed to the external portion of the wall and do not technically meet the requirements of non-combustibility due to the plastic coverings of the cabling and minor plastic components within the AC units themselves.

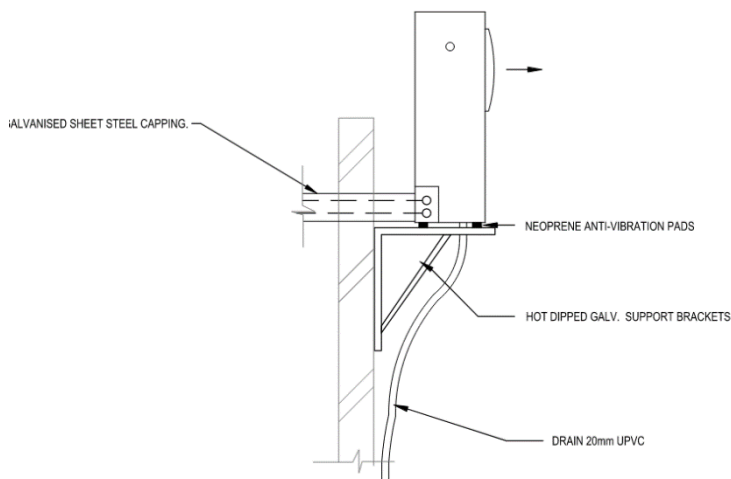


Figure 21: Condenser Mounting Detail



Figure 22: Example AC wall Bracket

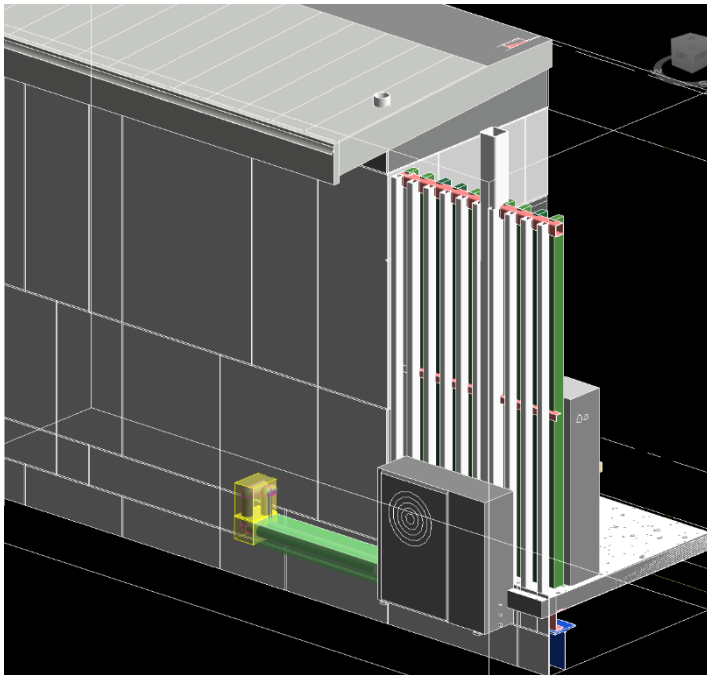


Figure 23: Snapshot of Installation Intent 1

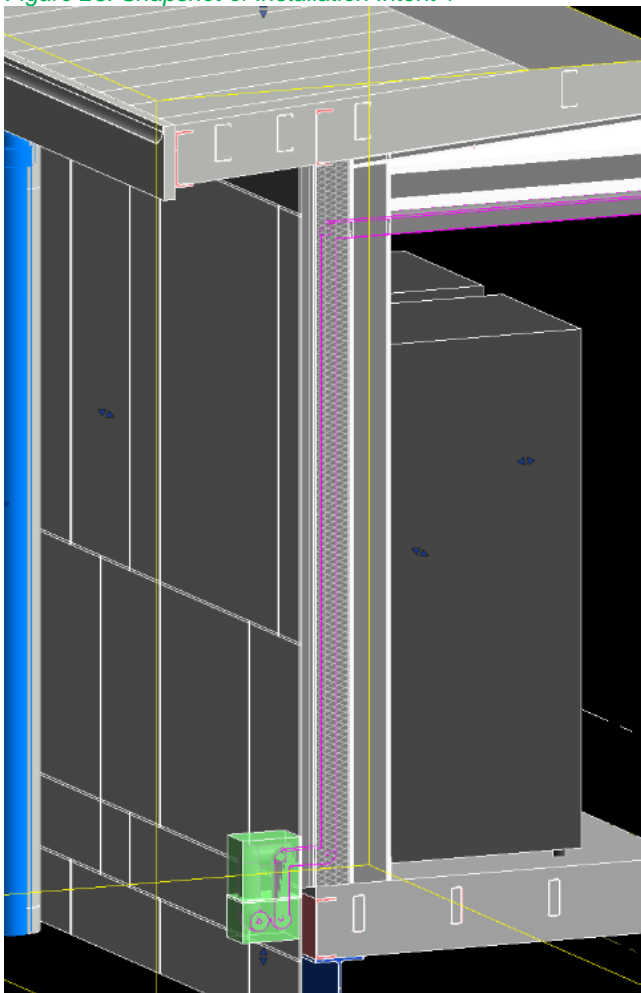


Figure 24: Snapshot of Installation Intent 2

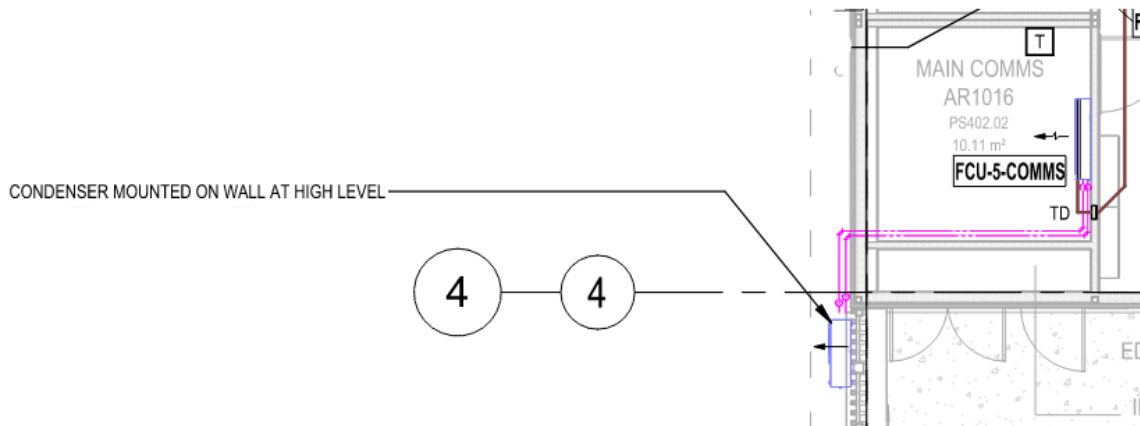


Figure 25: Snapshot of Installation Intent 3

Applicable DtS provisions (including clause excerpt):	C1.14	Applicable Performance Requirements:	CP2
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List key fire safety measures:

The signage is not permitted to be located over any egress paths.

Proposed performance solution:

BCA Intent

BCA Clause C1.14 outlines acceptable ancillary elements that can be attached to external walls. It states:

An ancillary element must not be fixed, installed, or attached to the internal parts or external face of an external wall that is required to be non-combustible unless it is one of the following:

- (h) A sign other than on provided under (a) or (g) that –
 - (i) Achieves a group number of 1 or 2; and
 - (ii) Does not extend beyond one storey; and
 - (iii) Does not extend beyond one fire compartment; and
 - (iv) Is separated vertically from other signs permitted under (h) by at least 2 storeys

The BCA guide states the intent of this clause is “To permit certain building components that may contain a limited amount of combustible materials to be attached to an external wall required to be non-combustible”. The intent of this clause can be understood as ensuring that ancillary elements on external walls do not facilitate fire spread outside of the fire compartment or storey of origin.

Performance Requirement CP2 requires that a building have elements which will, to the degree necessary, avoid the spread of fire to, from or within a building.

Analysis

The non-compliance is the signage material may not achieve a group number 1 or 2 depending on material selection. The remaining requirements such as the sign does not extend beyond one storey, does not extend beyond one fire compartment, and is separated vertically from other signs by at least 2 storeys shall be met due to the geometry of the building.

It is anticipated that the signage will be fixed to the external wall of the building on Level 1 facing the street to display the school name and emblem. As such, a portion of the wall will contain an ancillary sign that does not achieve a group 1 or 2 rating and hence will not benefit from the concession of C1.14 which allows combustible signage to be installed on an external wall.



Figure 26: 3D render concept

The minor nature of the signage and the sign being limited to one storey is expected to minimise the risk of fire spread throughout the building as it is expected to be contained to one side and non-continuous along the external wall.

Further, there are two credible scenarios for the ignition of the signage. They are, a fire from the boundary radiating heat onto the sign, and a fire in the signs electrical fixtures (if any). A fire from the boundary is not expected to impact the signage due to the site wide setback adopted by the design team. The building will be a minimum 5m away from the boundary on all sides and is surrounded by farmlands further limiting the risk of a large fire on the boundary.

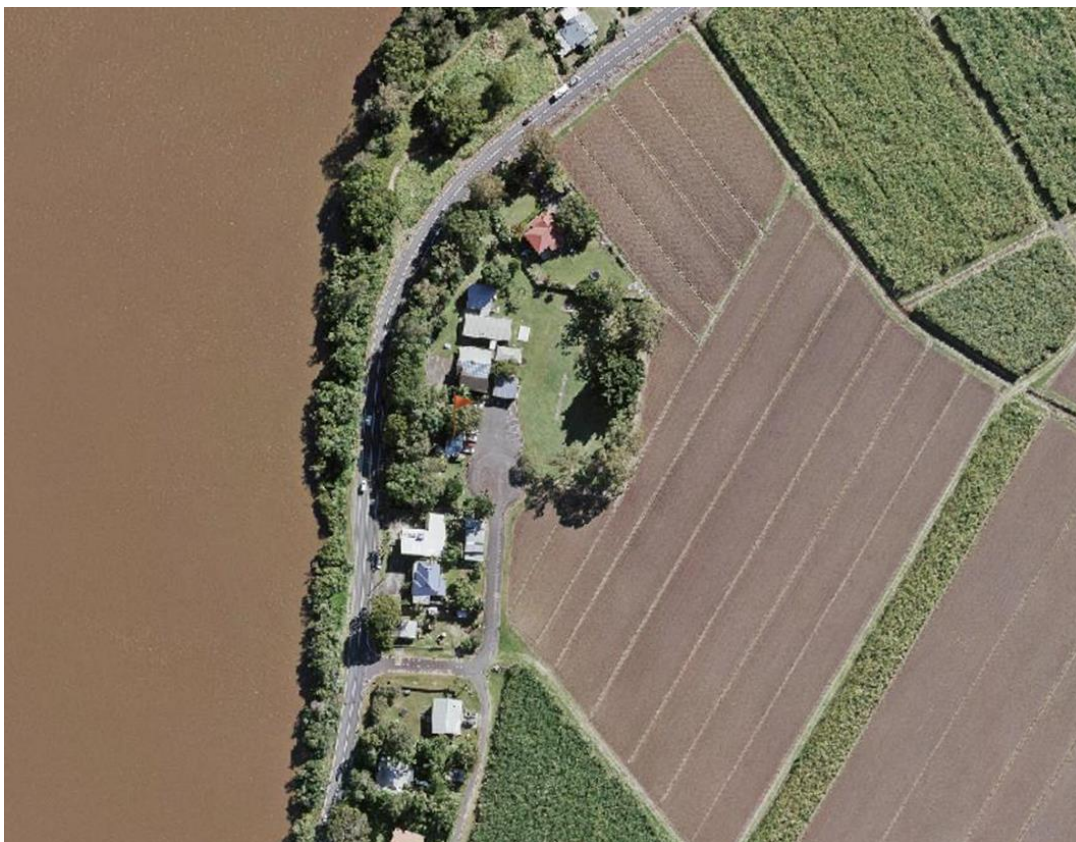


Figure 27: Six Maps - Broadwater Public School and adjacent allotments

A fire within an electrical fixture within the sign if they are to be backlit is not expected to increase the risk of fire spread throughout the whole building as the signage is not continuous around the building and limited to a portion

of one side of the external wall assembly. The signage is anticipated to be in the order of millimetres thick and as such will not significantly increase the fuel load attached to the wall assembly. Should a fire breakout in the signage, the sign is expected to burn away quickly. Once the signage has burnt away it is no longer considered to contribute to the fuel load and hence will not contribute to fire spread throughout the building.

Furthermore, it shall be a requirement that the signage is not located over any egress routes such that the products of combustion do not impact occupants seeking egress. Furthermore, the functionality of this building is similar to a Type C building as discussed in Item 1 of this FEBQ. The building is a Type C structure that is elevated off of the ground to minimise the impacts of flooding. Due to the raised nature of the building they NCC classifies it as a rise in storey of 2 and hence technically the Type B building requirements are triggered. On an identical building situated on the ground (i.e., no raised structure) the building would be permitted to have signage fixed highlighting the low-risk nature of the external signage. Furthermore, the building is effectively 1 storey for the purpose of external signage and therefore fire spread along the façade to a level above is not considered a credible scenario.

AC Units

It is proposed to install AC units on the external wall of the development. As such, NCC 2019 amendment 1 Clause C1.14 does not list this item as a recognised concession. As such, a technical non-compliance arises that the building now has ancillary elements attached to an external façade that is required to be non-combustible. The non-combustible requirement is due to the school being located on a gantry structure and as discussed in issue 1 of this document is a technicality. Where, for all intents and purposes functions like a Type C building.

Furthermore, NCC 2022 clarifies that AC units are exempt from clause C2D14. Further highlighting the minimal risk presented by allowing AC units to be attached to external walls that are required to be non-combustible.

Notes

C2D14 does not prevent the mounting of domestic air-conditioning condenser units on *external walls*.

Figure 28: NCC 2022 Extract

Conclusion

The qualitative analysis above shows that the combustible elements present in the proposed external signage and AC unit attachment are not expected to promote the spread of fire to, from or throughout the building. The exact location of these ancillary elements and signage material type will be included in the FER once fully defined, however, given the building is akin to a Type C building, the outcome of this assessment is unlikely to change. Therefore, performance requirement CP2 has been met.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
- A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
- A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
- A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
- A2G2(2)(c) or A2.2(2)(c) - Expert judgement
- A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- | | | |
|--|---|---|
| <input type="checkbox"/> Comparative | <input checked="" type="checkbox"/> Qualitative | <input checked="" type="checkbox"/> Deterministic |
| <input checked="" type="checkbox"/> Absolute | <input type="checkbox"/> Quantitative | <input type="checkbox"/> Probabilistic |

AFEG sub-systems used in the analysis:

- | | |
|---|--|
| <input checked="" type="checkbox"/> A – Fire initiation and development and control | <input type="checkbox"/> D – Fire detection, warning and suppression |
| <input type="checkbox"/> B – Smoke development and spread and control | <input type="checkbox"/> E – Occupant evacuation and control |
| <input checked="" type="checkbox"/> C – Fire spread and impact and control | <input type="checkbox"/> F – Fire services intervention |

Acceptance criteria and factor of safety:

The performance solution is considered acceptable if it is shown that the combustible external ancillary elements does not promote the spread of fire to, from or throughout the building.

Fire scenarios and design fire parameters:

The performance solution considers a fire affecting the external elements along the façade.

Describe how fire brigade intervention will be addressed or considered:

Brigade intervention is not considered to be impacted by this solution if it shown that the use of combustible external elements does not promote the spread of fire to, from or throughout the building.

Verification/validation analyses:

Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

E-LAB: Noted. Compliance shall be demonstrated in the FER.

Issue number: 6 Title: Canteen wall assembly

Details of departures from DtS provisions:

It is proposed to install polyisocyanurate (PIR) insulation within the canteen walls to achieve the thermal efficiency rating required for this space.

This is a DtS departure as the NCC requires all elements of an external wall to be non-combustible.

FRNSW comment: FRNSW recommend the extent of ISPs be clearly depicted to permit a considered review.

E-LAB: The PIR insulation is only to be installed in the walls of the canteen. All walls of the canteen shall possess the PIR insulation. The non-compliance strictly relates to the Type B construction requirements mandating all external wall to be constructed from non-combustible building elements. PIR while noted as being flame retardant does not meet the non-combustible requirements of the NCC.

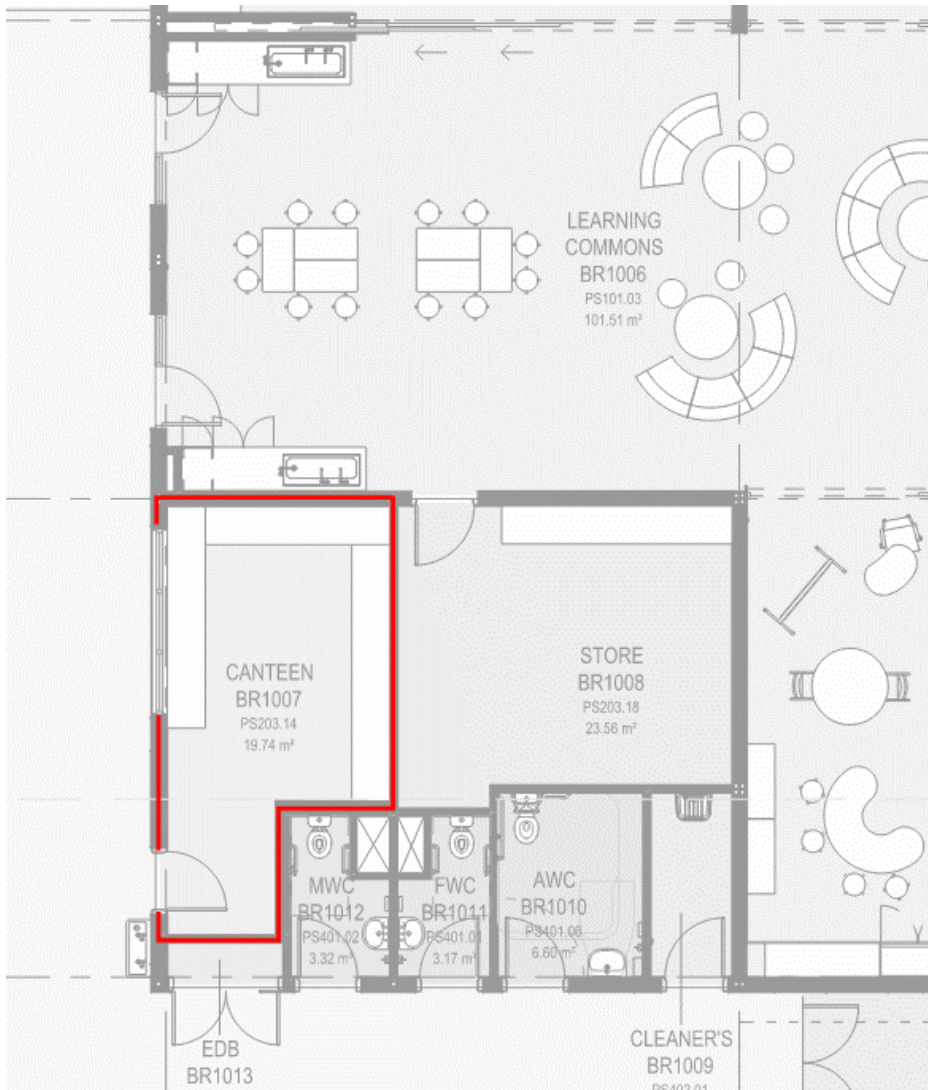


Figure 29: Canteen walls to have PIR insulation.

Smoke from the canteen may flow out and impact the servery section of the gantry. However, due to the gantry being partially open on both sides of the servery, smoke is expected to ventilate from the area rather than completely descend, allowing occupants to egress to either set of stairs unimpeded.

Applicable DtS provisions (including clause excerpt):	C1.9	Applicable Performance Requirements:	CP2, EP2.2
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List key fire safety measures:

A flame-retardant PIR type insulation shall be provided (i.e., Metecno panels of similar).

Proposed performance solution:

BCA Intent

Clause C1.9 states in a building required to be of Type A or B construction certain external walls including all components incorporated in them including the façade covering, framing and insulation must be non-combustible.

Performance requirement CP2 states a building must have elements which will, to the degree necessary, avoid the spread of fire to exits, and between building, and in a building. The intent of CP2 is to limit the spread of fire within and between buildings.

Analysis

In a type A or B building, all external walls including all components incorporated within them including façade covering and insulation are to be non-combustible. As such, a portion of the external canteen wall forms part of the external wall and would therefore be required to be non-combustible in its entirety.

It is proposed to permit fire retardant PIR insulation material (Metecno panel or similar) to be installed within the canteen wall. The risk of permitting combustible elements on the external wall is the risk of fire spread between adjacent fire compartments and different levels. As an example Metecno panels have been tested to AS1530.3 and achieved the following values:

- Ignitibility index 0
- Spread of flame index 0
- Heat evolved index 0
- Smoke Index 4
- Smogra RC <100

As clearly shown Metecno is expected to be a flame retardant material which is not expected to promote the spread of fire across the façade. Furthermore, fire spread from the boundary to the PIR insulation is not considered reasonable as the external wall is non-combustible which shall act as a shield for the PIR insulation and the canteen walls are set back from the boundary line.

The PIR when exposed to fire will combust, however PIR tends to char which prevents the combustible layer behind the char layer from being exposed to the full extent of the heat from the fire. This reduces the ability of the material to facilitate fire spread. The ignition temperature of PIR ranges between 300°C – 460°C. Tests carried out on three samples PIR insulation¹ have determined that when subjected to a high heat flux of 50 kW/m², PIR gives off an initial peak heat release rate of approximately 100 – 120 kW/m² and then reaches a steady rate of approximately 10 kW/m². The results can be seen in the figure below.

¹ McKenna ,S et al 2019, *Fire behaviour of modern façade materials – Understanding the Grenfell Tower fire*

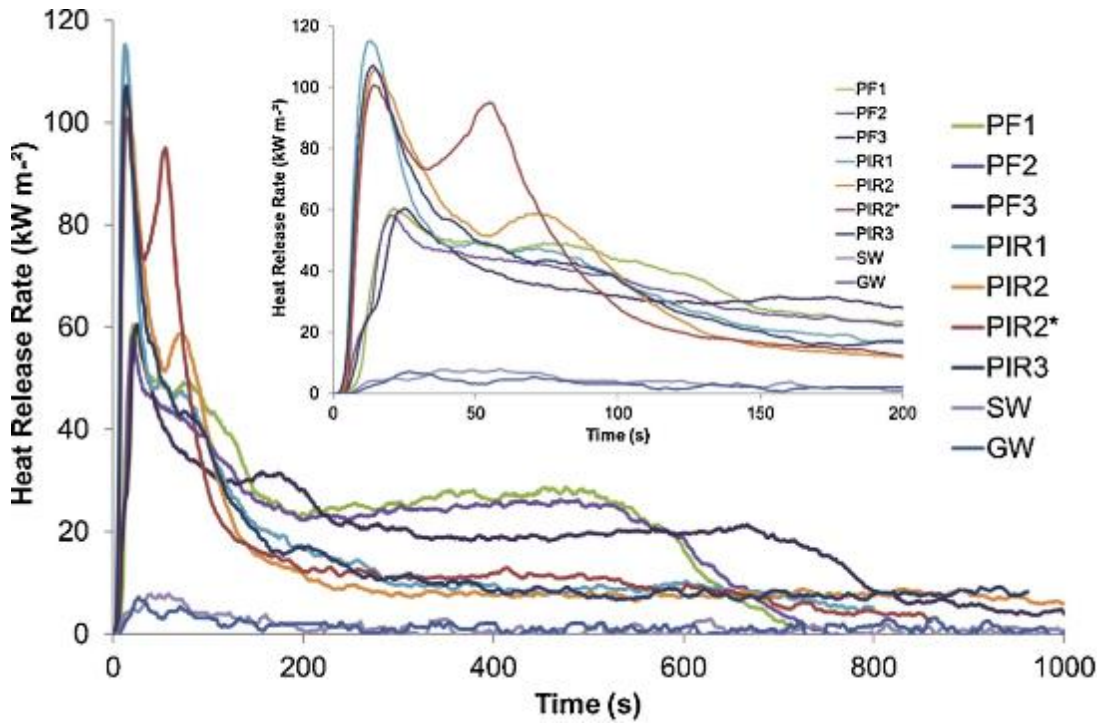


Figure 30: PIR heat release rate when subjected to 50 kW/m²

This low heat release rate of PIR is indicative of a material that chars and does not facilitate fire spread. The steady heat release rate of 10 kW/m² is not considered sufficient to cause fire spread and therefore in the absence of an external fire, PIR is expected to self-extinguish. Therefore, fire spread via the PIR would be limited to the area directly affected by another fire and is not expected to spread beyond that zone.

PIR is also not expected to propagate flames and is unable to self-sustain a fire. This is evident in the figure below where most of the fire damage is from the crib fire below with the zones outside the original fire appearing to have no notable fire damage when subject to a full façade fire test.

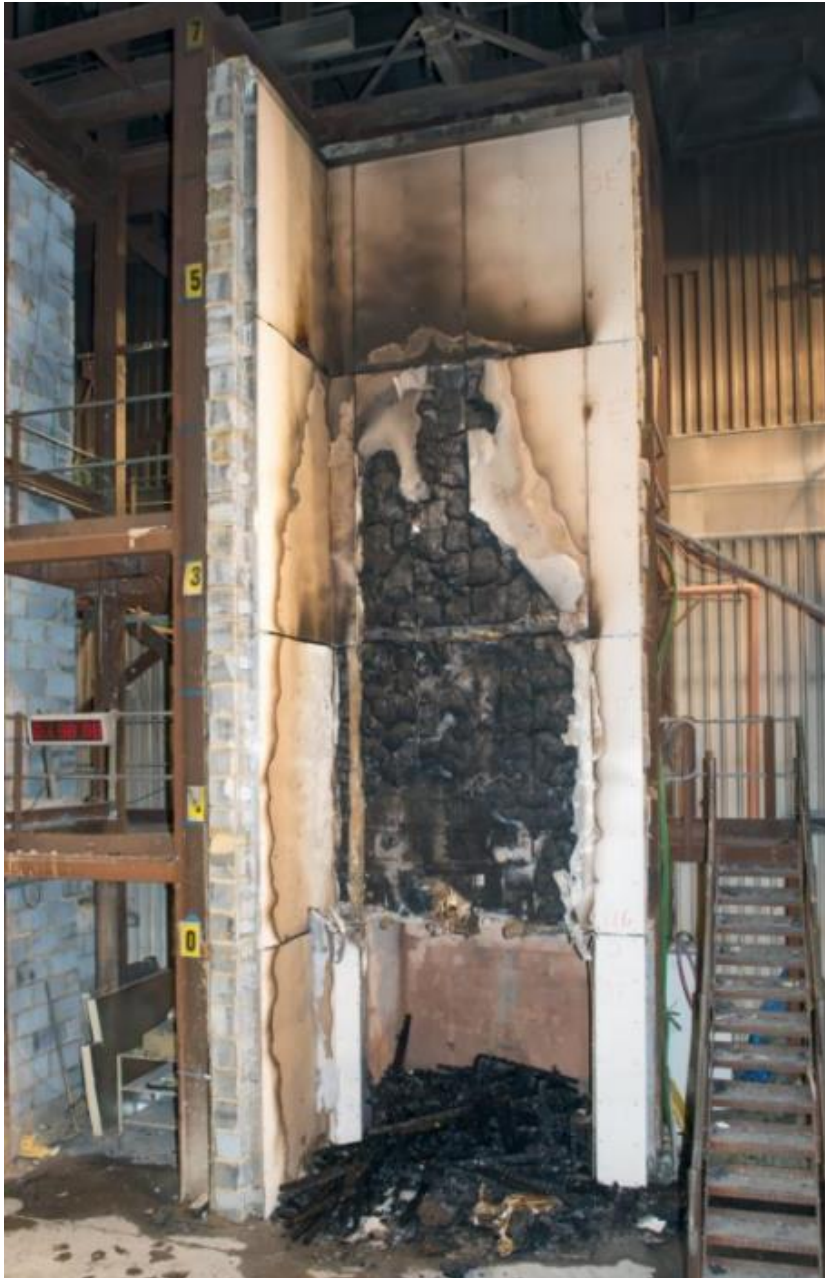


Figure 31: Post fire test – Extent of fire damage

From the above, it is evident that PIR would not contribute to fire spread along a façade in any significant way. It is clear that the PIR insulation may combust when subject to another fire source, however once the fire source is removed or in the areas away from the fire source, PIR is not expected to facilitate fire spread.

Conclusion

The PIR insulation material has been qualitatively demonstrated to adequately resist fire spread in the design. In the event of sprinkler failure the PIR material has been demonstrated to not be self-sustaining and is expected to auto extinguish in the absence of a flame. As such, performance requirement CP2 has been met.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
- A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
- A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
- A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
- A2G2(2)(c) or A2.2(2)(c) - Expert judgement

A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

Comparative Qualitative Deterministic
 Absolute Quantitative Probabilistic

AFEG sub-systems used in the analysis:

A – Fire initiation and development and control D – Fire detection, warning and suppression
 B – Smoke development and spread and control E – Occupant evacuation and control
 C – Fire spread and impact and control F – Fire services intervention

Acceptance criteria and factor of safety:

The performance solution is considered acceptable if it is shown that the flame retardant PIR insulation material adequately resists the spread of fire.

Fire scenarios and design fire parameters:

A fire on the canteen floorplate has been considered for this assessment.

Describe how fire brigade intervention will be addressed or considered:

Fire brigade intervention is not considered to be impacted if it is shown the insulation material does not facilitate fire spread.

Verification/validation analyses:

Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: FRNSW provides the following comments/recommendations:

- The proposed ISPs to be installed within the building must comply with the IPCA Ltd 2017 Code of Practice (CoP).
- Upon completion of construction, certification should be provided from the accredited installer (e.g. a Code Compliant Company with the CoP) to ensure that the ISPs comply and are installed in accordance with the CoP.
- The use of ISPs within the building should be identified by the labelling system outlined in the CoP which includes a key diagram, a number compliance plate and labels located at all doorways into compartments/rooms constructed with ISPs.
 - The key diagram which is required by the CoP should be provided at the main entry to the building. The key diagrams can assist firefighters when making operational decisions.

E-LAB: This is considered to be a manufacturing and installation requirement. The intent of the design is proposing to use PIR panels to meet the vermin control requirements outlined in the EFSG requirements for schools. As such, the manufacturer and installer will have to confirm compliance with the above requirements.

- Housekeeping and emergency procedures as per the CoP should be developed for the facility to include:
 - Regular inspections (to be determined by the building surveyor and the fire safety engineer) and a maintenance regime to ensure that the integrity of the panels remains intact and are not exposed to ignition sources.

E-LAB: Inspection of the PIR panel shall be included in the annual fire safety inspection.

- Ongoing training, education and execution of the emergency management procedures to be regularly conducted with all building occupants.

E-LAB: Not all occupants are permitted to be within the canteen. Canteen staff as part of their induction process shall be briefed and trained on the emergency management procedure for the canteen space.

- The ISPs being listed on the fire safety schedule for the building.

E-LAB: This shall be developed in conjunction with facility management, building surveyor, and certifier and will be listed on the fire safety schedule for the building.

Issue number: 7 **Title: Timber Noggins within the External Wall**

Details of departures from DtS provisions:

Combustible components (timber noggins) are proposed to be incorporated in the external wall. These attachments are combustible and are not considered to be exempt from the provisions of C1.9 and C1.14.

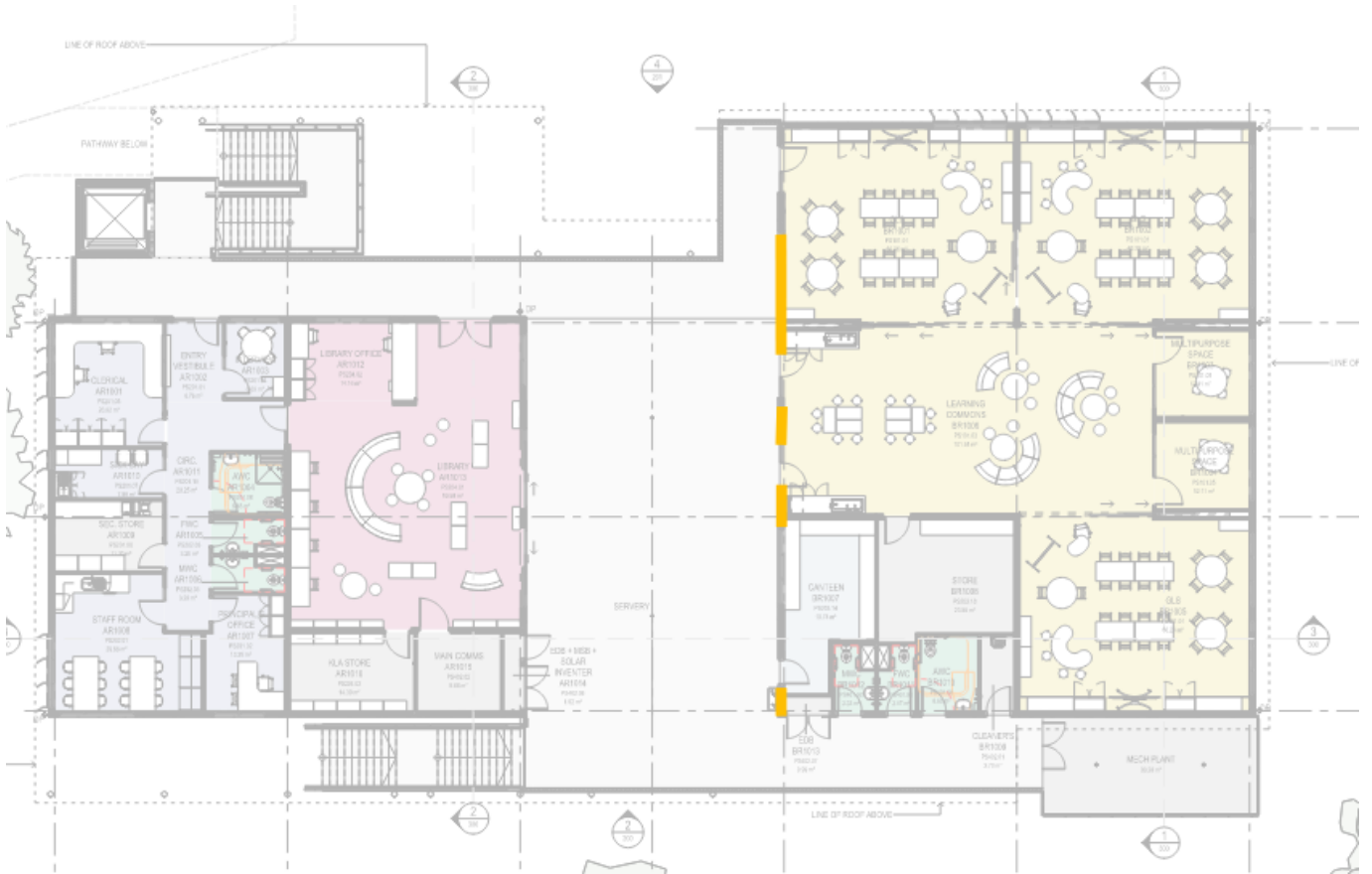


Figure 32: Location of proposed timber noggins.

Applicable DtS provisions (including clause excerpt):	C1.9, C1.14	Applicable Performance Requirements:	CP2
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List key fire safety measures:

-

Proposed performance solution:

BCA Intent

Clause C1.9(a) states in a building required to be of Type A or B construction, the following building elements and their components must be non-combustible:

- (i) External walls and common walls, including all components incorporated in them including the façade covering, framing and insulation.
- (ii) The flooring and floor framing of lift pits.
- (iii) Non-load bearing internal walls where they are required to be fire-resisting.

The concessions for Clause C1.9 are listed in part (d) and (e).

Clause C1.9(d) states the requirements of (a) and (b) do not apply to the following:

- (i) Gaskets
- (ii) Calking
- (iii) Sealants
- (iv) Termite management systems

- (v) Glass, including laminated glass.
- (vi) Thermal breaks associated with glazing systems.
- (vii) Damp-proof courses.

Clause C1.9(e) states the following materials may be used wherever a non-combustible material is required:

- (i) Plasterboard.
- (ii) Perforated gypsum lath with a normal paper finish.
- (iii) Fibrous-plaster sheet
- (iv) Fibre-reinforced cement sheeting.
- (v) Pre-finished metal sheeting having a combustible surface finish not exceeding 1mm thickness and where the spread-of-flame index of the product is not greater than 0.
- (vi) Sarking-type materials that do not exceed 1mm in thickness and have a flammability index not greater than 5.
- (vii) Bonded laminated materials where-
 - a. each lamina, including any core, is non-combustible.
 - b. each adhesive layer does not exceed 1mm in thickness and the total thickness of the adhesive layers does not exceed 2mm.

Clause C1.14 states an ancillary element must not be fixed, installed or attached to the internal parts or external face of an external wall that is required to be non-combustible.

CP2 states a building must have elements that will, to the degree necessary, avoid the spread of fire. It should be noted that the performance requirements do not make reference of specific minimum fire resistance levels as being the Performance Requirement.

As such, in order to meet Performance Requirement CP2, it must be demonstrated that the use of minor combustible elements as part of the external wall system will not facilitate the spread of fire within the building.

Analysis

This solution was included in anticipation for the eventual design requirements for internal timber noggins in the external wall system. A Performance Solution is often required during the construction phase of the project to capture this technical DtS departure. Under BCA DtS provisions, the external walls with the proposed timber noggins are required to have their construction be non-combustible.

The non-compliant combustible elements within the wall system are the timber noggins installed within the external wall. The main use of the timber noggins is to provide support to the local fittings and fixtures installed into the internal faces of external walls i.e. local air-conditioning units, water fittings, bag hooks etc. to add structural support to the fixtures and fittings. The timber noggins are not used to provide lateral support of the steel studs in any way, therefore in the event of timber noggin failure; it is unlikely to affect the steel stud construction of the internal wall system.

The extent of timber noggins within the walls is expected to be limited, with only minor timber noggin elements per room. As such, the timber noggins will pose a negligible increase in the fire load within each wall and therefore is not expected to adversely increase the risk of fire spread. Furthermore, as the timber noggins are located within the walls and thereby protected by the fire-rated plasterboard on both sides, it is considered the ignition risk exposure within the void is low. If a fire was to start within the walls i.e. electrical fault, as the timber noggins are not continuous, used to a minimal extent and installed amongst an otherwise wholly non-combustible wall, the likelihood of fire spread within the wall is considered low within the proposed development. Additionally, NCC 2022 is considered to reflect best and current building guidance. NCC 2022 permit timber noggins as per C2D10(4)(i)(iii) as seen in the figure below.

- (h) Compressible fillers and backing materials, including those associated with articulation joints, closing gaps not wider than 50 mm.
- (i) Isolated—
 - (i) construction packers and shims; or
 - (ii) blocking for fixing fixtures; or
 - (iii) fixings, including fixing accessories; or
 - (iv) acoustic mounts.

Figure 33: Excerpt (i) from NCC 2022 C2D10.

This highlights current building practices do not consider timber noggins to significantly increase the risk of fire spread as evidence by the latest concession.

Conclusion

The assessment qualitatively demonstrates that the internal combustible components contribute to a negligible increase in fire load and adequately limits fire spread, due to being non-continuous, the minimal extent and it being installed amongst an otherwise non-combustible wall. Therefore, compliance with CP2 is considered to be achieved.

Performance solution:

- A2G2(1)(a) or A2.2(1)(a) - Comply with all relevant performance requirements
- A2G2(1)(b) or A2.2(1)(b) - Be at least equivalent to the DtS provisions

Assessment methods:

- A2G2(2)(a) or A2.2(2)(a) - Evidence of suitability
- A2G2(2)(b)(i) or A2.2(2)(b)(i) - Verification methods provided in the NCC
- A2G2(2)(b)(ii) or A2.2(2)(b)(ii) - Other verification methods accepted by the appropriate authority
- A2G2(2)(c) or A2.2(2)(c) - Expert judgement
- A2G2(2)(d) or A2.2(2)(d) - Comparison with the DtS provisions

Assessment approach:

- | | | |
|--|---|---|
| <input type="checkbox"/> Comparative | <input checked="" type="checkbox"/> Qualitative | <input checked="" type="checkbox"/> Deterministic |
| <input checked="" type="checkbox"/> Absolute | <input type="checkbox"/> Quantitative | <input type="checkbox"/> Probabilistic |

AFEG sub-systems used in the analysis:

- | | |
|---|---|
| <input checked="" type="checkbox"/> A – Fire initiation and development and control | <input checked="" type="checkbox"/> D – Fire detection, warning and suppression |
| <input type="checkbox"/> B – Smoke development and spread and control | <input type="checkbox"/> E – Occupant evacuation and control |
| <input checked="" type="checkbox"/> C – Fire spread and impact and control | <input type="checkbox"/> F – Fire services intervention |

Acceptance criteria and factor of safety:

The Performance Solution is considered acceptable if it is shown that the minor combustible elements do not promote fire spread within the building via the external walls.

Fire scenarios and design fire parameters:

A fire affecting the external walls with timber noggins has been considered for this assessment.

Describe how fire brigade intervention will be addressed or considered:

Brigade intervention is not considered to have impacted if it is shown that the timber noggins are not expected to promote fire spread within the building via the external walls.

Verification/validation analyses:

- Sensitivity studies Redundancy studies Uncertainty studies None

N/A

Provide details on proposed modelling/assessment tools:

N/A

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

E-LAB: Noted. Compliance shall be demonstrated in the FER.

8 Construction, commissioning, management, use and maintenance

What considerations does the performance solution require during the construction phase?

N/A

How will the performance solution affect commissioning of the systems (e.g. listed on fire safety schedule as essential or critical measure, combined new and old installations)?

As per section 6

How will the performance solution be addressed for ongoing building management and use (e.g. details to be provided in a 'fire safety management plan' for the building manager)?

As per section 6

How will any restrictions on fuel load/use/populations within the performance solution be managed and enforced (e.g. details to be provided in 'fire safety management plan')?

As per section 6

How will the performance solution be addressed for maintenance (e.g. details included on fire safety schedule, location of fire engineering report on site, plain English summary adjacent to FIP)?

As per section 6

9 Additional comments

N/A

Note: Any in principle support extended for performance solution issues through consultation is contingent upon all assumptions, analyses and conclusions in the fire engineering report being fully justified, and referenced as appropriate, to demonstrate how the relevant performance requirements have been satisfied to the extent required by the agreed acceptance criteria.

10 Scheduled charges

FRNSW charge for the provision of services performed in connection with statutory fire safety as per the schedule of charges identified in [clause 46](#) and [schedule 3](#) of the *Fire Brigades Regulation 2014*.

The charge applicable is \$2,600 for each day (or part of a day) spent by the Commissioner or a fire brigade member providing advisory, assessment or consultancy services.

Note: For a full description of the charges applicable including terms, payment options, applying for a waiver or reduction of the charges, please refer to the FRNSW website at firesafety.fire.nsw.gov.au.

11 Submission of this form

This completed form is to be emailed to firesafety@fire.nsw.gov.au.

All plans and specifications required by FRNSW for assessment are to be attached to the email (or sent separately if necessary due to file size). Refer to [Submitting plans and specifications to FRNSW](#) for further information.

12 Contact us

For further information contact the Fire Safety Branch on (02) 9742 7434 or email firesafety@fire.nsw.gov.au.