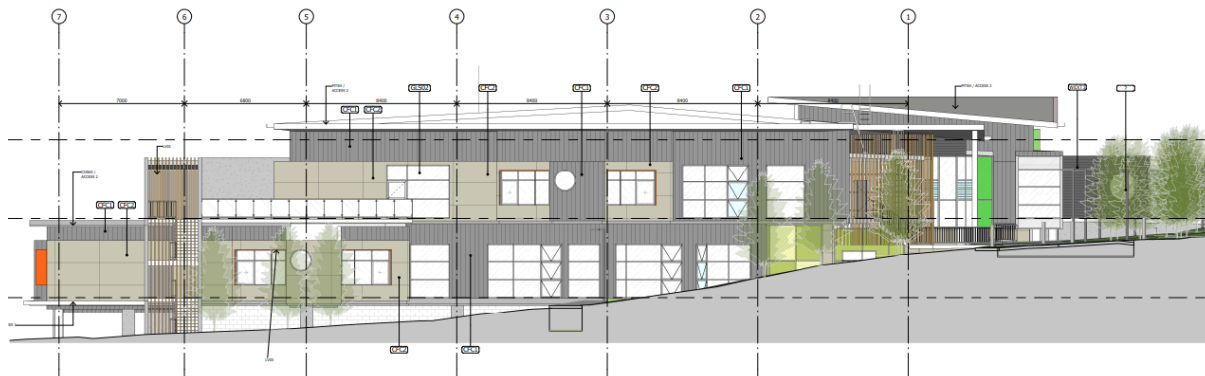


DWP

# **GOLD COAST UNIVERSITY HOSPITAL SECURE MENTAL HEALTH REHABILITATION UNIT**

## **FIRE ENGINEERING REPORT**

**PS126626  
ISSUE 08  
17 APRIL 2024**



INVISION

**WSP Australia Pty Limited**

Level 12, 900 Ann Street  
Fortitude Valley, Queensland  
4006 Australia

Tel: +61 7 3368 6600  
Fax: +61 7 3368 6699

**wsp.com**





# DOCUMENT AUTHORISATION

| Issue                          | Date       | Details                                                                                                                                                                                                                        | Prepared By:             | Reviewed By:   | Authorised By:                                                                                                        |
|--------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Fire Engineering Brief</b>  |            |                                                                                                                                                                                                                                |                          |                |                                                                                                                       |
| 01                             | 28/09/2021 | For stakeholder review and comment                                                                                                                                                                                             | Teagan MacDonald         | Jack Partridge | Jack Partridge<br>RPEQ 10529<br>   |
| 02                             | 07/10/2021 | Updated to incorporate stakeholder comments                                                                                                                                                                                    | Teagan MacDonald         | Jack Partridge | Jack Partridge<br>RPEQ 10529<br>   |
| 03                             | 20/10/2021 | Updated to incorporate stakeholder comments                                                                                                                                                                                    | Teagan MacDonald         | Jack Partridge | Jack Partridge<br>RPEQ 10529<br>   |
| 04                             | 10/11/2021 | Updated to incorporate Performance Solutions for proximity to the proposed ED Expansion building, non-fire isolated circulation stair on BL1 and LG, and obviation of fire sprinklers internally within the SMHRU link bridge. | Teagan MacDonald         | Jack Partridge | Jack Partridge<br>RPEQ 10529<br> |
| <b>Fire Engineering Report</b> |            |                                                                                                                                                                                                                                |                          |                |                                                                                                                       |
| 01                             | 13/12/2021 | For stakeholder review and comment                                                                                                                                                                                             | Teagan MacDonald         | Jack Partridge | Jack Partridge<br>RPEQ 10529<br> |
| 02                             | 13/01/2022 | Updated to incorporate stakeholder comments                                                                                                                                                                                    | Stephanie Dufourmantelle | Jack Partridge | Jack Partridge<br>RPEQ 10529<br> |

Documents and drawings incorporated or referenced in this report may undergo minor changes. It is the reader's responsibility to ensure that they observe the latest project related drawings and relate these to the Fire Engineering Provisions outlined in this document.

This fire engineering document relates to concepts and is based on a requirement for the building to comply with relevant Performance Requirements of the National Construction Code (NCC). Therefore, after issue of the latest revision of this document, minor revisions to services and/or architecture drawings need not necessarily require this document to be updated unless the intent requires to be modified.

It is not a fire engineering function to detail specific design components of individual installations, as this is a function of each specific services designer and/or the installing contractors concerned.

Notwithstanding the content of this document, full cognisance must be taken of, inter-alia, the Assumptions and Limitations in Appendix A, and any further assumptions made in developing the fire engineering solutions as reflected in this document.

## COPYRIGHT

This document may contain confidential and legally privileged information, neither of which are intended to be waived, and must be used only for its intended purpose. Any unauthorised copying, dissemination or use in any form or by any means other than by the addressee, is strictly prohibited. If you have received this document in error or by any means other than as authorised addressee, please notify us immediately and we will arrange for its return to us.

| Issue | Date       | Details                                                                                              | Prepared By:  | Reviewed By:       | Authorised By:                                                                                                            |
|-------|------------|------------------------------------------------------------------------------------------------------|---------------|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| 03    | 21/03/2022 | Updated to incorporate revised Linkway design                                                        | Thomas Thorne | Jack Partridge     | Jack Partridge<br>RPEQ 10529<br>       |
| 04    | 01/04/2022 | Updated to incorporate stakeholder comments                                                          | Thomas Thorne | Jack Partridge     | Jack Partridge<br>RPEQ 10529<br>       |
| 05    | 21/06/2022 | Updated to incorporate stakeholder comments                                                          | Thomas Thorne | Jack Partridge     | Jack Partridge<br>RPEQ 10529<br>       |
| 06    | 10/11/2023 | Updated to incorporate additional Performance Solution                                               | Harry James   | Jack Partridge     | Jack Partridge<br>RPEQ 10529<br>       |
| 07    | 23/02/2024 | Updated to incorporate additional Performance Solutions, refer to Items '4, 9 and 20' in Table ES.2. | Daryan Othman | Jack Partridge     | Jack Partridge<br>RPEQ 10529<br>     |
| 08    | 17/04/2024 | Updated to include additional Performance Solution, refer to Item '3' in Table ES.2.                 | Daryan Othman | Walther Groenewald | Walther Groenewald<br>RPEQ 26218<br> |



## TABLE OF CONTENTS

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>EXECUTIVE SUMMARY .....</b>                               | <b>1</b>  |
| <b>1 FIRE ENGINEERING PROVISIONS .....</b>                   | <b>6</b>  |
| 1.1 Fire Resistance and Stability .....                      | 6         |
| 1.2 Controlled Materials.....                                | 9         |
| 1.3 Compartmentation and Separation .....                    | 10        |
| 1.4 Protection of Openings .....                             | 13        |
| 1.5 Service Penetrations.....                                | 13        |
| 1.6 Doorsets and the Like.....                               | 14        |
| 1.7 Provisions for Escape .....                              | 17        |
| 1.8 Fire Hydrants, Hose Reels, and Extinguishers .....       | 18        |
| 1.9 Fire Sprinkler Systems .....                             | 19        |
| 1.10 Smoke Detection and Alarm System .....                  | 21        |
| 1.11 Mechanical System Shutdown .....                        | 21        |
| 1.12 Lighting, Signs, and Occupant Warning.....              | 22        |
| 1.13 Solar Panels.....                                       | 22        |
| 1.14 Commissioning, Maintenance, and Management-in-Use ..... | 23        |
| <b>2 PROJECT DETAILS .....</b>                               | <b>25</b> |
| 2.1 General .....                                            | 25        |
| 2.2 Fire Safety objectives .....                             | 25        |
| 2.3 Applicable Legislation and Regulatory Framework .....    | 25        |
| 2.4 Stakeholders.....                                        | 26        |
| 2.5 Relevant Information and Documentation.....              | 26        |
| <b>3 BUILDING CHARACTERISTICS .....</b>                      | <b>28</b> |
| 3.1 Building Description .....                               | 28        |
| 3.2 Location and Proximity to Fire Source Features .....     | 31        |
| 3.3 Means of Escape .....                                    | 32        |
| <b>4 OCCUPANT CHARACTERISTICS.....</b>                       | <b>35</b> |
| 4.1 Attributes .....                                         | 35        |
| 4.2 Disabled Evacuation .....                                | 36        |
| 4.3 Population Distribution .....                            | 36        |
| <b>5 FIRE BRIGADE CHARACTERISTICS .....</b>                  | <b>37</b> |
| 5.1 Objectives .....                                         | 37        |
| 5.2 Proximity to Fire Stations .....                         | 37        |

|      |                                                          |     |
|------|----------------------------------------------------------|-----|
| 5.3  | Notification, Equipment, and Access.....                 | 37  |
| 6    | KEY FIRE SAFETY SYSTEMS .....                            | 39  |
| 7    | PERFORMANCE SOLUTIONS.....                               | 40  |
| 7.1  | Link Bridge Provisions .....                             | 40  |
| 7.2  | FRL to Columns in External Walls .....                   | 44  |
| 7.3  | Steel Header Beams Penetrating Firewalls .....           | 48  |
| 7.4  | Plastic Packers within Façade .....                      | 57  |
| 7.5  | Plywood Linings.....                                     | 60  |
| 7.6  | Fire and Smoke Compartmentation .....                    | 63  |
| 7.7  | Fire boxes (Wall boxes) .....                            | 67  |
| 7.8  | Exit Travel Distances .....                              | 69  |
| 7.9  | Distance Between Alternative Exits .....                 | 77  |
| 7.10 | Non-Required Non-Fire-Isolated Stairs.....               | 80  |
| 7.11 | Sliding Doorways .....                                   | 83  |
| 7.12 | Door Swings .....                                        | 86  |
| 7.13 | Fail Secure Doors.....                                   | 89  |
| 7.14 | Internal Fire Hydrants Secure Cupboards.....             | 92  |
| 7.15 | Fire Hose Reels .....                                    | 94  |
| 7.16 | Portable Fire Extinguishers .....                        | 96  |
| 7.17 | Fire Sprinkler Provisions .....                          | 98  |
| 7.18 | Smoke Dampers .....                                      | 102 |
| 7.19 | Manual Call Point Locations .....                        | 105 |
| 7.20 | Consumer Bedroom Occupant Warning Speakers .....         | 107 |
| 7.21 | Exit and Directional Exit Signage Mounting Heights ..... | 109 |
| 8    | CONCLUSION .....                                         | 111 |
|      | BIBLIOGRAPHY .....                                       | 112 |

## LIST OF APPENDICES

|                                                         |
|---------------------------------------------------------|
| Appendix A Assumptions and Limitations                  |
| Appendix B Performance Solution Signage Template        |
| Appendix C Assessment Methodologies                     |
| Appendix D Research on heat flux attenuation of glazing |
| Appendix E Calculations                                 |
| Appendix F QFES FEB Meeting Minutes                     |



Appendix G MECHANICAL SERVICES AIR SCHEMATIC

Appendix H Legrand Fire and Acoustic Rated Wall Boxes

Appendix I Aconex Correspondence

# EXECUTIVE SUMMARY

WSP Australia Pty Limited has been appointed by DWP to undertake a review of the Fire and Life Safety Provisions associated with the Gold Coast University Hospital Secure Mental Health Rehabilitation Unit development located at 1 Hospital Blvd, Southport QLD 4215.

The intent of this document is to perform the fire engineering analysis and assessment in order to determine the Fire Engineering Provisions required such that the relevant Performance Requirements of the National Construction Code (NCC) shall be satisfied.

The National Construction Code applicable to this project is NCC 2019 Amendment 1.

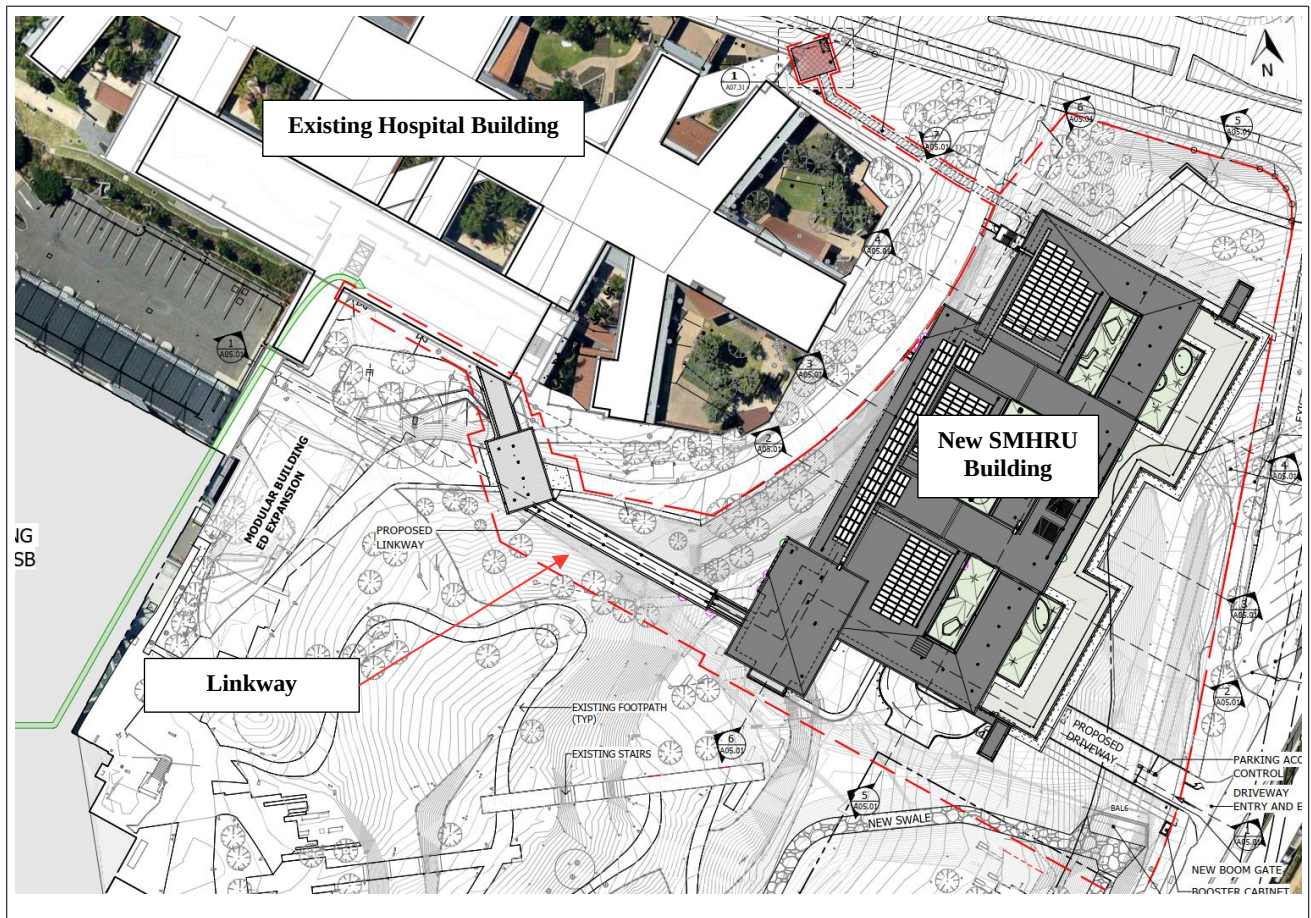
The proposed development consists of the new Secure Mental Health Rehabilitation Unit (SMHRU) at the Gold Coast Hospital Precinct, as shown indicatively in Figure ES.1. The building is primarily a Class 9a Patient Care Building and contains three storeys, labelled as Basement Level 2, Basement Level 1 and Lower Ground Level to maintain consistency with the existing hospital floor system. Due to the sloping nature of the site, all three levels are provided with access directly to road or open space. The building consists of the following:

- Basement Level 2 (Level B2): Carparking, secure sally port entrance, plant and undercroft. It is understood that the undercroft may be enclosed as part of future works, however that does not form the scope of this project.
- Basement Level 1 (Level B1): Consumer bedrooms (i.e. wards), staff areas, treatment areas, open air courtyards, lounge and dining and activity areas.
- Lower Ground Level (Level LG): Consumer bedrooms (i.e. wards), staff areas, treatment areas, open air courtyards, lounge and dining, activity areas and main reception for the building.

The facility is designed with 40 beds in total (20 beds per floor) and although a secure facility, consumers are considered to be ambulant. As such, while the evacuation process will be a staff managed process, occupants are not expected to be reliant on staff to evacuate them, which is in contrast to what would be expected in a typical Class 9a hospital ward.

The building is also provided with a link bridge providing connectivity between the existing hospital precinct and the new SMHRU building. This link bridge is primarily on grade, as shown indicatively in Figure ES.2 and is provided with an elevated awning structure, which divides the structure in two.

**Figure ES.1 Site Plan indicating location of new Secure Mental Health Rehabilitation Unit**



**Figure ES.2 Model View of link bridge between new SMHRU and existing Hospital buildings**

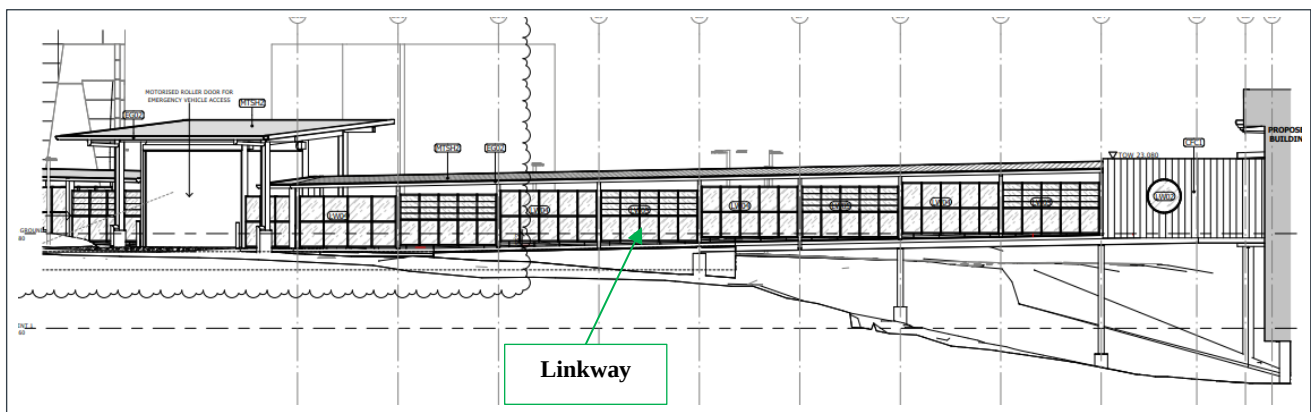


Table ES.1 provides the general subject building characteristics that are relevant to the NCC.

**Table ES.1 Building Description**

| Parameter            | Description                                          |
|----------------------|------------------------------------------------------|
| Effective Height     | 8.62 m                                               |
| Classification       | Class 7a – Carpark<br>Class 9a – Healthcare Building |
| Rise in Storeys      | 3                                                    |
| Storeys Contained    | 3                                                    |
| Construction of Type | Type A                                               |

This document relates and is limited to the items listed in Table ES.2, which details the NCC DtS Departures, the relevant Performance Requirements, a description of the NCC departure, and a cross-reference to the relevant Assessment Section.

**Table ES.2 NCC DtS Departures**

| Item | NCC DtS Clause                    | Performance Requirements | Description of Departure                                                                                                                                                                                                                      | Section Ref # |
|------|-----------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1    | C1.1, Specification C1.1          | CP1, CP2                 | Fire Resistance Levels (FRLs) associated with the proposed linkway between the existing hospital and the new building are to be rationalised to be in accordance with the requirements for Type C construction                                | 7.1           |
| 2    | C1.1, Specification C1.1          | CP1, CP3                 | Except for columns incorporated in fire walls, columns in external walls that support the roof only will be permitted not to achieve an FRL.                                                                                                  | 7.2           |
| 3    | C1.1, Specification C1.1 and C2.7 | CP1, CP2, CP3 and CP8    | Steel header beams that are not required to have an FRL are permitted in limited locations to penetrate the fire rated lining and connect to steel columns within lightweight fire walls separating fire compartments.                        | 7.3           |
| 4    | C1.9                              | CP2, CP4                 | Packers forming part of the façade system permitted to made of plastic, which are deemed combustible material, in lieu of non-combustible.                                                                                                    | 7.4           |
| 5    | C1.9, C2.5, Specification C2.5    | CP2, CP4                 | Plywood linings to be used for both internal fire-rated walls and the internal linings of external walls, in lieu of non-combustible construction.                                                                                            | 7.5           |
| 6    | C2.5                              | CP2, CP3, DP4 and EP2.2  | Smoke compartments within the Class 9a Ward Areas to be as follows:<br>— Up to 640 m <sup>2</sup> in lieu of 500 m <sup>2</sup> .<br>— Smoke proof construction and achieve an inherent FRL, in lieu of being fire rated to achieve 60/60/60. | 7.6           |
| 7    | C2.5                              | CP2, CP3, DP4 and EP2.2  | Doors within the walls forming part of the smoke compartmentation walls to be solid core smoke doors, in lieu of achieving -/60/30 FRL.                                                                                                       | 7.6           |
| 8    | C2.7                              | CP2, CP3, CP4, DP4, DP5  | Fire separation of the linkway between the existing hospital and the new building to be rationalised on the existing hospital building side.                                                                                                  | 7.6           |
| 9    | C3.15                             | CP2, CP8                 | Permit data cables to be housed within firebox that are installed within fire rated walls, in lieu of firebox being in accordance with the tested system.                                                                                     | 7.7           |

| Item | NCC DtS Clause            | Performance Requirements | Description of Departure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Section Ref # |
|------|---------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 10   | D1.4                      | DP4, EP2.2               | <p>Exit travel distance to be as follows:</p> <p><b><u>Level B2</u></b></p> <ul style="list-style-type: none"> <li>— To the nearest exit where travel in different directions to two exits is available to be not more than 45 m, in lieu of 40 m.</li> </ul> <p><b><u>Level B1</u></b></p> <ul style="list-style-type: none"> <li>— To a point from which travel in different directions to two exits is available to be not more than 13 m from the Secure Court, in lieu of 12 m.</li> <li>— To the nearest exit where travel in different directions to two exits is available to be not more than 39 m from the family visiting courtyard, in lieu of 30 m.</li> </ul> <p><b><u>Level LG</u></b></p> <ul style="list-style-type: none"> <li>— To the nearest exit where travel in different directions to two exits is available to be not more than: <ul style="list-style-type: none"> <li>— 33 m from the western external walkway,</li> <li>— 36 m to external stairs accessed via the external walkway, in lieu of 30 m.</li> </ul> </li> </ul> | 7.8           |
| 11   | D1.5                      | DP4, EP2.2               | <p>Distance between alternative exits to be as follows:</p> <ul style="list-style-type: none"> <li>— Up to 77 m on Level B1</li> <li>— Up to 65 m on Level LG</li> </ul> <p>in lieu of 45 m.</p> <p><b>Note:</b> These are considered to be technical non-compliances due to the number of alternative egress paths available and the NCC DtS requirement to measure the distance between alternative exits through the first point of choice.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7.9           |
| 12   | D1.12                     | DP4                      | Non required non-fire-isolated stairway to connect the Class 9a Level B1 and Level LG.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 7.10          |
| 13   | D2.19                     | DP2                      | <p>Internal sliding doorway to be installed within the following areas that do not open directly to a road or open space:</p> <ul style="list-style-type: none"> <li>— Level B1 and Level LG courtyards.</li> <li>— Single use rooms</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7.11          |
| 14   | D2.20, Specification C3.4 | CP3, DP4, DP5, EP2.2     | Smoke doors and fire doors between smoke compartments to swing in a single direction, in lieu of swinging in both directions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7.12          |
| 15   | D2.21                     | DP4, DP6, EP2.2          | Secured exit doors within the building (i.e. required exits) to be not readily openable without a key or swipe card from the side that faces the person seeking egress, in lieu of being readily openable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7.13          |
| 16   | E1.3                      | EP1.3                    | Where occupants pose a risk of tampering in Patient Care areas, internal floor plate fire hydrants are permitted to be located within secure cupboards (automatically unlocking on fire sprinkler activation).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7.14          |
| 17   | E1.4                      | EP1.1                    | Provision of portable additional fire extinguishers throughout the building, in lieu of compliant fire hose reel coverage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7.15          |

| Item | NCC DtS Clause                  | Performance Requirements | Description of Departure                                                                                                                                                                                                                                                                                     | Section Ref # |
|------|---------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 18   | E1.6                            | EP1.2                    | Portable fire extinguishers are permitted to be located within secure cupboards, in lieu of being located in a conspicuous and readily accessible position in accordance with AS 2444.                                                                                                                       | 7.16          |
| 19   | E1.5                            | EP1.4                    | Fire sprinklers to be obviated from the following areas: <ul style="list-style-type: none"> <li>— top of lift shafts.</li> <li>— internally within the link bridge.</li> <li>— underside of the Lower Ground Level naturally ventilated roof awning above the central Basement Level 1 courtyard.</li> </ul> | 7.17          |
| 20   | E2.2                            | EP2.2                    | Permit the removal of Motorised Smoke Dampers (MSD) at duct penetrating smoke walls, where the ducts serve a different compartment.                                                                                                                                                                          | 7.18          |
| 21   | E2.2, Specification E2.2a, E4.9 | EP2.2, EP4.3             | Manual Call points within ward compartments are permitted to be accessed using GCHHS Master key to activate and located within nurse/staff stations, in lieu of every 30 m.                                                                                                                                  | 7.19          |
| 22   | E2.2, Specification E2.2a       | EP2.1, EP2.2             | Requirements for occupant warning speakers within Consumer Bedrooms to be obviated.                                                                                                                                                                                                                          | 7.20          |
| 23   | E4.8                            | EP4.2                    | Exit and directional exit signage to be mounted at 3.0 m throughout, in lieu of 2.7 m above the finished floor level.                                                                                                                                                                                        | 7.21          |

All other aspects of the design are required to be in accordance with the NCC DtS provisions except where modified by the Performance Solutions contained herein or, where agreed by WSP, modified by an existing Performance Solution.

The analyses and assessments undertaken throughout the document with the methods and acceptance as agreed during the Fire Engineering Brief, it has been demonstrated that the implementation of the Fire Engineering Provisions satisfy the relevant NCC Performance Requirements, to the degree necessary.

This document affects the following Australian Fire Engineering Guidelines (AFEG) [1] Sub-Systems.

| SS-A: Fire Initiation & Development & Control | SS-B: Smoke Development & Spread & Control | SS-C: Fire Spread & Impact & Control | SS-D: Fire Detection & Warning & Suppression | SS-E: Occupant Evacuation & Control | SS-F: Fire Services Intervention |
|-----------------------------------------------|--------------------------------------------|--------------------------------------|----------------------------------------------|-------------------------------------|----------------------------------|
| ✓                                             | ✓                                          | ✓                                    | ✓                                            | ✓                                   | ✓                                |

# 1 FIRE ENGINEERING PROVISIONS

These Fire Engineering Provisions are required to address departures from the NCC DtS Provisions and are intended to achieve a level of fire and life safety satisfying the Performance Requirements of the NCC and to meet the Client's project objectives.

**The Fire Engineering Provisions listed and detailed in this section take precedence over the remainder of the document and must be implemented to achieve compliance. Notes are provided for commentary and to provide clarity. If in doubt on any aspect which has been documented, further clarification must be sought from the Fire Engineer prior to implementation.**

WSP recognise effective Safety in Design is essential for the successful and safe project delivery. The design team must identify and establish appropriate safety requirements for commissioning, operation, usage, maintenance, repair, and decommissioning of fire safety equipment and installations.

All other aspects of the design, regarding fire and life safety, are required to be compliant with the NCC DtS Provisions, or, where agreed by WSP, modified by an existing Performance Solution, or be as accepted by the relevant Regulatory Authorities.

---

## 1.1 Fire Resistance and Stability

- 1 The building must be constructed in accordance with the requirements for Type A construction, with the following requirements and exceptions:
  - a The link bridge Fire Resistance Levels (FRLs) are permitted to comply with the requirements for Type C construction, contingent on the following:
    - i The link bridge must be fire separated from the SMHRU building by fire doors achieving an FRL not less than -/120/30.
    - ii The door is permitted to be on electromagnetic hold open devices (EMHODs) provided the door closes upon activation of smoke detectors in accordance with Item '24d'.
    - iii The link bridge must be constructed of non-combustible materials and maintained as a circulation space only (i.e. storage, combustible furniture, rubbish or the like is not permitted to be located within the link bridge).

**Note:** The requirement for non-combustibility includes wall, ceiling and floor linings.
    - iv Exposure protection fire sprinklers must be provided to the underside of the link bridge and must extend not less than 4 m from the external wall of the SMHRU building, as detailed in Item '23b'.
    - v Any openings within the link bridge that are located within 4 m of the external wall of the SMHRU building or the existing building must be provided with external exposure protection, as detailed in Item '23c'.
  - b The columns forming part of the external wall that support the roof are permitted to achieve an inherent FRL only (i.e. no additional fire protection required), except that the columns incorporated in fire walls must achieve an FRL of 120/-/- so as not to reduce the FRL of the fire wall.
  - c Steel header beams that are not required to have an FRL are permitted in limited locations, as indicated in Figure 1-2 and Figure 1-3, to penetrate the fire rated lining and connect to steel columns within lightweight fire walls separating fire compartments, contingent on:
    - i The fire-rated plasterboard lining of the fire wall must be profiled so that there is only a 10 mm – 15 mm gap between the plasterboard and the PFC connections as shown in Figure 1-1. The gaps must be filled with a flexible fire rated mastic to form a fire seal in accordance with a tested system.

- ii The fire walls must comply in all other aspects with the tested system as per the manufacturer's details (i.e. Knauf approved framing details) to maintain the FRL of the fire wall.
- iii The subject steel columns within the fire walls on Basement 1 must be connected at the bottom to the concrete floor slab and at the top to the soffit of the concrete slab overhead.
- iv The subject steel columns within the fire walls on Lower Ground must be connected at the bottom to the concrete floor slab and at the top to the roof rafters which must be passively fire protected, as well as the columns supporting the rafters, so as not to reduce the FRL of the fire wall, i.e. collapse of the roof structure on one side of the fire wall must not affect the FRL of the fire wall. The outline of the fire walls superimposed on the roof structure is shown in Figure 1-4.
- v The connections of the subject steel column at the top and bottom must be protected to achieve an FRL of 120/-/- in accordance with the requirements of the tested system.

**Figure 1-1 Steel header beam connection to the columns detail**

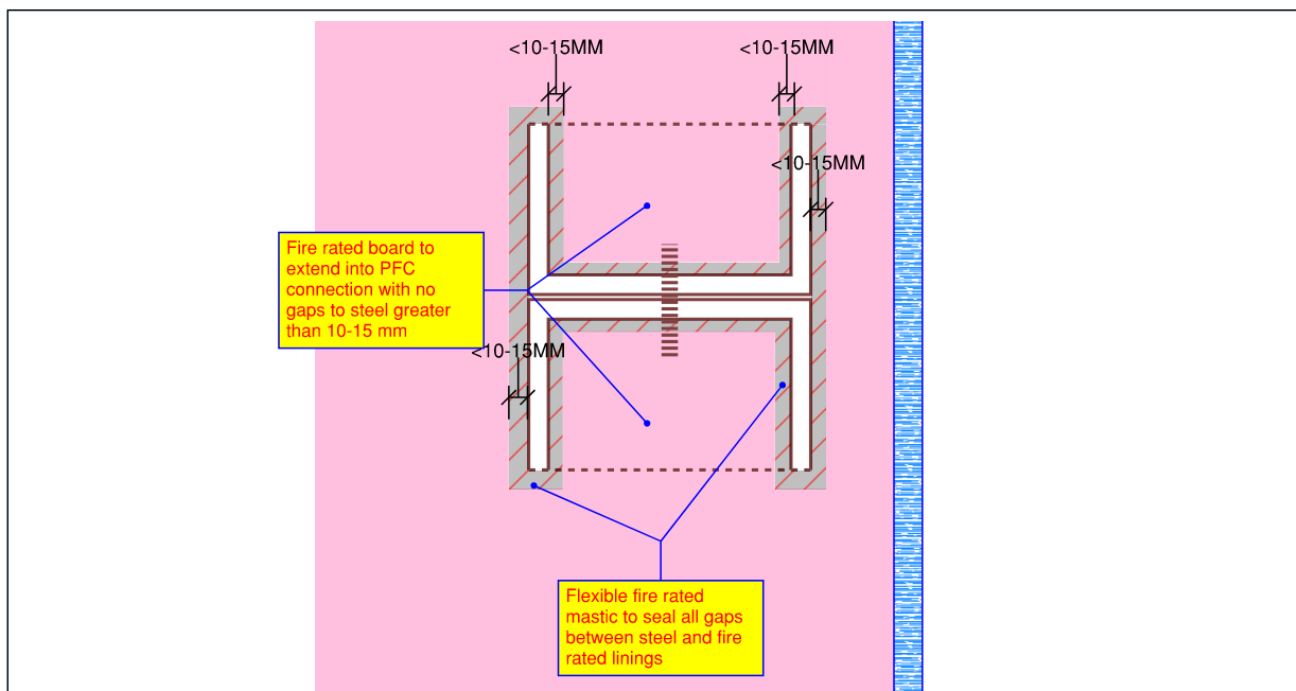


Figure 1-2 Steel header beam locations penetrating fire rated lining – Basement 1

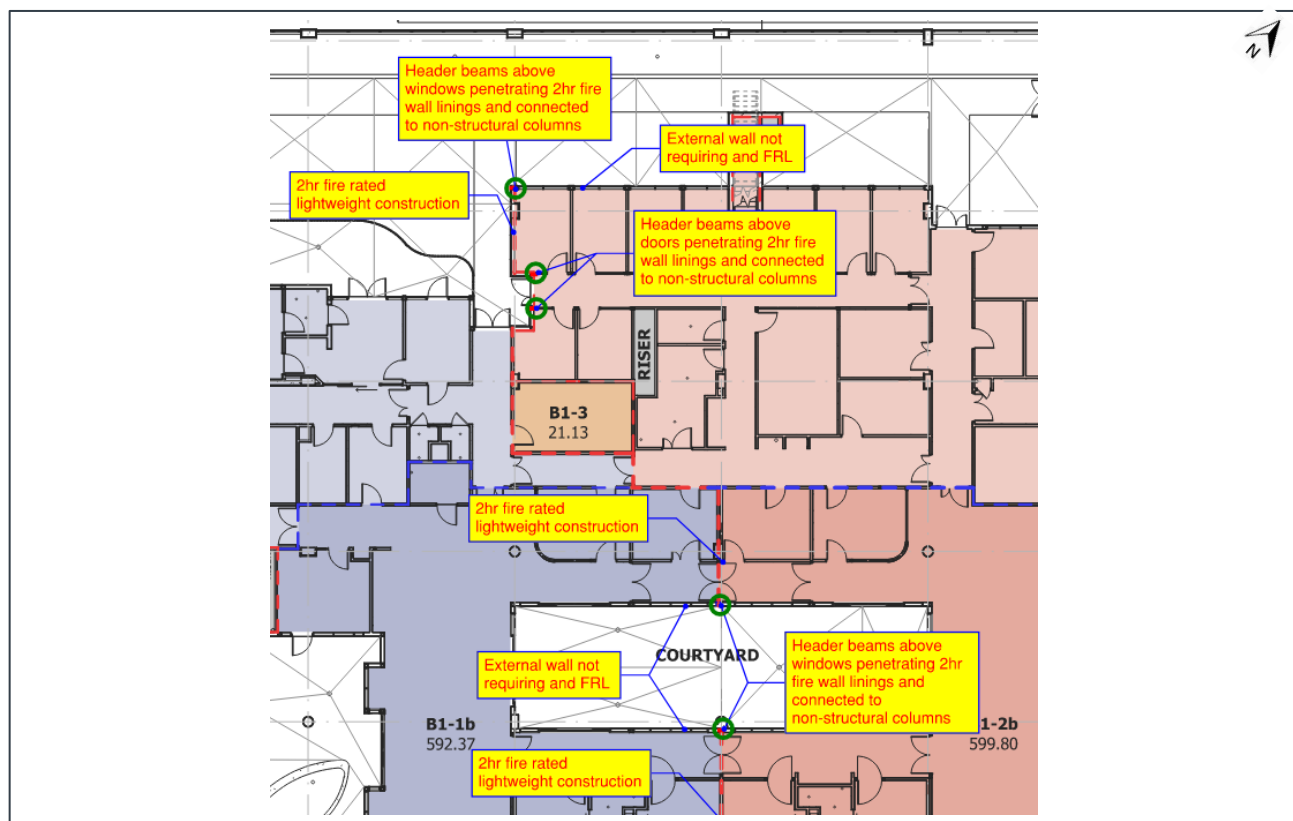
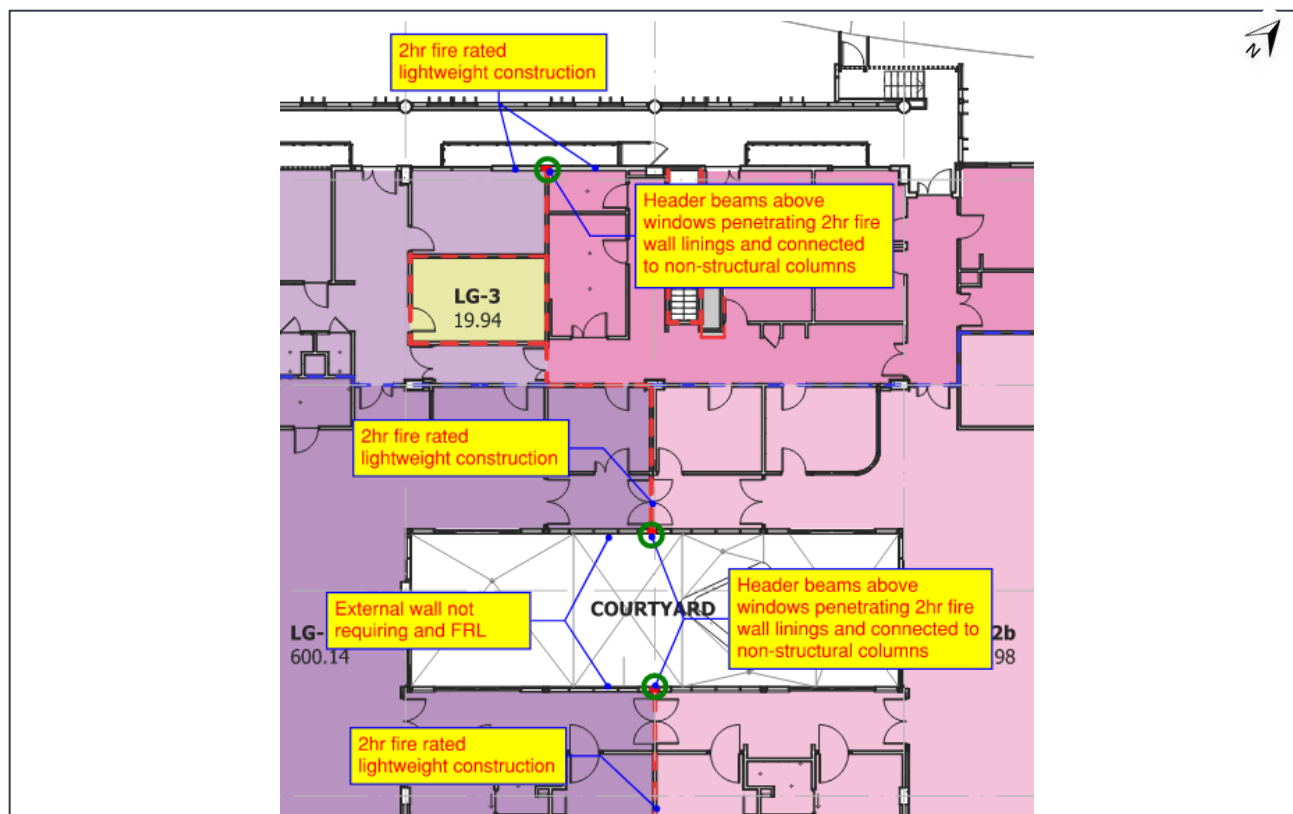
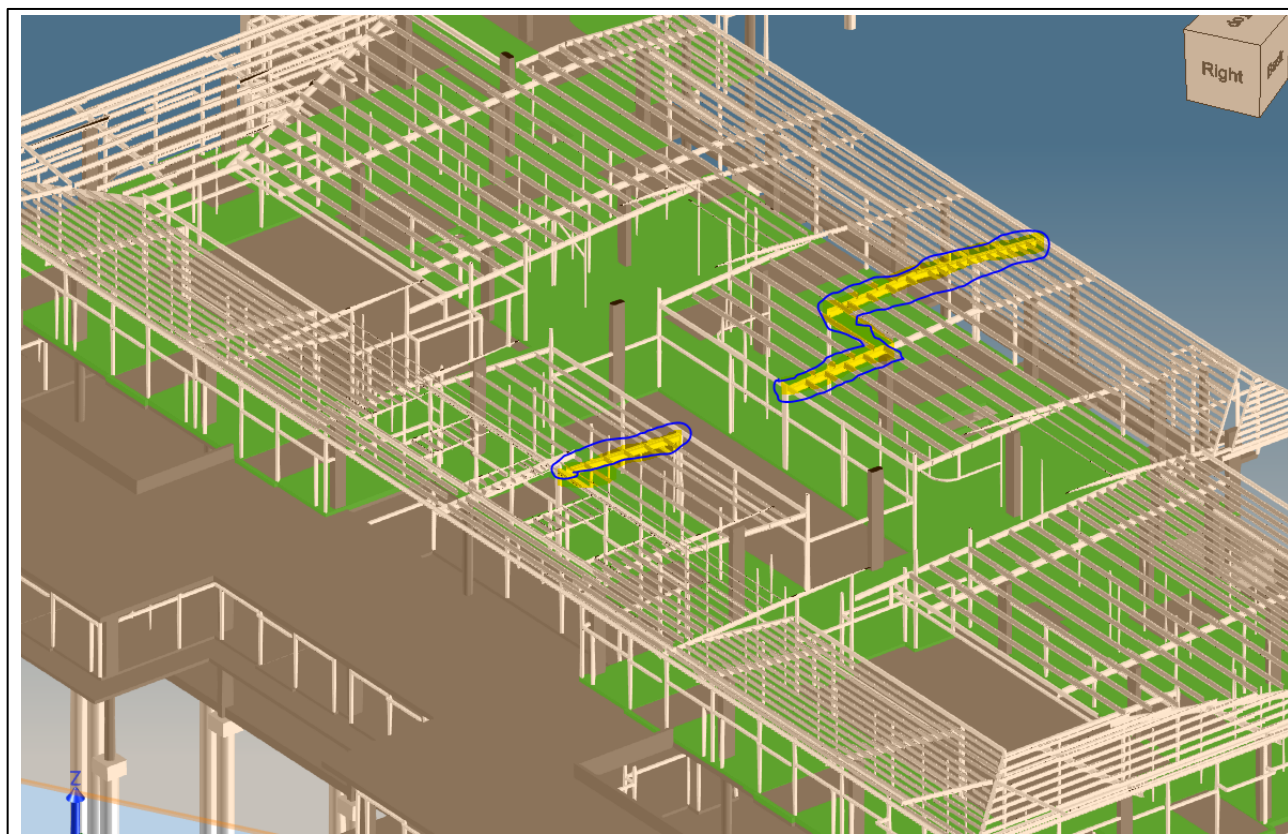


Figure 1-3 Steel header beam locations penetrating fire rated lining – Lower Ground



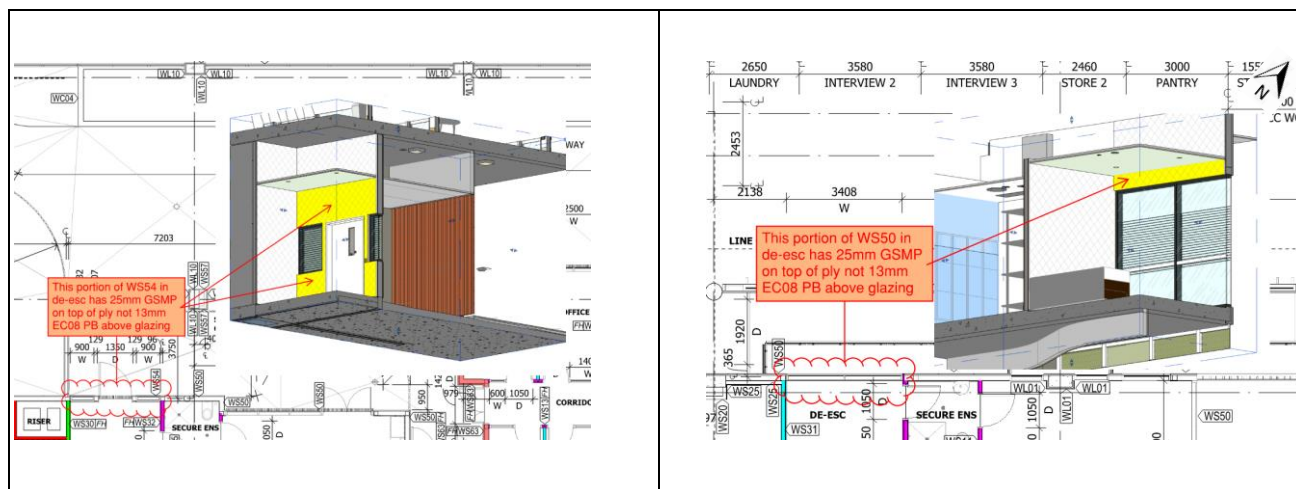
**Figure 1-4 Outline of fire wall shown superimposed on roof structure – Lower Ground**



## 1.2 Controlled Materials

- 2 All building elements must be in accordance with NCC DtS Clause C1.9, except that:
  - a Packers, which are made of plastic (combustible material), are permitted within the external façade of the building contingent on the following:
    - i Packers must be installed in accordance with the manufacturer's specification.
  - b Plywood timber linings are permitted to be used for internal linings of external walls, smoke walls, and fire walls contingent on the following:
    - i Plywood must extend from slab to slab only (i.e. is not permitted to continuously span between floors).
    - ii Plywood linings must be encapsulated between non-combustible construction.
    - iii The remainder of the external wall, smoke wall and fire wall construction must be non-combustible in line with the NCC DtS Provisions.
    - iv The external façade must be constructed of non-combustible materials.
    - v Gold Medal Safety Padding is to be fixed directly to the plywood within the internal linings of external walls of de-escalation rooms on Lower Ground and Basement 1, as shown in Figure 1-5.
- 3 Fire-rated walls must be constructed in accordance with a tested system to achieve the required FRL, except as follows:
  - a With exception of the presence of data cables, the fireboxes are installed in accordance with the tested system.
- 4 All other aspects of the fire-rated wall must comply with the tested system, except that limited timber noggins and wiring are permitted within the fire-rated walls as detailed in Item '2 and 3'.

**Figure 1-5 De-escalation rooms on Lower Ground (left) and Basement 1 (right)**



## 1.3 Compartmentation and Separation

- 5 Fire and smoke compartmentation throughout the Patient Care Areas and Ward Areas must comply with the NCC DtS Provisions, except that:
  - a Smoke compartments within Level B1 and Level LG are permitted to be up to 640 m<sup>2</sup>, as shown indicatively in Figure 1-6 and Figure 1-7, contingent on the following:
    - i Travel distances to a place of relative safety (e.g. nearest exit or adjacent smoke compartment), must comply with the NCC DtS provisions.
  - b Smoke walls between ward areas and treatment areas are permitted to be smoke walls only, contingent on the following:
    - i Partition walls inherently achieve a 60-minute FRL due to impact resistance specifications.
    - ii Doors within the smoke walls must comply with the following requirements:
      - A Doors must be solid core doors not less than 35 mm thick.
      - B Compliance with NCC DtS Specification C3.4 Clause 3 for smoke doors must be achieved.
      - C Glazing in vision panels must be in line with the typical glazing specification for vision panels in fire doors in accordance with AS 1905.1.

Figure 1-6 Basement Level 1 fire and smoke compartmentation (indicative only)

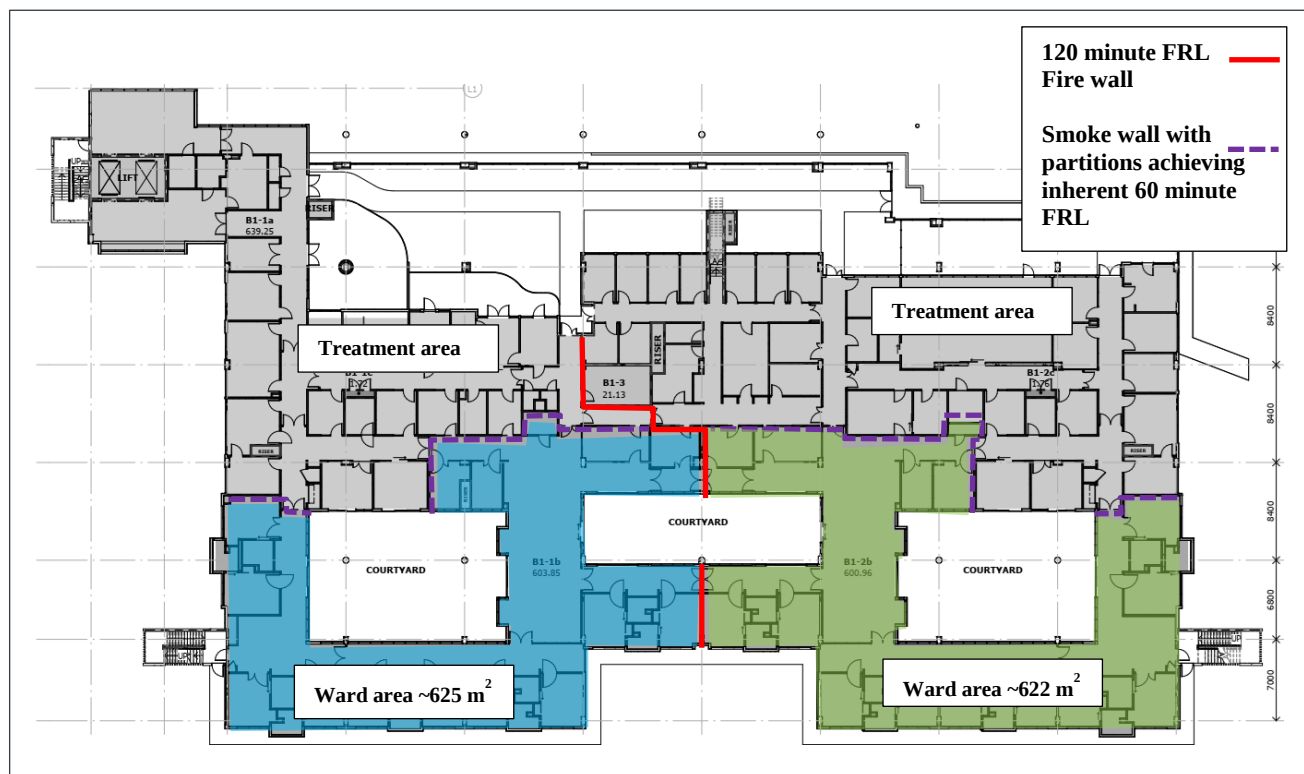
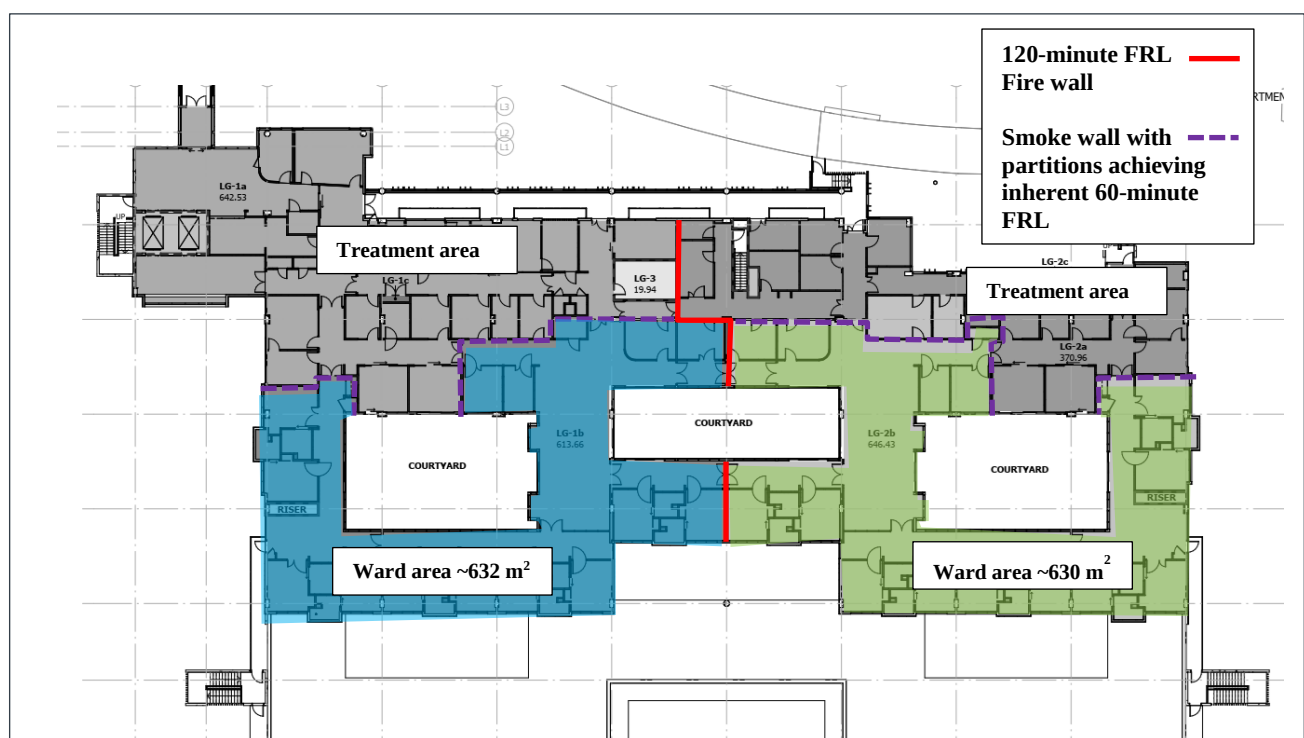


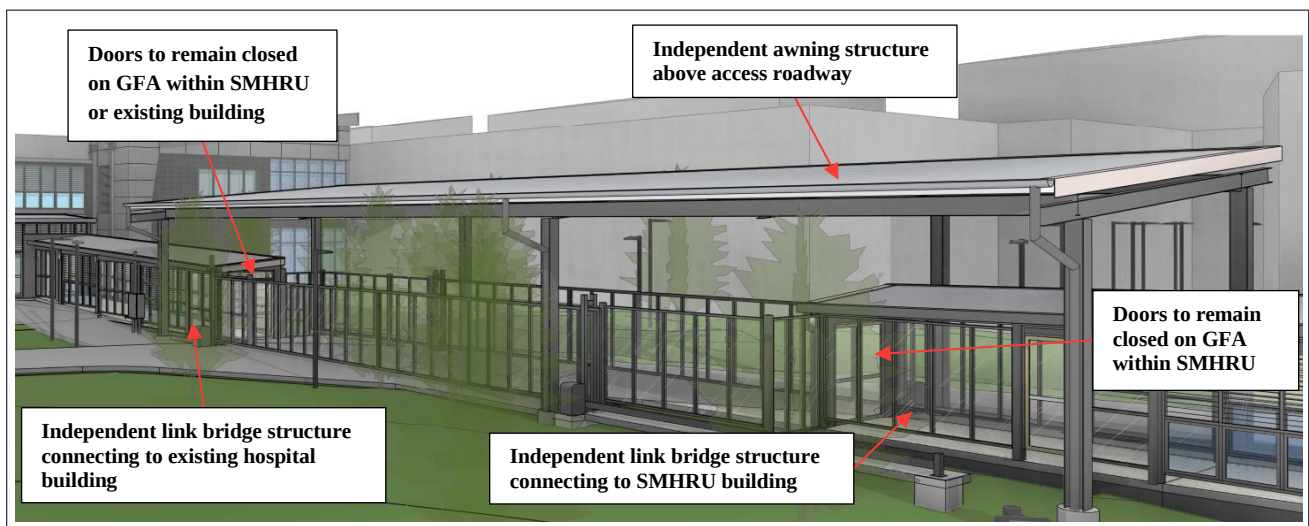
Figure 1-7 Lower Ground Level fire and smoke compartmentation (indicative only)



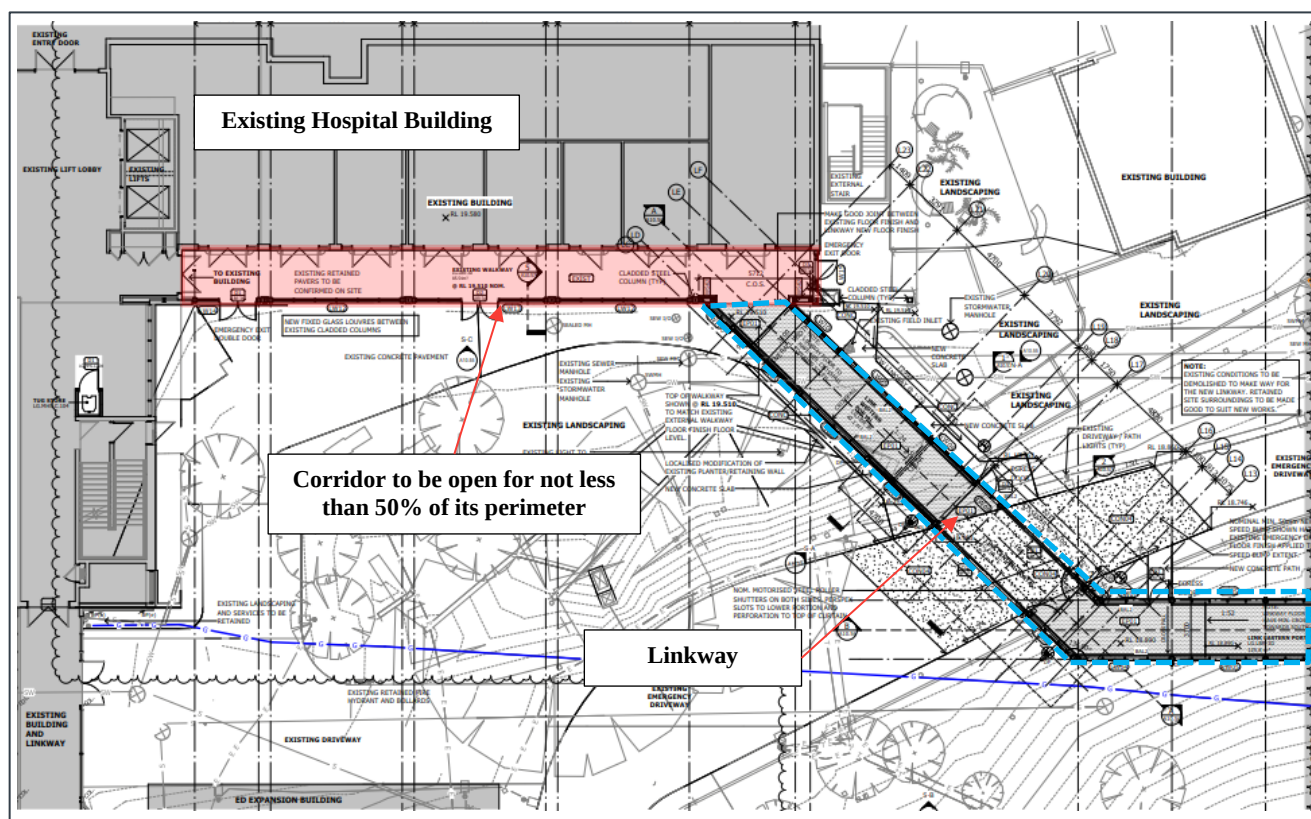
- 6 The link bridge between the SMHRU building and the existing hospital building need not be provided with fire separation within the link bridge on the existing hospital building side of the building, contingent on the following:
  - a The link bridge must be fire separated from the SMHRU as detailed in Item '1a'.

- b The existing hospital building areas leading to the existing link bridge (which the SMHRU link bridge connects to) must be provided fire separated from the existing link bridge, as shown indicatively in Figure 1-9.
  - c The link bridge connecting to the SMHRU must be an independent structure from the link bridge connecting to the existing hospital and the structures must be provided with not less than 6 m of separation.
- Note:** Current architectural drawings indicate that the structures are provided with approximately 20 m of separation where the access roadway passes through the structure.
- d The awning above the access roadway must be an independent and naturally ventilated independent structure and must have a clearance height of not less than 4.5 m to allow hospital vehicle access, as shown indicatively in Figure 1-8.
  - e The existing Hospital Building Access Corridor must be not less than 50% open to the external atmosphere, as shown indicatively in Figure 1-9.

**Figure 1-8** Artists Impression of Linkway indicating physical separation between the link bridge portions connecting the SMHRU building to the existing hospital building (indicative only)



**Figure 1-9 Floor Plan Illustrating Linkway Intersection with Existing Hospital Building (Indicative Only)**



## 1.4 Protection of Openings

- 7 The central courtyard within Level B1 and Level LG must be not less than 6 m in width and length.

## 1.5 Service Penetrations

- 8 A penetration register of service penetrations through fire and smoke walls and fire/smoke stopping systems must be developed and provided to WSP for review.
- 9 Any new penetrations through fire and smoke walls within construction stage must be incorporated in Penetration Register along with the fire/smoke stopping system and must be provided to WSP and the Building Certifier.
- 10 The final Penetration Register must be provided to the hospital Asset Management Services (AMS) following completion of the project.
- 11 Any new penetrations through fire and smoke walls following completion of the project must be incorporated in the Penetration Register along with the fire/smoke stopping system and must be reviewed by a suitably qualified registered Fire Engineer and/or certified by a passive fire designer, and provided to the hospital AMS.

---

## 1.6 Doorsets and the Like

12 The following sliding doorways are permitted to be installed in key egress routes:

- a Manual sliding doors may serve a single room or single use area and the courtyards within the building provided that they are able to be manually opened under a force not less than 110 N and are permitted to be located in areas that do not provide egress direct to a road or open space.
- b Sliding doors that are not serving as a required exit, not forming part of a required exit, or not located on a required path of travel to an exit, need not comply with the above requirements.

13 Swinging doors in required exits or forming part of a required exit must comply with the NCC DtS provisions, except that doors within fire and smoke walls, as shown indicatively in Figure 1-10 and Figure 1-11, are permitted to swing in a single direction only, contingent on the following:

- a On the side opening in the direction of egress the signage must state, "PUSH TO OPEN," or similar in letters not less than 50 mm high in a colour contrasting to the background.
- b On the side opening against the direction of egress, the signage must state, "PULL TO OPEN," or similar in letters not less than 50 mm high in a colour contrasting to the background.

**Note:** This signage is in addition to any signage required by NCC Clause D2.23

14 Doors in required exits within development must comply with the NCC DtS Provisions, except that secured exit doors are permitted to not be readily openable without a key from the side that faces the person seeking egress (i.e. be provided with 'Fail Secure' hardware locks), as shown indicatively in Figure 1-12 and Figure 1-13, contingent on the following:

- a All staff must be equipped with an override swipe card/key for secured doors, that they can use to unlock these doors in the event of a fire.
- b Staff must keep the above keys/swipe cards on them at all times whilst on duty.
- c A physical master key must be provided to manually unlock secure doors. This must be located within the FIP, the nearest staff station and in any other locations as required by Hospital Management.
- d The above requirements must form part of a Management-in-Use Plan provided in accordance with Item '36'.
- e Fire emergency staff to consumer ratio must be adequate such that staff can immediately respond to and safely cope with multiple consumer evacuation, if required.

**Note:** It is understood that the worst case (e.g. night shift) staff to consumer ratio will be at least 1 clinical staff member to 4 consumers. Changes to this minimum staff to consumer ratio will need to be required by a suitably qualified registered fire engineer.

15 Doors within 60-minute fire rated walls are permitted to comply with Item '5b'.

16 The link bridge must be fire separated from the SMHRU building by fire doors as detailed in Item '1a'.

Figure 1-10 Basement Level 1 fire and smoke doors swinging in single direction (indicative only)

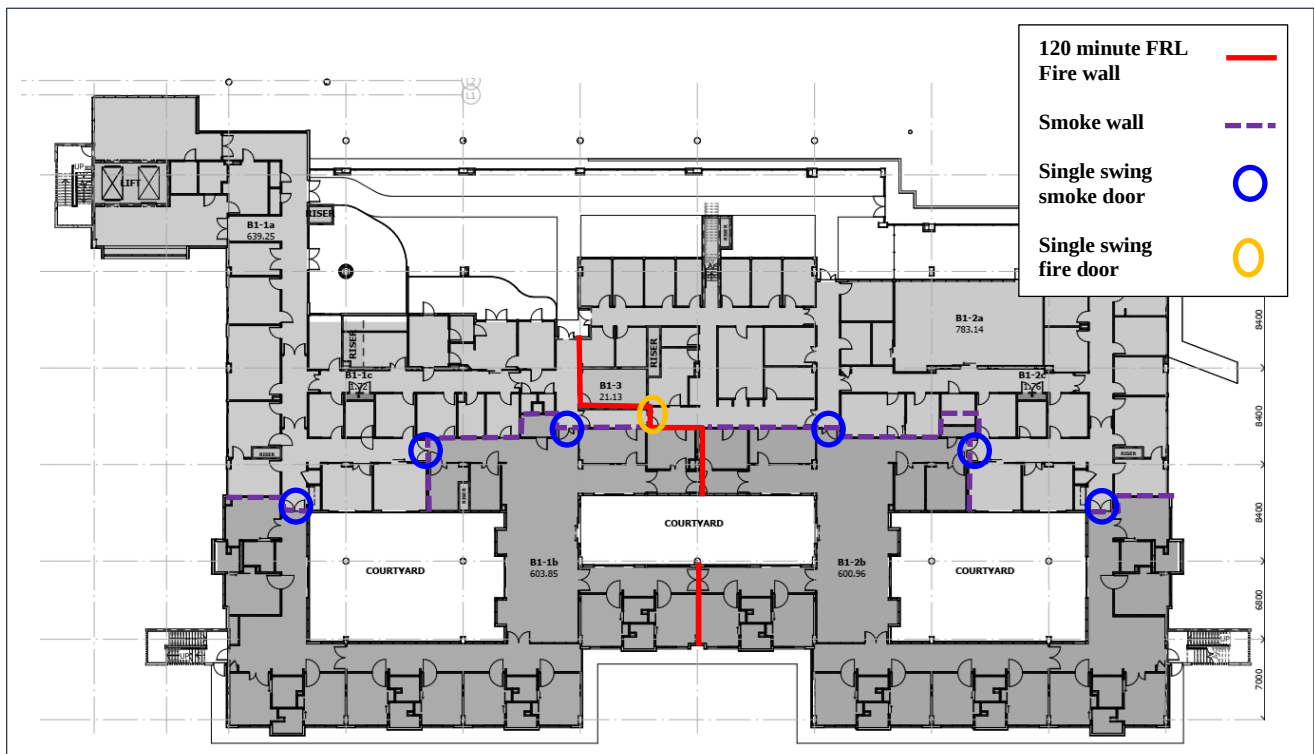


Figure 1-11 Lower Ground Level fire and smoke doors swinging in single direction (indicative only)

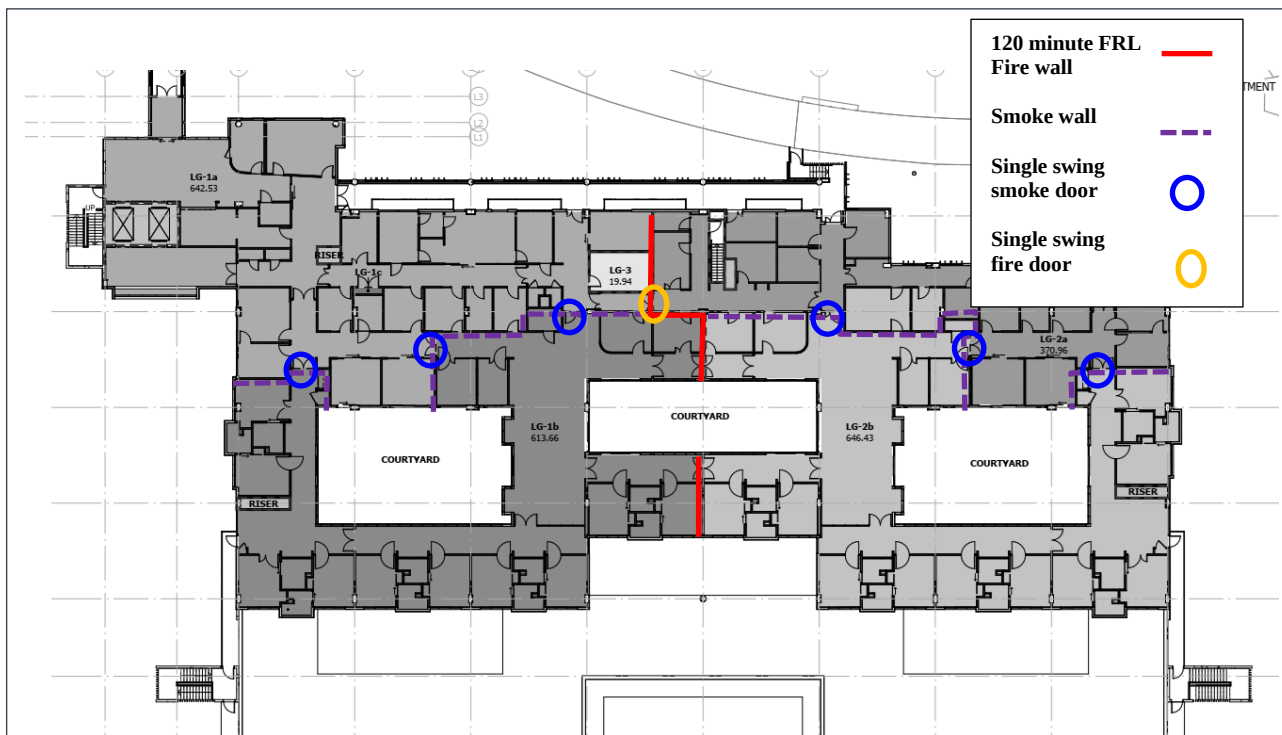


Figure 1-12 Basement Level 1 indicative secure door locations

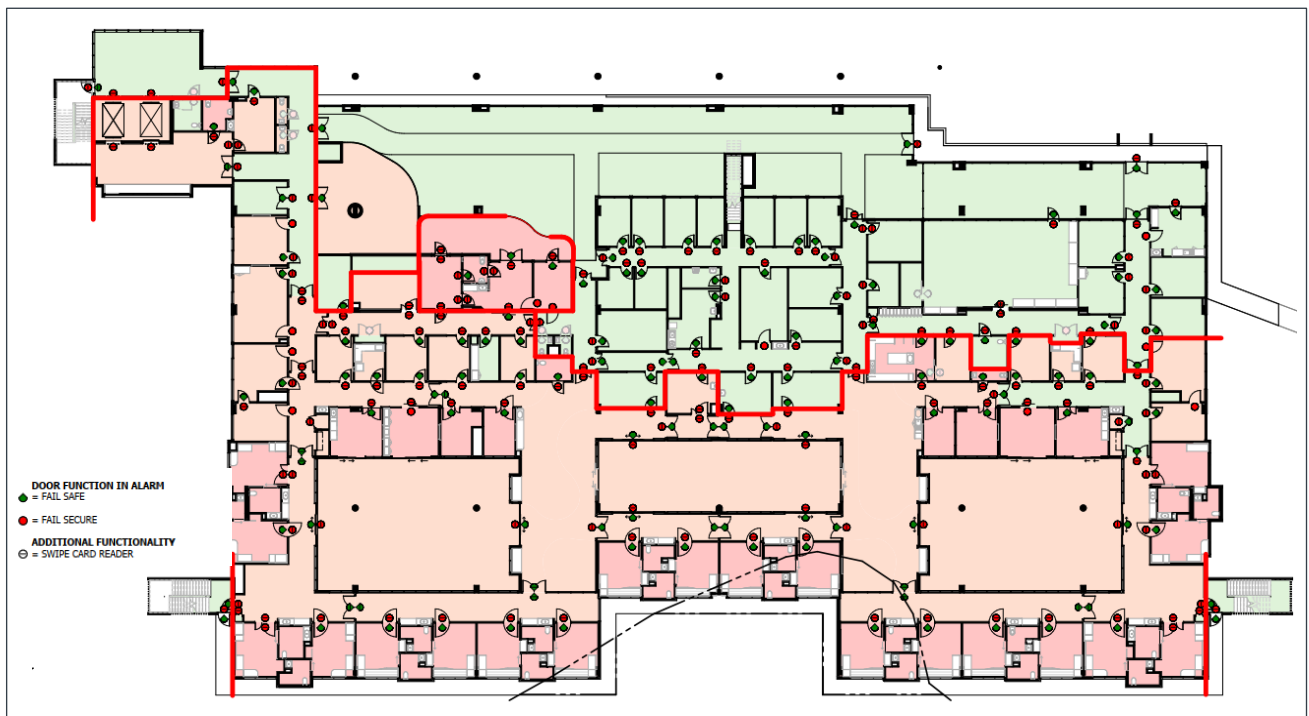
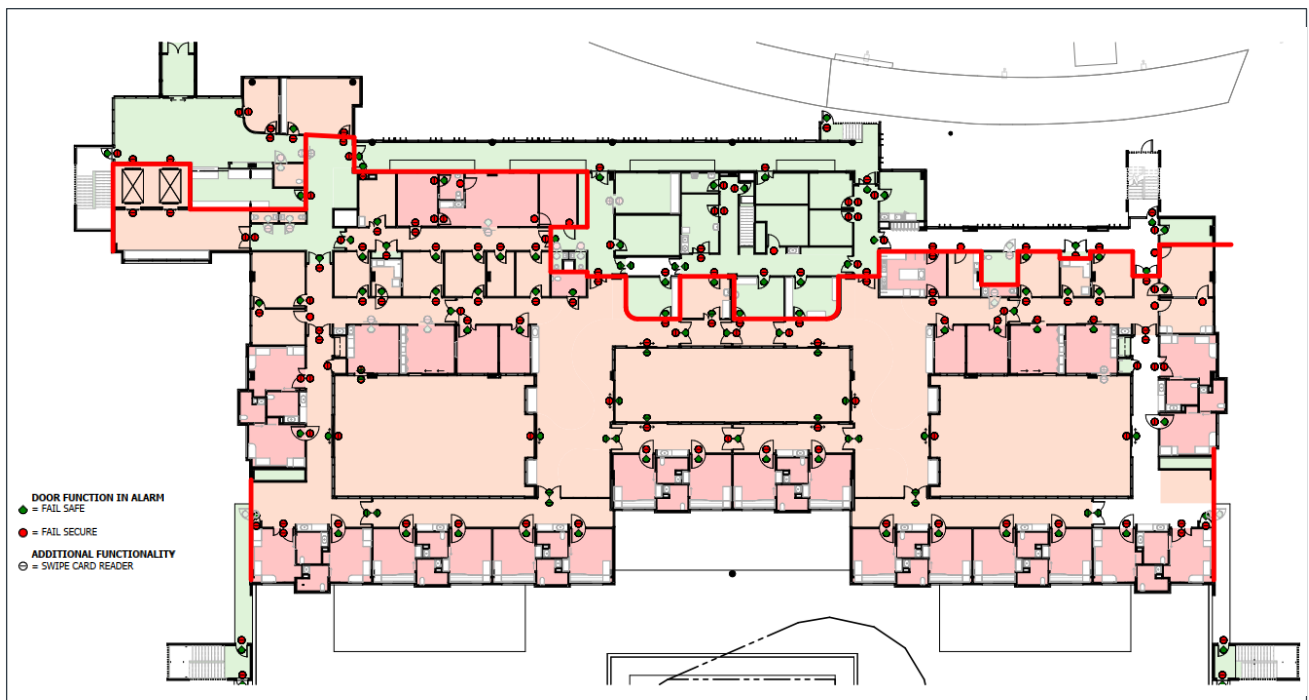


Figure 1-13 Lower Ground Level indicative secure door locations



- 17 Exit travel distance must be in accordance with the NCC DtS Provisions, except that the exit travel distance is permitted to be increased in the following areas:
  - a Up to 45 m to the nearest exit where travel in different directions to two exits is available on Basement Level 2.
  - b Up to 13 m to a point which travel in different directions to two exits is available from the Secure Court on Basement Level 1.
  - c Up to 39 m to the nearest exit where travel in different directions to two exits is available from the Family Visiting Courtyard on Basement Level 1.
  - d Up to 33 m to the nearest exit where travel in different directions to two exits is available from the from western external walkway on Lower Ground Level.
  - e Up to 36 m to the external stairs (i.e. the nearest exit) on Lower Ground Level, contingent on the external walkway not being enclosed (i.e. effective place of relative safety) and travel to the doors leading to the external walkways leading to Stair 2 and Stair 3 being not more than 30 m.
- 18 A non-required non fire-isolated stairway is permitted to connect Basement Level 1 with the Lower Ground level, contingent on the stair being fire separated from the Lower Ground Level by construction achieving an FRL not less than 120 minutes and a fire door achieving an FRL not less than -/120/30, as shown indicatively in Figure 1-14
- 19 Evacuation routes must be kept free from obstruction, as per the requirements of the Building Fire Safety Regulation 2008, or any legislation that supersedes it.

The floor plan shows a complex layout of rooms and corridors. Key areas include:

- Top Section:** EXTERNAL WALKWAY, VOID, SECURE LOUNGE & QUIET, COURTYARD, PHOTO BOOTH, CLINICAL WORK, CLEANER, STORE 1, OFFICE 2, STAFF ROOM, HWB.
- Middle Section:** COMMS, DIRTY UT & DISPOSAL, CLEAN UP, OFFICE 1, PNEUMATIC TUBE, WOW BAY, STORE - PTRV, ACC-WC, BATH, NURSE STATION 1, TREATMENT, MEDICATION, NURSE STATION 2, BAY, ADL KITCHEN, STAFF ACCESSIBLE, WC, EOB, INT, LDY, INT, STORE, FAMILY LOUNGE, SENSORY ROOM, C.LINEN, BED 20, ACC.
- Bottom Section:** LOUNGE / DINING 1, HWB, QUIET LOUNGE, MULTI FATCH, THERAPY, EXERCISE 2, C.LINEN, D.LINEN, BED 20, ACC.

A red rectangle highlights a vertical wall section between the CLINICAL WORK area and the DIRTY UT & DISPOSAL area, labeled as 'FIRE RATED CONSTRUCTION'.

**Fire rated construction achieving 120 minute FRL**

---

## 1.8 Fire Hydrants, Hose Reels, and Extinguishers

20 Fire hydrants must be provided in accordance with the NCC DtS provisions and/or Fire Brigade requirements, except as follows:

- a Where occupants within patient care areas within Level B1 and Level LG present a risk of tampering with the internal floor plate fire hydrants, they are permitted to be located within secure cupboards, contingent on the following:
  - i The secure cupboards must automatically unlock upon activation of fire sprinklers within the relevant fire sprinkler zone.
  - ii Secure cupboards must also be unlockable via an appropriately agreed swipe card or GCHHS Master key with Hospital Management.
  - iii Where swipe cards or electronic locking facilities are proposed to be used to unlock the hydrant cupboards, a physical GCHHS Master key must be provided to manually unlock the secure cupboards. This must be located within the FIP and in any other locations as required by Hospital Management.

21 Fire hose reel coverage need not be provided within the building, contingent on the following:

- a Additional appropriate portable fire extinguishers must be provided in accordance with Item '22'.

22 Portable fire extinguishers, must be in accordance with the NCC DtS provisions, with the following exceptions and requirements:

- a Portable fire extinguishers are permitted to be located within in secure cupboards, contingent on the following:
  - i Secure cupboards must be unlockable via an appropriately agreed swipe card/key with Hospital Management.
  - ii All Staff must be equipped with the above key and must be trained in emergency procedures, including the locations of the secure cupboards containing portable fire extinguishers.
  - iii Staff must keep the above swipe card/key on them at all times whilst on duty.
  - iv Where swipe cards or electronic locking facilities are proposed to be used, a physical master key must be provided to manually unlock the secure cupboards. This must be located within the FIP and in any other locations as required by Hospital Management.
  - v Where portable fire extinguishers are proposed to be collocated with internal fire hydrants, compliance with Item '20a', must also be met.
  - vi The above requirements must form part of a Management-in-Use Plan (MIUP), refer Item '36'.
- b Additional appropriate portable fire extinguishers must be provided and located where fire hose reels would have been required to be provided throughout the building, in accordance with AS 2444.

**Note:** These portable fire extinguishers are permitted to be located within secure cupboards in accordance with the requirements of Item '22a'.

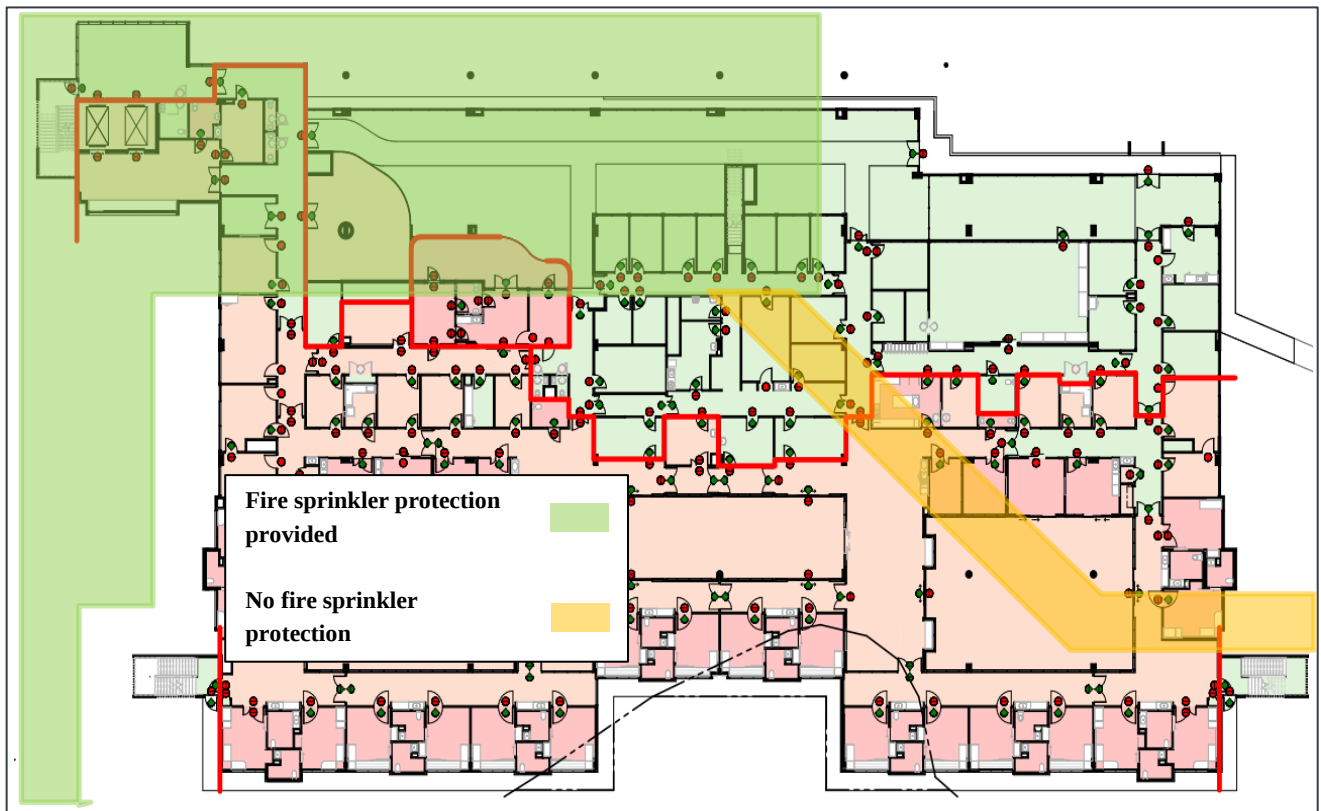
---

## 1.9 Fire Sprinkler Systems

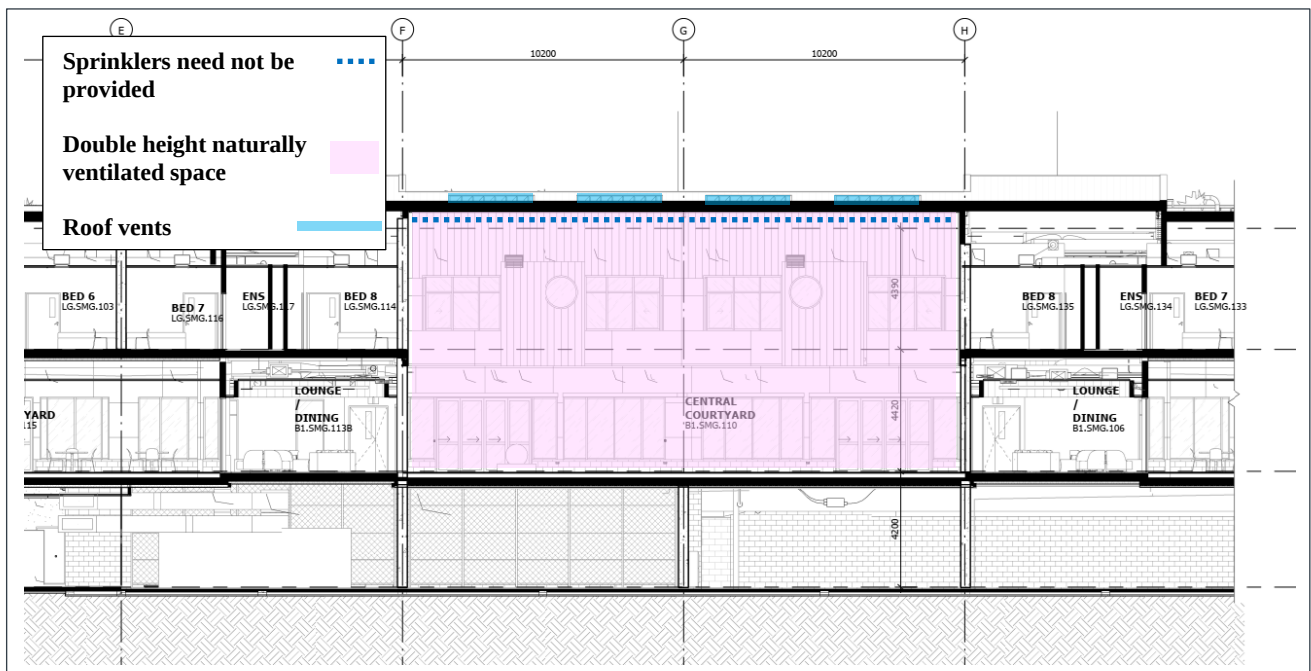
**23** A fire sprinkler system must be installed in accordance with the NCC DtS Provisions, and the following requirements:

- a** Fire sprinkler heads must be fast response type (i.e. RTI  $50 \text{ m}^{1/2}\text{s}^{1/2}$ ).
- b** External fire sprinkler protection must be provided to the underside of the link bridge for a distance not less than 4 m horizontally from the external wall of the SMHRU building.
- c** Where openings within the link bridge are located within 4 m horizontally of the connection to the SMHRU or the existing hospital building, exposure protection fire sprinkler heads must be provided to protect these openings.
- d** Fire sprinklers need not be provided in the following areas:
  - i** Top of lift shafts, contingent on an addressable smoke detector being installed at the top of the lift shaft, as per Item '24a'.
  - ii** Internally within the link bridge, contingent on the following:
    - A** Exposure protection sprinklers are provided to openings within the SMHRU link bridge where located within 4 m of the connection to the SMHRU building and the existing hospital building, as per Item '23c'.
    - B** The link bridge construction complies with Item '1a'.
    - C** Existing sprinklers within the existing hospital building link bridge (that the SMHRU link bridge connects into) must be maintained in accordance with the existing CoC, as shown indicatively in Figure 1-15.
  - iii** The underside of the Lower Ground Level naturally ventilated roof awning located above the Basement Level 1 central courtyard, as shown indicatively in Figure 1-16 and Figure 1-17, contingent on the following:
    - A** The Basement Level 1 central courtyard is a double height space and is permanently open on not less than one side at the Lower Ground Level elevation.

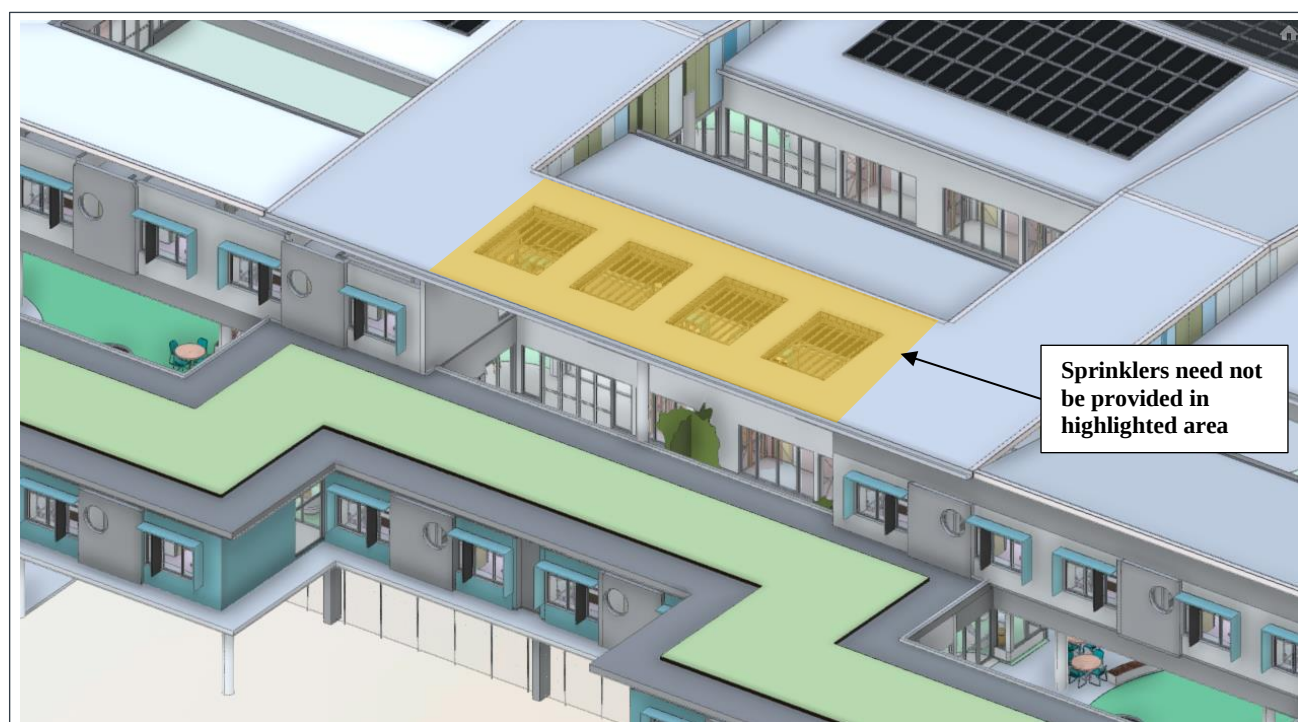
**Figure 1-15** Mark-up indicating where fire sprinkler protection is and is not provided within the link bridge at the connection to the existing link bridge (indicative only)



**Figure 1-16** Section indicating Lower Ground Level awning above Basement Level 1 where fire sprinklers need not be provided



**Figure 1-17** 3D Model Image indicating open extent of Lower Ground Level roof awning above Basement Level 1 central courtyard



---

## 1.10 Smoke Detection and Alarm System

**24** Smoke detection and alarm system must be provided throughout the hospital in accordance with the NCC DtS Provisions, and as follows:

- a** An addressable smoke detector must be provided at the top of each lift shaft.
- b** The link bridge is to be provided with smoke detectors throughout that are connected to the existing hospital building FIP.
- c** In addition to Item '24b', there must be at least one addressable smoke detector located within the link bridge that is connected to the SMHRU FIP.
- d** Where a fire door is required to be provided to separate the link bridge from the SMHRU in accordance with Item '1a ii', smoke detectors must be installed within 1.5 m of the door on each side, and activation of the smoke detectors must close the fire door.

---

## 1.11 Mechanical System Shutdown

**25** Air-handling systems serving the building must be constructed in accordance with NCC DtS requirements and comply with AS1668.1, except that Motorised Smoke Dampers (MSD) at duct penetrating smoke walls, where the ducts serve a different compartment need not be provided where:

- a** The duct does not serve the compartment being passed through.
- b** The duct is a solid metal duct.
- c** No flexible duct is connected to the duct run in the compartment being passed through.

**Note:** The Mechanical Engineer has confirmed that:

- There is no flexible ductwork in the return air systems.
- All instances where smoke dampers are proposed for removal consist of rigid ductwork passing through another smoke compartment (but not serving), refer to Appendix I (Aconex StantecA-GCOR-000523).

---

## 1.12 Lighting, Signs, and Occupant Warning

**26** Occupant Warning System must be provided in accordance with the NCC DtS Provisions, except that:

- a** Manual Call Points (MCPs) within the are permitted to be accessed using GCHHS Master key to activate and located within staff stations, contingent on the following:
  - i** All staff must be trained in emergency procedures, including the locations of the Manual Call Points (MCPs).
  - ii** All clinical staff must be equipped with the GCHHS Master key and must be trained in emergency procedures.
  - iii** Staff must keep the above key on them at all times whilst on duty.
  - iv** The above requirements must form part of a Management-in-Use Plan (MIUP), refer Item '36'.
- b** Occupant warning speakers need not be provided within the Consumer Bedrooms, contingent on the following:
  - i** Occupant warning must be provided throughout the remainder of the building.
  - ii** The Evacuation Procedure of Consumers must be an assisted evacuation (i.e. staff alert and guide occupants to a place of relative safety).
  - iii** The above requirements must form part of a Management-in-Use (MUI) Plan, as per Item '36'.

**27** Emergency lighting must be provided in accordance with the NCC DtS provisions.

**28** Exit signs must be provided in accordance with the NCC DtS provisions, except that directional and exit signage are permitted to be mounted at heights of 3.0 m above finished floor level in line with doorway heights.

---

## 1.13 Solar Panels

**29** The solar panel systems located on the roof must comply with the following:

- a** The solar panel systems must be provided with a Module-Level Shutdown System that automatically shuts down the DC current as well as the voltage in module and string wires (e.g. SolarEdge's SafeDC system).
- b** Automatic module-level shutdown must occur automatically upon any of the following occurrences:
  - i** The building is disconnected from the electrical grid.
  - ii** The inverter is turned off.
  - iii** Power optimizer thermal sensors for each module detect rising temperatures > 85°C.
- c** In safe mode (i.e. after automatic module-level shutdown), the output voltage for each solar panel module must not exceed 1 V.
- d** A manual shutdown switch must be provided adjacent the Fire Detection Control Indicating Equipment (FDCIE) within the main entrance on Basement Level 2.
- e** Instructional signage must be mechanically fixed adjacent to the switch, detailing the function of the switch and how to manually safely carry out module-level shutdown of the solar panels (e.g. by turning off the inverter).

- f** The above instructional signage must detail the locations of both the inverter and how to disconnect power (i.e. shutdown).
  - g** Additional instructional signage must also be provided at the inverter to further clarify how to turn off the inverter.
  - h** The solar panel systems inspected and maintained in the following intervals:
    - i** Annual inspections and maintenance checks (or more frequently if required by an installer or relevant standard or the product specifications) must be carried out on the system by a registered installer or maintenance contractor.
    - ii** Monthly monitoring (or more frequently if required by an installer relevant standard or the product specifications) of the system output must be carried out to identify potential system anomalies.
- 

## 1.14 Commissioning, Maintenance, and Management-in-Use

- 30** All fire safety equipment or equipment associated with fire safety must be correctly commissioned including integrated testing.
- 31** Fire Safety Installations must be maintained in accordance with current and future building maintenance legislation. Failure to do so will render the outcomes of this document invalid.
- 32** Maintenance of Fire Safety Installations must be undertaken by an independent, suitably qualified and/or competent representative licensed with the Queensland Building and Construction Commission (QBCC).
- 33** Up to date logbooks must be provided on site.
- 34** Fire and evacuation plans must be developed and implemented in accordance with the Building Fire Safety Regulation 2008 and/or future legislation, when it comes into force.
- 35** Emergency control organisation and procedures are to be developed and implemented in accordance with AS3745. The following must also be included as part of the procedures:
  - a** Details about the building's fire safety features and systems.
  - b** Location of fire-fighting equipment.
  - c** Procedures for evacuating the building in case of an emergency.
  - d** Fire wardens must be appointed and trained on a 12-monthly period (or more frequently if required by hospital procedures).
  - e** Staff members must be trained in the emergency evacuation practices, including training of new staff at induction.
  - f** Emergency evacuation practices must be held every 12 months (or more frequently if required by hospital procedures).
- 36** A Management in Use Plan (MIUP) must be developed for the building incorporating inter alia the following:
  - a** Staff must be trained in emergency procedures, including the location of secure cupboards with portable fire extinguishers and evacuation procedures for occupants located within the building.
  - b** All Staff must be inducted on the locations and use of the Manual Call Points (MCPs).
  - c** All staff must be equipped with GCHHS Master key for activating the MCPs.
  - d** All Staff must be equipped with an appropriately agreed swipe card/key for unlocking secure cupboards and must be trained in emergency procedures, including the locations of the secure cupboards containing portable fire extinguishers

- e All staff must also be equipped with an override swipe card/key for secured doors, that they can use to unlock doors in the event of a fire.
  - f Staff must keep the above keys/swipe cards on them at all times whilst on duty.
  - g A physical master key must be provided to manually unlock secure doors and secure cupboards housing portable fire extinguishers and MCPs. The key must be located within the FIP, the nearest staff station and in any other locations as required by Hospital Management.  
  
**Note:** Where portable fire extinguishers are proposed to be located in the same cupboard as internal fire hydrants, the access must be GCHHS Master key.
  - h Where swipe cards or electronic locking facilities are proposed to be used to unlock the hydrant cupboards, a physical GCHHS master key must be provided to manually unlock the secure cupboards. This must be located within the FIP and in any other locations as required by Hospital Management.
  - i Management-in-Use Procedure must be implemented for smoking ceremonies to prevent false alarms.
  - j Procedures to ensure that general house-keeping is undertaken to maintain the egress paths and exits clear in order to allow unimpeded travel.
  - k Reference to the relevant fire safety precautions and procedures – detailed in AS1851 and detailed in QDC MP6.1 – that must be followed during the shutdown and maintenance of essential fire safety systems (e.g. sprinklers, smoke detection, fire alarm etc.).
  - l Descriptions of the installed fire safety systems including the location of equipment; key system design and performance parameters; and the operation of active fire systems.
  - m Fire compartmentation, egress provisions, smoke hazard management and fire-fighting services for the building must be documented in a set of fire drawings for ease of maintenance and future fitout purposes.
  - n Operation and Maintenance (O&M) Manuals of all installed fire services.
  - o Registers of fire safety equipment. Fire safety equipment to be provided in situ with permanent and unique identification numbers corresponding to those contained in the equipment registers.
  - p Maintenance records of systems and equipment.
  - q Records of test activities.
  - r Where services are modified as part of a Performance Solution, these must be included in the maintenance and annual certification.
- 37 A sign must be provided adjacent to the FIP or in the main entry listing the Performance Solution applicable to the building. The sign must be incised, inlaid or embossed letters on a metal, wood, plastic or similar plate, securely and permanently attached to the wall.
- 38 A copy of the authority certified Fire Engineering Report must be provided at building handover, at one of the following locations:
- a within the FIP; or
  - b in the Essential Safety Measures log book cabinet; or
  - c Management in Use (MiU) Plan manual; or
  - d Maintenance manual for the fire protection systems.

## 2 PROJECT DETAILS

---

### 2.1 General

WSP Australia Pty Limited has been appointed by DWP to undertake a review of the Fire and Life Safety Provisions associated with the Gold Coast University Hospital Secure Mental Health Rehabilitation Unit development located at 1 Hospital Blvd, Southport QLD 4215.

This document relates only the identified NCC DtS Departures. All other aspects of the design are required to be in accordance with the NCC DtS provisions except where modified by the Performance Solutions contained herein, or, where agreed by WSP, modified by an existing Performance Solution.

---

### 2.2 Fire Safety objectives

The Performance Solutions are developed to meet the Fire Safety Objectives of the NCC (i.e. to protect the lives of the building occupants, facilitate Fire Brigade intervention in the event of an emergency, and protect adjacent property from the spread of fire and physical damage caused by structural failure [2]).

This document is for the use with the development at 1 Hospital Blvd, Southport QLD 4215 throughout its life. It should not be used in full or in part to support any other scheme and WSP does not and will not accept any responsibility for matters arising because of its misuse. This document, and the fire engineering assessment herein, should be referred to prior to further refurbishment, extension, upgrade, change in use, or renovation works are undertaken.

The findings and opinions expressed within this report are based on the conditions encountered and/or the information reasonably available at the date of issue of this document, and are applicable only to the circumstances envisaged herein.

It is confirmed by DWP that the project objectives are to achieve compliance with the NCC Performance Requirements.

This document affects the following Australian Fire Engineering Guidelines (AFEG) [1] Sub-Systems:

| <b>SS-A: Fire Initiation &amp; Development &amp; Control</b> | <b>SS-B: Smoke Development &amp; Spread &amp; Control</b> | <b>SS-C: Fire Spread &amp; Impact &amp; Control</b> | <b>SS-D: Fire Detection &amp; Warning &amp; Suppression</b> | <b>SS-E: Occupant Evacuation &amp; Control</b> | <b>SS-F: Fire Services Intervention</b> |
|--------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|------------------------------------------------|-----------------------------------------|
| ✓                                                            | ✓                                                         | ✓                                                   | ✓                                                           | ✓                                              | ✓                                       |

---

### 2.3 Applicable Legislation and Regulatory Framework

The following Queensland Regulatory Framework is applicable:

- Queensland Building Act, 1975 and subsequent amendments
- Queensland Building Fire Safety Regulation, 2008 and subsequent amendments
- Queensland Fire and Emergency Services Act, 1990 and subsequent amendments
- Queensland Work Health and Safety Act, 2011 and subsequent amendments
- Queensland Building Regulations, 2021 and subsequent amendments
- National Construction Code (NCC) 2019 Volume 1 Amendment 1, Building Code of Australia (BCA) Class 2 to Class 9 Buildings

## — Queensland Development Codes (QDC) MP2.2

The NCC provides a set of Performance Requirements that must be met to demonstrate compliance. Compliance with the Performance Requirements of the NCC can be via a Performance Solution, or Deemed-to-Satisfy (DtS) Solution, or a combination of both.

The NCC provides a set of prescriptive Deemed-to-Satisfy (DtS) Provisions which, if adhered to, are considered to provide an acceptable level of safety, and are deemed to comply with the Performance Requirements of the NCC.

A Performance Solution achieves compliance with the NCC if demonstrating meeting all relevant Performance Requirements or being equivalent to the DtS Provisions.

The Performance Solution can be undertaken using a variety or combination of assessment methods. These are defined in Clause A2.2 of the NCC. The relevant Performance Requirements are determined in accordance with Clause A2.4(3) of the NCC.

---

## 2.4 Stakeholders

The relevant stakeholders of this scheme are listed in Table 2.1.

**Table 2.1** Stakeholders

| Role                     | Company                                      | Representative                                               |
|--------------------------|----------------------------------------------|--------------------------------------------------------------|
| Client                   | Gold Coast Hospital and Health Service       | Brad Azzopardi                                               |
| Architect                | DWP                                          | Neil Carter<br>Sean Logue                                    |
| Building Certifier       | Henry Group                                  | Kylie Rowlands<br>Zach Troeger                               |
| Fire Brigade             | Queensland Fire and Emergency Service (QFES) | Lex Mildren<br>Rohan Wilschefski                             |
| Fire Protection Designer | MultiTech Solutions                          | Bim Kolade                                                   |
| Mechanical Engineer      | Stantec                                      | Patrick Chambers                                             |
| Structural Engineer      | Stantec                                      | Martin O'Connor                                              |
| Electrical Engineer      | MultiTech Solutions                          | Grant Steinback                                              |
| Fire Engineer            | WSP                                          | Jack Partridge (RPEQ)<br>Walther Groenewald<br>Daryan Othman |

---

## 2.5 Relevant Information and Documentation

This document is based on the following:

- Mechanical services air schematic prepared by Stantec, sent via Aconex (StantecA-RTRFI-000241) on 31 January 2024, refer to Appendix G.
- Legrand fire and acoustic rated wall boxes fire assessment report prepared by Warringtonfire (Report No. FAS 210125, R1.4) issued on 12 May 2022, refer to Appendix H.
- Aconex (StantecA-GCOR-000523) received from the Mechanical Engineer on 19 December 2023 refer to Appendix I.

- Confirmation of staff to consumer ratios from Gold Coast Health, received via email 20 September 2021.
- Architectural drawings 50% CD Issue produced by DWP, dated 30 November 2021.
- Compliance Assessment Review Issue 1, produced by Hendry Group dated 16 September 2021.
- Confirmation of staff numbers from Gold Coast Health, received via email on 15 September 2021
- Fire Services Plans 50% CD Issue produced by MultiTech Solutions, dated 30 November 2021.

## 3 BUILDING CHARACTERISTICS

### 3.1 Building Description

The proposed development consists of the new Secure Mental Health Rehabilitation Unit (SMHRU) at the Gold Coast Hospital Campus. The building is primarily a Class 9a Patient Care Building and contains three storeys, labelled as Basement Level 2, Basement Level 1 and Lower Ground Level to maintain consistency with the existing hospital floor system. Due to the sloping nature of the site all three levels are provided with access directly to road or open space, as shown indicatively in Figure 3.1 and Figure 3.2. The building consists of the following:

- Basement Level 2 (Level B2): Carparking, secure sally port entrance, plant and undercroft. It is understood that the undercroft may be enclosed as part of future works, however that does not form the scope of this project.
- Basement Level 1 (Level B1): Consumer bedrooms (i.e. wards), staff areas, treatment areas, lounge and dining and activity areas, as shown indicatively in Figure 3-3.
- Lower Ground Level (Level LG): Consumer bedrooms (i.e. wards), staff areas, treatment areas, lounge and dining, activity areas and main reception for the building, as shown indicatively in Figure 3-4.

The facility is designed with 40 beds in total (20 beds per floor) and although a secure facility, consumers are considered to be ambulant. As such, while the evacuation process will be a staff managed process, occupants are not expected to be reliant on staff to evacuate them, in contrast to what would be expected in a typical Class 9a hospital ward.

The building is also provided with a link bridge providing connectivity between the existing hospital precinct and the new SMHRU building. This link bridge is primarily on grade, as shown indicatively in Figure 3-5 and is provided with an elevated awning structure with at least 4.5 m of clearance to provide vehicular access the main hospital building.

Figure 3-1 Section through Southern end of building

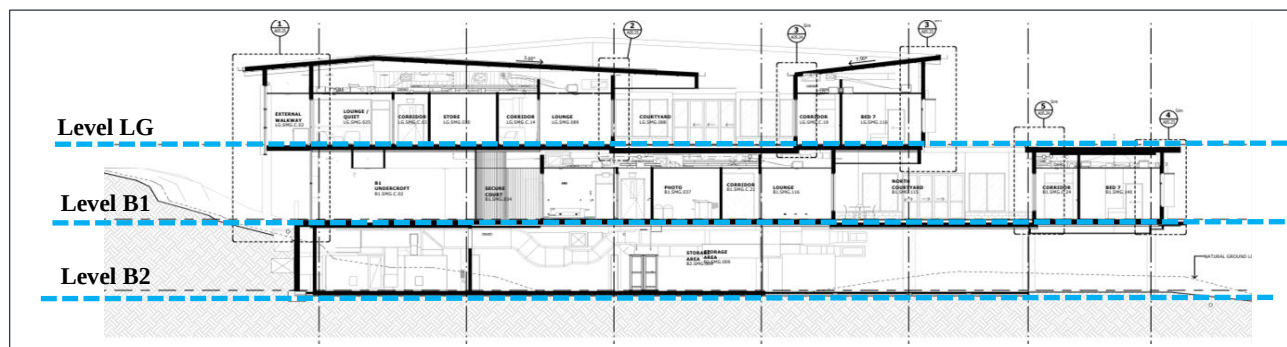


Figure 3-2 Section through Northern end of building

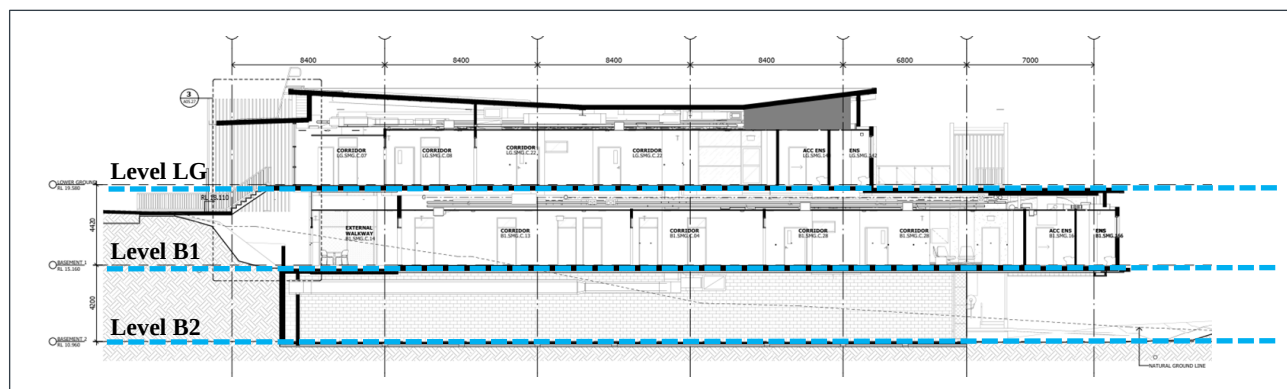
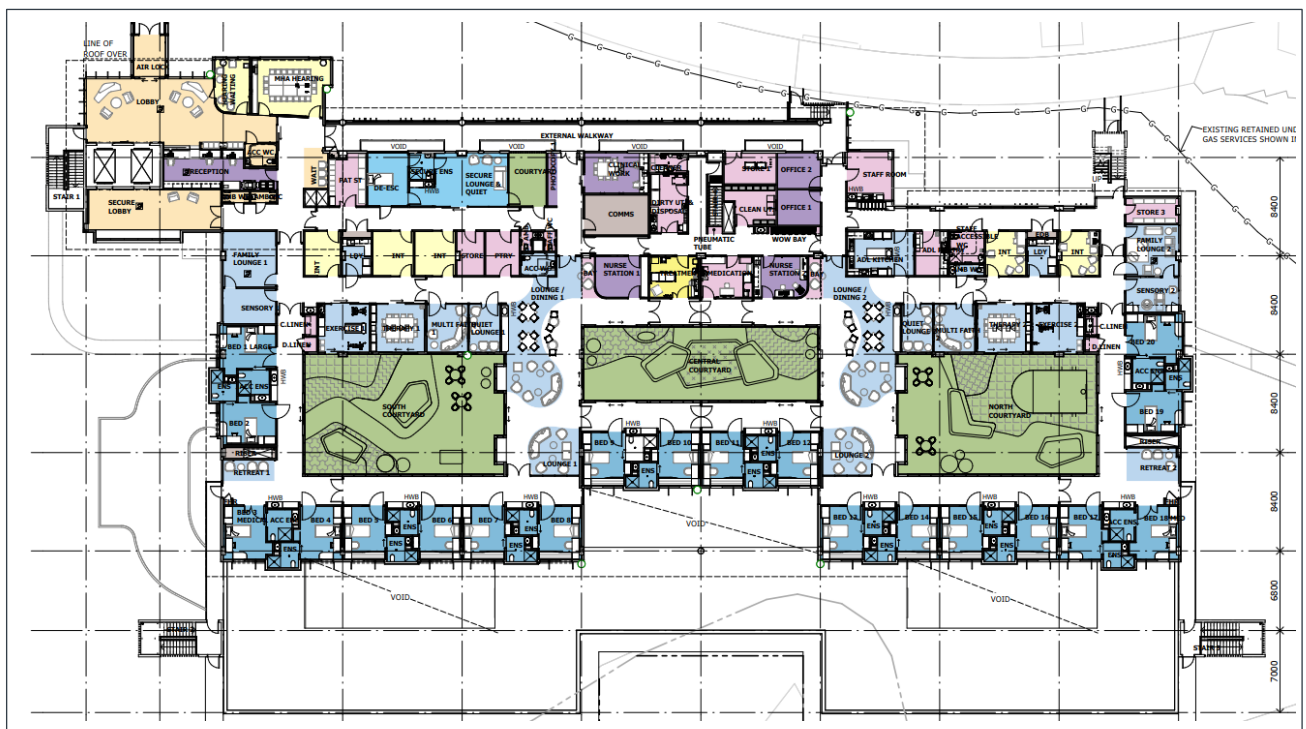


Figure 3-3 Basement Level 1 (Level B1) floor plan



Figure 3-4 Lower Ground (Level LG) floor plan



**Figure 3-5 Model View of link bridge between new SMHRU and existing Hospital buildings**

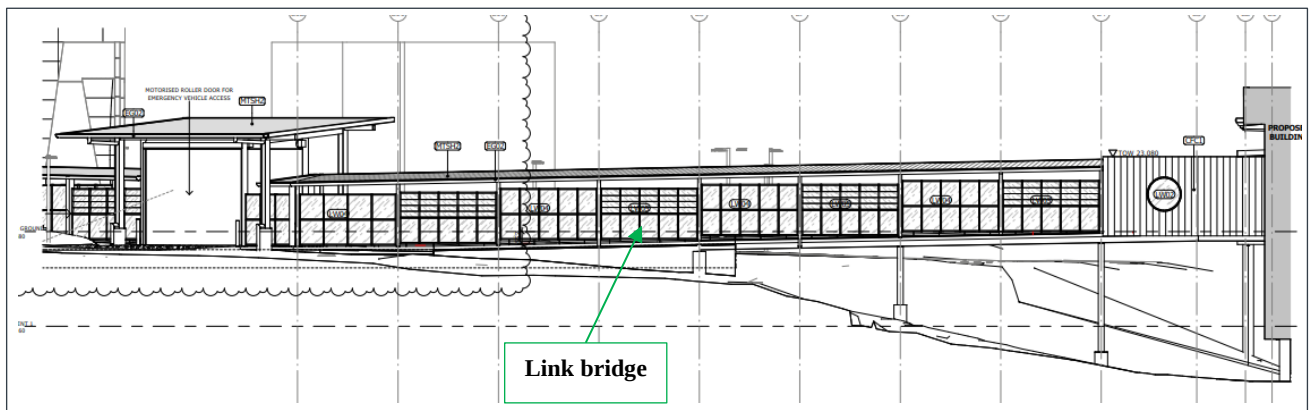


Table 3.1 provides the general subject building characteristics that are relevant to the NCC.

**Table 3.1 Building Description**

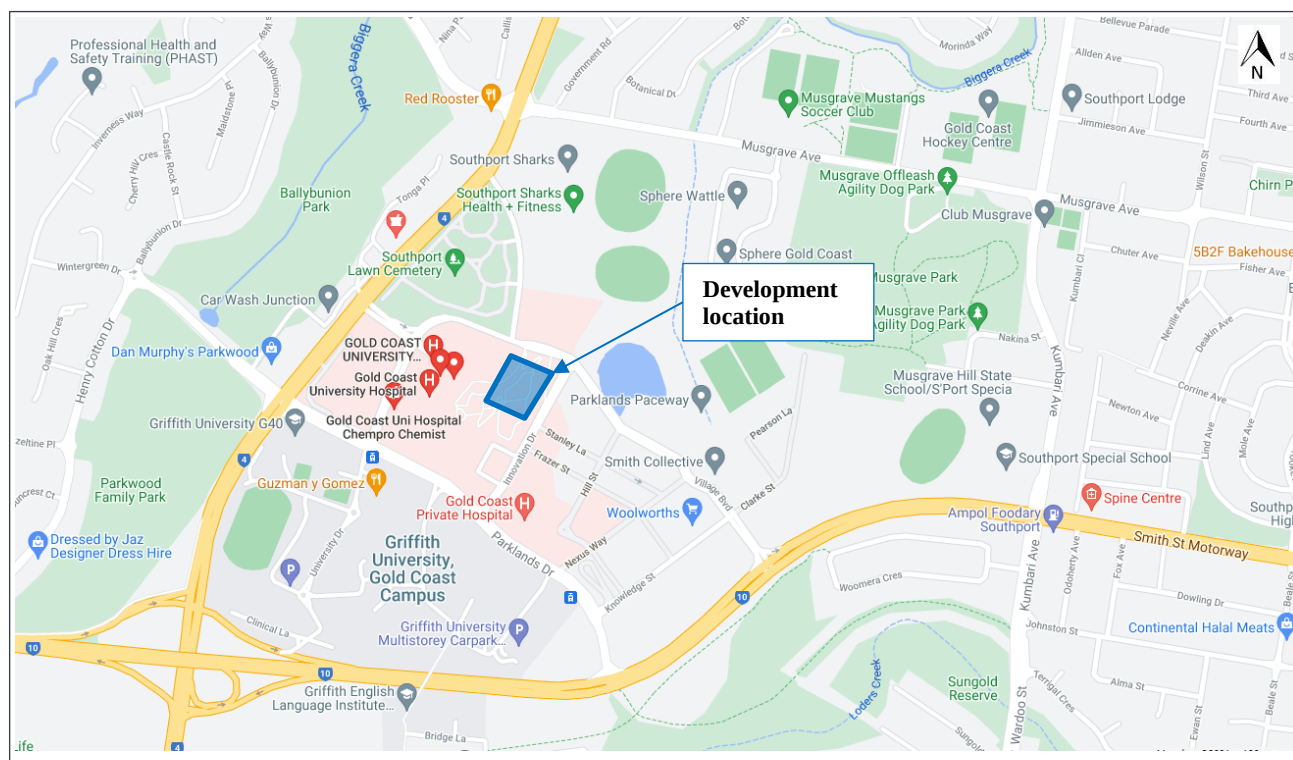
| Parameter            | Description                                          |
|----------------------|------------------------------------------------------|
| Effective Height     | 8.62 m                                               |
| Classification       | Class 7a – Carpark<br>Class 9a – Healthcare Building |
| Rise in Storeys      | 3                                                    |
| Storeys Contained    | 3                                                    |
| Construction of Type | Type A                                               |

## 3.2 Location and Proximity to Fire Source Features

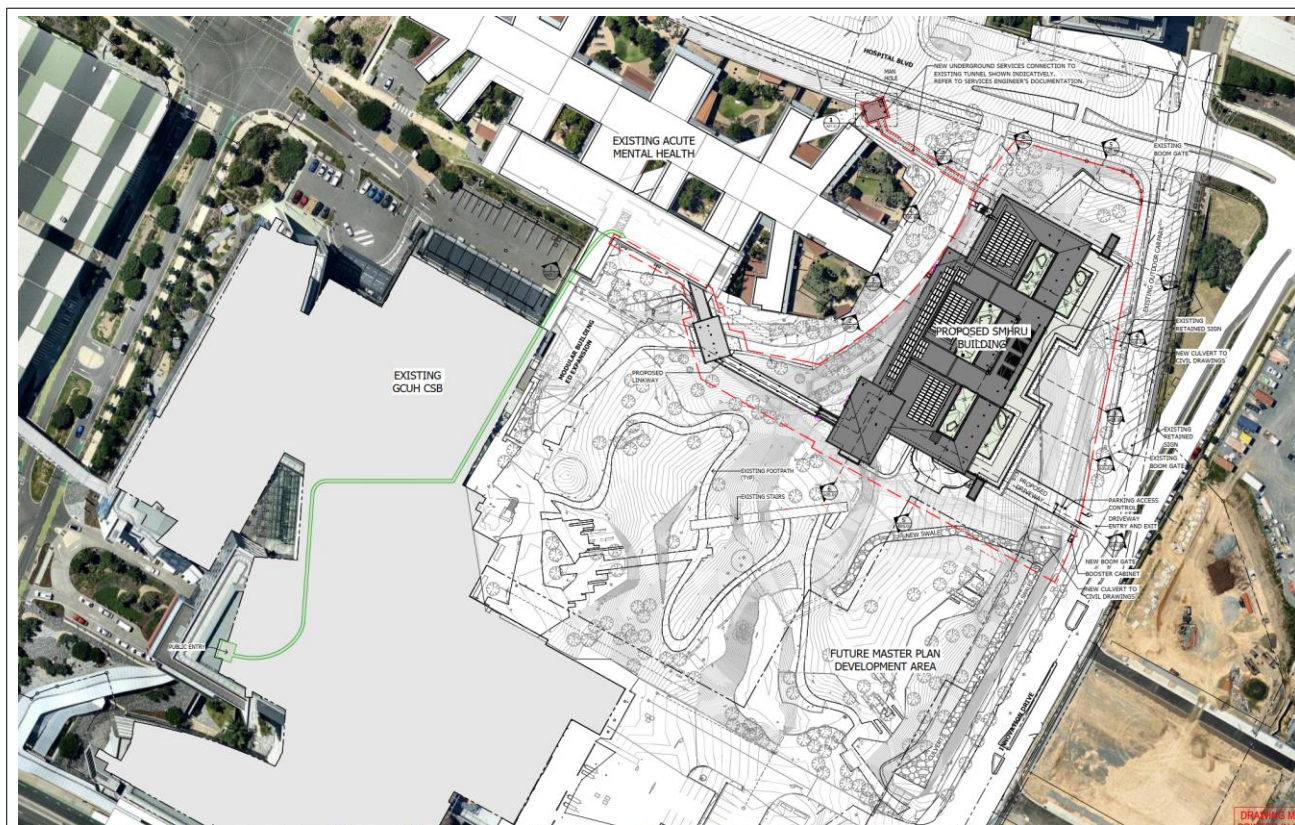
The development is located within the Gold Coast University Hospital precinct at 1 Hospital Blvd, Southport QLD 4215 and occupies a portion of the site, as shown in Figure 3-6 and Figure 3-7.

General compliance to boundaries and Fire Source Features (FSFs) is understood to be in accordance with the DtS provisions of the NCC, however fire separation between the link bridge and the SMHRU and existing hospital buildings is subject to a Performance Solution within Section 7.1.

**Figure 3-6 Site Location [3]**



**Figure 3-7 Development Location with respect to remainder of GCUH Precinct**



## 3.3 Means of Escape

### 3.3.1 Exit Strategy

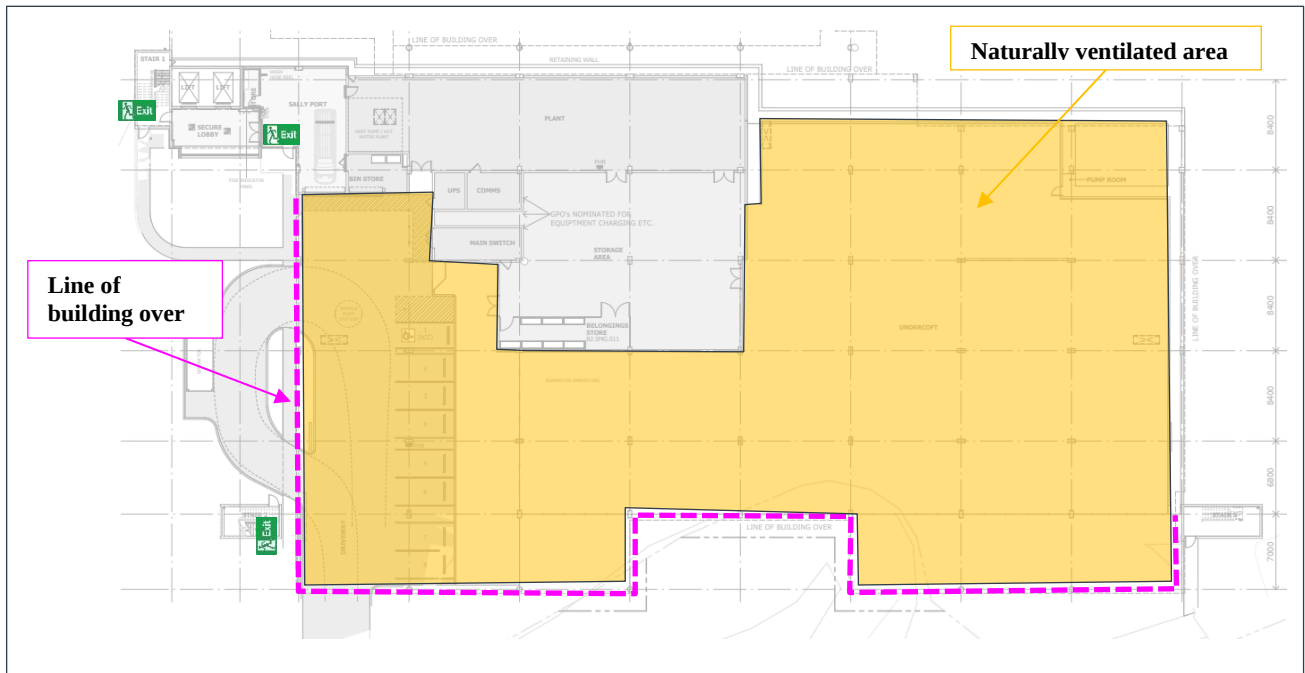
The building is provided with fire compartmentation within Level B1 and Level LG, three external stairs as well as exits directly to a road or open space on each level, as shown indicatively in Figure 3-8 to Figure 3-10. Each of the external stairs discharges directly to a road or open space on Level B2.

Occupants on Level B2, who consist primarily of staff, are afforded egress directly to road or open space. However, on Level B1 and Level LG where there are expected to be consumers, staff and visitors, a staff managed evacuation strategy is proposed to be implemented for consumers within the facility as follows:

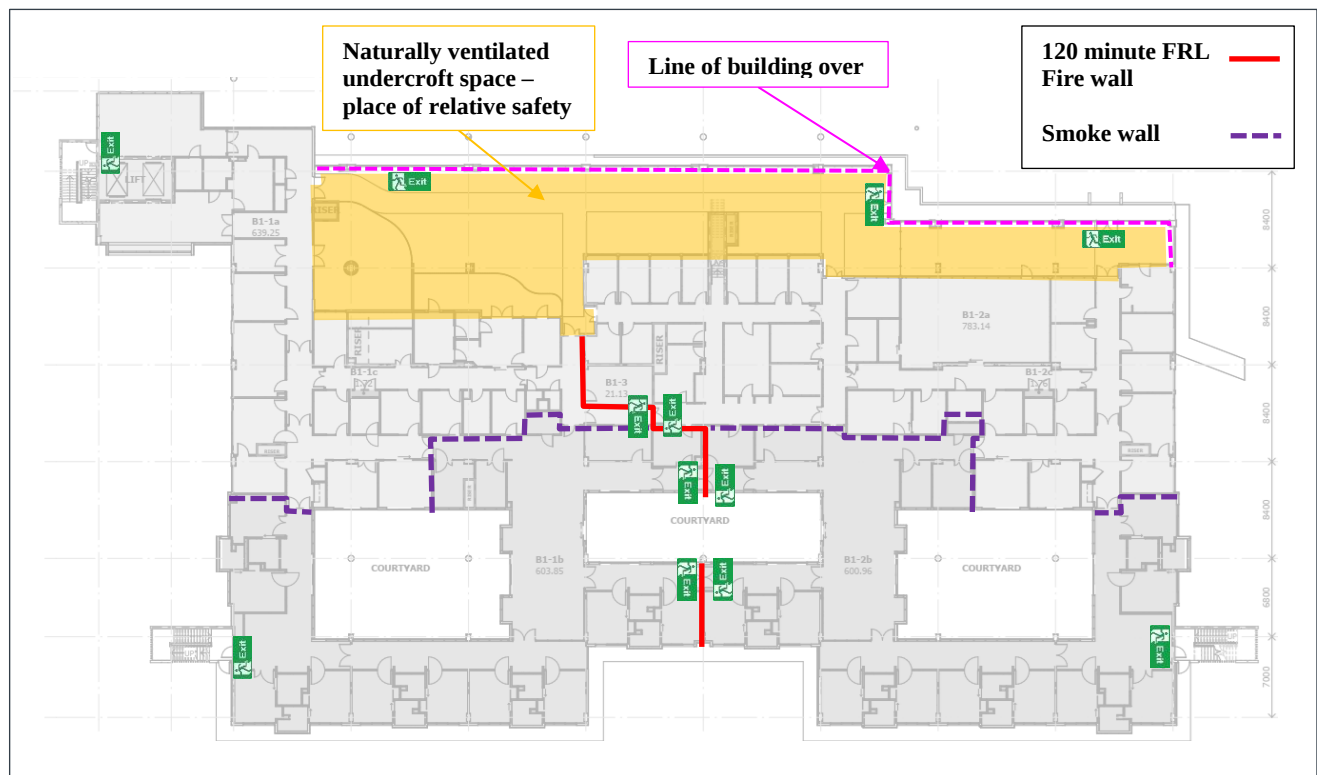
- Consumers:
  - Stage 1: Evacuate horizontally with staff direction to adjacent non-fire affected compartment and muster within the large courtyard in that compartment. Alternatively, if required (still staff managed), evacuate via the nearest exit and assemble in F Block (i.e. adjacent building on site).
  - Stage 2: Evacuate via nearest fire stairs to road or open space (if evacuated horizontally in Stage 1) and assemble in F Block.
- De-escalation Room:
  - Consumers in the de-escalation rooms (one per floor) are to be directly evacuated by staff members supervising the consumers. Staff are expected to follow the direction of wardens with respect to when evacuation is required and evacuate the consumers independently of the remainder of the consumers within the facility.

- Visitors:
  - Stage 1: Evacuate with staff direction via nearest exit or stairs to road or open space.
- Staff:
  - Stage 1: Assist with horizontal evacuation of consumers and mustering as instructed by the wardens.
  - Stage 2: Evacuate via nearest fire stairs to road or open space and assist consumers in moving to F Block for assembly.

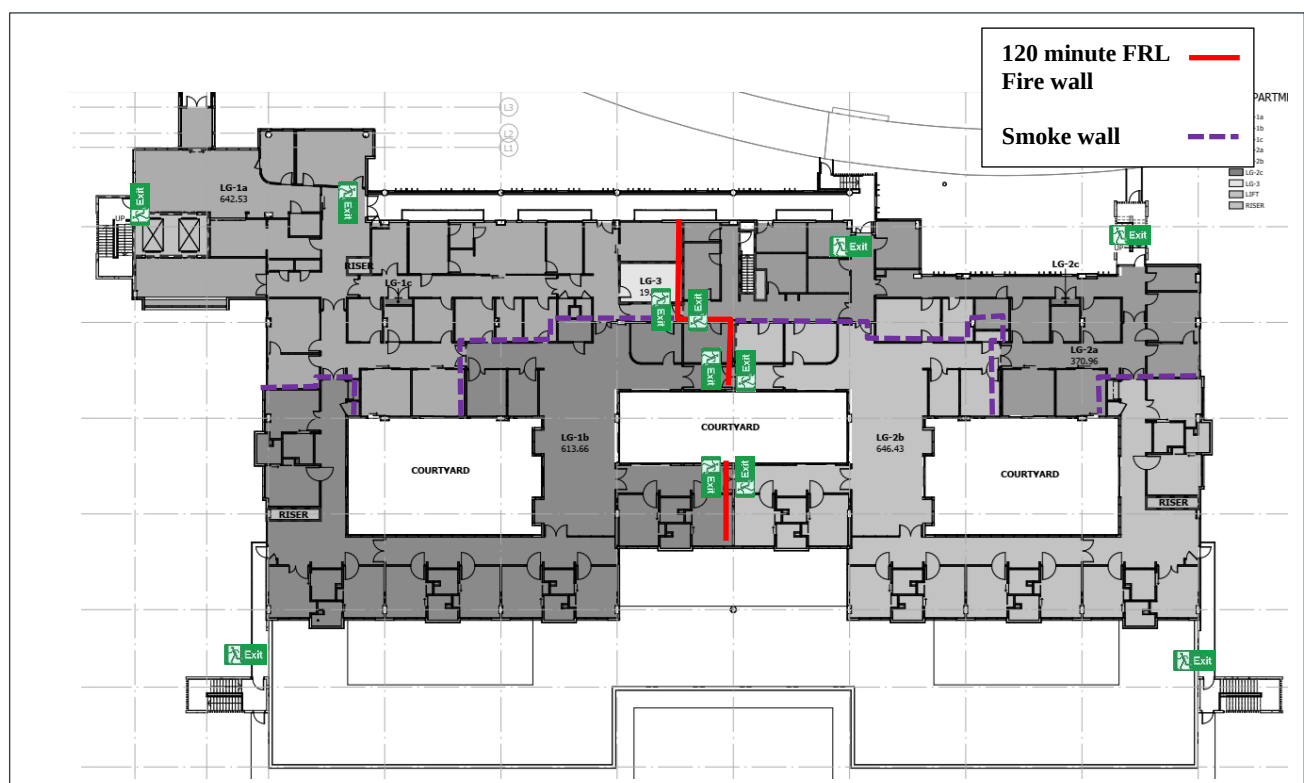
**Figure 3-8 Basement Level 2 indicating location of exits (indicative only)**



**Figure 3-9** Basement Level 1 floor plan indicating location of exits (including horizontal exits) and place of relative safety (indicative only)



**Figure 3-10** Lower Ground Level floor plan indicating location of exits (including horizontal exits) (indicative only)



## 4 OCCUPANT CHARACTERISTICS

### 4.1 Attributes

#### 4.1.1 General

Based on the function and use of the building, occupants can be classified into the dominant groups detailed in Table 4.1. These attributes are based on the expected attributes of the generalised occupant group and not on individuals.

**Table 4.1** Occupant Attributes

| Attribute                           | Description                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Consumers</b>                    |                                                                                                                                                                                                                                                                                                                                                                              |
| Awareness                           | May be awake or asleep and/or under the influence of drugs or alcohol. May not be alert or aware of their surroundings.                                                                                                                                                                                                                                                      |
| Physical and Mental State           | It is expected that the majority of consumers will not have any relevant physical impairments, however it is expected that majority of consumers will have mental impairments. There may be a minority of consumers who are physically impaired. In this instance, it is considered that the other staff members will aid in their evacuation.                               |
| Familiarity with the Building       | May not be familiar with the building configuration, including the location of the main entry and exit points as well as available egress paths.                                                                                                                                                                                                                             |
| Emergency Training                  | There is no expectation that consumers will be trained in emergency procedures or on the use of any initial fire-fighting equipment.                                                                                                                                                                                                                                         |
| <b>Staff</b>                        |                                                                                                                                                                                                                                                                                                                                                                              |
| Awareness                           | Generally awake, alert, and aware of their surroundings.                                                                                                                                                                                                                                                                                                                     |
| Physical and Mental State           | It is expected that the majority of staff will not have any relevant physical or mental impairments, as representative of the general population. However, there may be a minority of staff who are physically impaired. In this instance, it is considered that the other staff members will aid in their evacuation.                                                       |
| Familiarity with the Building       | Generally familiar with the building configuration, including the location of the main entry and exit points as well as available egress paths.                                                                                                                                                                                                                              |
| Emergency Training                  | Staff are expected to be trained in emergency evacuation procedures. This may include training using initial fire-fighting equipment, if safe to do so. Staff are also expected to understand the standard 'Evacuation' tone, have the ability to follow directions from voice over commands received via an Intercom System and be able to follow exit signage.             |
| <b>Visitors</b>                     |                                                                                                                                                                                                                                                                                                                                                                              |
| Awareness                           | Awake but may be under the influence of drugs or alcohol. Therefore, the visitors may not be alert or aware of their surroundings.                                                                                                                                                                                                                                           |
| Physical and Mental State           | It is expected that the majority of visitors will not have any relevant physical or mental impairments, as representative of the general population. However, there may be a minority of visitors who are physically and/or mentally impaired.                                                                                                                               |
| Familiarity with their surroundings | Visitors are expected to be familiar with the main entry to the building. However, familiarity with the building configuration is not expected.                                                                                                                                                                                                                              |
| Emergency Training                  | There is no expectation that visitors will be trained in emergency procedures or on the use of fire hose reels or fire extinguishers. However, visitors are expected to understand the standard 'Evacuation' tone, have the ability to follow directions from voice over commands received via an Intercom System and be able to follow emergency lighting and exit signage. |

---

## 4.2 Disabled Evacuation

Although the development is a Class 9a Health Care Facility, it is considered that most of the Mental Health Unit Population will not have any relevant physical impairments that could impact on their physical ability to evacuate. Nevertheless, each level is provided with access directly to a road or open space, noting that egress via a ramp will be required from Level L.

As discussed in Section 3.3, the primary evacuation strategy for consumers is based on horizontal egress in the first instance, with egress from the building (via either stairs or directly to outside) occurring at different stages depending on the extent of evacuation required. It is noted that consumer evacuation will be staff assisted. As such, any occupants that may be physically impaired are expected to be provided with the required assistance to safely evacuate the building.

---

## 4.3 Population Distribution

Expected occupant numbers have been provided by Gold Coast Health, referenced in Section 2.5. Table 4.2 indicates the expected occupant numbers within the building. It is also noted that the clinical staff to consumer ratios are expected to be 1 clinical staff member to 4 consumers with an extra clinical staff member on shift. As such based on the number of consumers per floor, there are expected to be at least 6 clinical staff available per floor to assist occupants in evacuating in the event of a fire.

**Table 4.2      Approximate Occupant Distribution**

| Level             | Population                                                                                                                      |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Level B2          | Use of this storey is understood to be ancillary to the use of the building and does not contribute to the building population. |
| Level B1/Level LG | Staff = 50 pax<br>Consumers = 40 pax<br>Visitors = 30 pax<br>Total Population = 60 pax per storey                               |

## 5 FIRE BRIGADE CHARACTERISTICS

### 5.1 Objectives

The Fire Brigade objectives throughout Australia is to protect life, property, and the environment from fire [4].

Queensland Fire and Emergency Services (QFES) corporate objectives include attendance to 90<sup>th</sup> percentile of all fires within 14 minutes from the time of notification [5].

### 5.2 Proximity to Fire Stations

Table 5.1 details the fire stations in the local area around the proposed development.

**Table 5.1** Fire Station Locations

| Fire Station | Station Number | Fire Station Address                      | Approx. Distance from Development (km) | Staffing Type |
|--------------|----------------|-------------------------------------------|----------------------------------------|---------------|
| Southport    | 31             | Binstead Dr, Southport QLD 4215           | 4.5                                    | Permanent     |
| Helensvale   | 36             | 1 Discovery Dr, Helensvale QLD 4212       | 8.6                                    | Permanent     |
| Nerang       | 39             | 139 Beaudesert Nerang Rd, Nerang QLD 4211 | 8.9                                    | Permanent     |

Source: Data obtained from a combination of [www.whereis.com](http://www.whereis.com), [www.google.com/maps](http://www.google.com/maps), and Fire Brigade online resources

### 5.3 Notification, Equipment, and Access

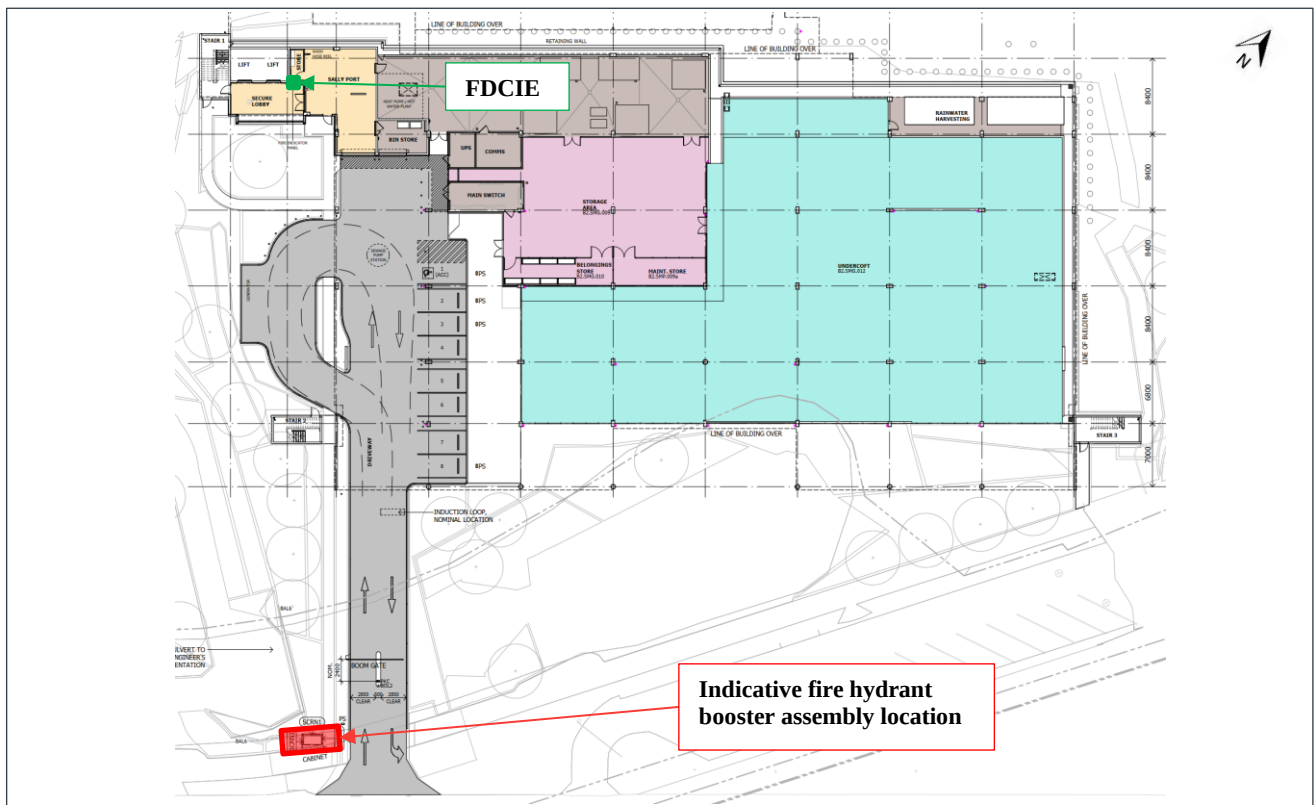
It is anticipated that the responding Fire Brigade (i.e. trained personnel) will arrive to this building on receipt of a public initiated call (i.e. occupant or passer-by) or an automated call from the activation of the installed smoke detection system or fire sprinkler system.

Consistent with Standard Operational Procedures, it is expected that responding Fire Brigade personnel will be wearing appropriate turnout uniform in accordance with occupational health and safety requirements.

The development is bound by Innovation Drive to the east, Hospital Blvd to the North, the fire brigade access road and existing Acute Mental Health facility to the west and the existing main hospital building and parkway to the south. Vehicular access to the building is via Innovation Drive or Hospital Blvd, with the fire hydrant booster assembly located on the boundary facing Innovation Drive, as shown indicatively in Figure 5-1. The Fire Detection Control Indicating Equipment (FDCIE) is located within the main entrance to the building on Basement Level 2 and is within sight of the booster assembly. It is understood that typical QFES protocol for the GCUH site is to provide two responding units, with one arriving at the subject building and the other arriving at main site fire control room and coordinating with the Facility Incident Coordinator.

Fire fighter access is provided on all sides of the building via either the external stairs or the direct entrance points to the building (highlighted in Section 3.3).

**Figure 5-1 Basement Level 2 floor plan indicating fire services locality**



## 6 KEY FIRE SAFETY SYSTEMS

The following key fire safety systems are provided to the building as protective measures. These are only general system installations for the building and are provided in line with the Part 2 of the Building Fire Safety Regulation, 2008.

Detailed requirements are provided in Section 1, Fire Engineering Provisions.

**Table 6.1 Key Fire Safety Systems**

| System                                                          | Provided                            | System                                       | Provided                            |
|-----------------------------------------------------------------|-------------------------------------|----------------------------------------------|-------------------------------------|
| <b>Facilities for Emergency Services</b>                        |                                     | <b>Detection Systems</b>                     |                                     |
| Fire mains                                                      | <input checked="" type="checkbox"/> | AS 3786 Smoke Alarms                         | <input type="checkbox"/>            |
| Emergency lifts                                                 | <input type="checkbox"/>            | AS 1670.1 Smoke detection                    | <input checked="" type="checkbox"/> |
| Fire control centre or room                                     | <input type="checkbox"/>            | AS 1668.1 Smoke Control                      | <input type="checkbox"/>            |
| Perimeter vehicular access                                      | <input type="checkbox"/>            | AS 1670.3 Monitoring                         | <input checked="" type="checkbox"/> |
| Standby power supply system                                     | <input type="checkbox"/>            | <b>Smoke Hazard Management</b>               |                                     |
| Building Act Section 79 (Hazardous Building)                    | <input type="checkbox"/>            | Zone smoke control                           | <input type="checkbox"/>            |
| NCC Clause E1.10 (Special Hazard)                               | <input type="checkbox"/>            | Smoke and heat vents                         | <input type="checkbox"/>            |
| <b>Fire Fighting Equipment</b>                                  |                                     | Smoke exhaust                                | <input type="checkbox"/>            |
| Portable fire extinguishers                                     | <input checked="" type="checkbox"/> | Smoke baffles                                | <input type="checkbox"/>            |
| Fire hose reels                                                 | <input type="checkbox"/>            | Ridge vents                                  | <input type="checkbox"/>            |
| Fire hydrant system                                             | <input checked="" type="checkbox"/> | Stair pressurisation                         | <input type="checkbox"/>            |
| Fire sprinkler system (other than wall-wetting)                 | <input checked="" type="checkbox"/> | Impulse / jet fans                           | <input type="checkbox"/>            |
| Wall-wetting fire sprinklers                                    | <input type="checkbox"/>            | <b>Signage and Lighting</b>                  |                                     |
| Special automatic fire suppression                              | <input type="checkbox"/>            | Emergency lighting                           | <input checked="" type="checkbox"/> |
| <b>Occupant Warning</b>                                         |                                     | Exit and directional signs                   | <input checked="" type="checkbox"/> |
| Building Occupant Warning (BOWS)                                | <input type="checkbox"/>            | Prohibitive signs                            | <input type="checkbox"/>            |
| Sound System and Intercom System for Emergency Purposes (SSIEP) | <input checked="" type="checkbox"/> | Warning and operational signs (e.g. strobes) | <input type="checkbox"/>            |

# 7 PERFORMANCE SOLUTIONS

## 7.1 Link Bridge Provisions

### 7.1.1 Introduction

The following assessment addresses Departure Items '1' and '8'.

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |          |                                                     |                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|-----------------------------------------------------|----------------------|
| DtS Clause           | C1.1, C2.7<br>Specification C1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Performance<br>Requirements | CP1, CP2 | Performance Solution<br>Compliance Method<br>(A2.2) | (1)(a)<br>(2)(b)(ii) |
| Description          | Fire Resistance Levels (FRLs) associated with the proposed linkway between the existing hospital and the new building are to be rationalised to be in accordance with the requirements for Type C construction<br><br>Fire separation of the linkway between the existing hospital and the new building to be rationalised.                                                                                                                                                                                                                                    |                             |          |                                                     |                      |
| Hazard               | The primary hazard associated with rationalising the FRL associated with the link bridge relates to the risk that a fire within the link bridge could lead to premature failure of the structure members. This has the potential for increased risk of fire spread and possible collapse.<br><br>The primary hazard associated with rationalising the fire separation between the existing hospital building and the SMHRU relates to the risk that a fire within the SMHRU or existing hospital building could lead to fire spread between the two buildings. |                             |          |                                                     |                      |
| Analysis Methodology | Qualitative analysis method based on the structural stability of the link bridge and the risk of fire spread between compartments.                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |          |                                                     |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the rationalised fire resistance levels to the link bridge and reduction in FRL will not unduly impact on the structural stability to the degree necessary and where the rationalised construction of the linkway will not unduly impact on the risk of fire spread, the ability of the occupants to safely evacuate the building, or on the ability of the fire brigade to carry out Fire Brigade Intervention.                                                                                                         |                             |          |                                                     |                      |

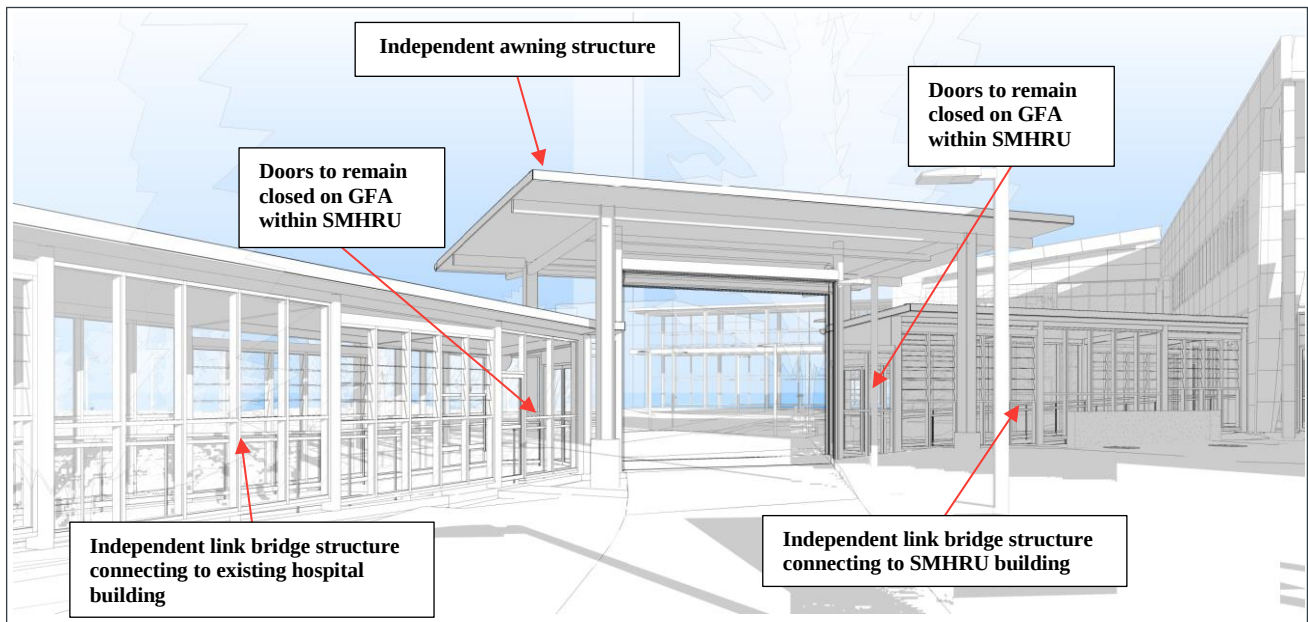
### 7.1.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to limit the risk of fire spread to the link bridge occurring.
- The link bridge must be fire separated from the SMHRU building by fire doors achieving an FRL not less than - /120/30.
- The door is permitted to be on electromagnetic hold open devices (EMHODs) provided the door closes upon activation of smoke detectors within 1.5 m on each side of the door.
- The link bridge must be constructed of non-combustible materials and maintained as a circulation space only (i.e. storage, combustible furniture, rubbish or the like is not permitted to be located within the link bridge).
- Exposure protection fire sprinklers must be provided to the underside of the link bridge and must extend not less than 4 m from the external wall of the SMHRU building.
- Any openings within the link bridge that are located within 4 m of the external wall of the SMHRU building must be provided with external exposure protection.

- The link bridge connecting to the SMHRU must be an independent structure from the link bridge connecting to the existing hospital and the structures must be provided with not less than 6 m of separation. Current architectural drawings indicate that the structures are provided with approximately 20 m of separation where the access roadway passes through the structure.
- Doors must be provided at the link bridge on each side of the access roadway and must remain closed on General Fire Alarm within each building that the portion of the link directly connects to.
- The awning above the access roadway must be an independent and naturally ventilated independent structure and must have a clearance height of not less than 4.5 m, as shown indicatively in Figure 7-1. In the event of a fire within either side of the link bridge, the separation between the two structures and natural ventilation provided is expected allow smoke and hot gases to vent to the atmosphere.
- The existing access corridor, as denoted in Figure 7-2, is to be fire sprinkler protected, and provided with openings to the external atmosphere making up not less than 50% of its perimeter.

**Figure 7-1 Model view of link bridge indicating physical separation between the link bridge portions connecting the SMHRU building to the existing hospital building (indicative only)**



### 7.1.3 Assessment

The SMHRU building is required to be constructed in accordance with the NCC DtS requirements for Type A construction. Due to the direct connection, the link bridge is also required to be constructed in accordance with the requirements for Type A construction. Additionally, the SMHRU building is considered to be a separate building to the existing hospital building. Due to the connection of the link bridge between the two buildings, fire separation in accordance with the requirements of NCC DtS Clause C2.7 is required to be provided.

The intent of these provisions and Performance Requirement CP1, in context to the Performance Solution is to require building elements maintain structural stability during fire to the degree necessary, with respect to such factors as the function and use of the building, fire load and intensity, height of the building and any active fire systems installed within. Additionally, Performance Requirement CP2 intends to avoid the spread of fire to exits, between buildings and in a building to the degree necessary, with respect to the factors stated above.

However, due to the sloping nature of the site, the link bridge is primarily located on ground and contains a single storey (i.e. not elevated). It is therefore proposed that the FRLs within the link bridge be rationalised to be in line with the requirements for Type C construction. Additionally, the fire separation at the connection of the link bridge to the existing hospital building is proposed to be rationalised based on the characteristics of the structure. In recognition of the intent of the Performance Requirements, the primary hazard associated with these proposals relates to the potential impacts on the structural stability of the link bridge in the event of a fire and the risk of fire spreading between the existing hospital building and the SMHRU. The following qualitative assessment discusses the proposed mitigating measures to address the identified hazards.

The link bridge is primarily a circulation space and therefore storage, combustible furniture or the like is not expected to be located within the link bridge. This is required to form part of a management-in-use plan for the facility. Additionally, the link bridge is required to be constructed of non-combustible materials, this includes floor, wall and ceiling linings. As such, the fuel load associated with the link bridge is considered to be negligible. In addition to the fire load, ignition sources must be present. Electrical components such as light fittings, wall sockets and services cupboards (e.g. electrical) are identified as the most prominent form of ignition, and these components are required to be installed in accordance with AS 3000-2018. As such, the likelihood of a fire originating and being sustained within the link bridge is considered to be very low. Nevertheless, in the unlikely event of a fire within the link bridge, the fire is expected to be limited in size and localised only, such that the potential risk of fire spread and impact on the structure is considered to be low. It is therefore considered that the primary hazard associated with the reduction in FRLs relates to the risk of a fire within the existing hospital building and SMHRU building spreading to the link bridge.

As part of the Performance Solution, it is recognised that both the existing hospital and the SMHRU buildings are provided with fire sprinkler protection. It is generally acknowledged that fast response fire sprinklers will activate in the early stages of the fire to either control or suppress a fire. Research conducted by CIBSE [6] and Warrington [7] shows that the upper layer temperatures are not likely to exceed 100°C during a fire sprinkler-controlled fire and 200°C for a fire sprinkler shielded fire. In the event of a fire within the existing hospital building or the SMHRU building, the fire sprinklers are expected to control or suppress a fire such that fire spread to the link bridge is mitigated to the degree necessary.

Nevertheless, to further reduce the risk of fire spreading from the SMHRU building to the link bridge, the link bridge is fire separated from the SMHRU building. Additionally, exposure protection fire sprinklers are required to be provided to the underside of the link bridge structure for a distance not less than 4 m of the connection to the SMHRU. Any openings within the link bridge that are located within 4 m of the connection to the SMHRU building are also required to be provided with external exposure protection fire sprinklers. Should the link bridge structure be exposed to increased temperatures from a fire on the level below or on the same level as the link bridge, it is expected that the exposure protection fire sprinklers will activate and cool the structure and openings, thus limiting fire spread between the SMHRU and link bridge.

On the existing hospital building side, the link bridge connects into an existing access corridor. As part of the Performance Solution, the SMHRU link bridge is not required to be fire separated at the connection to the existing access corridor. However, it is recognised that the existing access corridor is fire sprinkler protected. Additionally, the existing access corridor is to be not less than 50% open to the external atmosphere around its perimeter, permitting the free ventilation of smoke and fire products which may otherwise impinge upon the Link Bridge, as shown indicatively in Figure 7-2.

Existing Hospital Building

Corridor to be open for not less than 50% of its perimeter

Linkway

EXISTING ENTRY DOOR

EXISTING LIFT LOBBY

EXISTING BUILDING

EXISTING LANDSCAPING

EXISTING DRIVEWAY

EXISTING EMERGENCY DRIVEWAY

ED EXPANSION BUILDING

NOTE: EXISTING CONDITIONS TO BE DEMOLISHED TO MAKE WAY FOR THE NEW LINKWAY. EXISTING SITE SUBORDINATE TO BE MADE GOOD TO SUIT NEW WORK.

### 7.1.4 Conclusion

Therefore, it is considered that the Performance Requirements CP1 and CP2 are satisfied.

## 7.2 FRL to Columns in External Walls

### 7.2.1 Introduction

The following assessment addresses Departure Item ‘2’

| DtS Clause           | C1.1, Specification C1.1                                                                                                                                                                                                                                                                                                   | Performance Requirements | CP1, CP3 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii)<br>(2)(c) |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|-----------------------------------------------|--------------------------------|
| Description          | Except for columns incorporated in fire walls, columns in external walls that support the roof only will be permitted to not achieve an FRL.                                                                                                                                                                               |                          |          |                                               |                                |
| Hazard               | The primary hazards associated with non-fire rated columns supporting the roof are as follows: <ul style="list-style-type: none"><li>— Premature structural failure of the external walls / roof impacting occupant evacuation.</li><li>— Structural failure of the columns impacting fire brigade intervention.</li></ul> |                          |          |                                               |                                |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of buildings occupants and Fire Brigade Intervention.                                                                                                                                                                                                             |                          |          |                                               |                                |
| Acceptance Criteria  | Acceptance will be demonstrated where the columns without an FRL will not unduly impact the ability of the occupants to safely evacuate the building, or on Fire Brigade Intervention.                                                                                                                                     |                          |          |                                               |                                |

### 7.2.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Except for columns incorporated in fire walls, columns in external walls that support the roof on the upper level are permitted not to achieve an FRL.

As part of the Performance Solution, it is recognised that:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to limit the risk of fire spread via heat transfer to the external walls containing the roof supporting columns.
- The building has a smoke detection and alarm system installed in accordance with AS 1670.1. This is expected to provide early notification of a fire to occupants of a fire event, permitting early evacuation from the fire effected compartment. Additionally, early fire brigade notification is expected via the Alarm Signalling Equipment.
- The roof is not fire rated, due to the concession applied for a non-combustible roof covering and sprinkler protection.
- The internal columns are not fire rated, due to a concession applied whereby no FRL required where the roof concession mentioned above is applicable and the rise in storeys is no more than 3.
- Common ignition sources such as wall sockets and light fittings will be installed in accordance with AS 3000-2007 and where penetrating fire rated construction will be fire sealed in accordance with the NCC DtS Provisions. Therefore, the risk of a fire igniting or being sustained within the wall cavity is considered to be relatively low.

### 7.2.3 Assessment

The intent of the clause being deviated as per the Guide to the BCA is:

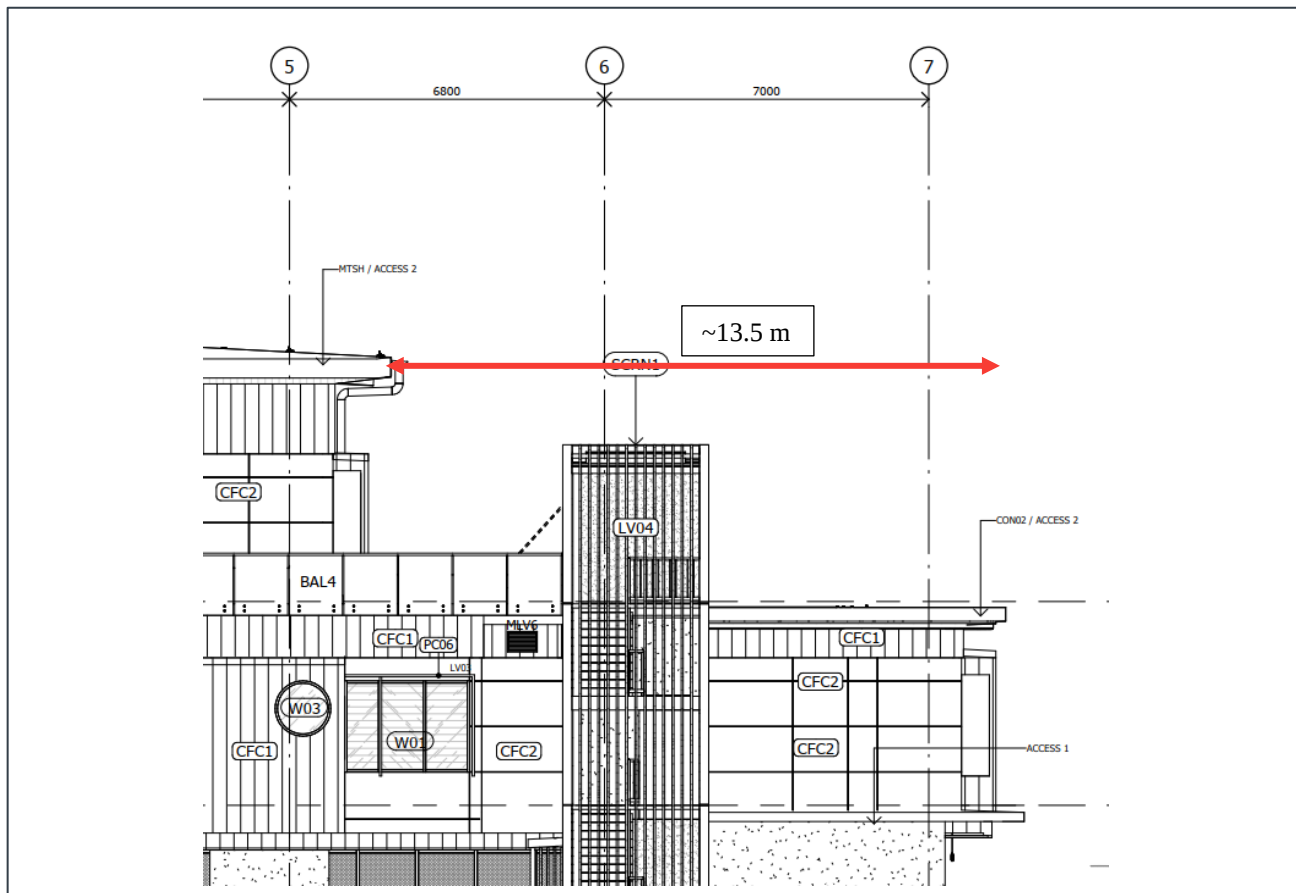
*“To specify the fire-resistance level (FRL) and other requirements for building elements in Type A construction.”*

The primary hazards associated with non-fire rated columns supporting the roof are as follows:

- Premature structural failure of the external walls / roof impacting occupant evacuation.
- Structural failure of the columns impacting fire brigade intervention.

Due to the sloping site (sloping west down to east), generally, the building has only two storeys above ground on most elevations, except that on the East Elevation and the part of the South Elevation there is one additional storey. However, with the East elevation, the top storey is set well back from the lower level (about 13.5 m as per the below drawing), leaving the section of the Southern Elevation as the only part with 3 storeys fully aligned above ground. As a result, the building is designated Type A construction which triggers more stringent FRL requirements for relevant building elements.

**Figure 7-3 East elevation, top storey set back from lower level**



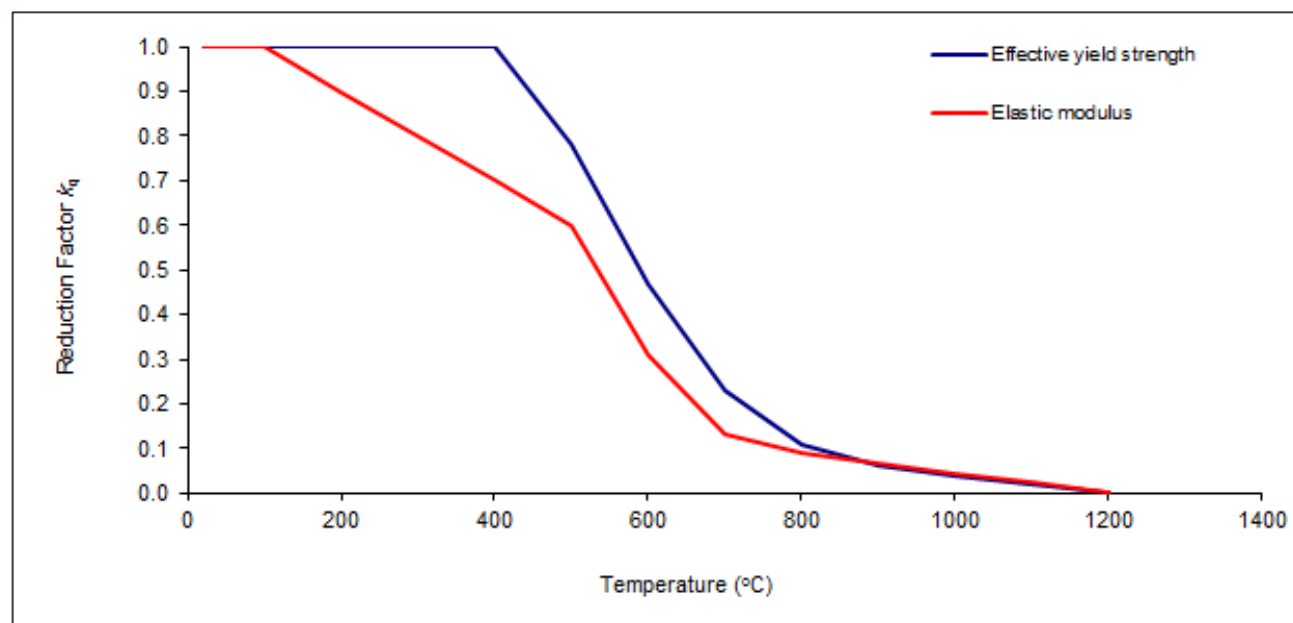
Under the DtS provisions of the BCA, specifically Table 4 of Specification C1.1 for a Type A construction and Class 9a building, columns incorporated within external walls are required to achieve an FRL of 120/-/-. As per Clause 3.5 of Specification C1.1, the roof itself is not required to achieve an FRL on the basis that the building is sprinkler protected or has a rise in storeys of 3 or less, which are both applicable to the subject building. Furthermore, Clause 3.7 of Specification C1.1 allows internal columns to not achieve an FRL on the basis the columns are supporting a roof that is not required to achieve an FRL in a Class 9 building does not have a rise in storeys exceeding 3. As such, the columns are only required to achieve an FRL as it forms part of the external wall, which is required to achieve an FRL if it is in proximity to a fire-source feature.

In the subject building, the loadbearing columns forming part of the external wall only support the building roof. As such it could be argued that as the DtS provisions provide concessions to omit FRLs to internal columns supporting a non-fire rated roof, the same can be applied here.

In the event of a fire occurring in the building, it is expected that the smoke detection and alarm system triggers and alerts staff to commence evacuation of the building and alerts fire brigade dispatch. Patients located within the smoke compartment of fire origin would be horizontally evacuated to the adjacent compartment, away from the fire. If located on the Lower Ground (top-most storey), the patients would only need to travel one floor below (via stairs or via lift if stretcher facilities are required, to Basement Level 1) to egress directly outside to a road or open space. In this instance, it is likely that patients would be evacuated from the compartment of fire origin prior to the activation of the sprinkler system. If the fire continues to grow, it is expected the fire sprinkler system activates and likely limits the growth and spread to the area of fire origin. As such in this scenario, the risk of the unprotected columns thereby the roof failing and impacting occupant evacuation and fire brigade intervention is adequately low.

In the event the fire grows undetected by the smoke detection system, it is expected that the fire sprinkler system activates and likely suppresses the fire, containing it to the area of fire origin. A sprinkler-controlled fire is expected to be of reduced intensity, and the smoke produced from such a fire is expected to be cooler, dilute and less buoyant. Furthermore, research conducted by CIBSE [6] and Warrington [7] shows that the upper layer temperatures are not likely to exceed 100°C during a fire sprinkler controlled fire and 200°C for a fire sprinkler shielded fire. Under sprinkler controlled temperatures of 200°C, unprotected structural steel is expected to be able to maintain 100% of its strength [8]. Figure 7-4 shows the material reduction factors of carbon steel at elevated temperatures, based on Eurocode 3 [9]. At 200°C steel is still expected to maintain 90% of its elastic modulus and 100% of its yield strength. While it is noted that there may be a delay to trigger the emergency warning system and fire brigade dispatch (compared to early warning provided by smoke detection), the resulting outcome in relation to occupant egress and fire brigade intervention would be similar to the scenario described in the paragraph above.

**Figure 7-4 Properties of Carbon Steel at Elevated Temperatures**



The event of the smoke detection system and the fire sprinkler system failing simultaneously is extremely unlikely as both systems are highly reliable. This is a low probability event (and even lower when the probability of a fire occurring is included), nevertheless, in the case of fire sprinkler failure, given the number of small rooms within the building, a flashover event within a room is probable. In this instance, the internal room temperatures will greatly exceed the critical temperature of the columns. Under the DtS, this would potentially cause failure of the internal columns and the roof. Under the Performance Solution, if the fire is in a room that is on the perimeter of the building, all columns and the roof may potentially fail. Due to the presence of the smoke detection and alarm system, in both cases it is expected that the immediate area will be evacuated prior to any potential structural failure, with occupants moved to neighbouring fire compartments, or to outside the building. It is the opinion of WSP that the risk to occupants is not increased by the lack of fire rating applied to the columns within the external walls.

With regard to fire brigade intervention, again the only danger of failure is present when the fire sprinkler system does not operate to control or suppress the fire. In the Performance Solution situation, the risk of roof failure and failure of the internal columns is no different to that in the DtS. However, external columns may fail. The risk to fire brigade intervention in this instance is likely to be where external intervention is being undertaken, with the potential for falling debris at a distance from the building, due to height. It is understood that the requirement for the fire rating of the columns in external walls is driven by the height of the building and the potential for falling debris to fall at a distance from the building line. The only face where 3 storeys are directly above each other is the Southern face of the building. The height of this face is not excessive and the top level is able to be reached by a hose stream from a hydrant at ground level. Firefighters have good access to this face and are able to attack it from multiple directions, as well as attack the fire internally. While fire fighters may need to be further back from the building footprint than if it was a two storey building, this should not overly impact on the intervention strategy. Additionally, aerial appliances may be used, which would not be subject to same risk of falling debris.

#### **7.2.4 Conclusion**

Based on the above assessment, it is considered that the rationalised FRLs to the columns forming part of the external walls supporting the roof will not unduly impact on the structural stability to the degree necessary and where the rationalised FRLs of the columns will not unduly impact on the risk of fire spread, the ability of the occupants to safely evacuate the building, or on the ability of the fire brigade to carry out Fire Brigade Intervention, to the degree necessary.

Therefore, it is considered that the Performance Requirements CP1 and CP3 are satisfied.

## 7.3 Steel Header Beams Penetrating Firewalls

### 7.3.1 Introduction

The following assessment addresses Departure Item ‘2’

| DtS Clause           | C1.1, Specification C1.1 and C2.7                                                                                                                                                                                                                                                                                                                                                                                                                                            | Performance Requirements | CP1, CP2, CP3 and CP8 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|-----------------------------------------------|----------------------|
| Description          | Steel header beams that are not required to have an FRL are permitted in limited locations to penetrate the fire rated lining and connect to steel columns within lightweight fire walls separating fire compartments.<br><br>NCC DtS Clause C2.7 requires that building elements, other than roof battens with dimensions 75 mm x 50 mm or less must not pass through or cross the fire wall unless the required fire-resisting performance of the fire wall is maintained. |                          |                       |                                               |                      |
| Hazard               | The hazard associated with steel elements penetrating through the fire-rated lining of fire walls is the potential risk of compromising the fire wall (i.e. may deteriorate at a faster rate under fire conditions compared to a wall without steel penetrations), with resultant fire and/or smoke spread between two adjacent compartments.                                                                                                                                |                          |                       |                                               |                      |
| Analysis Methodology | Qualitative analysis method is based on an assessment of the risk of structural stability of the firewall and fire spread between compartments under fire conditions.                                                                                                                                                                                                                                                                                                        |                          |                       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the unprotected steelwork penetrating through the fire-rated wall will not unduly impact on performance and stability of the firewall and fire spread between compartments.                                                                                                                                                                                                                                                            |                          |                       |                                               |                      |

### 7.3.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Steel header beams that are not required to have an FRL are permitted in limited locations, as indicated in Figure 7-6 and Figure 7-8, to penetrate the fire rated lining and connect to steel columns within lightweight fire walls separating fire compartments, contingent on:
  - The fire-rated plasterboard lining of the fire wall must be profiled so that there is only a 10 mm – 15 mm gap between the plasterboard and the PFC connections as shown in Figure 7-5. The gaps must be filled with a flexible fire rated mastic to form a fire seal in accordance with a tested system.
  - The fire walls must comply in all other aspects with the tested system as per the manufacturer's details (i.e. Knauf approved framing details) to maintain the FRL of the fire wall.
  - The subject steel columns within the fire walls on Basement 1 must be connected at the bottom to the concrete floor slab and at the top to the soffit of the concrete slab overhead.
  - The subject steel columns within the fire walls on Lower Ground must be connected at the bottom to the concrete floor slab and at the top to the roof rafters which must be passively fire protected, as well as the columns supporting the rafters, so as not to reduce the FRL of the fire wall, i.e. collapse of the roof structure on one side of the fire wall must not affect the FRL of the fire wall. The outline of the fire walls superimposed on the roof structure is shown in Figure 7-10.
  - The connections of the subject steel column at the top and bottom must be protected to achieve an FRL of 120/- in accordance with the requirements of the tested system.

Figure 7-5 Steel header beam connection to the columns detail

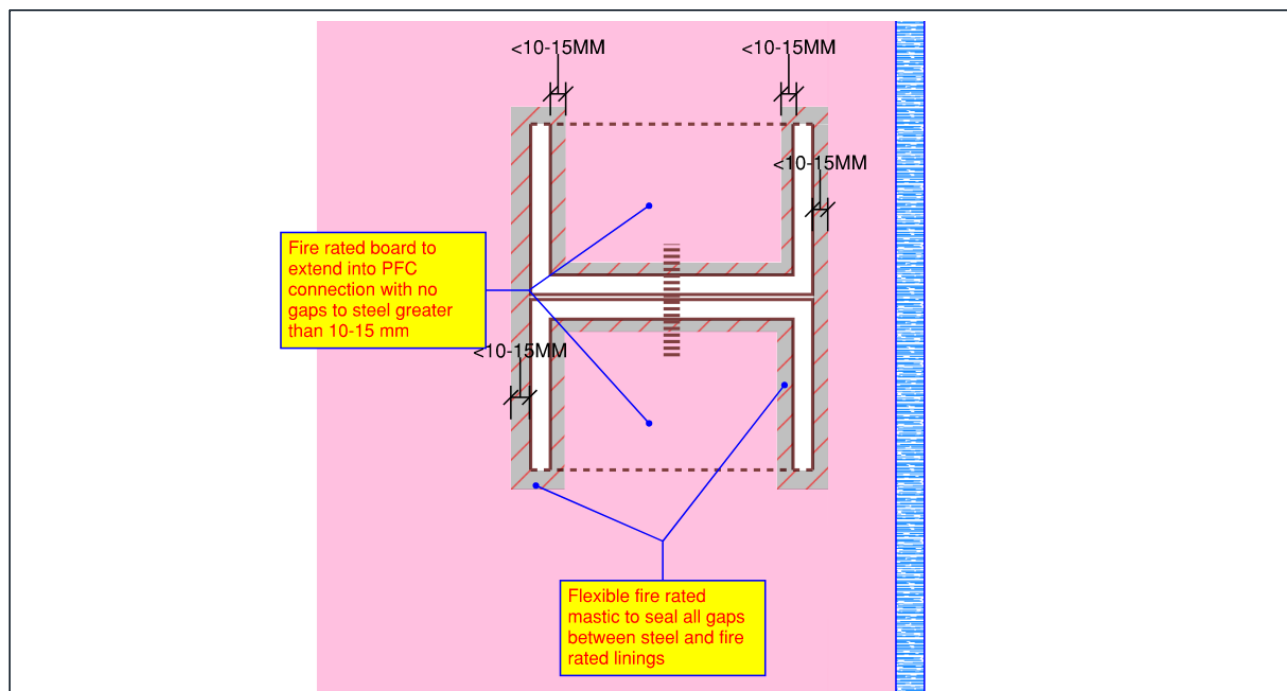


Figure 7-6 Steel header beam locations penetrating fire rated lining indicated by green circles– Basement 1

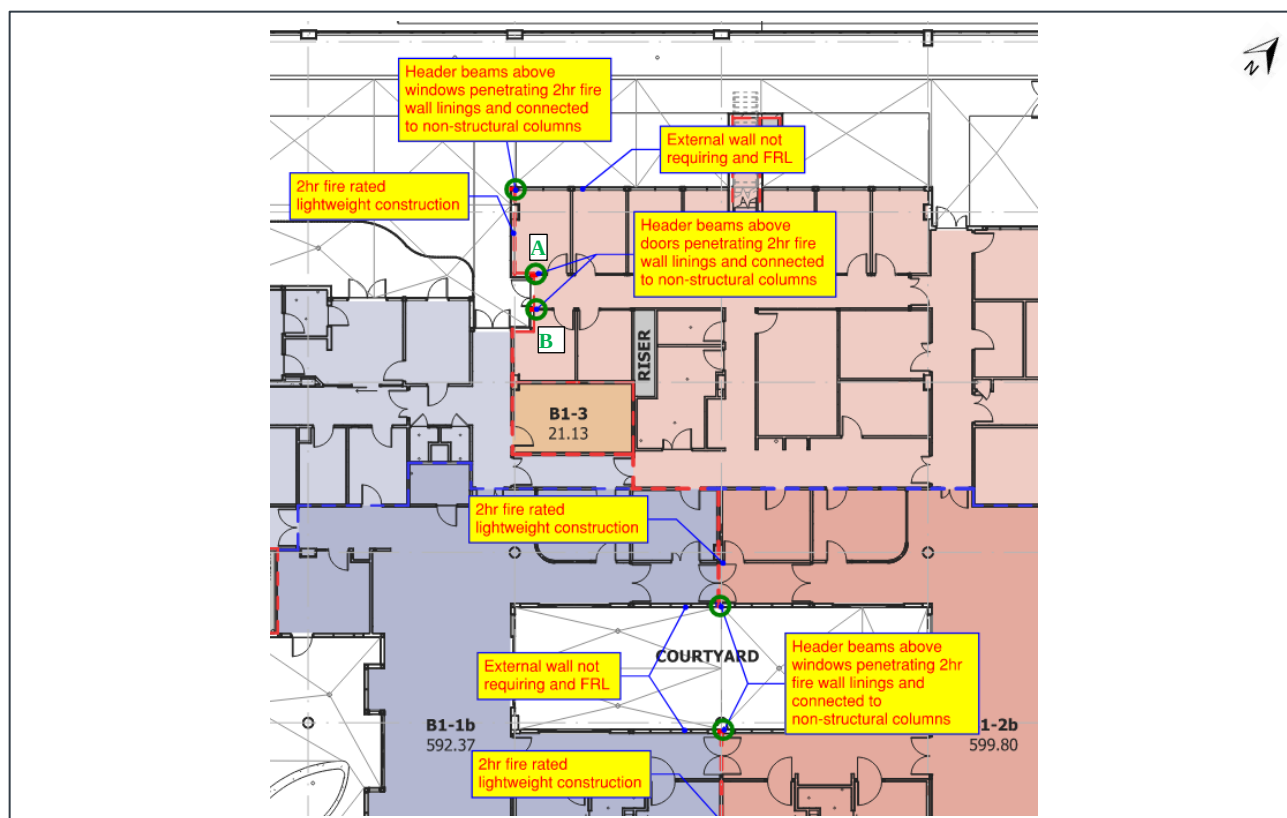


Figure 7-7 Outline of fire wall on structural model indicating steel header beam connections in red – Basement 1

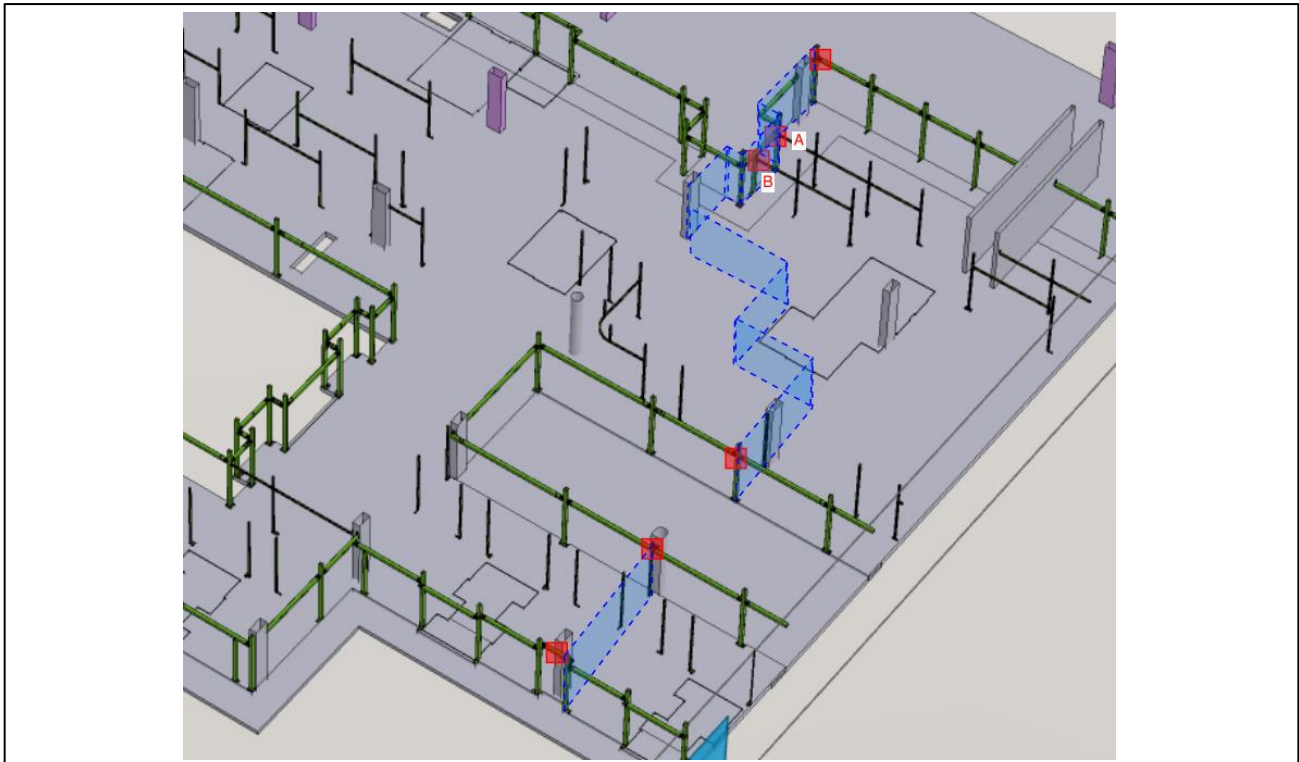


Figure 7-8 Steel heard beam locations penetrate fire rated lining – Lower Ground

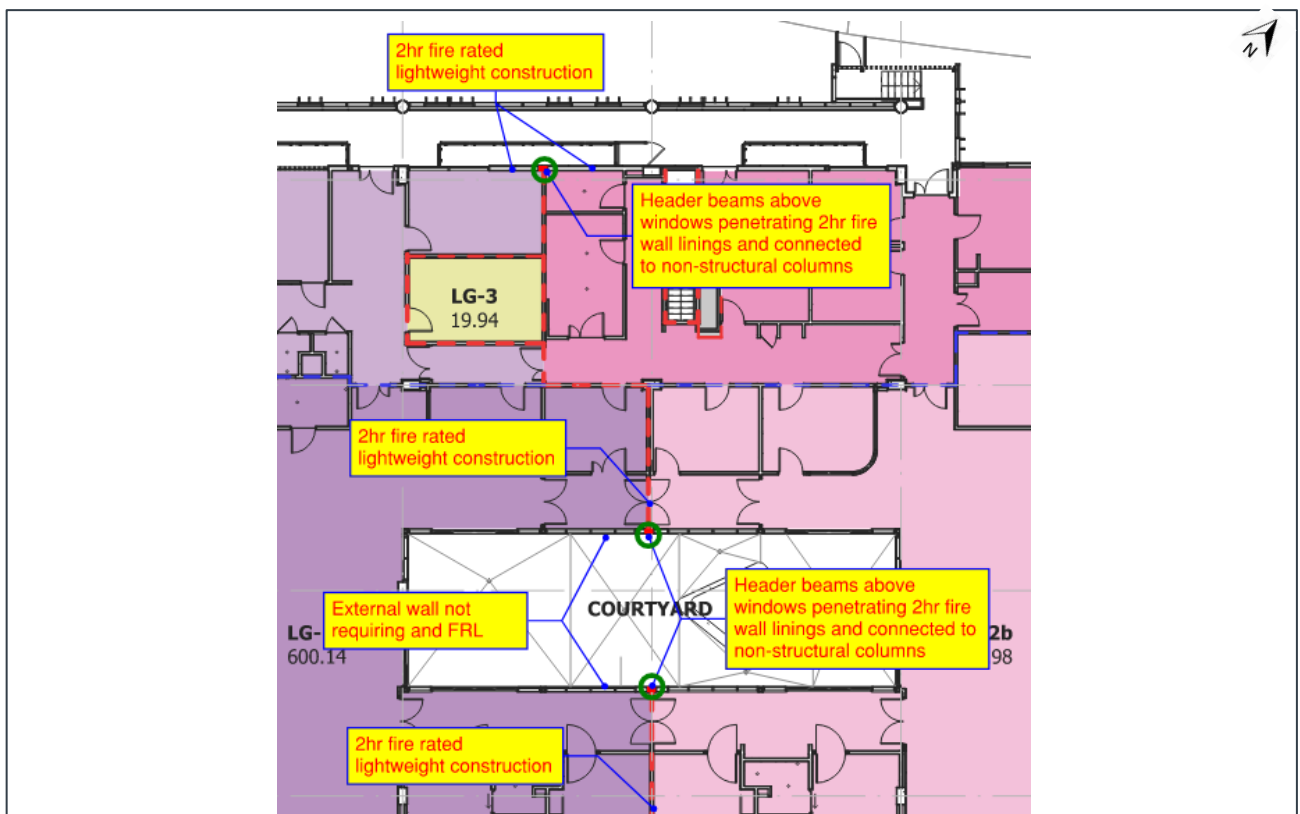


Figure 7-9 Outline of fire walls on structural model indicating steel header beam connections in red (roof structure not shown) – Lower Ground

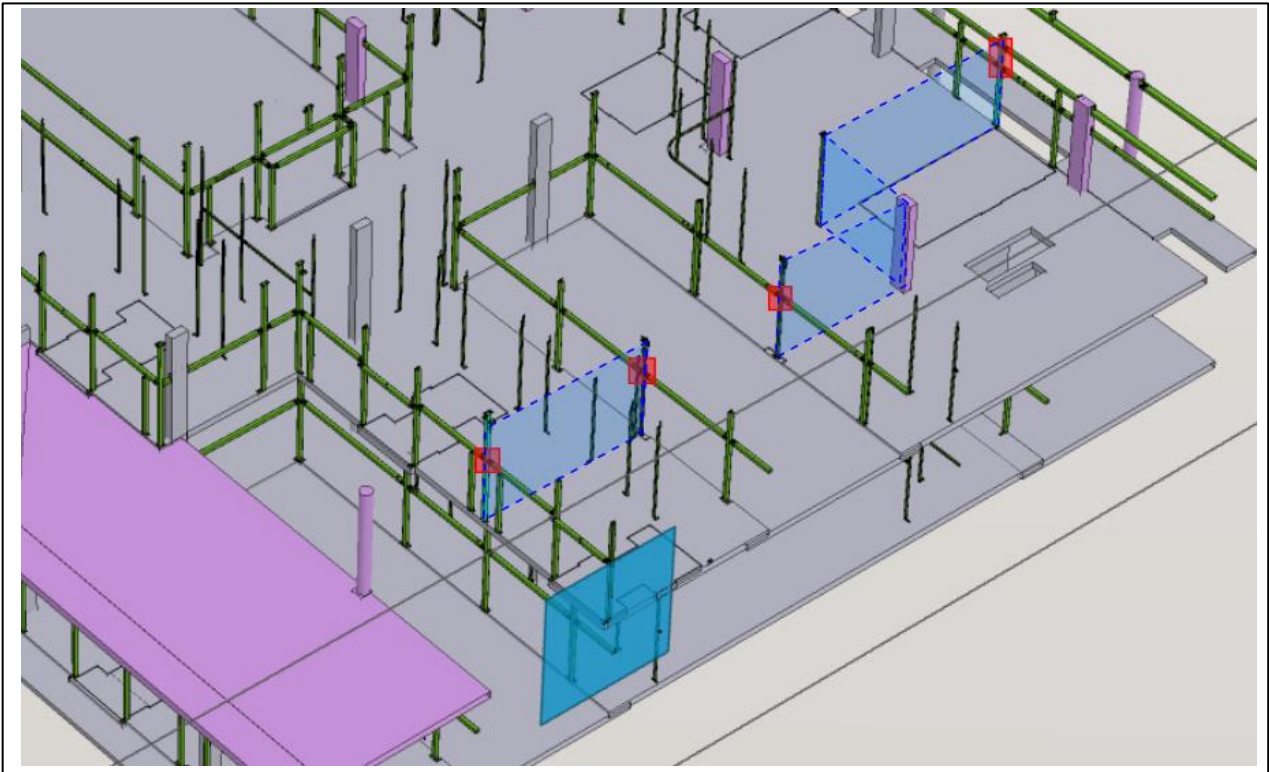
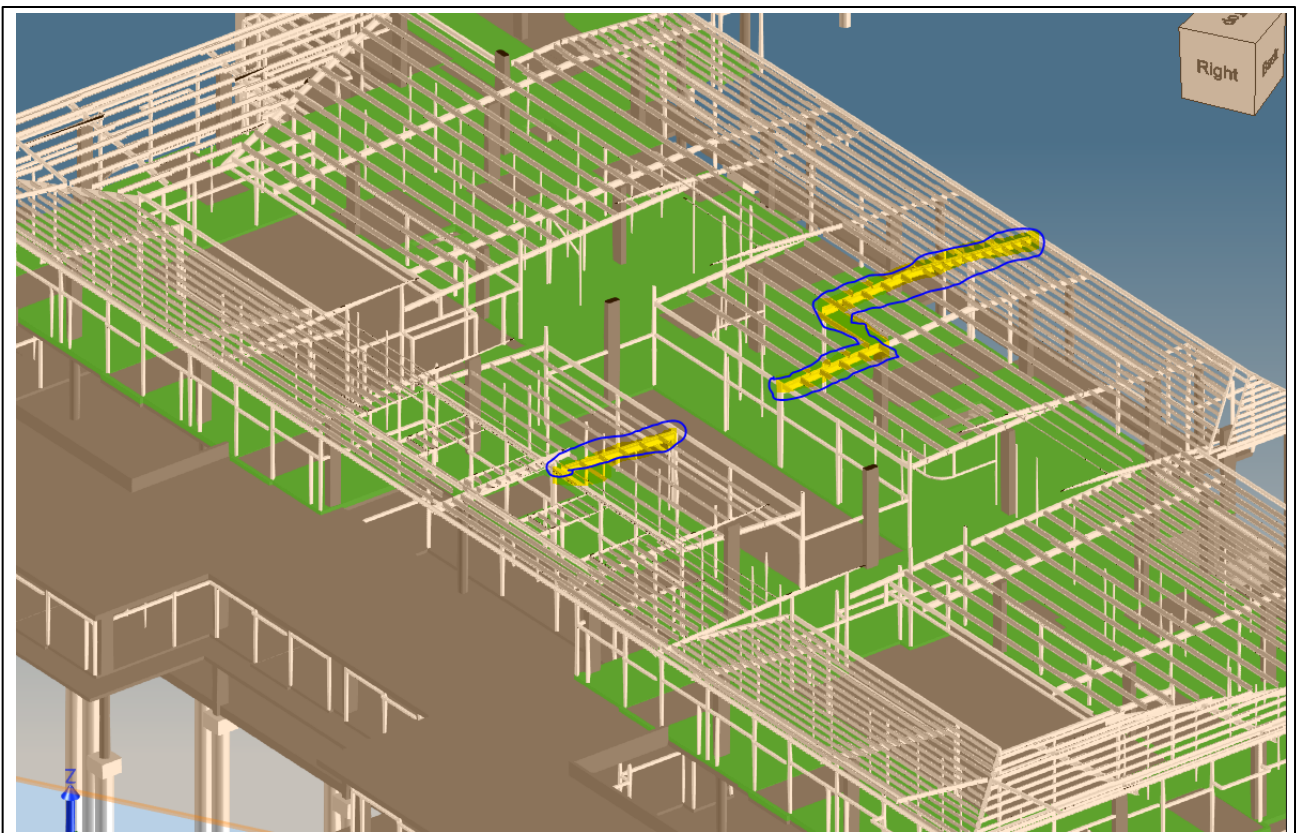


Figure 7-10 Outline of fire wall shown superimposed on roof structure – Lower Ground



As part of the Performance Solution, it is recognised that:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, This is expected to limit the risk of fire spread via heat transfer to the external walls containing the roof supporting columns.
- The building has a smoke detection and alarm system installed in accordance with AS 1670.1. This is expected to provide early notification of a fire to occupants of a fire event, permitting early evacuation from the fire effected compartment. Additionally, early fire brigade notification is expected via the Alarm Signalling Equipment.

Note: The roof is not fire rated, due to the concession applied for a non-combustible roof covering and sprinkler protection.

### 7.3.3 Assessment

NCC DtS Clause C2.7 requires that a fire wall must have the required FRL as prescribed under NCC Specification C1.1, and building elements, other than roof battens with dimensions 75 mm x 50 mm or less must not pass through or cross the fire wall unless the required fire-resisting performance of the fire wall is maintained. The intent of NCC DtS Clause 1.1, as stipulated by the Guide to the NCC, is to establish the minimum fire-resisting construction required for Class 2 to Class 9 buildings and Specification C1.1 is used to clarify the requirements for fire-resisting construction of building elements.

By achieving the Fire Resistance Levels (FRLs) and other requirements stipulated in Clause 3.1 and Table 3 of Specification C1.1, it is considered that an acceptable degree of separation and structural stability is provided to reduce the potential, to the degree necessary, for fire spread and structural failure.

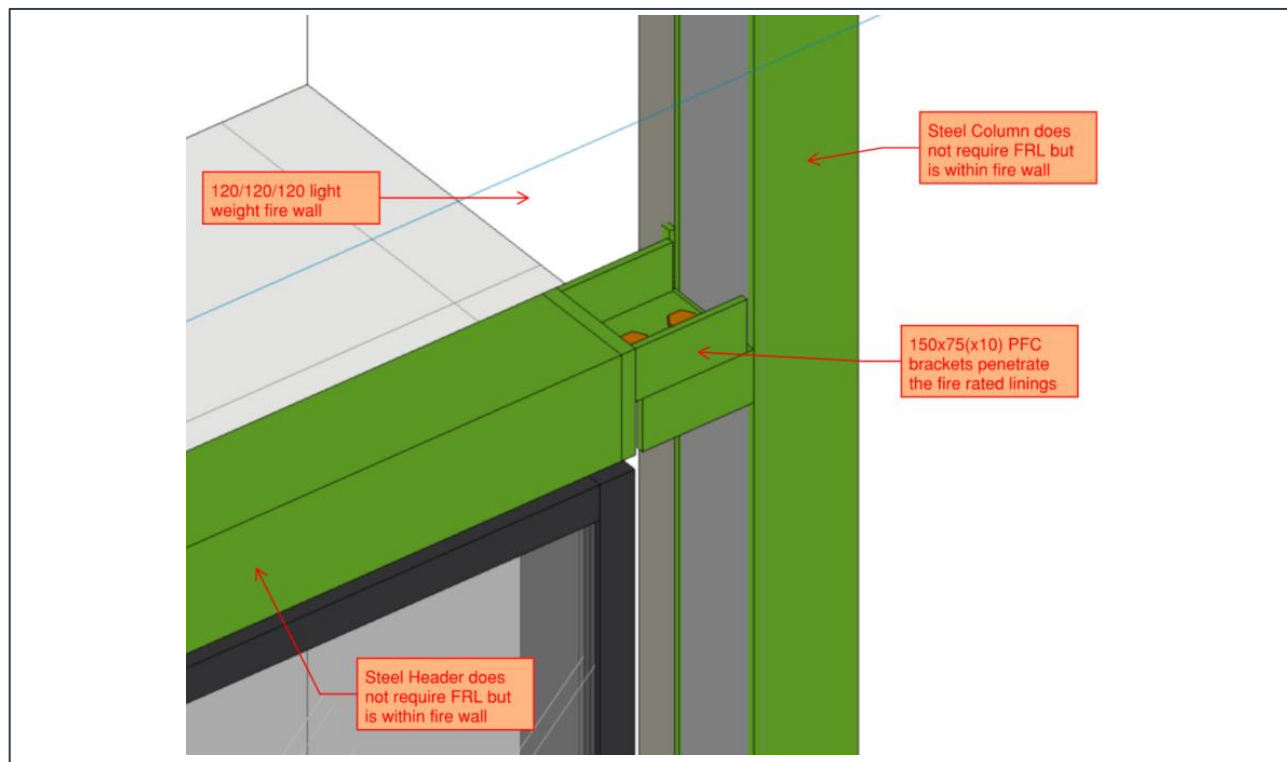
Performance Requirements CP2 and CP8, as stipulated by the Guide to the NCC and in context to the Performance Solution, deal with the building's exposure to a fire in another building and/or the risk of fire spreading via openings within building elements. A building must have in-built safeguards to prevent the spread of fire:

- from one part of the building to another
- to allow sufficient time for the occupants to safely evacuate (i.e. the occupants may be asleep and will take some time to evacuate the building)
- to allow the Fire Brigade to undertake search and rescue, if necessary, and fire-fighting operations.

In the SMHRU building, the structural parts of the building are reinforced concrete, except for some steel columns supporting the steel roof structure on the Lower Ground Level. Compartmentation is achieved by utilising lightweight construction, which consists of a steel frame encapsulated in fire rated plasterboard to achieve the required FRL between adjacent compartments.

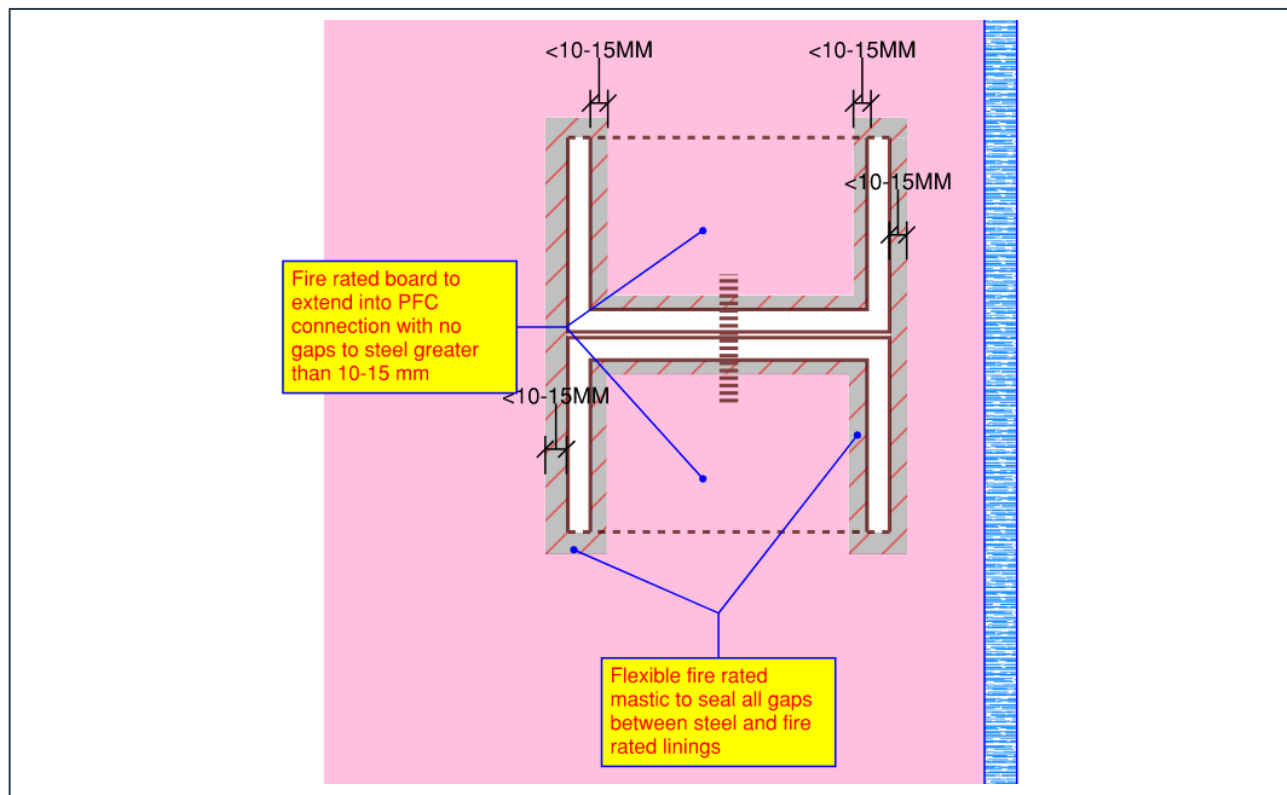
There are some instances where steel header beams supporting the framing of windows and doors are connected to the steel columns incorporated in the fire walls as indicated in Figure 7-6 to Figure 7-10. Due to the connection to the columns, the beams penetrate the fire rated plasterboard lining. The beam-to-column connection is formed by two parallel flange channels (PFCs) bolted together where one PFC is welded to the header beam and one is welded to the column as shown in Figure 7-11. The largest connections comprise of 150 PFC sections.

**Figure 7-11 Steel header beams penetrating through the fire rated plasterboard lining**



As part of the Performance Solution, it is proposed that the parallel flange channel (PFC) connections need not be protected, but fire-rated plasterboard lining of the fire wall must be profiled so that there is only a 10 mm – 15 mm gap between the plasterboard and the PFC connections as shown in Figure 7-12. The gaps must be filled with a flexible fire rated mastic to form a fire seal in accordance with a tested system. As the beams are embedded within the external walls, they are provided with a degree of protection (i.e. window frames from the bottom and architectural lining from inside and outside).

Figure 7-12 Steel header beam connection to the columns detail



Since the header beams are unprotected, they will heat up in the event of a fire. The unprotected steel header beams connecting to the columns within the fire wall could then potentially impact the stability/integrity of the fire walls if in a fire event the header beams:

- deflect and impose lateral loads on the columns so that the fire wall deflects significantly, or
- conduct sufficient heat into the column to reduce its loadbearing capacity so that it cannot sustain the imposed load, or
- conduct sufficient heat from one side of the fire wall to the other side such that the temperature of the header beam on the unexposed side is high enough to ignite combustibles in contact with the beam.

As the building is sprinkler protected, the header beams would not be expected to be heated to any significant temperature that could cause any of the failure mechanisms outlined above, as the sprinkler system would be expected to control the fire such that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200°C for a fire sprinkler shielded fire [6] [7].

Nevertheless, for robustness the low probability event of sprinkler failure will also be considered.

### Insulation

With regards to whether conductive heat transfer through the unprotected header connections could cause the temperature of the unprotected header on the other side of the fire wall to be raised beyond the ignition temperature of ordinary combustibles, it is noted that the headers are enclosed within the external wall construction which is required to be non-combustible except for localised plastic packers as discussed in Section 7.4. As such, the headers would not be in direct contact with any combustibles other than potentially plastic packers. As highlighted in Section 7.4, the surface temperature of the steel header on the unexposed side would need to be greater than 300°C before the plastic packers could be ignited.

Fire testing has been conducted by the Centre for Environmental Safety and Risk Engineering (CESARE) of Victoria University to determine the temperature of unprotected steel members passing through fire walls [10]. Fire tests were performed with steel plates of 2 mm, 8 mm and 12 mm thickness passing through lightweight fire rated steel stud plasterboard walls. Fire rated plasterboard walls with stud depths of 92 mm and 150 mm and lined on both sides with either one or two layers of 16 mm thick fire rated plasterboard achieving FRLs of 60 minutes, 90 minutes and 120 minutes were tested. One fire test was also conducted with 12 mm thick steel plates connected to a beam imbedded within the fire rated plasterboard wall.

The fire testing found as expected that a thicker steel plate conducts more heat through the fire wall than a thinner steel plate. The 150 PFC sections used for the steel header connections have a web thickness of 6 mm and a flange thickness of 9.5 mm. The test results with the 12 mm thick plate would therefore provide a conservative estimate of temperature of the steel header beams on the unexposed side. The test with a 150 mm stud wall lined with 2 x 16 mm fire rated plasterboard on both sides recorded a temperature of 201°C on the 12 mm steel plate on the unexposed side. Furthermore, with the steel plates connected to the steel beam embedded in the fire wall, the temperature of the steel plate on the unexposed side reduced to 115°C, indicating that the beam acts as a significant heat sink. As these temperatures are significantly lower than would be required to ignite ordinary combustibles, it is concluded that the steel header beam connections would not be expected to cause fire spread across the fire wall.

## **Stability and Integrity**

### **Basement Level**

At Basement Level, the steel columns incorporated in the fire walls are understood to be non-loadbearing (concrete columns support the Lower Ground slab). The steel header beams that connect into the columns in the fire wall provide rigidity to the façade glazing.

It is noted that the columns are connected at the top and the bottom to concrete slabs, which provide restraint from lateral movement. The connections are passively fire protected. Furthermore, except for two instances indicated by 'A' and 'B' in Figure 7-6 and Figure 7-7, there are steel header beam connections on both side of the fire wall. Therefore, if the steel header on one of the fire wall collapse or deflect excessively, the cold steel header on the unexposed side and the connections at the top and bottom of the columns would not be expected to unduly cause the columns to deflect an affect the stability or integrity of the fire wall.

In the case of column 'A' in Figure 7-6 and Figure 7-7, there is a protected steel header within the fire wall that will oppose any force exerted by the unprotected steel header. In the case of column 'B', it is noted that the column is connected to the adjacent corner column via a header beam inside the fire wall. These connections, together with the top and bottom restraint of the columns would resist deflection of the columns and fire wall. As such, the unprotected steel header connections would not be expected to unduly cause the columns to deflect an affect the stability or integrity of the fire wall.

### **Lower Ground**

From Figure 7-8 to Figure 7-10 it is seen that the unprotected steel header beams are connected to both sides of the columns within the fire walls. The fire walls are also connected to the concrete floor and to protected rafters incorporated in the fire wall at the top. As such, failure of the steel headers on one side of the fire wall would not be expected to unduly impact the stability or integrity of the fire wall as the cold steel on the other side would provide lateral restraint to the fire wall. This scenario is in accordance with Clause 2.2(b)(iv) of NCC Specification C1.1 which states that an element providing lateral support to a fire wall or fire-resisting wall need not be protected, provided the wall is supported on both sides and failure of the element on one side does not affect the fire performance of the wall.

Since the steel columns embed in the fire wall support the roof and are loadbearing, it is necessary to consider whether the heat conducted via the steel header beams connections into the steel columns within the fire wall could raise the temperature of the steel to a point where it can no longer support the applied load.

In the fire testing undertaken by CESARE, the temperature of the steel stud and temperature of the air within the cavity of the 150 mm stud fire rated plasterboard wall was measured to be 410°C and 450°C respectively at 120 minutes. Without the steel connections, the column temperature would be expected to be lower than this value due to the thermal mass of column. The steel beam connections would however be expected to increase the column temperature locally at the connection as a result of conductive heat transfer, but a significant temperature increase would not be expected considering that heat will be conducted and dissipated along the length of the column in the fire wall, and heat will also be conducted out through the header connection on the unexposed side.

Furthermore, the gravity load on the columns supporting the roof only is typically ~0.25 of the ultimate capacity of the frame under gravity loads [10]. This means that temperatures greater than 650°C will be required within the columns to cause stability issues. As this temperature is significantly higher than would be expected, the structural stability of the columns is unlikely to be unduly affected by the steel header beam connections.

#### **7.3.4 Conclusion**

Based on the above assessment, it is considered that not providing protection to the steel header beam connections to the columns within the fire walls, will not unduly impact the performance of the fire wall, nor impact the risk of fire spread to the degree necessary.

Therefore, it is considered that the Performance Requirements CP1, CP2, CP3 and CP8 are satisfied.

## 7.4 Plastic Packers within Façade

### 7.4.1 Introduction

The following assessment addresses Departure Item '4'.

| DtS Clause           | C1.9                                                                                                                                                                                                              | Performance Requirements | CP2, CP4 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|-----------------------------------------------|----------------------|
| Description          | Packers forming part of the façade system permitted to made of plastic, which are deemed combustible material, in lieu of non-combustible.                                                                        |                          |          |                                               |                      |
| Hazards              | The primary hazard is the potential for the ancillary combustible elements to facilitate external spread of fire, potentially defeating aspects the building's fire safety strategy.                              |                          |          |                                               |                      |
| Analysis Methodology | Qualitative assessment method based on the risk of fire spread via the extremal wall system of the building due to the isolated combustible elements (i.e. plastic packers).                                      |                          |          |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the allowance of the isolated combustible elements (i.e. plastic packers) within the façade will not unduly impact on the risk of fire spread via the external wall system. |                          |          |                                               |                      |

### 7.4.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to assist in limiting fire spread beyond the fire source feature.
- Packers must be installed in accordance with the manufactures specification.
- The remainder of the external wall construction must be non-combustible materials in line with the NCC DtS provisions.

As part of the Performance Solution, it is recognised that:

- Packers installed within confined spaces between two (2) non-combustible elements i.e. between the glass surfaces and aluminium curtain walls or steel frame and top hat.
- The risk of fire exposure is low.

### 7.4.3 Assessment

In a building of Type A or Type B construction, NCC DtS Clause C1.9 requires external walls (including all components incorporated in them including the façade covering, framing and insulation), the flooring and floor framing of lift pits, and non-loadbearing internal walls that are required to be fire rated must be constructed of non-combustible materials.

The intent of the NCC DtS Clause C1.9, as stipulated by the Guide to the NCC, is to specify the non-combustibility for building elements and to permit the use of certain materials that are known to provide acceptable levels of fire safety where an element is required to be non-combustible.

It is recognised that under NCC 2019 the DtS Provision C1.9(a) requirements does not include concessions for isolated construction packers such as plastic packers used for levelling window frames at fixing joints. However, the current NCC 2022 Provision C2D10(4)(i)(i), as shown in Figure 7-13, includes concessions for elements and minor ancillary items forming part of an external wall, and packers are include under the concessions.

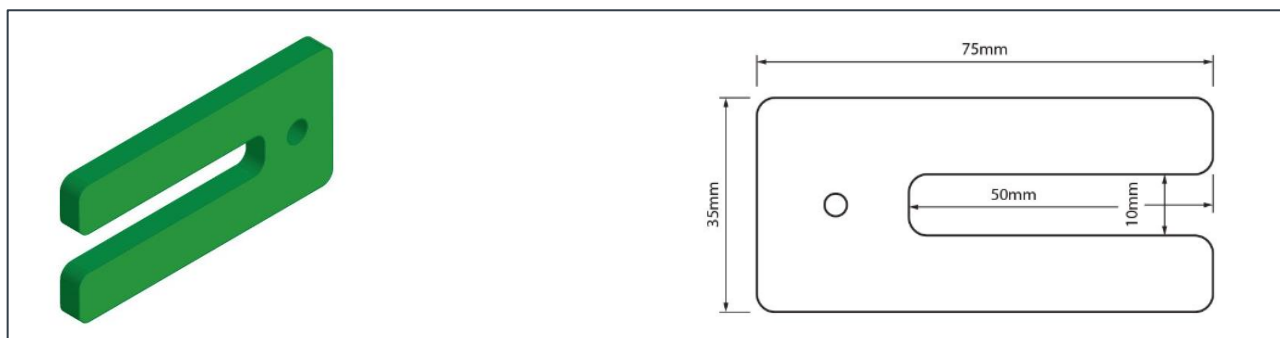
Figure 7-13 Extract from NCC 2022

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------|
| C2D10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Non-combustible building elements | [2019: C1.9] |
| <p>(1) In a building <i>required</i> to be of Type A or B construction, the following building elements and their components must be <i>non-combustible</i>:</p> <p>(a) <i>External walls and common walls</i>, including all components incorporated in them including the facade covering, framing and insulation.</p> <p>(b) The flooring and floor framing of lift pits.</p> <p>(c) <i>Non-loadbearing internal walls</i> where they are <i>required</i> to be <i>fire-resisting</i>.</p> <p>(2) A <i>shaft</i>, being a lift, ventilating, pipe, garbage, or similar <i>shaft</i> that is not for the discharge of hot products of combustion, that is <i>non-loadbearing</i>, must be of <i>non-combustible</i> construction in—</p> <p>(a) a building <i>required</i> to be of Type A construction; and</p> <p>(b) a building <i>required</i> to be of Type B construction, subject to C3D11, in—</p> <p>(i) a Class 2, 3 or 9 building; and</p> <p>(ii) a Class 5, 6, 7 or 8 building if the <i>shaft</i> connects more than 2 storeys.</p>                                                                                                                                                  |                                   |              |
| NCC 2022 Volume One - Building Code of Australia (1 May 2023)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   | Page 110     |
| Fire resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   | C2D10        |
| <p>(3) A <i>loadbearing internal wall</i> and a <i>loadbearing fire wall</i>, including those that are part of a <i>loadbearing shaft</i>, must comply with Specification 5.</p> <p>(4) The requirements of (1) and (2) do not apply to the following:</p> <p>(a) Gaskets.</p> <p>(b) Caulking.</p> <p>(c) Sealants.</p> <p>(d) Termite management systems.</p> <p>(e) Glass, including laminated glass, and associated adhesives, including tapes.</p> <p>(f) Thermal breaks associated with—</p> <p>(i) glazing systems; or</p> <p>(ii) <i>external wall</i> systems, where the thermal breaks—</p> <p>(A) are no larger than necessary to achieve thermal objectives; and</p> <p>(B) do not extend beyond one <i>storey</i>; and</p> <p>(C) do not extend beyond one <i>fire compartment</i>.</p> <p>(g) <i>Damp-proof courses</i>.</p> <p>(h) Compressible fillers and backing materials, including those associated with articulation joints, closing gaps not wider than 50 mm.</p> <p>(i) Isolated—</p> <p>(i) <u>construction packers and shims; or</u></p> <p>(ii) blocking for fixing fixtures; or</p> <p>(iii) fixings, including fixing accessories; or</p> <p>(iv) acoustic mounts.</p> |                                   |              |

Nonetheless, the following qualitative assessment is undertaken to demonstrate that limited use of combustible plastic packers will not unduly increase the risk of fire spread in the building as well as impact upon the occupants evacuation or fire brigade intervention.

Packers are utilised as a spacer including the installing structural steel framing, CFC, windows, roofing and align the cladding sub-frame. The proposed packers are understood to be 100% polypropylene and therefore considered to be combustible. As such the packers are subject to the Performance Solution under NCC 2019. Typically, the packers are made of polypropylene and have horse-shoe shape with a thickness of up to 10 mm, as shown in Figure 7-14. Assuming the dimensions in Figure 7-14, the total area of a packer is 2.6 cm<sup>2</sup>, which is very small amount of polypropylene.

Figure 7-14 Polypropylene packer



The Cladding Materials Library Database [11] provides data on the peak heat release rate of sarking materials with Polypropylene (92%) is in the order of  $125 \text{ kW/m}^2$  and  $\text{kW/m}^2$  when it is exposed to an incident heat flux of  $35 \text{ kW/m}^2$  and  $80 \text{ kW/m}^2$ . Although the packers are solid polypropylene this data provides some intuition of the potential peak heat release rate when the compound is ignited. The data provided is for a  $1 \text{ m}^2$  sample of thickness  $\sim 0.3 \text{ mm}$ . Multiplying this by a factor of 34 (to achieve the 10 mm thickness of the packers) and accounting for the  $\sim 26 \text{ cm}^2$  surface area of the packer, a peak heat release rate of approximately 19.2 kW (per packer) would be achieved.

Additionally, ignition of the polypropylene requires a received radiant flux of  $>13 \text{ kW/m}^2$ , or material surface temperature of  $344^\circ\text{C}$ . The time for ignition is approximately 48 seconds (with a critical flux of  $35 \text{ kW/m}^2$ ).

In order to become involved in a fire, a pilot flame must first engulf and impinge the façade system which would occur following internal compartment flashover, the occurrence of which would be a direct result of fire sprinkler failure within the compartment of fire origin. In such instance, a heat release rate in the order of 19 kW (per packer) would be insignificant compared to the pilot flame, which would likely be in the hundreds, or thousands of kilowatts (i.e. 3 MW)

The peak release rate from the Cladding Materials Library measurements lasts only a few seconds meaning that consideration of the heat release rates noted above as constants, is particularly conservative, given that the minimum flux for ignition is required to be sustained for around 48 seconds.

Further, it is recognised that the packers installed between the glass surfaces and aluminium curtain walls or steel frame and top hat which is sandwiched between two (2) non-combustible elements. It is considered that exposure of the packer is low.

Given the above assessment, the packers in the restricted quantities are not expected to unduly impact on the risk of fire spread of fire, occupant egress or fire brigade intervention, to the degree necessary.

#### 7.4.4 Conclusion

Based on the above assessment, it is considered that the provision of plastic packers as part of the façade system will not unduly impact on the risk of fire spread within the building, to the degree necessary.

Therefore, it is considered that the Performance Requirements CP2 and CP4 are satisfied.

## 7.5 Plywood Linings

### 7.5.1 Introduction

The following assessment addresses Departure Item '5'.

| DtS Clause           | C1.9, C2.5, Specification C2.5                                                                                                                                                                                                                                                         | Performance Requirements | CP2, CP4 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|-----------------------------------------------|----------------------|
| Description          | Plywood linings to be used for both internal fire-rated walls and internal linings of external walls, in lieu of non-combustible construction.                                                                                                                                         |                          |          |                                               |                      |
| Hazards              | The primary hazard associated with the plywood linings relates to the risk that the combustible material could contribute to fire spread within the wall cavity and potentially lead to fire spread between, smoke compartments or fire compartments both horizontally and vertically. |                          |          |                                               |                      |
| Analysis Methodology | Qualitative and the risk of fire spread between compartments, the ability of occupants to safely evacuate the building and Fire Brigade Intervention.                                                                                                                                  |                          |          |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the lining materials will not unduly impact on the risk of fire spread, the ability of the occupants to safely evacuate the building, or on the ability of the fire brigade to carry out Fire Brigade Intervention.                              |                          |          |                                               |                      |

### 7.5.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to assist in limiting fire spread beyond the fire source feature.
- Plywood linings extend from slab to slab only (i.e. do not continuously span between floors). This is considered to assist in mitigating the risk of fire spread between floors.
- Plywood linings are encapsulated within the wall construction and are provided with an outer lining of plasterboard (i.e. plywood linings are fully encapsulated between non-combustible construction).
- The remainder of the fire wall, smoke wall and external wall construction (except plastic packers permitted in Section 7.3) must be non-combustible materials in line with the NCC DtS provisions.

As part of the Performance Solution, it is recognised that:

- Common ignition sources such as wall sockets and light fittings will be installed in accordance with AS 3000-2007 and where penetrating fire rated construction will be fire sealed in accordance with the NCC DtS Provisions. Therefore, the risk of a fire igniting or being sustained within the wall cavity is considered to be relatively low.

### 7.5.3 Assessment

In a building of Type A or Type B construction, NCC DtS Clause C1.9 requires external walls (including all components incorporated in them including the façade covering, framing and insulation), the flooring and floor framing of lift pits, and non-loadbearing internal walls that are required to be fire rated must be constructed of non-combustible materials. Additionally, in accordance with NCC DtS Specification C2.5 smoke-proof walls required by C2.5 in Class 9a health-care buildings are required to be constructed from non-combustible materials. Given the building is a Class 9a health-care building that is required to comply with the requirements for Type A construction, the above non-combustibility requirements apply to the subject building. The intent of these provisions is to limit the risk of fire spread to exits, within a building and between buildings as a result of a particular building element.

It is recognised that the building is a secure mental health rehabilitation unit, and therefore the walls are required to be constructed from robust materials to assist in providing impact resistance within the facility. As part of this design intent, the internal walls including fire walls, smoke walls and internal linings of external walls are proposed to be provided with plywood linings. This means that the construction of these walls is not entirely non-combustible and therefore does not comply with the requirements of NCC DtS Clause C1.9 and Specification C2.5. The primary hazard associated with the proposal relates to the risk that the combustible material could contribute to fire spread within the wall cavity and potentially lead to fire spread between smoke compartments or fire compartments both horizontally and vertically. Therefore, the following qualitative assessment discusses the proposed mitigating measures implemented to demonstrate that the risk of fire spread between compartments is not unduly impacted.

Except where discussed in this document, it is recognised that the building is required to be provided with a fast response fire sprinkler system throughout. It is generally acknowledged that fast response fire sprinklers will activate in the early stages of the fire to either control or suppress a fire. Research conducted by CIBSE [6] and Warrington [7] shows that the upper layer temperatures are not likely to exceed 100°C during a fire sprinkler-controlled fire and 200°C for a fire sprinkler shielded fire. The sprinkler system is therefore expected to cool the upper smoke layer, wet adjacent combustibles and partitions helping to prevent the fire from spreading beyond the area of origin. This is also expected to reduce the risk of the plywood lining becoming involved in a fire event and therefore reduce the risk of fire, smoke and external walls being compromised and therefore assist in mitigating the risk of the fire walls, smoke walls and internal linings of external walls becoming involved in a fire event.

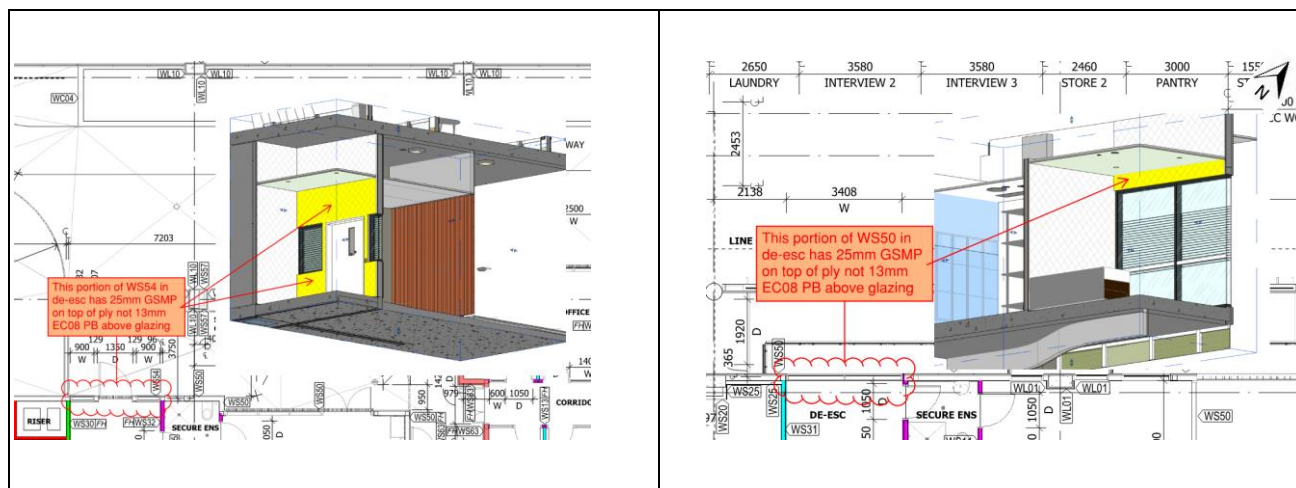
As part of the Performance Solution, the plywood linings are required to be encapsulated by non-combustible construction. The subject outer lining of the wall is plasterboard, and in most cases is understood to be either fire rated plasterboard or EC08 Impact MR plasterboard (or similar). In a tested system these products are capable of achieving an FRL [12]. Although a single layer does not explicitly provide an FRL, in the early stages of a fire and prior to fire sprinkler activation, it is considered that it will provide some initial fire protection to the plywood lining. As such the risk of the plywood lining being subject to direct flame impingement in the early stages of a fire is considered to be low.

It is understood that there are two de-escalation rooms on Lower Ground and Basement 1 that are required to have Gold Medal Safety Padding attached to the internal linings of external walls. The manufacturer installation requires that the Gold Medal Safety Padding is to be fixed directly to the plywood. This means that either fire rated plasterboard or EC08 Impact MR plasterboard (or similar) will not be provided.

Due to the use of these rooms the fire load within them is very low, with the rooms being absent the normal furniture that would be associated with a patient room or an office. Additionally, the walls (in particular the external wall) will not have GPOs (power points) or other electrical ignition sources installed within them. Therefore the fire hazard associated with these rooms is considered to be low to very low. It is noted that the plywood in these areas, as with that in other parts of the building, will only extend from slab to slab (i.e. it does not span across multiple levels).

Given the location of quantity of the product and the function of the rooms as shown in Figure 5-1, in addition to the sprinkler system and the low fire hazard within these rooms, not providing the fire rated plasterboard or EC08 Impact MR plasterboard (or similar) is not considered to increase the risk of fire spread within the wall cavity and potentially lead to fire spread between, smoke compartments or fire compartments both horizontally and vertically.

**Figure 7-15 De-escalation rooms on Lower Ground (left) and Basement 1 (right)**



Common ignition sources as wall sockets and light fittings are also required to be installed in accordance with AS 3000-2018, and where there are penetrations through the fire rated or smoke proof construction, they will be fire and smoke sealed in accordance with the NCC DtS Provisions. Therefore, the risk of a fire igniting or being sustained within the wall cavity that could result in direct flame impingement on the internal plywood linings is considered to be relatively low.

In addition to the above, it is recognised that the walls (including external walls) extend from slab to slab only and do not span more than a single storey. In accordance with the requirements for Type A construction the floors are required to achieve an FRL not less than 120 minutes. This is considered to provide fire separation between each level and therefore limit the risk of fire spread between floors, to the degree necessary. The provision of plywood linings is therefore considered to not unduly impact on the risk of fire spread between floors.

## 7.5.4 Conclusion

Based on the above assessment, it is considered that the provision of plywood linings within smoke walls, fire walls and internal linings of external walls will not unduly impact on the risk of fire spread within the building, to the degree necessary.

Therefore, it is considered that the Performance Requirement CP2 is satisfied.

## 7.6 Fire and Smoke Compartmentation

### 7.6.1 Introduction

The following assessment addresses Departure Items ‘6’ and ‘7’.

| DtS Clause           | C2.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Performance Requirements | CP2, CP3, DP4 and EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------|-----------------------------------------------|----------------------|
| Description          | Smoke compartments within the Class 9a Ward Areas to be as follows: <ul style="list-style-type: none"><li>— Up to 640 m<sup>2</sup> in lieu of 500 m<sup>2</sup>.</li><li>— Smoke proof construction and achieve an inherent FRL, in lieu of being fire rated to achieve 60/60/60.</li></ul> Doors within the walls forming part of the smoke compartmentation walls to be solid core smoke doors, in lieu of achieving -/60/30 FRL.                                                                                                                                                                        |                          |                         |                                               |                      |
| Hazards              | The primary hazard associated with increasing the smoke compartment size relates to the potential for an increase in occupant numbers in smoke compartments and increase in resultant evacuation time. Occupants within the smoke compartment of fire origin could therefore be exposed to potentially hazardous conditions.<br><br>The primary hazard associated with providing smoke proof construction where 60-minute fire rated construction is required relates to the risk that the wall does not maintain integrity for the required duration which could lead to fire spread between compartments. |                          |                         |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the risk of fire spread between compartments, the ability of occupants to safely evacuate the building and Fire Brigade Intervention.                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |                         |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the increase in smoke compartment size and rationalisation of door FRLs will not unduly impact on the risk of fire spread, the ability of the occupants to safely evacuate the building, or on the ability of the fire brigade to carry out Fire Brigade Intervention.                                                                                                                                                                                                                                                                                                |                          |                         |                                               |                      |

### 7.6.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is also expected to assist in maintaining tenability conditions, and reduce the risk of fire and smoke spread throughout the building.
- The building is provided with a smoke detection and alarm system throughout to activate the Occupant Warning System and facilitate fire brigade call-out.
- Travel distances to the nearest exits within the increased smoke compartments are in line with the NCC DtS Provisions.
- Due to requirements for impact resistance the wall specifications inherently achieve a 60 minute FRL.
- Doors within the smoke walls are 35 mm solid core doors and compliant with NCC DtS Specification C3.4 Clause 3.
- Vision panel glazing in doors within the smoke walls must meet the specification for glazed vision panels in fire doors as per AS 1905.1.

As part of the Performance Solution, it is recognised that:

- Patient care area (i.e. two hour) fire compartments are less than 1,400 m<sup>2</sup>. As such, while fire rated areas exceed 1,000 m<sup>2</sup> (noting that fire rated areas do not form fire compartments), fire compartment floor areas have been reduced to marginally exceed 1,000 m<sup>2</sup>.
- Egress from the ward compartments will be staff assisted and staff are expected to be awake, alert and aware of their surroundings.
- NCC DtS Table D1.13 states that patient care areas should allow 10 m<sup>2</sup> per person (i.e. extrapolated to equate to approximately 43 occupants per 500 m<sup>2</sup> smoke compartment within a Ward; discounting the travel paths between alternative exits being 1.5 m wide corridor 45 m long).
- Subject smoke compartments have a maximum of 10 bedrooms per smoke compartment and there is expected to be 1 occupant per bedroom (i.e. reduced expected number of occupants when compared to NCC DtS Provisions), therefore evacuation process is expected to be no worse than the NCC DtS compliant design.
- Corridors are primarily circulation space and are expected to contain a low fuel load and negligible ignition sources. Additionally, given corridors form key egress paths they are required to be kept free from obstruction. As such, the likelihood of a fire igniting and being sustained within the corridor in proximity of the rationalised FRL doors is considered to be low.

**Figure 7-16      Basement Level 1 fire and smoke compartmentation (indicative only)**

**Figure 7-17      Lower Ground Level fire and smoke compartmentation (indicative only)**

### 7.6.3      Assessment

NCC DtS Clause C2.5, requires that ward areas within Class 9a buildings, must be divided into floor areas not exceeding 1,000 m<sup>2</sup> by construction achieving an FRL not less than 60 minutes and must be further divided into smoke compartments not exceeding 500 m<sup>2</sup>. Additionally, where division of ward areas into fire rated areas is not required due to the size of the ward areas (i.e. wards do not exceed 1,000 m<sup>2</sup> in floor area), smoke proof walls are required to achieve an FRL not less than 60 minutes. This is in recognition that consumers within Class 9a buildings are often unable to evacuate the building without assistance and therefore the required compartmentation is to allow for the staged evacuation of consumers (i.e. make sure that fire and smoke only affects small areas of the building).

As part of the Performance Solution, the ward smoke compartments on Basement Level 1 and the Lower Ground Level are permitted to be up to 640 m<sup>2</sup>. Additionally, the smoke wall and door construction along the smoke compartment lines is permitted to be smoke proof, in lieu of also achieving an FRL of 60 minutes. Based on the intent of the NCC Clause, it is considered that the primary hazard relates to the potential for an increase in occupant numbers in smoke compartments, which could increase the time taken for staff to evacuate the occupants. This could mean occupants within the smoke compartment of fire origin could be exposed to potentially hazardous conditions. In addition, rationalising the required construction to be smoke proof could lead to an increased risk in fire spread between the smoke compartments. Therefore, the following qualitative assessment demonstrates that the smoke compartment sizes and construction will not unduly impact on the ability of occupants to safely evacuate the building.

### 7.6.3.1 Increased Smoke Compartment Sizes

As part of the Performance Solution, it is recognised that there are only 10 bedrooms per ward and there is expected to be one occupant per bedroom (i.e. 10 consumers per ward). In comparison, NCC DtS Table D1.13 states that patient care areas should allow 10 m<sup>2</sup> per person. This can be extrapolated to equate to approximately 43 occupants per 500 m<sup>2</sup> smoke compartment within a Ward, (discounting the travel paths between alternative exits being 1.5 m wide corridor 45 m long). As such, the number of occupants within the compartment is expected to be significantly less than what could be expected within a NCC DtS 500 m<sup>2</sup> smoke compartment. This is expected to improve the occupant evacuation times within each smoke compartment.

Occupants within the SMHRU building are also considered to be ambulant, and while the evacuation process is controlled and managed by staff, who will instruct and guide occupants to the appropriate exit, occupants are considered to be capable of moving to an exit. In comparison, the requirements of NCC DtS Clause C2.5 with respect to compartment sizes and evacuation are intended to cater for scenarios where occupants are unable to evacuate themselves and are entirely reliant on staff to move them to a place of relative safety. The time taken for consumers within the subject building to evacuate and therefore required physical staff assistance is therefore likely to be improved.

It is also noted that the NCC fire compartmentation requirements are based on minimal on-duty staff being available at any time. However, as part of the evacuation strategy, it is required that there is at least 1 clinical staff member to every 4 consumers present at all times. This is considered to reduce the amount of work that the staff members are required to carry out in an evacuation and such that the staff member is able to keep track of the consumers in an evacuation. The positive benefits of staff assistance are therefore recognised as part of the Performance Solution.

The building is also provided with a fast response fire sprinkler system throughout the building. This is generally expected to control or suppress a fire within the building, therefore cooling the upper layer temperatures and resulting in improved tenability conditions. Additionally, the smoke detection system, is expected to activate the Building Occupant Warning System in the early stages of a fire and provide occupants and staff notification to evacuate the area.

On the basis of the above discussion, and the proposed fire safety measures, it is considered that the smoke compartment sizes will not unduly impact on the ability of occupants to safely evacuate the building.

### 7.6.3.2 Smoke Proof construction

Basement Level 1 and Lower Ground Level are each divided into two fire compartments approximately 1,400 m<sup>2</sup> by a fire wall achieving an FRL not less than 120 minutes. As a result, the ward areas in each compartment are less than 1,000 m<sup>2</sup> and therefore the smoke walls are also required to achieve an FRL of 60 minutes in accordance with NCC DtS Provisions. However, as discussed above, the construction is permitted to be smoke proof.

It is noted that for acoustic and impact reasons, the walls are lined with 13 mm EC08 Impact MR plasterboard (or similar performing product). In accordance with the Redbook [13], a single 13 mm thick layer can achieve an FRL of 60 minutes. It is therefore recognised that the wall build-up will inherently achieve the required FRL. It is also recognised that mastic sealants for smoke sealing penetrations typically also achieve an FRL. As such, it is likely that penetrations through the walls (e.g. cable trays etc) will inherently achieve an FRL. Nevertheless, penetrations through the smoke walls are expected to be minimal. As such, the performance solution relates primarily to the construction of the smoke doors.

The smoke doors are required to be solid core doors with a minimum thickness of 35 mm. Similarly vision panel glazing in doors within the smoke walls is required to meet the specification for glazed vision panels in fire doors. These provisions are considered to provide enhanced levels of fire resistance to the doors. Nevertheless, it is recognised that the smoke doors are located within corridors, which are primarily circulation spaces. Additionally, all corridors form key egress paths and therefore they are required to be kept free from obstructions. The fuel load within the corridors is therefore expected to be low. There are also no major ignition sources within the corridor. The likelihood of a fire igniting and being sustained within the corridors is considered to be low. As such, the risk of the smoke proof construction being compromised is considered to be low.

It is also recognised that, except as addressed in Section 7.17, the building is provided with a fast response fire sprinkler system. Fast response fire sprinklers are generally acknowledged to control or suppress a fire with evidence [14] [7] suggesting the following when sprinklers operate as designed and appropriate to the hazard:

- Sprinklers control fire size (if not suppressing the fire) and limit fire spread by wetting adjacent combustibles.
- Sprinklers are expected to reduce the smoke temperature to 100°C – 200°C in the vicinity of the fire, and remote from the fire to temperatures below the sprinkler activation temperature of 68°C. Smoke buoyancy and the propensity of smoke spread are therefore reduced.
- The temperature and toxicity of smoke is greatly reduced in a sprinkler controlled fire.

As such, by cooling the areas within proximity of the fire and limiting fire spread beyond the immediate fire seat, it is considered that the risk of the smoke proof construction being compromised is low.

#### **7.6.4 Conclusion**

Based on the assessment and the required Fire Engineering Provisions, it is considered that the smoke compartment provisions will not unduly impact on the risk of fire spread within the building, the ability of occupants to safely evacuate the building or on fire brigade intervention.

Therefore, it is considered that the Performance Requirements CP2, CP3, DP4 and EP2.2 are satisfied.

## 7.7 Fire boxes (Wall boxes)

### 7.7.1 Introduction

The following assessment addresses Departure Item '9'.

| DtS Clause           | C3.5                                                                                                                                                                                                                                                    | Performance Requirements | CP2, CP8 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|-----------------------------------------------|----------------------|
| Description          | Permit data cables to be housed within firebox that are installed within fire rated walls, in lieu of firebox being in accordance with the tested system.                                                                                               |                          |          |                                               |                      |
| Hazards              | The hazard associated with the use of fireboxes for data cables within fire rated wall that is not strictly as per the tested system is that the fire resistance of the wall may be impacted, therefore facilitate fire spread across the fire barrier. |                          |          |                                               |                      |
| Analysis Methodology | Qualitative analysis based on the risk of fire spread.                                                                                                                                                                                                  |                          |          |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the use of fireboxes for data cables within fire rated walls will not unduly impact on the risk of spread of fire.                                                                                                |                          |          |                                               |                      |

### 7.7.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- All other aspects of the fire-rated wall must comply with the tested system, except the items covered within this FER (i.e. limited timber noggins and wiring are permitted within the fire-rated walls) as detailed in Section 7.3 and 7.5.
- The remainder of the external wall construction must be non-combustible materials in line with the NCC DtS provisions.

As part of the Performance Solution, it is recognised that:

- The building be provided with a fast response fire sprinkler system throughout. This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to assist in limiting fire spread beyond the fire source feature.

### 7.7.3 Assessment

As stated above, BCA DtS Provision C3.15 requires services, building elements and any protection method at a penetration to be identical with a prototype assembly of the service, building element and protection method which has been tested in accordance with AS4072.1 and AS 1530.4 and has achieved the required FRL or resistance to the incipient spread of fire.

In absence of testing to confirm the presence data cables within the fireboxes instead of electrical cables as per the tested system does not unduly impact on the risk of fire spread between fire compartments, to the degree necessary, it is proposed to provide a fire engineering assessment.

The hazard associated with the services (i.e. data cables) penetrating a fire-rated wall not strictly as per the tested system is that the penetration and presence of the data cables may impact the fire resistance of the fire wall, therefore facilitating fire spread between fire compartments.

Whilst the proposed variations to the tested system are minor (i.e. presence data cables within the fireboxes instead of electrical cables made of copper), the FRL of the wall system is considered to be compromised. However, if the wall system with the proposed variations were to be tested, the wall system would likely to achieve the required FRL.

It is recognised that although the type of the cable varies from the tested system, the overall fuel load and fire exposure via the penetration is likely to be consistent with the tested system. Given the data cables are not live (i.e. carrying high voltage), the risk of spark or ignition within the wall cavity is considered low.

As mentioned above, the building be provided with a fast response fire sprinkler system throughout. As such it is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. This is expected to assist in limiting fire spread beyond the fire source feature.

When a fire sprinkler system activates within a room of fire origin, not only is the heat release rate of the burning fuel reduced or controlled to a relatively small level, but the gas temperature inside the room can be reduced or maintained due to the cooling effect of water spray. Damage to the fire rated plasterboard barriers due to the fire is considered likely to be minimal and the risk to life safety is low. Therefore, the impact of a fire that is controlled by fire sprinkler activation is considered to be relatively minor.

Moreover, the temperatures developed by the time the fire sprinklers activate are unlikely to cause any damage to fire rated barriers or structural elements to the extent that this would lead to structural distress or even failure.

Given the fireboxes are embedded within a fire rated partition wall, the fireboxes are protected with fire rated plasterboard. Further, the installation of the fireboxes will be in accordance with the tested system, where the cable penetrations will be sealed with fire rated sealant and as such the initial risk of fire and smoke spread is considered to be low.

As per the manufacturer's details, the fireboxes are also provided with intumescent pads. In the event of a large fire or a localized fire near the penetrations, the intumescent pad within the box is expected to expand and seal the gap around cable penetrations and any void from the failure of the cables. This configuration is considered likely to restrict fire spread via the cable penetration. Refer to Appendix H for the fire assessment report.

#### **7.7.4 Conclusion**

Based on the above assessment, the provision of the sprinkler system, the fire rated sealant and intumescent, the presence of the data cables is not considered to increase the risk of fire spread through the wall or unduly impact the risk of fire spread of fire, occupant egress or fire brigade intervention, to the degree necessary.

Therefore, it is considered that the Performance Requirements CP2 and CP8 are satisfied.

## 7.8 Exit Travel Distances

### 7.8.1 Introduction

The following assessment addresses departures Item '10'.

| DtS Clause           | D1.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Performance Requirements | DP4, EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|-----------------------------------------------|----------------------|
| Description          | <p>Exit travel distance to be as follows:</p> <p><b><u>Level B2</u></b></p> <ul style="list-style-type: none"><li>— To the nearest exit where travel in different directions to two exits is available to be not more than 45 m, in lieu of 40 m, refer Figure 7-18.</li></ul> <p><b><u>Level B1</u></b></p> <ul style="list-style-type: none"><li>— To a point from which travel in different directions to two exits is available to be not more than 13 m from the Secure Court, in lieu of 12 m, refer Figure 7-19.</li><li>— To the nearest exit where travel in different directions to two exits is available to be not more than 39 m from the family visiting courtyard, in lieu of 30 m, refer Figure 7-19.</li></ul> <p><b><u>Level LG</u></b></p> <ul style="list-style-type: none"><li>— To the nearest exit where travel in different directions to two exits is available to be not more than:<ul style="list-style-type: none"><li>— 33 m from the western external walkway, refer Figure 7-20</li><li>— 36 m to external stairs accessed via the external walkway, refer Figure 7-21, in lieu of 30 m.</li></ul></li></ul> |                          |            |                                               |                      |
| Hazards              | <p>The primary hazard associated extended travel distances relates to the risk that occupants are required to travel a greater distance (than that permitted in the NCC DtS Provisions) in order to reach the exit, potentially increasing the time to reach an exit and potential increased risk of exposure to untenable conditions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |            |                                               |                      |
| Analysis Methodology | <p>Qualitative analysis method based on the safe evacuation of building occupants.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                          |            |                                               |                      |
| Acceptance Criteria  | <p>Acceptance will be demonstrated where the increase in exit travel distance will not unduly impact on the ability of the occupants to safely evacuate the building.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                          |            |                                               |                      |

### 7.8.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, it is recognised that:

- Building Wide:
  - The building is provided with a fast response fire sprinkler system throughout, which is expected to control or suppress a fire within the building.
  - Evacuation routes be kept clear of obstruction.
- Basement Level 2:
  - Occupants on Basement Level 2 are expected to be primarily maintenance personnel who are not expected to have any relevant physical or mental impairments and are expected to be alert awake and aware of their surroundings. Such occupants are expected to respond relatively quickly in the event of a fire.

- Basement Level 2 is only expected to be intermittently occupied and when occupied the number of occupants is expected to be very low.
- The Basement Level 2 undercroft is a naturally ventilated space, such that any smoke and hot gases from a fire event are expected to vent directly to the atmosphere.
- Basement Level 1 Secure Court:
  - Consumers are expected to be ambulant and capable of evacuating with staff direction (e.g. typical Class 9a occupant characteristics are not necessarily applicable to consumers).
  - Travel distance increase is minor (~1 m), which is expected to have negligible impact on the time taken for occupants to reach a point of choice:
  - Occupants within the secure court are expected to be supervised by staff members, who are alert awake and aware and able to assist occupants in evacuating the area quickly.
- Basement Level 1 Family Visiting Courtyard:
  - Consumers are expected to be ambulant and capable of evacuating with staff direction (e.g. typical Class 9a occupant characteristics are not necessarily applicable to consumers).
  - The family visiting courtyard is located in the Basement Level 1 undercroft, which is a naturally ventilated space consisting primarily of landscaping and walkways.
  - The undercroft is expected to contain a relatively low fuel load and negligible ignition sources (i.e. likelihood of fire igniting and being sustained is expected to be low).
  - In the unlikely event of a fire smoke and hot gases are expected vent directly to the atmosphere, such that development and descent of a smoke layer is expected not to occur.
- Lower Ground Level Western External walkway:
  - The walkway is expected to contain a relatively low fuel load and negligible ignition sources (i.e. likelihood of fire igniting and being sustained is expected to be low).
  - In the unlikely event of a fire smoke and hot gases are expected vent directly to the atmosphere, such that development and descent of a smoke layer is expected not to occur.
- Lower Ground Level External Stairs
  - The external walkway is not enclosed (i.e. effective place of relative safety)
  - Travel to the doors leading to the external walkways leading to Stair 2 and Stair 3 being not more than 30 m.
  - Evacuation strategy is to evacuate consumers into a non-fire-affected compartment in the first instance, as such occupants are expected not to be located on the external walkway in the event of a fire within a bedroom near the walkway.

### 7.8.3 Assessment

To enable occupants to evacuate the building within a safe period of time, NCC DtS sets out maximum distances occupants can travel during the event of a fire to a point of choice, to an exit, between alternate exits and via a non-fire isolated corridor. However, there are a number of areas within the building where occupants may be required to travel distances that are in excess of the maximum distances allowed under the DtS Provisions.

The intent of NCC DtS Provision D1.4, as stipulated by the Guide to the NCC, is to maximise the safety of occupants by enabling them to be close enough to an exit to safely evacuate. Additionally, the intent of Performance Requirement DP4, as stipulated by the Guide to the NCC and in context of the Performance Solution, is to require that exits within the building be provided such that occupants can evacuate safely with respect to the number, location and dimensions of the exit appropriate to the travel distance, occupant characteristics and function and use of the building. EP2.2 aims to maintain tenable conditions in the building for the period of time it takes to evacuate.

Based on the intent of the clause and the Performance Requirements, it is considered that the primary hazard associated with increased travel distances relates to the risk that occupants may not be able to safely evacuate from the areas. Therefore, the following sections qualitatively demonstrate that the areas subject to increase exit travel distances and distance between alternative exits will not unduly impact on the ability of occupants to safely evacuate the building.

It is recognised that, except as addressed in Section 7.17, the building is provided with a fast response fire sprinkler system. Fast response fire sprinklers are generally acknowledged to control or suppress a fire with evidence [14] [7] suggesting the following when sprinklers operate as designed and appropriate to the hazard:

- Sprinklers control fire size (if not suppressing the fire) and limit fire spread by wetting adjacent combustibles.
- Sprinklers are expected to reduce the smoke temperature to 100°C – 200°C in the vicinity of the fire, and remote from the fire to temperatures below the sprinkler activation temperature of 68°C. Smoke buoyancy and the propensity of smoke spread are therefore reduced.
- The temperature and toxicity of smoke is greatly reduced in a sprinkler controlled fire.

Therefore, where a fire occurs in a building where sprinkler coverage is provided, there is an increased likelihood that a fire is suppressed in its early stages and allows occupants a greater level of tenability to allow escape. As such, the likelihood of occupant egress being impeded by a fire event, is considered to be low. Nevertheless the assessment has been divided into a number of sub sections, which discuss the additional inherent building characteristics and mitigation measures that have been implemented to further reduce the risk of occupant egress being unduly impacted.

#### 7.8.3.1 Basement Level 2

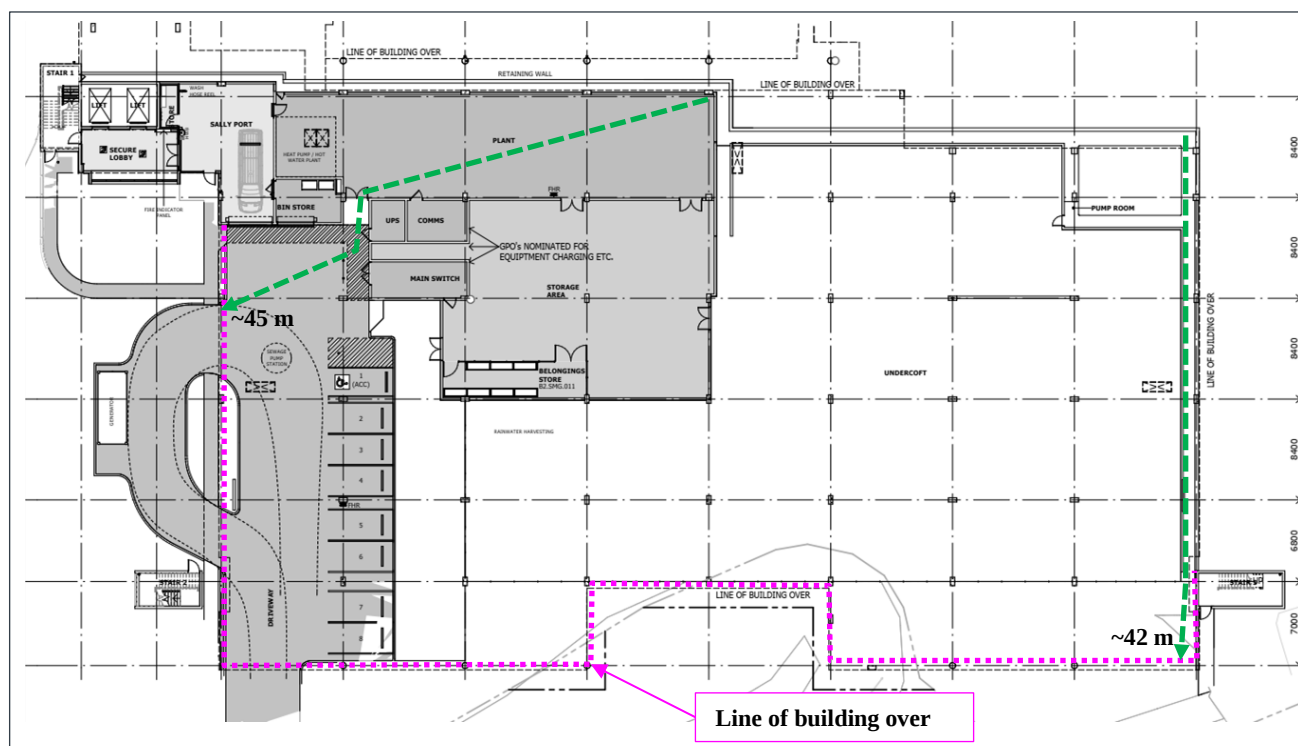
Occupants within Basement Level 2 may be required to travel up to 45 m to reach the nearest exit, as shown indicatively in Figure 7-18. Basement Level 2 is primarily a staff and Back of House Area (BoH), containing plant rooms and a naturally ventilated undercroft area. The area is expected to be accessed by primarily maintenance staff only. Staff are expected to be alert awake, generally familiar with the layout of the area and not typically have any relevant physical impairments. Additionally, given the area primarily contains plant equipment and an undercroft, the area is expected to be occupied intermittently. Therefore, the likelihood of an occupant being located within Basement Level 2 at the time of a fire, is considered to be relatively low.

Occupants within the plant rooms are provided with multiple egress points, and in the event of a fire are expected to be exposed to direct cues (e.g. visual, audible or olfactory). As such, in the event of a fire, occupants would be expected to observe a fire event in the early stages and either attempt to extinguish the fire (if safe to do so) or evacuate the area. This would be expected to occur prior to the potential onset of untenable conditions.

Additionally, it is recognised that while the extended travel distance increase is relatively minor, occupants can also reach the naturally ventilated undercroft or the naturally ventilated parking area within 40 m. Given these areas are naturally ventilated, and smoke and hot gases from a fire event are expected to vent directly to the atmosphere. Therefore, development and descent of a smoke layer is expected to be delayed, such that occupants are considered to be able to make their way out from under the building line.

On the bases of the above discussion, it is considered that the increase in travel distance within Basement Level 2 will not unduly impact on the ability of occupants to safely evacuate the building.

**Figure 7-18 Basement Level 2 indicative extended travel distances**



### 7.8.3.2 Basement Level 1 Secure Court

Within the Basement Level 1 secure court, occupants may be required to travel up to 13 m to reach a point of choice, as shown indicatively in Figure 7-19. It is recognised that the extended length of travel is 1 m only, which is considered to have negligible impact on the movement time of occupants within the area.

As part of the Performance Solution, it is recognised that consumers within the secure court are expected to be ambulant and will be under the direct supervision of staff. Staff are expected to be alert, awake, aware of their surroundings and trained in emergency procedures such that they can respond quickly and efficiently in a fire event. Additionally, evacuation from the area is required to be staff assisted, such that the staff guide the occupants to the nearest appropriate exit. On the basis of the above discussion and in recognition of the positive benefits of the smoke detection and alarm system within the facility and the fire sprinklers, it is considered that the minor increase in travel distance within the Basement Level 1 secure court is considered to not unduly impact on the ability of occupants to safely evacuate the area.

Occupants within the family visiting courtyard may be required to travel up to 39 m to reach the nearest exit, as shown indicatively in Figure 7-19. The family visiting courtyard is a naturally ventilated undercroft space consisting primarily of landscaping and walkways. When in use, the area is constantly under the supervision of staff and the evacuation process from the area is expected to be staff assisted, with staff directing family and visitors to the nearest exits and assisting consumers to either evacuate horizontally or also evacuate from the building.

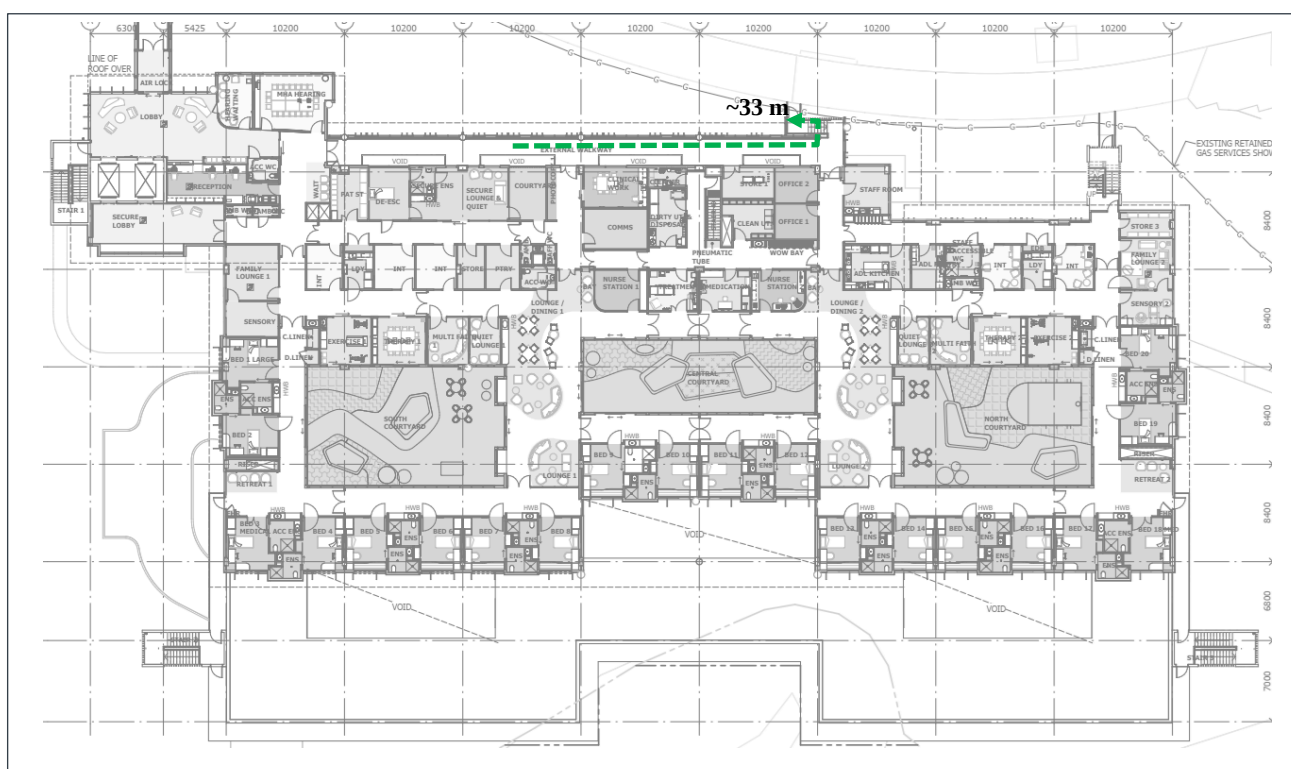
Furthermore, occupants are provided with clear sight lines along the terrace. As such, they are expected to be exposed to direct fire cues (e.g. visual, audible, olfactory) in the early stages of a fire and therefore evacuate prior to significant fire growth or spread within the area. Occupants are also provided with multiple different points of egress from the area (e.g. move directly to outside or back into the building to an alternative exit), allowing them turn and walk away from a fire event if required. Therefore, in the event of a fire within the Basement Level 1 family visiting courtyard, occupants egress is expected not to be unduly impacted.

#### 7.8.3.4 Lower Ground Level Western External Walkway

Along the Level 1 external walkway occupants may be required to travel up to 33 m to reach the nearest exit, as shown indicatively in Figure 7-20. It is recognised that the external walkway is a narrow walkway for circulation only. It is considered that the area will not contain furniture, storage, rubbish or the like. On this basis the fuel load within the walkway is considered to be negligible. Additionally, there are not expected to be major ignition sources located within the area, with minor ignition sources such as light fittings being installed in accordance with AS 3000-2018. On this basis the likelihood of a fire igniting and being sustained within the area is considered to be low. Nevertheless, given the area is naturally ventilated, smoke and hot gases from a fire within the area are expected to vent directly to the atmosphere and they are not expected to accumulate within the space. As such, development and descent of a smoke layer is not expected to occur.

It is recognised that given the area is for circulation, occupants on the walkway are expected to be moving. They are also provided with direct sight lines along the walkway and therefore are expected to be exposed to direct fire cues. As such occupants are expected to respond quickly to a fire event, such that the pre-movement time would be negligible. Occupants are also provided with multiple different points of egress from the area (e.g. move directly to outside or back into the building to an alternative exit), allowing them turn and walk away from a fire event if required. On the basis of the above discussion, it is considered that the increase in travel distance will not unduly impact on the ability of occupants to evacuate the Lower Ground Level external walkway.

**Figure 7-20 Lower Ground Level floor plan indicating extended travel distances (indicative only)**



#### 7.8.3.5 Lower Ground Level External Stairs

Within the Lower Ground level, occupants may be required to travel up to 36 m to reach external Stair 2 and up to 31 m to reach external Stair 3, as shown indicatively in Figure 7-21. This is because occupants are required to travel via an external walkway on this level to reach the stairs.

As part of the Performance Solution, it is recognised that the external walkways leading to the external stairs are open to the sky and external to the building. As such, once occupants are on the external walkways they are considered to be within an effective place of relative safety. Additionally, given the external walkways are circulation spaces primarily used for accessing the fire stairs, they are expected to be circulation spaces. Similarly, because they form part of the required egress paths, they are required to be kept free from obstructions. The fuel load associated with the external walkways is expected to be negligible and the likelihood of a fire occurring and being sustained within this area is considered to be negligible. It is also noted that occupants are provided with travel distances of less than 30 m to reach the external walkways, as such the extended travel distance associated with the external walkways is considered not to unduly impact on the ability of occupants to safely evacuate the area.

It is recognised that there is one bedroom with an opening located within 6 m of each external walkway. The primary hazard associated with this relates to the risk that a fire within a bedroom adjacent the external walkway could provide undue radiant heat exposure for occupants on the walkway. However, this is considered to be inherently mitigated by the provision of fire sprinkler protection within the building. As discussed above, fire sprinklers are expected to control or suppress a fire, resulting in upper layer temperatures of 100°C for a controlled fire and 200°C for a shielded fire. In the event of a shielded fire, 200 °C upper layer temperatures correspond to a radiant heat flux of 2.8 kW/m<sup>2</sup>. Studies on critical exposure times for radiant heat exposure to humans [15], indicate that humans can be exposed to radiant heat fluxes of 3.0 kW/m<sup>2</sup> for a duration of 20 seconds or less. Occupants on the external walkway are required to travel 10 m from the door leading to the walkway to the external stair, as such assuming an average travel speed of 0.8 m/s, a travel time of 12.5 seconds would result. As such, without taking into account any reductions in radiant heat due to perpendicular orientation or view factor, the occupant travel time on the external walkway is considered to be less than the time of critical exposure from the radiant heat flux emitted at the nearest window to the external walkway.

Nevertheless, it is recognised that the evacuation strategy within the facility is to evacuate consumers to the adjacent fire compartment. As such, in the event of a fire within a bedroom adjacent an external walkway, occupants are expected not to be located on the external walkway. Occupant evacuation is guided and controlled by staff, as such staff will be able to monitor and direct occupants of the appropriate evacuation routes. As such, the risk of occupant egress being impeded is considered to be low.

On the basis of the above assessment, it is considered that the extended travel distances associated with the external walkways leading to Stair 2 and Stair 3 on the Lower Ground Level, will not unduly impact on the ability of occupant to safely evacuate the building.

**Figure 7-21 Lower Ground Level plan indicating location of extended travel to external stairs (indicative only)**



## 7.8.4 Conclusion

Based on the assessment and the required Fire Engineering Provisions, it is considered that the exit travel distance provisions within the building will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirements DP4 and EP2.2 are satisfied.

## 7.9 Distance Between Alternative Exits

### 7.9.1 Introduction

The following assessment addresses departures Item '11'.

| DtS Clause           | D1.5                                                                                                                                                                                                                                                                                                                                                                   | Performance Requirements | DP4, EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|-----------------------------------------------|----------------------|
| Description          | Distance between alternative exits to be as follows:<br>— Up to 77 m on Level B1<br>— Up to 65 m on Level LG<br>in lieu of 45 m.<br><b>Note:</b> These are considered to be technical non-compliances due to the number of alternative egress paths available and the NCC DtS requirement to measure the distance between alternative exits through a point of choice. |                          |            |                                               |                      |
| Hazards              | The primary hazard associated increased distance between alternative exits is the risk that occupants are required to travel a greater distance in order to reach the exit, potentially increasing the time to reach an exit and potential increased risk of exposure to untenable conditions.                                                                         |                          |            |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of building occupants.                                                                                                                                                                                                                                                                                        |                          |            |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the increase in exit travel distance will not unduly impact on the ability of the occupants to safely evacuate the building.                                                                                                                                                                                                     |                          |            |                                               |                      |

### 7.9.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, it is recognised that:

- The building is provided with a fast response fire sprinkler system throughout, which is expected to control or suppress a fire.
- Evacuation routes are required to be kept free from obstructions. This is inherently expected to be achieved as corridors are for circulation of occupants within the building.
- The fuel load associated with corridors is expected to be low, such that the likelihood of a fire igniting and being sustained within the corridor is considered to be low. As such, corridor egress paths are not expected to be impeded due to a fire event.
- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond immediately in the event of a fire alarm.
- The evacuation strategy is primarily based around staff assisted evacuation, whereby staff are expected to be in communication with each other and aware of the compartment of the smoke compartment of fire origin, such that they are always evacuating occupants away from a fire event. As such, the likelihood of the path of travel being blocked or unusable due to a fire event is considered to be low.
- There are multiple available egress routes within the building. Should one egress path be blocked (e.g. due to fire event), occupants are likely to perceive the threat via direct cues (e.g. visual, olfactory or audible), prior to walking all the way to the fire source (or exit in the event that the fire occurs adjacent the exit). As such, occupants are expected to turn and find an alternative exit accordingly.

- Due to the compartmentation, should an alternative exit be required occupants can reach an adjacent smoke or fire compartment within 45 m, which is considered to be a place of relative safety as occupants move towards an alternative exit.

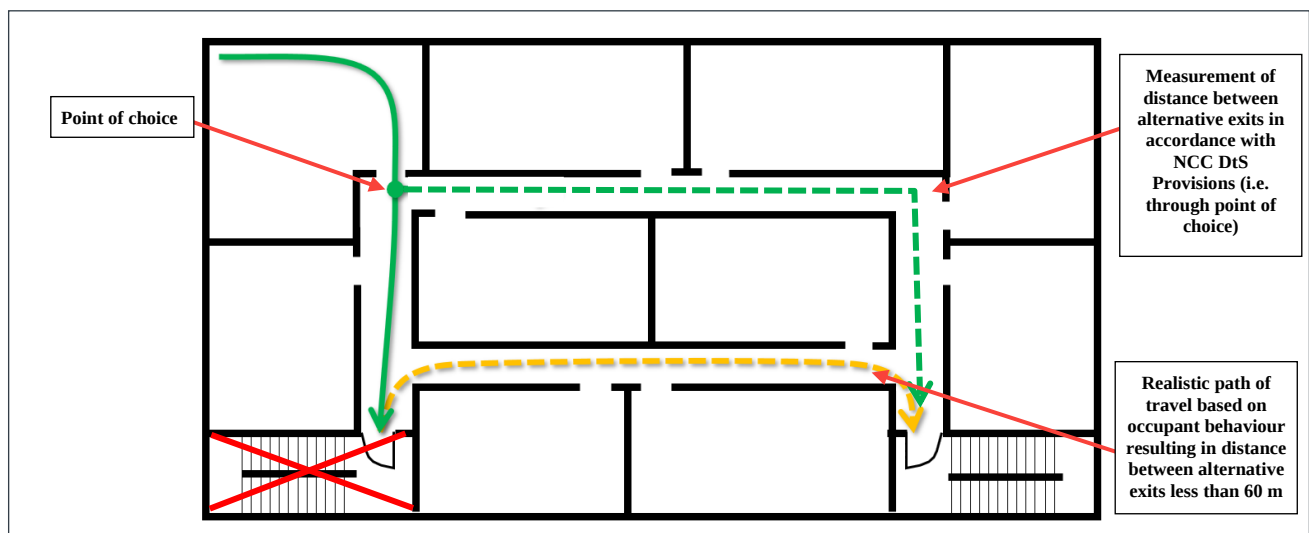
### 7.9.2.1 NCC Method of Measurement

The NCC provides a method of measurement for travel distances within a building and details this in Clause D1.15. This clause defines how to measure the distance for the purposes of Clause D1.4 (exit travel distances), as well as the minimum and maximum distances for D1.5 (i.e. distance between exits).

NCC DtS Clause D1.15 stipulates that if more than one corridor, hallway or other internal path of travel connects required exits, for the purposes of the measurement of the distance between alternative exits, the measurement is along the path of travel through the point at which travel in different directions to those exits is available, as shown indicatively in Figure 7-22.

The method of measurement detailed in this clause provides a definition for the geometry of the building but does not account for human behaviour and their interaction with the way-finding systems within the building (i.e. building layout and signage). In recognition of this and the proposed layouts, it is therefore proposed that the methodology associated with the distance between alternative exits assessment account for a more realistic path of potential travel taken by occupants during an evacuation.

**Figure 7-22 Method of Measurement of Distance Between Alternative Exits**



### 7.9.3 Assessment

As discussed above, the NCC provides a method of measurement for travel distances within a building and details this in Clause D1.15. This clause stipulates that if more than one corridor, hallway or other internal path of travel connects required exits, for the purposes of the measurement of the distance between alternative exits, the measurement is along the path of travel and back through the first point at which travel in different directions to those exits became available. When measuring the distance between alternative exits using this methodology occupants may be required to travel up to 77 m on Basement Level 1 and 65 m on the Lower Ground Level. Whilst this approach takes into account the geometry of the building, it does not account for human behaviour and their interaction with the way-finding systems within the building (i.e. identification of another potential path of travel that is available prior to reaching the original point of choice).



## 7.10 Non-Required Non-Fire-Isolated Stairs

### 7.10.1 Introduction

The following assessment addresses Departures Item '12'.

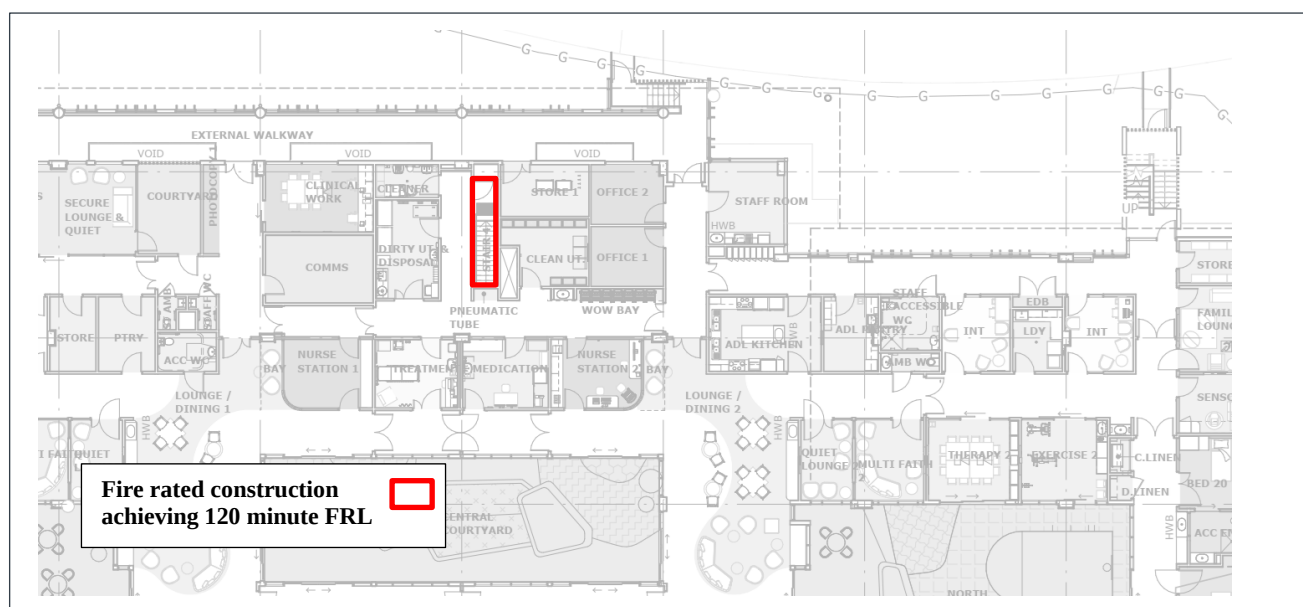
| DtS Clause           | D1.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Performance Requirements | DP4 | Performance Solution Compliance Method (A2.2) | A2.2(1)(a)<br>A2.2(2)(b)(ii) |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----|-----------------------------------------------|------------------------------|
| Description          | Non required non-fire-isolated stairway to connect the Class 9a Level B1 and Level LG..                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                          |     |                                               |                              |
| Hazards              | <p>The primary hazard associated with a non-required non-fire-isolated stair being provided within a Class 9a patient care area relates to the risk of fire spread throughout the facility which could impact on the ability of occupants to safely evacuate the building. This is particularly of concern in a Class 9a occupancy for the following reasons:</p> <ul style="list-style-type: none"><li>— The evacuation strategy is primarily based on horizontal evacuation via smoke and fire compartments.</li><li>— Occupants in Class 9a patient care areas often require staff assistance to evacuate and are not capable of evacuating themselves</li></ul> |                          |     |                                               |                              |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of building occupants.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |     |                                               |                              |
| Acceptance Criteria  | Acceptance will be demonstrated where the non-required stair will not unduly impact on the ability of the occupants to safely evacuate the building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |     |                                               |                              |

### 7.10.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is provided:

- The non-required non-fire-isolated stair be fire separated from Level LG by construction achieving a 120-minute FRL. This is considered to limit the risk of fire spread between compartments below such that the evacuation strategy is not expected to be unduly impacted, refer Figure 7-24.
- The stair does not form a required egress path and will not be provided with signage for egress.
- The stair is located in a Back of House staff area (i.e. not expected to be used or accessed by consumers).

**Figure 7-24 Lower Ground Level part floor plan indicating required fire separation for non-required non-fire isolated stair (indicative only)**



### 7.10.3 Assessment

To allow for circulation between the Level B1 and LG staff areas, it is proposed that a non-fire-isolated circulation stair be provided. However, in accordance with NCC DtS Clause D1.12, a non-required non-fire-isolated stair must not be used between storeys in a Class 9a health care building. The intent behind this provision is in recognition that within Class 9a health care buildings there are challenges with evacuating occupants (particularly in ward areas), and compartmentation and horizontal evacuation forms a critical part of the safe evacuation of building occupants. A non-fire-isolated circulation stair could compromise this strategy. The primary hazard associated with the proposal relates to the risk of fire spread throughout the facility, which could impact on the ability of occupants to safely evacuate the building.

It is recognised that while the facility is a Class 9a health care building, due to the function or use on Level B1 and Level LG (Secure Mental Health Rehabilitation Unit), consumers are considered to be ambulant, such that the same evacuation risks associated with typical Class 9a ward areas (i.e. non-ambulant occupants that require full assistance in evacuating) are not present. Similarly, the circulation stair is located in a back-of-house (BoH) area that is accessed by and for the use of staff only.

Nevertheless, to mitigate the risk associated with fire spread between the two areas, it is proposed that the stair be fire-separated from Level LG with construction achieving an FRL not less than 120 minutes, as shown indicatively in Figure 7-24. Level LG is therefore vertically separated from Level B1 below, such that fire spread between compartments is considered to be mitigated to the degree necessary. In fire mode, the proposed design is therefore considered to be at least equivalent to the NCC DtS provisions, in that fire spread between the areas is expected not to occur and the occupant evacuation strategy remains in line with the NCC DtS expectations. It is also recognised that the subject circulation stair is not a required egress stair. As such, the only occupants using the stair during fire mode are those located on the stair at the time of the alarm signal or occupants who may be familiar with the building. The door providing access to and from the stair on Level LG is therefore expected to be closed at all times during a fire event, such that the opportunity for a fire or smoke from the level below to spread via the stair door is mitigated.

#### **7.10.4 Conclusion**

Based on the assessment and the required Fire Engineering Provisions, it is considered that the proposed circulation stair, will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary. Therefore, it is considered that the Performance Requirement DP4 is satisfied.

## 7.11 Sliding Doorways

### 7.11.1 Introduction

The following assessment addresses Departure Item '13'.

| DtS Clause           | D2.19                                                                                                                                                                                                                                                                               | Performance Requirements | DP2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----|-----------------------------------------------|----------------------|
| Description          | Internal sliding doorway to be installed within the within the following areas that do not open directly to a road or open space:<br>— Level B1 and Level LG courtyards.<br>— Single use rooms                                                                                      |                          |     |                                               |                      |
| Hazards              | The primary hazard associated with the provision of sliding doors within Class 9a buildings relates to the risk that the door may obstruct a person evacuating (e.g. staff providing assistance in a Class 9a patient care area may be delayed due to time taken to open the door). |                          |     |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of building occupants.                                                                                                                                                                                                     |                          |     |                                               |                      |
| Acceptance Criteria  | Acceptances will be demonstrated where the sliding door provisions will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                                              |                          |     |                                               |                      |

### 7.11.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Manual sliding doors are proposed for the courtyards, they must be able to be manually opened under a force of not more than 110 N.
- Identification and use of this door must be included in staff induction and training plans.

As part of the Performance Solution, the following is recognised:

- Consumers within the facility are considered to be ambulant, in lieu of typical Class 9a ward area occupants, and therefore capable of opening sliding doors.
- Occupants within the courtyards and single use rooms are expected to be under staff supervision.
- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond immediately in the event of a fire alarm.

### 7.11.3 Assessment

Within the Level B1 and Level LG courtyards and within single use rooms, sliding doors are proposed to be installed, as shown indicatively in Figure 7-25 and Figure 7-26. Within Class 9a buildings sliding doors are not permitted to be provided, with the exception of the final exit from the building. It is understood that the intent of this provision is to provide occupants within patient care areas appropriate means of egressing from the area and reducing the risk of the door failing to open or delaying staff assisted evacuation of occupants. It is noted that the subject doors are not final exit doors.

As part of the Performance Solution, it is recognised that the sliding doors proposed are all manual sliding doors. It is proposed that manual sliding doors only be permitted to serve a single room or single use area (e.g. courtyard) that is not within a primary egress route. They must also be manually openable under a force of not more than 110 N. This is in line with the NCC DtS Provisions for the force required to open doors and is considered to be an appropriate provision for manual sliding doors throughout the facility. It is recognised that single rooms or single use areas do not form part of required key egress paths from other parts of the building.

It is also recognised that while occupants are located within the courtyards, they are expected to be under staff supervision and the sliding doors are likely to be open, therefore occupants would be provided with direct access from the area. Alternatively, staff who are expected to be physically able to manually open the door and who are awake, alert and aware of their surroundings, are expected to be able to assist occupants in opening the doors if required. It is also recognised that while the facility is a Class 9a health care building, due to the function or use on Level B1 and Level LG (Secure Mental Health Rehabilitation Unit), consumers are considered to be ambulant, such that the same evacuation risks associated with typical Class 9a ward areas (i.e. non-ambulant occupants that require full assistance in evacuating) are not present. As such, consumers are also likely to be able to use the sliding doors if required.

On the basis of the above assessment and required fire safety measures, it is considered that the sliding door provisions will not unduly impact on the ability of occupants to evacuate the building, to the degree necessary.

**Figure 7-25 Basement Level 1 sliding doors (indicative only)**

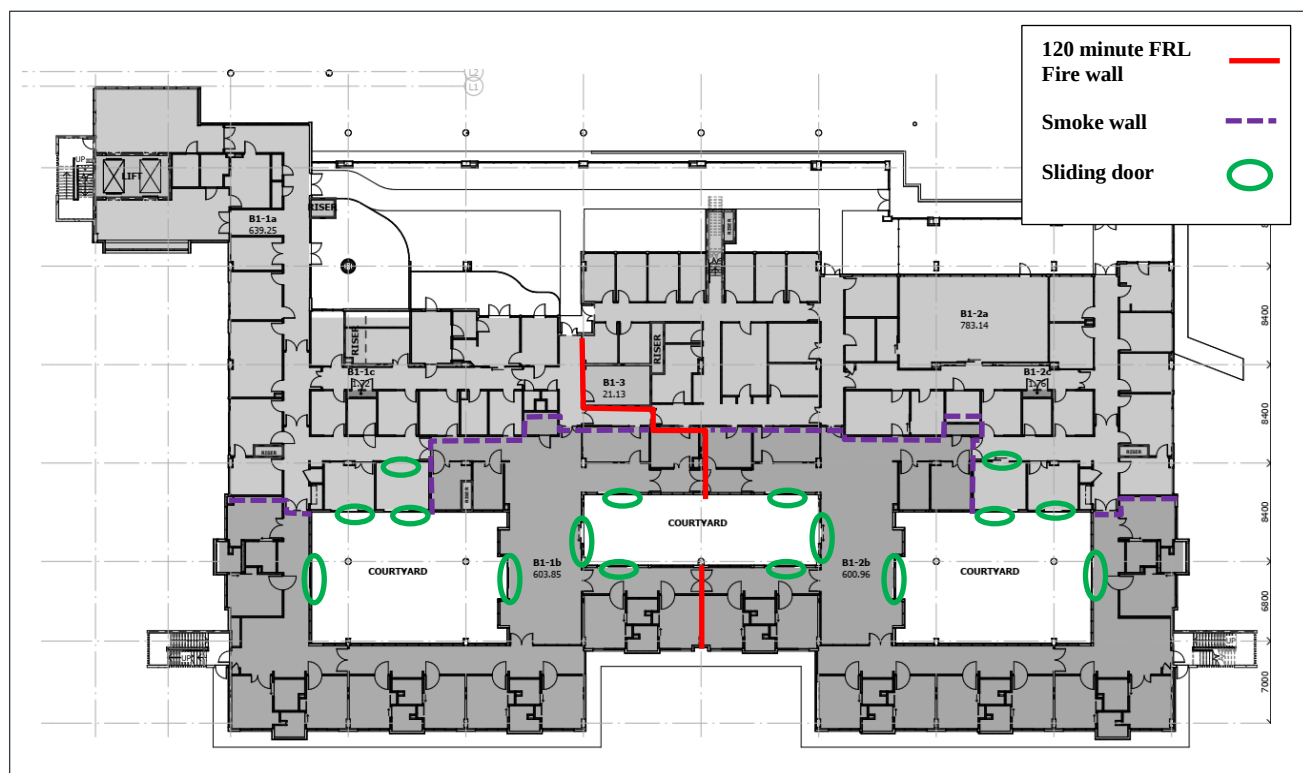
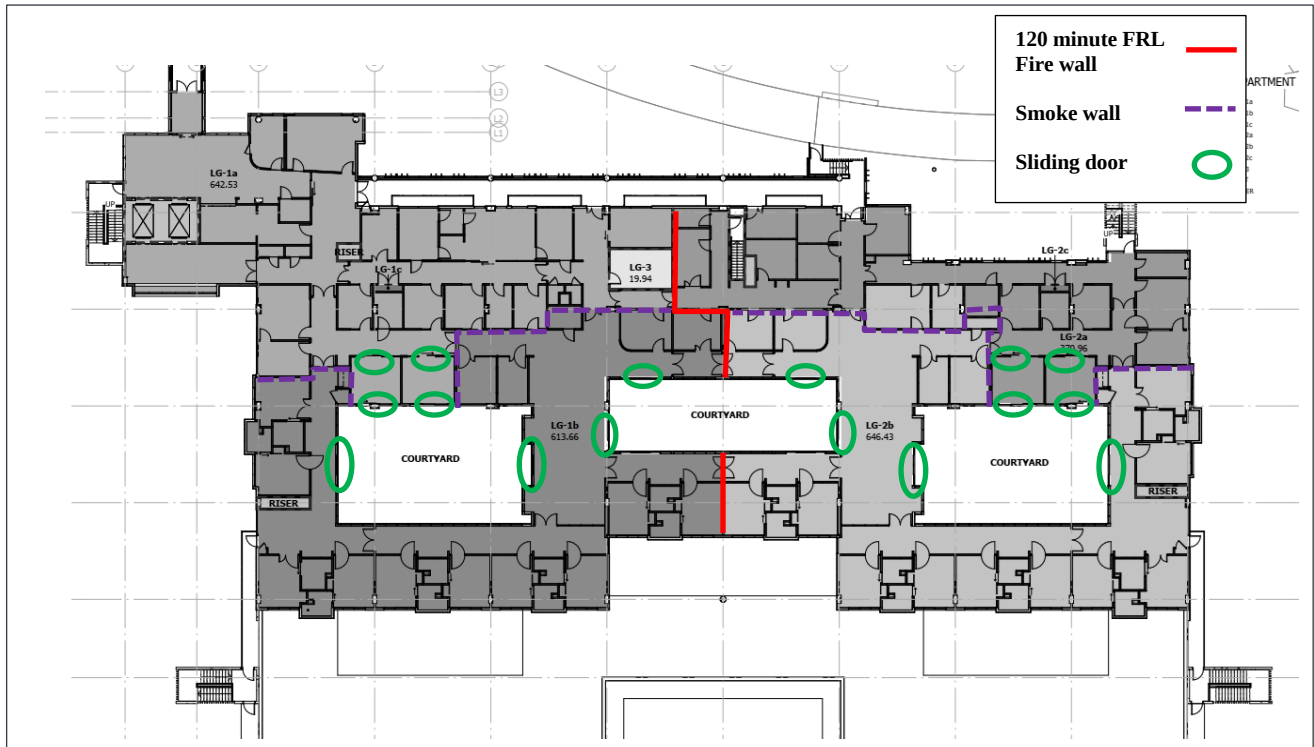


Figure 7-26 Lower Ground Level sliding doors (indicative only)



#### 7.11.4 Conclusion

Based on the assessment and the required Fire Engineering Provisions, it is considered that the egress provisions, will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirement DP2 is satisfied.

## 7.12 Door Swings

### 7.12.1 Introduction

The following assessment addresses Departure Item '14'.

|                      |                                                                                                                                                                                                                                                                                       |                          |                      |                                               |                      |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|-----------------------------------------------|----------------------|
| DtS Clause           | D2.20, Specification C3.4                                                                                                                                                                                                                                                             | Performance Requirements | CP3, DP4, DP5, EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
| Description          | Smoke doors and fire doors between smoke compartments to swing in a single direction, in lieu of swinging in both directions.                                                                                                                                                         |                          |                      |                                               |                      |
| Hazards              | The primary hazard associated with doors in the path of egress swinging in a single direction relates to the risk that the door may obstruct a person evacuating (e.g. staff providing assistance in a Class 9a patient care area may be delayed due to time taken to open the door). |                          |                      |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of building occupants.                                                                                                                                                                                                       |                          |                      |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the door swing will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                                                              |                          |                      |                                               |                      |

### 7.12.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, it is proposed that:

- The doors be provided with signage on both sides of the door indicating the direction of the swing to notify occupants and staff of the door swing.
- Evacuation procedures are expected to be staff assisted, such that staff will operate doors for occupants to move through.

As part of the Performance Solution, it is recognised that:

- Staff are expected to be alert, awake, aware and familiar with the building layout, inclusive of secured doors and required door swings.
- The evacuation of consumers is a staff assisted evacuation strategy.

### 7.12.3 Assessment

Specification C3.4 provides requirements for construction of fire doors, smoke doors, fire windows and fire shutters. Clause 3.2 of this specification requires that smoke doors must be side hung to swing in the direction of egress or both directions (i.e. where the direction of the required egress path could be in either direction smoke doors must swing in both directions). As a result, in the subject building, doors providing direct connection between compartments containing fire-isolated stairs or exits to outside are required to swing in both directions. This is because these doors form required egress paths, as shown indicatively in Figure 7-27 and Figure 7-28.

Figure 7-27 Basement Level 1 fire and smoke doors swinging in single direction (indicative only)

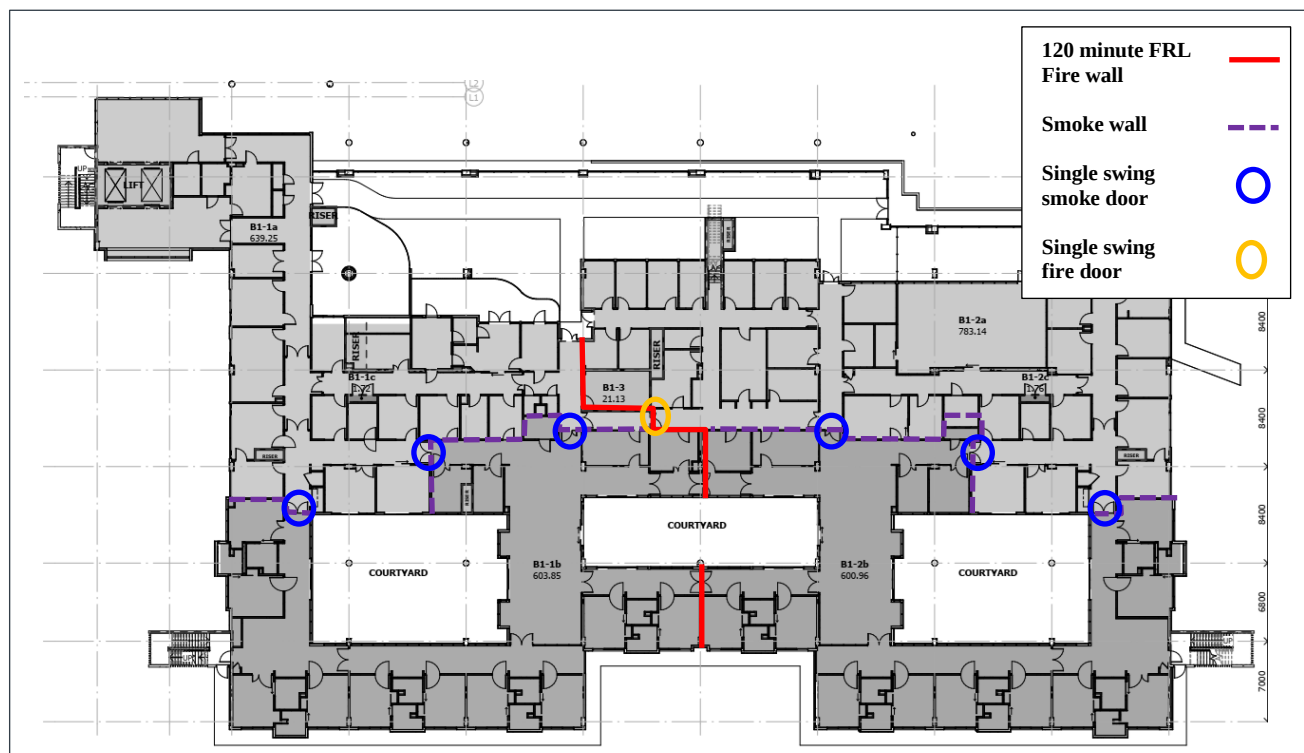
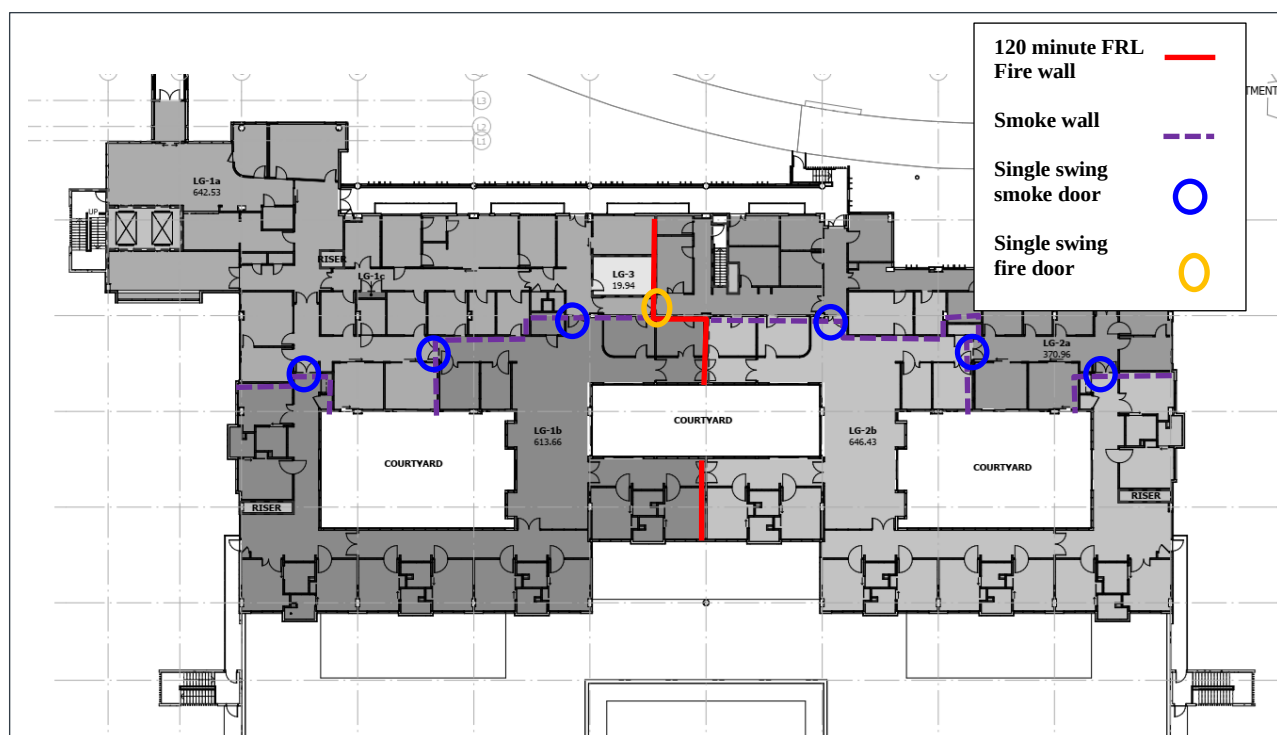


Figure 7-28 Lower Ground Level fire and smoke doors swinging in single direction (indicative only)



However, smoke doors and fire doors that are required to swing in two directions can present challenges from an installation and maintenance perspective and management and operational perspective within a hospital. As a result, it is proposed that the smoke doors and the ‘cat/kitten’ fire doors be permitted to swing in a single direction only.

Given the intent of the doors swinging in multiple directions is to minimise the risk that a door may obstruct a person evacuating from the building, it is considered that the primary hazard with the doors swinging in a single direction is, that occupants may be delayed opening the door because of the pressure of other people behind them. Therefore, the following qualitative assessment demonstrates that the provision of the subject doors swinging in a single direction will not unduly impact on the ability of occupants to safely evacuate the building.

As part of the Performance Solution, it is proposed that signage be provided on each side of the door, indicating either 'PUSH TO OPEN' or 'PULL TO OPEN', depending on which side of the door the occupants are on, in letters not less than 20 mm high in a colour contrasting to the background. This is considered to alert occupants to which direction to open the door in. Additionally, in recognition of the function or use of the building, the evacuation strategy from the building is a staff assisted evacuation strategy as part of a Management-in-Use Plan. Staff are expected to be alert, awake and aware of their surroundings, familiar with the building layout and familiar with the evacuation procedures. Therefore, as part of the evacuation strategy it is considered that staff will assist occupants in opening the doors, to facilitate egress from the area such that there not expected to be delays with the occupant evacuation.

Therefore, on the basis of the above discussion and proposed fire safety measures, it is considered that the subject smoke and fire doors swinging in a single direction will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

#### **7.12.4 Conclusion**

Based on the assessment and the required Fire Engineering Provisions, it is considered that the door swing will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirements CP3, DP4, DP5 and EP2.2 are satisfied.

## 7.13 Fail Secure Doors

### 7.13.1 Introduction

The following assessment addresses Departure Item '15'.

| DtS Clause           | D2.21                                                                                                                                                                                                                                              | Performance Requirements | DP4, DP6, EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------|-----------------------------------------------|----------------------|
| Description          | Secured exit doors within the building (i.e. required exits) to be not readily openable without a key or swipe card from the side that faces the person seeking egress as shown in Figure 7-29 and Figure 7-30, in lieu of being readily openable. |                          |                 |                                               |                      |
| Hazards              | The primary hazard associated with fail-secure doors in egress paths relates to the risk that occupants may not be able to safely evacuate the area.                                                                                               |                          |                 |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the safe evacuation of building occupants.                                                                                                                                                                    |                          |                 |                                               |                      |
| Acceptance Criteria  | Acceptances will be demonstrated where the egress provisions will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                   |                          |                 |                                               |                      |

### 7.13.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The Evacuation Procedures of occupants within the SMHRU be a staff assisted evacuation (i.e. staff alert and guide occupants to a place of relative safety).
- All staff be provided with a physical override swipe card/key that can be used to unlock secured doors.
- All staff keep the above key on them at all times whilst on duty.
- Where swipe cards are implemented, a physical master key be provided to manually unlock secure doors. This must be located within the FIP and in any other locations as required by Hospital Management. This will allow Fire Brigade Intervention to occur within the secured areas and provide a back-up option in the event that power failure occurs for a duration longer than battery back-up of secured doors.
- Management-in-Use Plan be implemented to cover the above requirements.

As part of the Performance Solution, the following is recognised:

- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond quickly in the event of a fire alarm.
- The building is provided with smoke and fire compartmentation throughout. This is expected to limit the risk of fire and smoke spread within the compartment of fire origin.
- The building is provided with a fire sprinkler system throughout, which is expected to control or suppress a fire, improving the tenability conditions within the compartment of fire origin.

Figure 7-29 Basement Level 1 indicative secure door locations

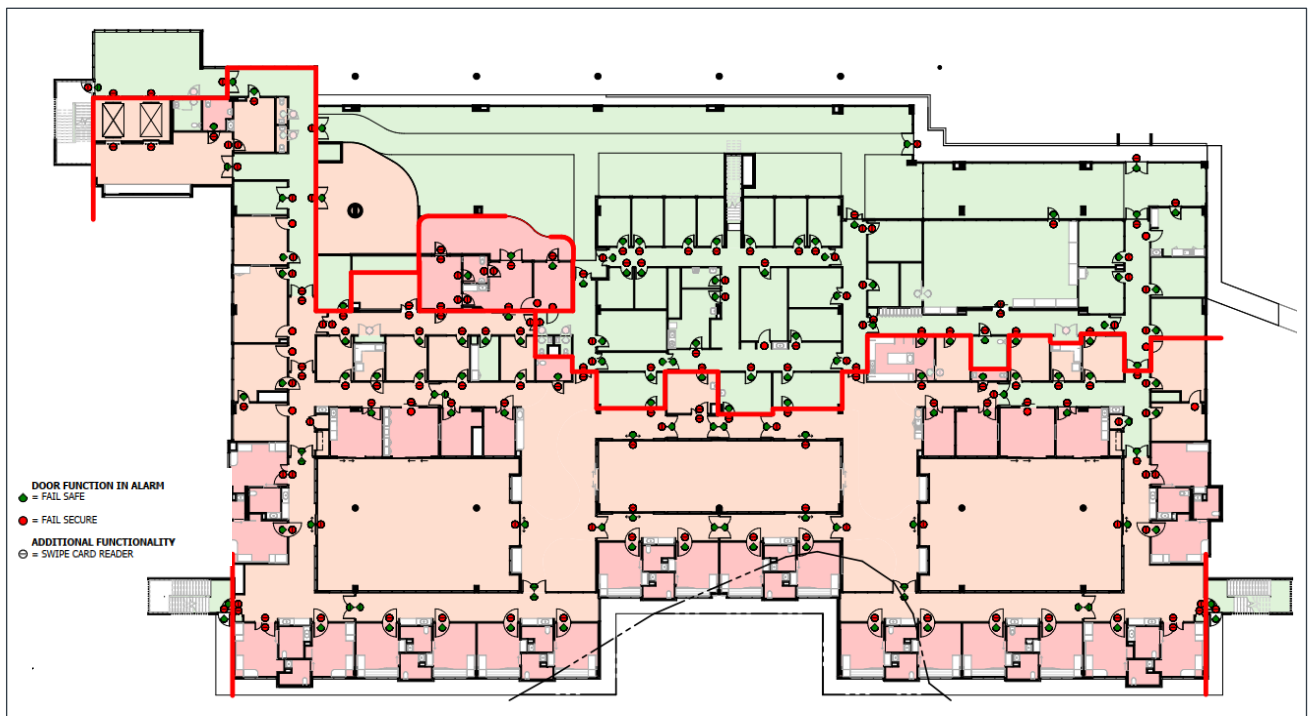
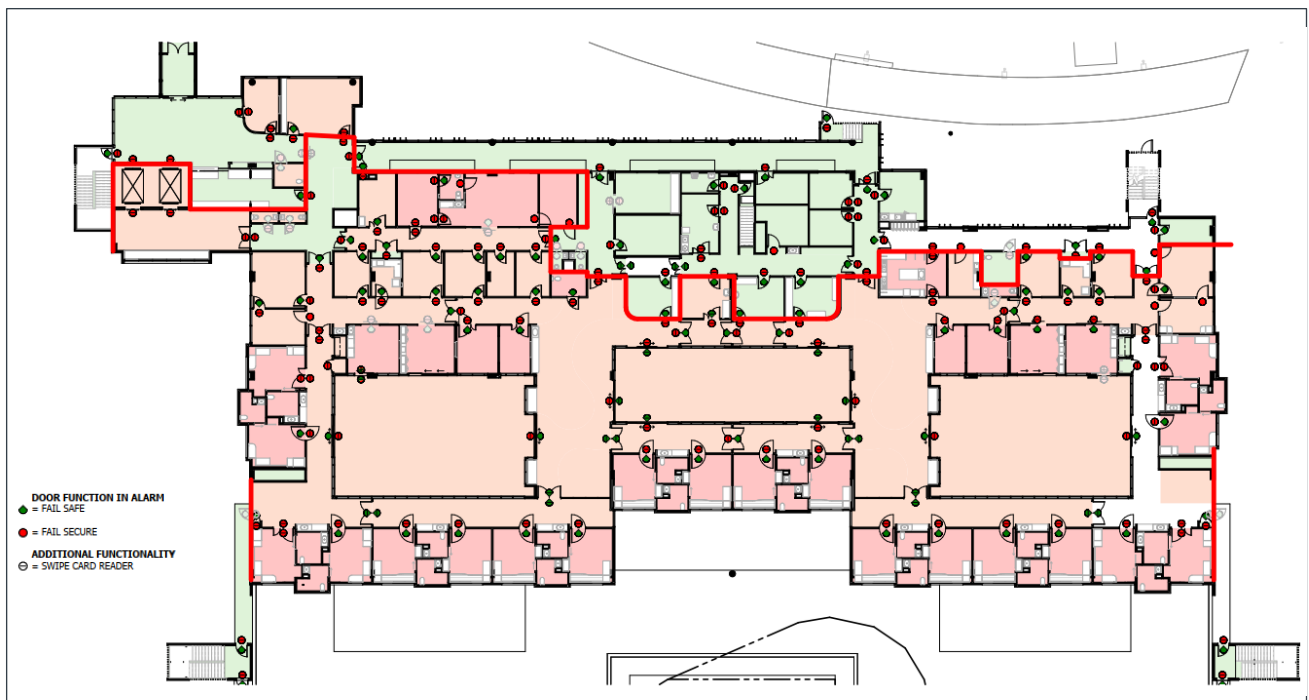


Figure 7-30 Lower Ground Level indicative secure door locations



### 7.13.3 Assessment

Within the secure parts of Level B1 and Level LG, it is proposed that 'fail-secure' locks are to be provided within some paths of egress, in lieu of fail-safe devices from secure rooms. This will allow staff to control the evacuation process from these areas. The intent of the NCC DtS Provisions requiring fail-safe devices on the doors, is to provide occupants with sufficient means to safely evacuate the building. Therefore, the following qualitative discussion demonstrates that the proposed egress provisions will not unduly impact on the ability of occupants to evacuate the building, to the degree necessary.

It is understood that the building caters for consumers with a level of dependency that may require a high level of support. As a result, for the safety of consumers and operation of the facility, within the secure line (indicated in red in Figure 7-29 and Figure 7-30) appropriate security measures are required to minimise the risk of consumers leaving the premises unescorted. It is proposed that, in addition to an access control card system, "fail-secure" hardware locks will be installed at all egress points within the secure areas. Therefore, as part of the Performance Solution, it is proposed that evacuation of consumers within the building be staff controlled and assisted. As part of this procedure, all staff are required to be equipped with the physical override keys/swipe card for the 'fail-secure' locks and all staff are required to keep the above key on them at all times whilst on duty. These provisions are required to form part of the Management-in-Use Procedures for the facility.

Where swipe cards for override are proposed, an additional physical master key must also be provided to manually unlock secure doors. Staff need not carry this key in addition to the swipe cards, however this master key is required to be located within the FIP, the closest staff station and in any other areas as required by the Hospital Management. As such, in the event that the swipe cards fails to release the lock on the secure door, a physical master key is able to unlock the subject doors.

As part of the Performance Solution, it is recognised that, the building is provided with smoke and fire compartmentation throughout. This is expected to limit fire and smoke spread throughout the facility. Furthermore, a fast response fire sprinkler system will be provided throughout the development. Fire sprinklers are generally acknowledged to control or suppress a fire in the early stages. This is expected to reduce the temperatures within the compartment of fire origin and reduce smoke production in a fire, thus improving the tenability conditions for the purposes of occupant egress.

On the basis of the above assessment and proposed fire safety measures, it is considered that the egress provisions, will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

### 7.13.4 Conclusion

Based on the assessment and the required Fire Engineering Provisions, it is considered that the egress provisions, will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirements DP4, DP6 and EP2.2, are satisfied.

## 7.14 Internal Fire Hydrants Secure Cupboards

### 7.14.1 Introduction

The following assessment addresses Departure Item '16'.

| DtS Clause           | E1.3                                                                                                                                                                                                                                                                                           | Performance Requirements | EP1.3 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Where occupants pose a risk of tampering in Patient Care areas, internal floor plate fire hydrants are permitted to be located within secure cupboards (automatically unlocking on fire sprinkler activation).                                                                                 |                          |       |                                               |                      |
| Hazards              | The primary hazard with locating internal floor plate fire hydrants within secure cupboards relates to the risk that fire fighters may not be able to access the fire hydrants during fire mode, which could impact on the ability of the fire brigade to carry out fire brigade intervention. |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of the fire brigade to carry out fire brigade intervention.                                                                                                                                                                                   |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where locating the fire hydrants in secure cupboards will not unduly impact on the ability of the fire brigade to carry out fire brigade intervention.                                                                                                         |                          |       |                                               |                      |

### 7.14.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Internal fire hydrants within floor plates are only permitted to be located within secure cupboards where occupants pose a risk of tampering.
- Upon activation of fire sprinklers, the fire hydrant cupboards within the relevant fire sprinkler zone automatically unlock, allowing the fire bridge to directly access the cupboards as required.
- Internal fire hydrants may be collocated with portable fire extinguishers, therefore secure cupboards are also unlockable via an appropriately agreed swipe card or GCHHS Master key with Hospital Management.
- In addition, a physical GCHHS Master key must also be provided and located at the FIP and as agreed with Hospital Management to allow the cabinets to be manually unlocked.

As part of the Performance Solution, the following is recognised:

- The Performance Solution applies to internal hydrants where they are required to be located on the floor plates only. The solution does not apply to any fire hydrants located within fire stairs, which are located on each level that the fire stairs serve. As such, these fire hydrants will be readily accessible for fire brigade set-up at all times, and may provide assistance in accessing floor plate fire hydrants if required.

### 7.14.3 Assessment

AS 2419.1 Clause 3.2.3 stipulates that internal hydrants shall be provided to protect the whole building or those parts of the building not able to be protected by external fire hydrants. It also requires that where there are fire-isolated exits within the building internal fire hydrants shall be located within fire isolated exits and additional fire hydrants must be provided if coverage cannot be achieved from these fire hydrants.

Within the subject building, due to the compartmentation, a number of additional on-floor internal fire hydrants may be provided to achieve compliant fire hydrant coverage. Within the Class 9a patient care areas, consumers (patients) may be present and observe the hydrant locations. Due to the expected occupant characteristics within a mental health unit, it is recognised that there may be a risk of occupants attempting to (or successfully) tamper with the fire hydrants. This could

present not only high risk for occupants but could provide hazards for the responding fire brigade should an internal fire hydrant be tampered with and not function correctly.

The intent of EP1.3, as stipulated by the guide to the NCC is to provide adequate water under sufficient pressure and flow to allow the fire brigade to fight fires. To reduce the risk that the internal fire hydrants could be tampered with, it is proposed that where occupants pose a risk of tampering within the Patient Care Areas, the internal hydrants be located within secure cupboards.

It is noted that this proposal does not apply to the fire hydrants that are located within the fire-isolated stairs (i.e. only applies where hydrants are located within floor plates). This means that fire brigade will be able to readily access fire stair hydrants and set-up within the stair on the level of fire origin (or levels above or below). This approach is considered to assist in providing protection along the route when accessing the internal fire hydrants (if required). It is noted that the readily accessible fire hydrants within the stairs also allows fire brigade to carry out an initial check of the non-fire affected floors.

It is proposed that secure cupboards housing the floor plate fire hydrants be unlockable via the following means:

- Automatically unlock on activation of the fire sprinklers within the relevant fire sprinkler zone (i.e. floor of fire origin).  
Activation of fire sprinklers are considered to represent a confirmed alarm. Automatically unlocking the cupboards on fire sprinkler activation is considered to mitigate security and safety risks associated with false alarms if the cupboards were to activate on smoke detector activation. Additionally, should the fire brigade be required to enter the floor plate of fire origin to access the cupboards, automatically unlocking the cupboards allows fire brigade direct access to the cupboards, such that they can quickly access the hydrant once at the cupboard.
- A physical GCHHS Master key, which is located at the FIP and in any other locations as required by Hospital Management.  
This redundancy measure also allows the fire brigade to manually unlock the cupboards, as well as access fire hydrant cupboards within the non-fire affected fire sprinkler zone (i.e. level above or below), if required.
- An GCHHS Master key.  
This is of particular importance to allow staff to carry out initial attack where internal hydrants are collocated with portable fire extinguishers. Refer Section 7.16 for discussion on Portable Fire Extinguishers in secure cupboards. Regardless of this, once fire sprinklers activate within the floor plate, the cupboards will automatically unlock.

These provisions are considered to allow the fire brigade to access the cupboard and prevent occupants from accessing the cupboards. This is considered to provide improved protection to the fire hydrants, noting that the alternative provision of anti-tamper caps only on the hydrants, would still allow occupants to access the cupboards.

As part of the Performance Solution it is recognised that the building is provided with a smoke detection and alarm system and a fast response fire sprinkler system both providing automatic fire brigade call-out. It is generally acknowledged that the fire sprinkler system will either control or suppress a fire, in the early stages, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. As such, in the event that the initial response by staff is ineffective, it is expected that the fire sprinkler system will activate and either control or suppress the fire, reducing the risk of fire and smoke spread throughout the facility, and therefore resulting in improved tenability conditions for fire brigade intervention.

#### **7.14.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that locating of internal floor plate fire hydrants being located within secure cupboards where occupants pose a risk of tampering, will not unduly impact on the ability of the fire brigade to carry out fire brigade intervention.

Therefore, it is considered that the Performance Requirement EP1.3 is satisfied.

## 7.15 Fire Hose Reels

### 7.15.1 Introduction

The following assessment addresses Departure Item '17'.

| DtS Clause           | E1.4                                                                                                                                                                                                                                                                                                                                                 | Performance Requirements | EP1.1 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Provision of portable additional fire extinguishers throughout the building, in lieu of compliant fire hose reel coverage.                                                                                                                                                                                                                           |                          |       |                                               |                      |
| Hazards              | The primary hazard associated with obviation of fire hose reels relates to the risk that if the fire is noticed at a later stage, it may have developed to a size where it is beyond the capabilities of a fire extinguisher. A fire hose reel might be sufficient, but due to the larger fire size the risk to occupants would have also increased. |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of occupants to carry out initial attack.                                                                                                                                                                                                                                                           |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where provision of additional portable fire extinguishers in lieu of fire hose reels will not unduly impact on the ability of building occupants to commence initial attack on the fire.                                                                                                                             |                          |       |                                               |                      |

### 7.15.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Additional portable fire extinguishers complying with AS2444, be provided and located where fire hose reels would be required to be provided within the building, to provide occupants a method of carrying out initial attack on a fire.
- The building is provided with a fast response fire sprinkler system throughout, which is expected to activate in the early stages of a fire and either control or suppress a fire.
- Staff will be trained in emergency procedures including the locations of portable fire extinguishers

### 7.15.3 Assessment

Under the NCC Clause E1.4, a fire hose reel system is to be provided to serve the whole building where one or more internal fire hydrants are installed. As part of the Performance Solution, it is proposed that a fire hose reel system is removed entirely from the building and replaced with fire extinguishers.

The intent of NCC Clause E1.4, as stipulated by the Guide to the NCC, is to require the installation of suitable fire hose reel systems to enable, where appropriate, building occupants to undertake an initial attack on the fire. The intent of Performance Requirement EP1.1, as stipulated by the Guide to the NCC and in context to the Performance Solution, is to allow occupants to safely undertake an initial attack on a fire appropriate to the size of the fire, function and use of the building and fire hazard.

As stated above, as part of the Performance Solution, it is proposed that Fire Hose Reels are not provided throughout the building and appropriate portable fire extinguishers be provided and located where the fire hose reels would have been required to be provided (e.g. within 4 m of exits as a minimum). It is recognised that misuse of fire hose reels carries a high risk in areas such as mental health units or areas where there is compartmentation (i.e. occupants dragging hose reels through compartment doors, thus the door being left partially open). Therefore, the substitution of fire hose reels with portable fire extinguishers located in secure cupboards, as discussed in Section 7.16, and general fire extinguishers throughout the remainder of the building is considered to assist in mitigating the risk of misuse or loss of compartmentation.

It is generally recognised that occupants (i.e. staff) within a building are more likely to use a fire extinguisher instead of fire hose reels. From experience based on discussions with various hospital management groups over multiple projects throughout Queensland, it has been expressed that staff are primarily trained to use the portable fire extinguishers and not fire hose reels. This is primarily because a fire extinguisher has a finite quantity, once it is empty occupants begin to realise that the fire is bigger than they can handle and therefore must evacuate the building. This is also because in ward facilities specifically, staff have a requirement to assist with occupant evacuation. A fire hose reel system would appear to a user to have an infinite supply of water to the user, potentially luring them into a false sense of security that they are capable to control the fire themselves. This could expose staff and other occupants within the building to untenable conditions due to an undue responsibility to control the fire. Not only this, but fire hose reels can be dragged through smoke doors and therefore compromise the smoke and fire separation provided within the facility. Similarly, the amount of water sprayed by a fire hose reel can present risks challenges for evacuation of occupants.

Nevertheless, it is recognised that the building is provided with a fast response fire sprinkler system throughout, which is expected to activate and either control or suppress a fire in the early stages. Therefore, if the initial attack is not successful in the early stages of a fire, the fire sprinkler system is expected to assist with reducing the risk of fire and smoke spread within the building. It is noted that as part of the performance Solution, obviating fire hose reels throughout the building is contingent on the building being provided with a fire sprinkler system.

Therefore, based upon the aforementioned and the proposed fire safety measures, the removal of a fire hose reel system will not unduly impact upon the ability for occupants to undertake an initial attack on the fire.

#### **7.15.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that obviating of fire hose reels will not unduly impact on the ability of the occupants to undertake initial attack on a fire event.

Therefore, it is considered that the Performance Requirement EP1.1 is satisfied.

## 7.16 Portable Fire Extinguishers

### 7.16.1 Introduction

The following assessment addresses Departure Item '18'.

| DtS Clause           | E1.6(a)(iii)                                                                                                                                                                                                       | Performance Requirements | EP1.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Portable fire extinguishers are permitted to be located within secure cupboards, in lieu of being located in a conspicuous and readily accessible position in accordance with AS 2444.                             |                          |       |                                               |                      |
| Hazards              | The primary hazard associated with locating the fire extinguishers within secure cupboards relates to the risk that occupants may be unable to carry out initial attack (if safe to do so) in the event of a fire. |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of the occupants to carry out initial attack, along with mitigating unwanted alarms and the ability.                                                              |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where locating the portable fire extinguishers in secure cupboards will not unduly impact on the ability of occupants to carry out initial attack or safely evacuate the building. |                          |       |                                               |                      |

### 7.16.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Secure cupboards housing portable fire extinguishers be unlockable via an appropriately agreed key with Hospital Management.
- All Staff be equipped with the above key and must be trained in emergency procedures, including the locations of the secure cupboards containing portable fire extinguishers.
- Staff keep the above key on them at all times whilst on duty.
- Where swipe cards or electronic locking facilities are proposed to be used, a physical GCHHS Master key must be provided to manually unlock the secure cupboards. This must be located within the FIP and in any other locations as required by Hospital Management.
- The above requirements form part of a Management-in-Use Plan (MIUP).

As part of the Performance Solution, the following is recognised:

- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond quickly in a fire event.
- The building is provided with a fast response fire sprinkler system throughout, which is expected to activate in the early stages of a fire and either control or suppress a fire.

### 7.16.3 Assessment

The NCC DtS Provisions stipulate that portable fire extinguishers be provided to address specific hazards. These extinguishers are required to be located in a readily accessible position to enable early intervention. However due to the expected occupant characteristics within a mental health unit, it is recognised that misuse of portable fire extinguishers carries a high risk if these systems were located in open areas.

The intent of NCC DtS Clause E1.6 and Performance Requirement EP1.2, as stipulated by the Guide to the NCC and in context to the Performance Solution, is to allow occupants to undertake an initial attack on the fire using the fire extinguishers by providing them in plain view and along normal paths of egress.

As part of the Performance Solution, it is expected that, as a mental health facility, any initial fire intervention operation or building evacuation is expected to be managed by trained hospital staff, who are expected to be stationed within the wards at all times (i.e. 24 hrs 7 days a week), and not the consumers (patients). Staff are therefore expected to be alert, awake and aware of their surroundings, and respond quickly in a fire event to either attempt to extinguish a fire or initiate the evacuation process.

As part of the Performance Solution, it is proposed that the secure cupboards containing Portable Fire Extinguishers be lockable via an appropriate key/swipe card agreed with the hospital management system, which all staff are issued with and required to carry with them at all time while on duty. The intent of this is to benefit the security of the fire safety systems within the building. Furthermore, as part of the required emergency training for the staff, they are required to be notified of the location of the portable fire extinguishers to ensure the most efficient response in the event of a fire.

Nevertheless, it is recognised that the building is provided with a smoke detection and alarm system throughout, along with a fast response fire sprinkler system. Therefore, in the unlikely event that a fire event is unnoticed within the early stages, it is expected that the smoke detection system will activate the occupant warning system in the early stages of a fire, providing sufficient notification to evacuate from the building. Furthermore, it is generally acknowledged that the fire sprinkler system will either control or suppress a fire, in the early stages, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire. As such, in the event that the initial response by staff is ineffective, it is expected that the fire sprinkler system will activate and either control or suppress the fire, reducing the risk of fire and smoke spread throughout the facility, and therefore resulting in improved tenability conditions (compared to a non-fire sprinkler protected building).

On the basis of the above assessment, and the proposed fire safety measures, it is considered that locating the portable fire extinguishers within secure cupboards will not unduly impact on the ability of the occupants to carry out initial attack or safely evacuate the building, to the degree necessary.

#### **7.16.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that the location of Fire Extinguisher's will not unduly impact on the ability of the occupants to undertake initial attack on a fire.

Therefore, it is considered that the Performance Requirement EP1.2 is satisfied.

## 7.17 Fire Sprinkler Provisions

### 7.17.1 Introduction

The following assessment addresses Departure Item '19'.

| DtS Clause           | E1.5                                                                                                                                                                                                                                                                                                     | Performance Requirements | EP1.4 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Fire sprinklers to be obviated from the following areas: <ul style="list-style-type: none"><li>— top of lift shafts.</li><li>— internally within the link bridge.</li><li>— underside of the Lower Ground Level naturally ventilated roof awning above the central Basement Level 1 courtyard.</li></ul> |                          |       |                                               |                      |
| Hazards              | The primary hazard with obviating fire sprinklers from selected areas relates to the risk that a fire within the selected areas could become fully developed, spread and/or overwhelm the fire sprinkler system.                                                                                         |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the risk of fire spread, safe evacuation of occupants and fire brigade intervention.                                                                                                                                                                                |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where obviating the fire sprinklers from the selected areas will not unduly impact on the risk of fire spread, the ability of occupants to safely evacuate the building and fire brigade intervention.                                                                   |                          |       |                                               |                      |

### 7.17.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- Addressable smoke detector must be provided at the top of each lift shaft.
- The link bridge is maintained as a circulation space only and is constructed of non-combustible materials. Therefore, the likelihood of a fire igniting and being sustained within the link bridge is low.
- The link bridge is fire separated from the SMHRU and the existing hospital building by fire rated construction.
- Exposure protection fire sprinklers are provided to link bridge openings where the link bridge connects into the SMHRU and the existing hospital building and extend not less than 4 m from the connection point.
- Existing sprinklers within the existing hospital link bridge (that the SHMRU link bridge connects into) are maintained as per the existing CoC.
- The portion of the link bridge connecting to the SMHRU is to be an independent structure from the portion of the link bridge connecting to the existing hospital and the structures are to be provided with not less than 6 m of separation. Current architectural drawings indicate that the structures are provided with approximately 20 m of separation where the access roadway passes through the structure. As such, it is considered that there is no direct physical pathway for fire to spread between the SMHRU and the existing hospital building by way of the link bridge.
- The Basement Level 1 central courtyard is a naturally ventilated space, being permanently open at the Lower Ground Level elevation and is provided with roof vents.
- The remainder of the building is provided with a fast response fire sprinkler system.

### 7.17.3 Assessment

#### 7.17.3.1 Top of Lift Shafts

It is proposed that fire-sprinklers are not provided within the top of lift shafts. It is noted that the lift shafts are used to enable occupants to transfer between floors and therefore naturally provide a potential pathway for the spread of smoke between vertical fire compartments. It can be considered that the area will generally be kept clear of combustible items, minimising the risk of a fire occurring. However, given that the lift system is expected to be an electrical system, there is potential for a fire to occur within this area.

With any automatic fire sprinkler head there is a risk of failure and false activation. Failure or false activation of an automatic fire sprinkler to the top of a lift shaft may not only cause significant damage to the lift equipment, but also represents a risk to the occupants and the fire brigade if the lift is in use. For mitigation against this risk, it is proposed that the automatic fire sprinkler head will be replaced by an addressable point type smoke detector. The provision of an addressable point type smoke detector will provide significantly earlier warning to the occupants and notification to the Fire brigade in comparison to a fire sprinkler head.

The lift shaft is provided with NCC DTS compliant fire ratings and being a lift shaft, there are limited fuel sources. Therefore, the risk of fire spread from and within the lift shaft is considered to be low. Furthermore, the lift shaft is a relatively sterile area, therefore the risk of fire ignition and spread from and within the lift shaft is considered to be low. It is considered that any fire load that might be generated or contained within the lift shaft will fall to the lift pit at the bottom. A fire sprinkler head will be located at the bottom of the lift shaft in accordance with AS2118.1. This is considered to address the risks associated with any fuel load within the lift pit.

Based on the above, it is considered that the omission of fire sprinklers from the top of lift shafts will not unduly impact on spread of fire, safe evacuation of building occupants or Fire Brigade intervention.

#### 7.17.3.2 Link Bridge

The Link Bridge provides connection between the existing hospital building and the subject SMHRU building and is primarily a circulation space. In accordance with the NCC DTS provisions, fire sprinklers are required to be provided throughout the link bridge. As part of the Performance Solution, it is proposed that fire sprinklers be obviated from the link bridge. The primary hazard associated with obviating fire sprinklers from the link bridge relates to the risk that a fire within the Link Bridge could become uncontrolled, spread to the SMHRU Building or existing hospital building and potentially overwhelm the fire sprinkler system within the building.

As discussed above, the link bridge is primarily a circulation space and therefore storage, combustible furniture or the like is not expected to be located within the link bridge. Additionally, the link bridge is required to be constructed of non-combustible materials, this includes floor, wall and ceiling linings. As such, the fuel load associated with the link bridge is considered to be negligible. In addition to the fire load, ignition sources must be present. Electrical components such as light fittings, wall sockets and services cupboards (e.g. electrical) are identified as the most prominent form of ignition and these components will be installed in accordance with AS3000-2018. As such, the likelihood of a fire originating and being sustained within the link bridge is considered to be very low.

Additionally, as part of the Performance Solution, the link bridge is required to be fire separated from both the subject SMHRU building and the existing hospital building by construction achieving an FRL not less than 120 minutes. Openings within the link bridge that are located within 4 m of the connection to the SMHRU building and existing hospital building are also required to be provided with exposure protection externally for not less than 4 m from the connection point. This is in line with the requirements for separation of fire compartments (NCC DTS Clause C3.3) when walls and openings in different fire compartments are oriented at 90°. These provisions are considered to assist in limiting the risk of fire spreading to and from the link bridge from either building. As such the likelihood of fire spreading between the SMHRU, the existing hospital building and the link bridge is considered to be negligible.

Nevertheless, it is recognised that the portion of the link bridge connecting to the SMHRU is be an independent structure from the portion of the link bridge connecting to the existing hospital, and the structures are be provided with not less than 6 m of separation. Current architectural indicate that the structures are provided with approximately 20 m of separation where the access roadway passes through the structure. As such, it is considered that there is no direct physical pathway for fire to spread between the SMHRU and the existing hospital building by way of the link bridge. Similarly, the awning structure between each portion of the link bridge is a naturally ventilated structure. Any smoke and hot gases from a fire within the link bridge on either side are expected to vent away from the structures and directly to the atmosphere. This is expected the limit fire spread between structures.

Additionally, in the highly unlikely event of a fire within the link bridge, it is recognised that the link bridge will be provided with smoke detectors throughout. Activation of these smoke detectors will activate the occupant warning system within the relevant building and provide occupants with notification to activate the area.

On the basis of the above assessment, it is considered that obviating fire sprinklers from the link bridge will not unduly impact on the risk of fire spread to and from the link bridge and therefore on the ability of occupants to safely evacuate the building or fire brigade to carry out fire brigade intervention, to the degree necessary.

#### 7.17.3.3 Basement Level 1 Central Courtyard

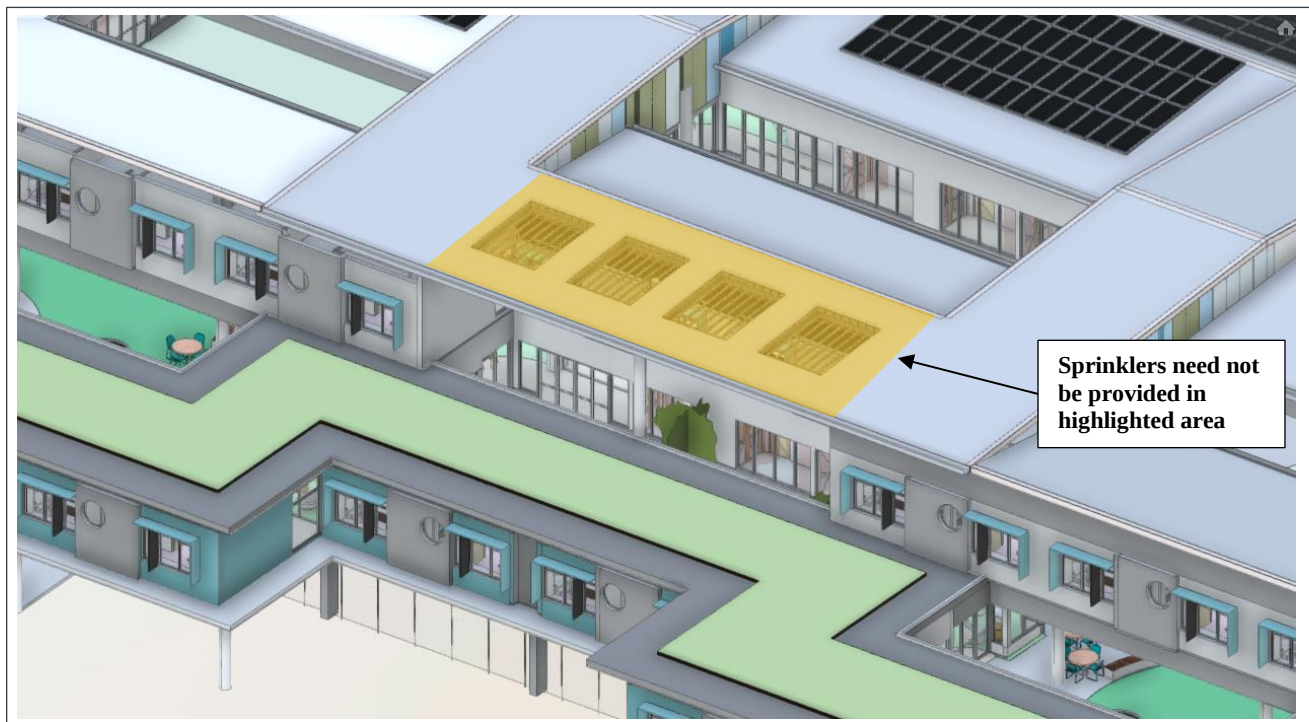
Fire sprinklers are proposed to be obviated from the Basement Level 1 central courtyard as part of the Performance Solution. The Basement Level 1 central courtyard is a double height naturally ventilated space, as shown indicatively in Figure 7-31. The floor to roof height is approximately 9.5 m and there are four large vents in the roof at Lower Ground Level.

The Basement Level 1 central courtyard contains primarily landscaping and circulation areas with some limited outdoor furniture (i.e. localised fuel load only). As such, the fuel load within the area is considered to be relatively low. In addition, there are no major ignition sources within the area. The likelihood of a fire igniting and being sustained within the area is considered to be low. Based on the relatively low fire load and the height of the roof above the area, it is considered unlikely that the fire size and resultant smoke and hot gases from a fire event would be sufficient to activate fire sprinklers in the area, or that fire sprinkler operation would be effective. Similarly, due to the extent of ventilation, smoke and hot gases are expected to vent directly to the atmosphere via either roof vents or via the permanently open elevation at Lower Ground level. As such, smoke and hot gases from a fire event (even if large enough to activate fire sprinklers), would not be expected to accumulate around the fire sprinkler heads for a sufficient period to activate the fire sprinklers. As such, fire sprinkler operation would be expected to be ineffective. Due to the extent of ventilation, it is also considered that flashover conditions would not be expected to occur within the area (i.e. fire would be localised to the fuel load only).

Occupants are provided with clear sightlines of the central courtyard whether in the courtyard or inside. As such, in the unlikely event of a fire within the courtyard, occupants would be expected to be provided with direct cues, with staff either attempting to extinguish the fire (if safe to do so) or sounding the alarm. Sounding the alarm includes the automatic notification of fire brigade. Given the building is occupied and staffed 24 hours 7 days a week, a fire within the area, which is located adjacent the lounge and dining facilities would be expected to be observed in the early stages, such that occupant evacuation is considered to be not unduly impacted.

Based on the above assessment, it is considered that the non-provision of fire sprinklers to the underside of the Lower Ground Level awning above the Basement Level 1 central courtyard, will not unduly impact on the risk of fire spread, occupant evacuation or on fire brigade intervention.

**Figure 7-31** 3D Model Image indicating open extent of Lower Ground Level roof awning above Basement Level 1 central courtyard



#### **7.17.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that where obviating the fire sprinklers from the selected areas will not unduly impact on the risk of fire spread, the ability of occupants to safely evacuate the building and fire brigade intervention.

Therefore, it is considered that the Performance Requirement EP1.4 satisfied.

## 7.18 Smoke Dampers

### 7.18.1 Introduction

The following assessment addresses Departure Item '20'.

| DtS Clause           | E2.2                                                                                                                                                                                                                                      | Performance Requirements | EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Permit the removal of Motorised Smoke Dampers (MSD) at duct penetrating smoke walls, where the ducts serve a different compartment.                                                                                                       |                          |       |                                               |                      |
| Hazards              | The hazard associated with not providing dampers at the smoke wall penetrations is that smoke spread to adjacent compartments may occur via mechanical service (i.e. ducts).                                                              |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the likelihood of smoke and fire spread throughout building via the ducts and impact occupant life safety.                                                                                           |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the deletion of smoke dampers at duct penetrating smoke walls, where the ducts serve a different compartment will not unduly impact upon fire spread within the buildings, to the degree necessary. |                          |       |                                               |                      |

### 7.18.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed that the smoke dampers within limited locations are to be removed from duct in smoke walls where the following conditions are met:

- The duct does not serve the compartment being passed through.
- The duct is a solid metal duct.
- No flexible duct is connected to the duct run in the compartment being passed through.

As part of the Performance Solution, it is confirmed by the Mechanical Engineer that:

- There is no flexible ductwork in the return air systems.
- All instances where smoke dampers are proposed for removal consist of rigid ductwork passing through another smoke compartment (but not serving).

As part of the Performance Solution, it is recognised that:

- The building is fitted with a smoke detection and alarm system throughout.
- The building be provided with a fast response fire sprinkler system throughout (except the areas covered in Section 7.17). This is expected to activate in the early stages of a fire and either control or suppress a fire, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire.

### 7.18.3 Assessment

As a Performance Solution, it is permit the removal of smoke dampers at duct penetrating smoke walls, where the ducts serve a different compartment. The intent of the NCC DtS Clause E2.2 Table E2.2a, as stipulated by the Guide to the NCC, is to specify the requirements to minimis the risk of smoke spread.

NCC Performance Requirement EP2.2 specifically relates to evacuation route conditions. The conditions within the evacuation route must be maintained for the period of time occupants take to evacuate the affected fire compartment, so that they are not overcome by the effects of fire.

By achieving the required level of smoke control, the NCC acknowledges that the risk of smoke entering an adjoining part of the building will be minimised to the degree necessary and provide sufficient time for occupants to evacuate from the building without being overcome by environmental factors.

The objective of EP2.2 is to safeguard occupants from illness or injury while evacuating in an emergency by warning them of a fire so that they may evacuate safely and further safeguard occupants from illness or injury while evacuating during a fire. The conditions within the evacuation route(s) are therefore required to facilitate this.

The main objective of the NCC, as stated by the Guide, is that occupants must be given time to evacuate before the onset of untenable conditions. The NCC DtS requirements for the use of mechanical exhaust for smoke hazard management is therefore intended to prolong tenability relative to the fire hazard and evacuation time for occupants.

NCC clause E2.2 states the air-handling system which does not form part of a smoke hazard management system in accordance with Table E2.2a or Table E2.2b and which recycles air from one fire compartment to another fire compartment or operates in a manner that may unduly contribute to the spread of smoke from one fire compartment to another fire compartment must

- be designed and installed to operate as a smoke control system in accordance with AS1668.1; or
- comply with the following:
  - incorporate smoke dampers where the air-handling ducts penetrate any elements separating the fire compartments served; and
  - be arranged such that the air-handling system is shut down and the smoke dampers are activated to close automatically by smoke detectors complying with Clause 7.5 of AS1670.1

There is no further detail or designated exemptions as such in the NCC with regard to where a duct does not serve a compartment that it is crossing through and not actually supplying air to the multiple compartments so there are limitations here on discretion.

As part of the Performance Solution, it is proposed that the Motorised Smoke Dampers (MSD) within limited locations, refer to Appendix G, are to be removed from ducts passing through smoke walls where the following conditions are met:

- The duct does not serve the compartment being passed through.
- The duct is a solid metal duct.
- No flexible duct is connected to the duct run in the compartment being passed through.

Appendix G, which is the mechanical services air schematic prepared by Stantec, indicates the Motorised Smoke Dampers (MSD) that are proposed to be removed and will meet the above requirements.

It is recognised that the building is provided with a smoke detection and alarm system throughout, along with a fast response fire sprinkler system. Therefore, in the unlikely event that a fire event is unnoticed, it is expected that the smoke detection system will activate the occupant warning system in the early stages of a fire, providing sufficient notification to evacuate from the building. Whilst this building is required to be sprinkler protected, the NCC provides no concession recognising the benefit that sprinklers provide in preventing significant fire events occurring.

From the fire engineering point of view, should a fire occur, the sprinklers would be expected to operate at a temperature below 100 °C to control the fire, if not extinguish it, thereby limiting spread to the area of origin, and reduce any adverse impact on the building structure, including the floors and columns. It is generally acknowledged (as supported by statistics) that a fire will be controlled or extinguished by automatic fire sprinkler operation.

Furthermore, it is generally acknowledged that the fire sprinkler system will either control or suppress a fire, in the early stages, with studies conducted by CIBSE and Warrington [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire, respectively.

As mentioned above, the building is predominately a Class 9a building, it will be provided with a smoke detection system for fire and smoke compartmentation to allow trained staff to evacuate patients to safe areas of the building via horizontal exits. In the very unlikely event that both floor and additional concealed sprinkler systems fail to operate or control the fire development, it is expected that the building occupants will be notified and evacuated by the time when the integrity of the ducts will be compromised sufficiently to spread fire to other levels.

On the basis of the above assessment, and the proposed fire safety measures, it is considered that deletion of the Motorised Smoke Dampers (MSD) at limited locations only will not unduly impact on the ability of the occupants to safely evacuate the building, to the degree necessary.

#### **7.18.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that deletion of Motorised Smoke Dampers (MSD) will not unduly impact on the ability of the occupants to safely evacuate the building.

Therefore, it is considered that the Performance Requirements EP2.2 are satisfied.

## 7.19 Manual Call Point Locations

### 7.19.1 Introduction

The following assessment addresses Departure Item '21'.

| DtS Clause           | E2.2, Specification<br>E2.2a Clause 4(c)(ii),<br>E4.9                                                                                                                                                                                                                                                                                                                                   | Performance<br>Requirements | EP2.2, EP4.3 | Performance Solution<br>Compliance Method<br>(A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|-----------------------------------------------------|----------------------|
| Description          | Manual Call Points are permitted to be accessed using GCHHS Master key to activate and located within nurse/staff stations, in lieu of every 30 m.                                                                                                                                                                                                                                      |                             |              |                                                     |                      |
| Hazards              | The primary hazard associated with reducing the frequency and number of manual call points within the facility relates to the risk that occupants are delayed in manually activating a fire alarm. Additionally, occupants may not know where to go to activate a manual fire alarm. This could cause delays for providing notifications to occupants of the need to evacuate the area. |                             |              |                                                     |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of the occupants to carry out initial attack and/or activate the fire alarm system, along with mitigating unwanted alarms.                                                                                                                                                                                                             |                             |              |                                                     |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where locating Manual Call Points (MCPs) in staff stations only will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                                                                                                                     |                             |              |                                                     |                      |

### 7.19.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- All staff must be trained in emergency procedures, including the locations of the Manual Call Points (MCPs).
- All clinical staff must be equipped with the GCHHS Master key and must be trained in emergency procedures.
- The above requirement forms part of a Management-in-Use Plan (MIUP).

As part of the Performance Solution, the following is recognised:

- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond quickly in a fire event.
- The building is fitted with a smoke detection and alarm system throughout.

### 7.19.3 Assessment

The NCC DtS Provisions require that manual call points be located along evacuation routes so that no point on a floor is more than 30 m from a manual call point. These MCPs are required to be located in a readily accessible position to enable early activation of the occupant warning system in the event of a fire. However due the expected occupant characteristics within a MHU, it is recognised that misuse of the Manual Call Points carries a high risk if these systems were located in open areas. As such, it is proposed that MCPs be located within staff stations and be key activated with a GCHHS Master key in line with the remainder of the GCUH hospital precinct.

The intent of NCC DtS Clause E2.2a is to specify the requirement for a health care building to provide manual call points in evacuation routes in the view of occupants. The intent of Performance Requirement EP2.2 is that occupants be given an appropriate time to evacuate due to the active fire system installed such that they aren't exposed to dangerous temperature, low visibility and high levels of toxicity. Manual call points therefore provide occupants a means of activating a fire alarm within a building in the event that a fire is observed prior to activation of any automatic fire safety systems (e.g. smoke detectors or fire sprinklers).

As a mental health facility any initial fire intervention operation or building evacuation will be managed by trained hospital staff, who are expected to be stationed within the wards at all time (i.e. 24 hrs 7 days a week), and not the consumers (patients). Staff are therefore expected to be alert, awake and aware of their surroundings and respond quickly in a fire event and either attempt to extinguish a fire or initiate the evacuation process. Therefore, the intent of locating MCPs within staff stations and providing key activation for them is to reduce false alarms within the building. As part of the required emergency training for the staff, they are required to be notified of the location of the MCPs to ensure the most efficient response in the event of a fire and they are required to carry the GCHHS Master key with them while on duty at all times. As such, should staff need to activate a manual call point, they will be aware of the location and able to activate the system.

Nevertheless, it is recognised that the building is provided with a smoke detection and alarm system throughout, along with a fast response fire sprinkler system. Therefore, in the unlikely event that a fire event is unnoticed, it is expected that the smoke detection system will activate the occupant warning system in the early stages of a fire, providing sufficient notification to evacuate from the building. Furthermore, it is generally acknowledged that the fire sprinkler system will either control or suppress a fire, in the early stages, with studies [6] [7] suggesting that the upper layer temperatures are not likely to exceed 100 °C during a fire sprinkler controlled fire and 200 °C for a fire sprinkler shielded fire.

On the basis of the above assessment, and the proposed fire safety measures, it is considered that locating the MCPs within staff stations only will not unduly impact on the ability of the occupants to safely evacuate the building, to the degree necessary.

#### **7.19.4 Conclusion**

Based on the qualitative assessment and the required Fire Engineering Provisions, it is considered that locating MCP's within staff stations will not unduly impact on the ability of the occupants to safely evacuate the building.

Therefore, it is considered that the Performance Requirements EP2.2 and EP4.3 are satisfied.

## 7.20 Consumer Bedroom Occupant Warning Speakers

### 7.20.1 Introduction

The following assessment addresses Departure Item '22'.

| DtS Clause           | E2.2, Specification E2.2a                                                                                                                                                                                                                                                                              | Performance Requirements | EP2.1, EP2.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------|-----------------------------------------------|----------------------|
| Description          | Requirements for occupant warning speakers within Consumer Bedrooms to be obviated.                                                                                                                                                                                                                    |                          |              |                                               |                      |
| Hazards              | The primary hazard associated with not providing occupant warning speakers within consumer bedrooms relates to the risk that occupants may not hear the occupant warning tone. This could cause delays in occupant evacuation and potentially lead to occupants being exposed to hazardous conditions. |                          |              |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of occupants to safely evacuate the building, with recognition of the occupant familiarity with the building and the staff managed evacuation process.                                                                                                |                          |              |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the occupant warning speaker provisions will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                                                      |                          |              |                                               |                      |

### 7.20.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- The Evacuation Procedure of consumers is an assisted evacuation (i.e. staff alert and guide occupants to a place of relative safety).
- At all times there is at least 1 clinical staff member to every 4 consumers. This ratio is considered appropriate for staff to alert occupants of a fire event and assist them in evacuating the area.
- Occupant warning be provided throughout the remainder of the consumer bedroom areas to alert staff of a fire event within the building.
- Evacuation routes are required to be kept free from obstruction.

As part of the Performance Solution, the following is recognised:

- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond quickly in a fire event.
- Reduced sound pressure levels within the consumer bedrooms is intended as a provision to reduce the risk of panic and undue confusion amongst consumers within the building.
- The building is provided with a smoke detection and alarm system and fast response fire sprinkler system

### 7.20.3 Assessment

NCC DtS Specification E2.2a requires that an occupant warning system (i.e. Emergency Warning and Intercommunication System) must be provided throughout Class 9a buildings. The NCC requires that the system must be arranged to provide warning for occupants, but also permits the alarms to be reduced in volume and content to minimise trauma consistent with the type and conditions of the patients. The intent of these provisions is to provide adequate warning to occupants to facilitate evacuation from the building with recognition of occupant characteristics.

While the NCC permits reduced alarm volumes in ward areas (e.g. in the context of a secure mental health rehabilitation unit, this is to reduce the risk of undue panic and confusion), it is also recognised that the provision of speakers in consumer bedrooms could provide a tamper risk for consumers. It is therefore proposed that occupant warning speakers be obviated from the consumer bedrooms. In recognition of the intent of the NCC, it is considered that the primary hazard associated with the proposal relates to the risk that occupants are not provided with sufficient notification to evacuate the area in a timely manner. Therefore, the following qualitative assessment, demonstrates that the proposal will not unduly impact on the ability of occupants to evacuate the area.

As part of the Performance Solution, it is proposed that evacuation of consumers be a fully staff assisted and guided process. Staff are expected to be alert, awake, aware of their surroundings and trained in emergency procedures such that they can respond quickly and efficiently in a fire event. In the event of a fire staff are therefore expected to alert occupants of the need to evacuate. Furthermore, to ensure that there is an appropriate number of staff present to assist occupants, it is required that there is at least 1 clinical staff member to every 4 occupants present at all times. This is considered to reduce the amount of work that the staff members are required to carry out in an evacuation and such that the staff member is able to keep track of the consumers in an evacuation. It is also recognised that while occupant warning speakers are not provided in consumer bedrooms, consumers are likely to hear some noise from the adjacent corridor in the event of a fire and therefore may already be prepared for staff instruction.

Additionally, with the exception of the consumer bedrooms, the remainder of the occupant warning system is required to comply with the requirements of the NCC DtS Provisions. This occupant warning system with the smoke detection system is expected to alert staff of a fire event within the building in the very early stages of a fire. The building is also provided with a fast response fire sprinkler system throughout. It is generally acknowledged that a fire sprinkler system will control or extinguish a fire within the building resulting in a reduction in the upper layer temperatures and improvement in the tenability conditions.

On the basis of the above assessment and proposed fire safety measures, it is considered that the reduced sound pressure levels in the bedrooms will not unduly impact on the ability of occupants to safely evacuate the building.

#### **7.20.4 Conclusion**

Based on the assessment and the required Fire Engineering Provisions, it is considered that the occupant warning provisions will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirements EP2.1 and EP2.2 are satisfied.

## 7.21 Exit and Directional Exit Signage Mounting Heights

### 7.21.1 Introduction

The following assessment addresses Departure Item '23'.

| DtS Clause           | E4.8                                                                                                                                                                                                                                                                                                                                        | Performance Requirements | EP4.2 | Performance Solution Compliance Method (A2.2) | (1)(a)<br>(2)(b)(ii) |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-----------------------------------------------|----------------------|
| Description          | Exit and directional exit signage to be mounted at 3.0 m throughout, in lieu of 2.7 m above the finished floor level.                                                                                                                                                                                                                       |                          |       |                                               |                      |
| Hazards              | The primary hazard associated with increasing the mounting heights of the exit and directional exit signage relates to the risk that it may no longer be within view of the occupants and therefore occupants may not be aware of the exit locations. This could unduly impact on the ability of occupants to safely evacuate the building. |                          |       |                                               |                      |
| Analysis Methodology | Qualitative analysis method based on the ability of occupants to safely evacuate the building, with recognition of the occupant familiarity with the building and the staff managed evacuation process.                                                                                                                                     |                          |       |                                               |                      |
| Acceptance Criteria  | Acceptance will be demonstrated where the increased mounting heights of exit and directional exit signage will not unduly impact on the ability of occupants to safely evacuate the building.                                                                                                                                               |                          |       |                                               |                      |

### 7.21.2 Relevant Fire Engineering Provisions

As part of the Performance Solution, the following is proposed:

- All Staff must be trained in emergency procedures, including the evacuation protocol for consumers within the building.
- The above requirement forms part of a Management-in-Use Plan (MIUP).

As part of the Performance Solution, the following is recognised:

- Staff are expected to be alert, awake, aware and trained in emergency procedures, as such they are expected to respond quickly in a fire event.
- Staff are expected to be familiar with the location of exits and the consumer evacuation protocol (i.e. evacuate consumers to the non-fire affected outer courtyard).
- The increase in mounting height is due to ceilings being located at 3 m above finished floor level.
- Given ceiling heights are also located at 3 m, the exit and directional exit signage is unlikely to be blocked from view by obstructions.
- AS 2293.1 Clause 6.8.1 notes that variations to the mounting heights shall be allowed when specifically agreed by the relevant regulatory authority, indicating that were appropriate the mounting heights can be increased.

### 7.21.3 Assessment

In accordance with the NCC DtS Provisions emergency lighting and exit signage is required to comply with the requirements of AS2293.1. AS2293.1 requires that exit signage shall be mounted not less than 2 m and not more than 2.7 m above floor level, or immediately above the doorway if the doorway is higher than 2.7 m. The intent of this requirement is that each exit sign is within the field of view of a person within the applicable viewing distance and looking at the relevant door or along the relevant egress path. This is also in line with the intent of Performance Requirement EP4.2, which is to provide occupants with clear and concise information on what route to take to evacuate a building.

AS 2293.1 Clause 6.8.1 also notes that variations to the mounting heights shall be allowed when specifically agreed by the relevant regulatory authority, indicating that where appropriate the mounting heights can be increased. Within the subject building it is proposed that exit signage and directional exit signage be mounted at a height of 3 m above finished floor level, in line with the ceiling heights throughout the facility. The increase in mounting height is considered to be relatively minor and is to align with the ceiling heights within the facility. Additionally, the mounting heights are likely to be out of reach of most occupants, such that the risk of consumers tampering or attempting to tamper with the signage is mitigated. As such, the adopted mounting heights are considered to be appropriate for the facility.

Nevertheless, a holistic assessment has been carried out for the facility to assess the potential impacts associated with the increased exit signage mounting heights. In recognition of the intent of the exit signage mounting height requirements, it is considered that the primary hazard associated with the proposal relates to the risk that occupants may not observe the exit signage as it could be out of the field of view. This could impact on the ability of the occupants to safely evacuate the building. The following qualitative assessment therefore demonstrates that the proposed mounting heights will not unduly impact on the ability of occupants to safely evacuate the building.

As part of the Performance Solution, it is required that evacuation of consumers be a fully staff assisted and guided process. Staff are expected to be alert, awake, aware of their surroundings and trained in emergency procedures such that they can respond quickly and efficiently in a fire event. Staff are also expected to be familiar with the layout of the building and with the evacuation marshal points for each stage of the evacuation. As such, staff are expected to be familiar with the locations of exits within the facility, such that the exit signage is supplementary to the evacuation process. Additionally, given the facility is a secure mental health rehabilitation unit, consumers are expected to be located within the facility for extended periods of time. Consumers are therefore also considered to have a level of familiarity with exit locations from the ward areas.

Nevertheless, it is recognised that the increase in mounting heights of exit signage is 0.3 m. Given the intent of the mounting height limitation is to ensure that each exit sign is within the field of view of a person within the applicable viewing distance and looking at the relevant door or along the egress path, the minor increase in exit signage height is considered to be minimal, such that the ability of occupants to see the sign when approaching from a distance is considered to be not unduly impacted. Similarly, because the finished ceiling level is also at 3 m, it is recognised that the exit signage is unlikely to be blocked from view by obstructions such as services, which are located above the finished ceiling.

### 7.21.4 Conclusion

Based on the assessment and the required Fire Engineering Provisions, it is considered that the exit and directional exit signage mounting heights will not unduly impact on the ability of occupants to safely evacuate the building, to the degree necessary.

Therefore, it is considered that the Performance Requirement EP4.2 is satisfied.

## 8 CONCLUSION

Refer to the Fire Engineering Provisions section for detailed fire safety measures which form part of the Performance Solution for the building(s) applicable as listed in this document.

The Fire Engineering Provisions are required to address the NCC DtS departures and/or are required to deliver an adequate level of fire and life safety which meets objectives of this document.

The analysis and assessment undertaken throughout the document with the methods and acceptance as agreed during the Fire Engineering Brief, it has been demonstrated that the implementation of the Fire Engineering Provisions satisfy the relevant NCC Performance Requirements, to the degree necessary.

# BIBLIOGRAPHY

- [1] ABCB, International Fire Engineering Guidelines, 2005 Edition, Canberra: Australian Building Codes Board, 2005.
- [2] Australian Building Codes Board, “Productivity Commission Study into the Reform of Building Regulation in Australia (ABCB Chairman’s Submission),” Australian Building Codes Board, Canberra City ACT, April 2014.
- [3] “www.google.com.au/maps,” [Online].
- [4] Australasian Fire Authorities Council, Fire Brigade Intervention Model, V2.2 ed., Australasian Fire Authorities Council, October 2004.
- [5] Queensland Fire and Emergency Services, “2016-17 Annual Report - Performance,” Queensland Fire and Emergency Services, 2017.
- [6] The Chartered Institution of Building Services Engineers (CIBSE), Relationships for Smoke Control Calculations, London: Chartered Institution of Building Services Engineers, 1995.
- [7] J. P. England, S. A. Young, M. C. Hui and N. Kurban, Guide for the Design of Fire Resistant Barriers and Structures, Warrington Fire Research (Aust) Pty Ltd, Building Control Commission, August 2000.
- [8] Standards Australia, “AS 4100, Steel Structures,” Standards Australia International Ltd, NSW, Australia, 1998.
- [9] BSI, “Eurocode 3 – Design of Steel Structures General Rules - Structural Fire Design, BS EN 1993-1-2,” British Standards Institution, 2005.
- [10] Bennetts, I.A and Moinuddin, K.M., “Aspects of the Design of Fire-Resistant Plasterboard Walls in Fire,” *Electronic Journal of Structural Engineering*, 2006.
- [11] M. McLaggan et al, “The Material Library of Cladding Materials. Data Collection.,” 2019. [Online].
- [12] CSR Limited, The Red Book Fire & Acoustic Design Guide, CSR Limited, November 2011.
- [13] CSR, The Red Book: Fire and Acoustic Design Guide, CSR Australia, 2011.
- [14] CIBSE, CIBSE Technical Memoranda TM19 - Relationships for Smoke Control Calculations, London: Chartered Institution of Building Services Engineers, 1995.
- [15] NFPA, SFPE Handbook of Fire Protection Engineering (5th Ed.), Quincy, Massachusetts: National Fire Protection Association, 2016.
- [16] M. Spearpoint, Fire Engineering Design Guide, Christchurch: New Zealand Centre for Advanced Engineering, University of Canterbury, NZ, Third Edition, 2008.
- [17] D. V. Babrauskas, “Temperatures in flames and fires,” February 2006. [Online]. Available: <http://www.doctorfire.com/flametmp.html>.
- [18] T. Alam and P. Beever, “Flashover Fires – An Experimental Program,” Centre for Environmental Safety and Risk Engineering, October 1996.
- [19] Standards Australia, AS 3959-2009 Construction of buildings in bushfire-prone areas, Sydney, NSW: Standards Australia, 2009.
- [20] P. A. Bowditch, A. J. Sargeant, J. E. Leonard and L. Macindoe, Window and Glazing Exposure to Laboratory-Simulated Busfires, Melbourne, AU: Bushfire CRC, 2006.
- [21] British Standards Institution, Eurocode 1: Actions on structures—Part 1-2: General actions—Actions on structures exposed to fire, London: British Standards Institution, 2002.
- [22] J. Hall, U.S Experience with Sprinklers, Quincy: National Fire Protection Association, 2012.
- [23] H. Marryatt, Fire: A Century of Automatic Sprinkler Protection in Australia and New Zealand 1886–1988, Melbourne: Craftsman Press Pty Ltd, 1988.

- [24] B. E. K. S. C. F. Bukowski R. W., Estimates of the Operational Reliability of Fire Protection Systems, Fire Protection Strategies for 21st Century Building and Fire Codes Symposium Proceedings, 2002.
- [25] M. Ahrens, "US Experience with Sprinklers," National Fire Protection Association (NFPA), 2021.
- [26] D. V. Babrauskas, "Glass breakage in fires," April 1997. [Online]. Available: <http://www.doctorfire.com/GlassBreak.pdf>.
- [27] A. W. Moulen and W. J. Grubits, "Water Curtains to Shield Glass from Radiant Heat from Building Fires," North Ryde, Australia, 1975.
- [28] A. K. Kim and G. D. Loughheed, "The Protection of Glazing Systems with Dedicated Sprinklers," *Journal of Fire Protection Engineering*, vol. Vol. 2 No. 2, pp. 49-59, May 1990.

# APPENDIX A

## ASSUMPTIONS AND LIMITATIONS

---

### A1. Assumptions

The following assumptions apply to the fire engineering assessments contained in this document:

- 1 Except where explicitly noted herein, all standards and other documentation that are referred to within this document are assumed to be:
    - a For a standard or other document **referenced by the NCC**, the version or edition listed by the NCC revision applicable to the project, as determined by the Authority Having Jurisdiction (AHJ) and cited in this document.
    - b For all other codes, standards, and documentation **not referenced by the NCC**, the current version or edition at the time of design, or an alternative approved edition, and includes the use of any international documents having been approved by the AHJ.
  - 2 All Fire Safety Installations will be commissioned and maintained in accordance with the manufacturer's details.
  - 3 All Fire Safety Installations will be maintained to the operational capacity to which they were designed, installed, commissioned and certified.
  - 4 Except where explicitly noted herein, all Fire Safety Installations discussed within this document are assumed to be functioning correctly during a fire situation.
- 

### A2. Limitations

The following limitations apply to the fire engineering assessment contained in this document:

- 1 The fire engineering scope for this project is strictly limited to the NCC DtS departures as listed herein, irrespective of specific details that may be contained on or within any referenced or non-referenced third-party project documentation.
- 2 This document incorporates all reasonable and practical efforts into producing a Fire Safety Strategy commensurate with the client's objectives, expectations, and operations. Guarantees cannot be provided, in producing a fire engineering documentation, that ignition or fire will not occur. Moreover, no amount of advice can guarantee that ignition or fire will not occur.
- 3 This report addresses compliance with the National Construction Code (NCC) and related Performance Requirements.
- 4 Requirements by others to achieve compliance with provisions not covered by the Building Act 1975 must supersede any requirements noted herein.
- 5 The report will not include for building and contents damage, stock loss, goodwill impact, environmental impact (in a fire situation) or any loss of trade or business interruption associated directly or indirectly with a fire in these premises.
- 6 Stipulated design criteria/parameters for engineering assessment to meet the relevant Performance Requirements of the NCC are set out herein. Where not specifically mentioned, the design, with respect to fire engineering, is expected to meet the NCC DtS provisions of all relevant codes and legislation at the time of construction and/or at the time of production of this document.
- 7 No liability is accepted for the application or use of the Fire Engineering Provisions or the design criteria/parameters contained within this report by any party not engaged to undertake design, construction or commissioning work associated with this development.
- 8 No liability is accepted for the accuracy of the documents and professional advice provided by others which form the basis of the analysis.
- 9 Changes to the documents and professional advice provided by others may require further fire engineering assessment to determine compliance implications.
- 10 Liability for re-installation and costs of any damages caused by fire is beyond the WSP scope of responsibility.

- 11** Drawings, figures, sketches, photographs, etc. referred to or incorporated in this document:
- a** provide indicative supporting information and are for illustrative purposes only; and
  - b** may change due to design variations. Where changes occur, readers of all fire engineering documentation must ensure that they observe the latest project related drawings and relate these to the Fire Engineering Provisions outlined in this document.
- 12** Future changes to the development, occupant, or fuel conditions outside those considered by this document may invalidate the findings of this document. If the design changes, those changes must be referred to the Building Certifier and/or an appropriately qualified Fire Safety Engineer, for review and clarification on the compliance implications.
- 13** The concepts outlined in this report assume a complete and operational building, and do not address protection of the building during construction, renovation, or demolition.
- 14** The assessment of deliberate fires through acts of malicious intent, arson or acts of terrorism are outside the scope of this report, and are limited to the assessment as addressed in the NCC DtS provisions. Summarily:
- a** the likelihood of a fire through acts of malicious intent or arson is no greater than for a compliant design. The proposed design is equivalent to the NCC DtS provisions in this regard.
  - b** multiple fire ignitions are not considered in either the NCC DtS provisions or the proposed design. While possible through malicious intent or arson, this event is unlikely, and therefore is outside the scope of the fire engineering assessment.
  - c** Ignition of a single item of fuel contained on the premises is within the limitation of this analysis in so far as it is considered to result in design fires like those resulting by accidental cause.
- 15** Except where specifically noted herein, the fire engineering assessment will not address nor analyse explosive materials, multiple ignition sources and locations, processing of flammable liquids, arson, and sabotage of existing fire safety systems, bulk storage or the like.
- 16** Specific consideration of the effects of an LPG boiled liquid evaporation vapour explosion (BLEVE) in a carpark fire involving a vehicle with an LPG tank is excluded from the fire engineering assessment. The effects from a BLEVE Fire are potentially severe and could lead to catastrophic events within the building. We limit our liability in this analysis and note in this limitation that all LPG installations whether within carparks or fixed installations as part of the building services, are assumed to be maintained to current regulatory and statutory requirements, and that all appropriate safety procedures are followed. We consider that the BLEVE is an extreme event, is outside the realms of a NCC DtS compliant building, and outside the scope of this fire engineering assessment.
- 17** Fire Resistance Level (FRL) grading periods, where not specifically indicated as a three component unit for building works, must be applied at the given FRL rating in accordance with the structural adequacy/integrity/insulation criteria specified in the relevant NCC DtS provision for the Class occupancy applicable.
- 18** This fire engineering solution is derived making all reasonable assumptions regarding Disability Discrimination Act (DDA) issues. That is, all physically and intellectually handicapped occupants within the building are capable of evacuating to the fire exit of their own accord, or are assisted by colleagues/others.
- 19** The fire engineering process identifies specific issues and sets the required criteria to address these issues to satisfy Performance and Functional Requirements.
- 20** It is not a fire engineering responsibility to detail specific design components of individual installations. This is a function of each relevant specific services designer and/or the installing contractors concerned.
- 21** Provisions for managing the occupancy, including generation of an Emergency Response and Evacuation Plan and Maintenance Procedures Plan, is the Building Owner and/or Building Operator responsibility.
- 22** The Performance Solutions noted here in address departures from the NCC DtS provisions and are intended to address aspects as they relate to fire safety and are not intended to address other access requirements that may relate to the Workplace Health and Safety.

# APPENDIX B

## PERFORMANCE SOLUTION SIGNAGE TEMPLATE

This Performance Solution Signage Template satisfies Fire Engineering Provision Item '37'.

This sign must be provided adjacent to the FIP or in the main entry and must be incised, inlaid, or embossed letters on a metal, wood, plastic, or similar plate, and be securely and permanently attached to the wall.



# BUILDING SUBJECT TO FIRE ENGINEERING

Gold Coast University Hospital Secure Mental  
Health Rehabilitation Unit  
1 Hospital Blvd, Southport QLD 4215

| NCC DtS Clause                    | Performance Requirements | Description of Departure                                                                                                                                                                                               |
|-----------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C1.1, Specification C1.1          | CP1, CP2                 | Fire Resistance Levels (FRLs) associated with the proposed linkway between the existing hospital and the new building are to be rationalised to be in accordance with the requirements for Type C construction         |
| C1.1, Specification C1.1          | CP1, CP3                 | Except for columns incorporated in fire walls, columns in external walls that support the roof only will be permitted not to achieve an FRL.                                                                           |
| C1.1, Specification C1.1 and C2.7 | CP1, CP2, CP3 and CP8    | Steel header beams that are not required to have an FRL are permitted in limited locations to penetrate the fire rated lining and connect to steel columns within lightweight fire walls separating fire compartments. |
| C1.9                              | CP2, CP4                 | Packers forming part of the façade system permitted to made of plastic, which are deemed combustible material, in lieu of non-combustible.                                                                             |
| C1.9, C2.5, Specification C2.5    | CP2, CP4                 | Plywood linings to be used for both internal fire-rated walls and the internal linings of external walls, in lieu of non-combustible construction.                                                                     |
| C2.5                              | CP2, CP3, DP4 and EP2.2  | Smoke compartments within the Class 9a Ward Areas to be as follows:<br>Up to 640 m2 in lieu of 500 m2.<br>Smoke proof construction and achieve an inherent FRL, in lieu of being fire rated to achieve 60/60/60.       |
| C2.5                              | CP2, CP3, DP4 and EP2.2  | Doors within the walls forming part of the smoke compartmentation walls to be solid core smoke doors, in lieu of achieving -/60/30 FRL.                                                                                |
| C2.7                              | CP2, CP3, CP4, DP4, DP5  | Fire separation of the linkway between the existing hospital and the new building to be rationalised on the existing hospital building side.                                                                           |
| C3.15                             | CP2, CP8                 | Permit data cables to be housed within firebox that are installed within fire rated walls, in lieu of firebox being in accordance with the tested system.                                                              |

| NCC DtS Clause            | Performance Requirements | Description of Departure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D1.4                      | DP4, EP2.2               | <p>Exit travel distance to be as follows:</p> <p><b>Level B2</b></p> <p>To the nearest exit where travel in different directions to two exits is available to be not more than 45 m, in lieu of 40 m.</p> <ul style="list-style-type: none"> <li>Level B1</li> <li>To a point from which travel in different directions to two exits is available to be not more than 13 m from the Secure Court, in lieu of 12 m.</li> </ul> <p>To the nearest exit where travel in different directions to two exits is available to be not more than 39 m from the family visiting courtyard, in lieu of 30 m.</p> <p><b>Level LG</b></p> <p>To the nearest exit where travel in different directions to two exits is available to be not more than:</p> <p>33 m from the western external walkway,</p> <p>36 m to external stairs accessed via the external walkway,</p> <p>in lieu of 30 m.</p> |
| D1.5                      | DP4, EP2.2               | <p>Distance between alternative exits to be as follows:</p> <p>Up to 77 m on Level B1</p> <ul style="list-style-type: none"> <li>Up to 65 m on Level LG</li> </ul> <p>in lieu of 45 m.</p> <p><b>Note:</b> These are considered to be technical non-compliances due to the number of alternative egress paths available and the NCC DtS requirement to measure the distance between alternative exits through the first point of choice.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| D1.12                     | DP4                      | Non required non-fire-isolated stairway to connect the Class 9a Level B1 and Level LG.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| D2.19                     | DP2                      | <p>Internal sliding doorway to be installed within the following areas that do not open directly to a road or open space:</p> <p>Level B1 and Level LG courtyards.</p> <ul style="list-style-type: none"> <li>Single use rooms</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| D2.20, Specification C3.4 | CP3, DP4, DP5, EP2.2     | Smoke doors and fire doors between smoke compartments to swing in a single direction, in lieu of swinging in both directions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| D2.21                     | DP4, DP6, EP2.2          | Secured exit doors within the building (i.e. required exits) to be not readily openable without a key or swipe card from the side that faces the person seeking egress, in lieu of being readily openable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| E1.3                      | EP1.3                    | Where occupants pose a risk of tampering in Patient Care areas, internal floor plate fire hydrants are permitted to be located within secure cupboards (automatically unlocking on fire sprinkler activation).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| E1.4                      | EP1.1                    | Provision of portable additional fire extinguishers throughout the building, in lieu of compliant fire hose reel coverage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| <b>NCC DtS Clause</b>           | <b>Performance Requirements</b> | <b>Description of Departure</b>                                                                                                                                                                                                             |
|---------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E1.6                            | EP1.2                           | Portable fire extinguishers are permitted to be located within secure cupboards, in lieu of being located in a conspicuous and readily accessible position in accordance with AS 2444.                                                      |
| E1.5                            | EP1.4                           | Fire sprinklers to be obviated from the following areas:<br>top of lift shafts.<br>internally within the link bridge.<br>underside of the Lower Ground Level naturally ventilated roof awning above the central Basement Level 1 courtyard. |
| E2.2                            | EP2.2                           | Permit the removal of Motorised Smoke Dampers (MSD) at duct penetrating smoke walls, where the ducts serve a different compartment.                                                                                                         |
| E2.2, Specification E2.2a, E4.9 | EP2.2, EP4.3                    | Manual Call points within ward compartments are permitted to be accessed using GCHHS Master key to activate and located within nurse/staff stations, in lieu of every 30 m.                                                                 |
| E2.2, Specification E2.2a       | EP2.1, EP2.2                    | Requirements for occupant warning speakers within Consumer Bedrooms to be obviated.                                                                                                                                                         |
| E4.8                            | EP4.2                           | Exit and directional exit signage to be mounted at 3.0 m throughout, in lieu of 2.7 m above the finished floor level.                                                                                                                       |

Fire Engineering Report: PS126626-FSE-FER-08  
For enquiries contact WSP Fire Engineering: +61 7 3368 6638

# APPENDIX C

## ASSESSMENT METHODOLOGIES

The following assessment methodologies have been formulated to demonstrate that the Performance Solution achieves compliance with the relevant Performance Requirements of the NCC.

---

### C1. Fire Spread Between Buildings

Assessment of the risk of fire spread between buildings is carried out using an absolute quantitative analysis method with deterministic data. The objective of the assessment methodology is to avoid the spread of fire between buildings and protect the other buildings from physical damage caused by structural failure of the building. A fire in the subject building should not cause spread of fire to another building via radiation, as this could potentially endanger public safety or health and amenity.

Acceptance for the spread of fire can be demonstrated using the following assessment methodology and compliance with the following criteria:

- The subject building is able to withstand, without ignition [based on the critical heat flux ( $q_{cr}$ )], a received heat flux ( $q_r$ ).
- The subject building will not cause a received heat flux ( $q_r$ ) in excess of the critical heat fluxes ( $q_{cr}$ ) at various locations within the adjacent allotment.

The radiant heat emitted from the subject building will be determined via the following radiation formulae detailed in Section 7.5 of the Fire Engineering Design Guide [16].

$$q_r = k_1 \Phi \epsilon \sigma [(T_e + 273)^4 - (T_r + 273)^4]$$

Where:

$q_r$  is the radiant heat flux received (kW/m<sup>2</sup>)

$k_1$  is the radiation reduction (or attenuation) factor

$\Phi$  is the configuration (or view) factor

$\epsilon$  is the resultant emissivity (i.e.  $\epsilon = \epsilon_f \times \epsilon_r$ )

where:  $\epsilon_f$  is the emissivity of the compartment/fire

$\epsilon_m$  is the emissivity of the receiving material

$\sigma$  is the Stefan Boltzman Constant ( $56.7 \times 10^{-12}$  kW/m<sup>2</sup> K<sup>4</sup>)

$T_e$  is the temperature of the emitting surface (°C)

$T_r$  is the temperature of the receiving surface (24 °C)

The following assumptions have been made for the above values within the radiation formula:

- Radiation reduction (or attenuation) Factor,  $k_1$   
The degree to which the radiation will be reduced will depend on whether any protective measure is provided. This value ranges from zero (i.e. a solid fire rated wall) to one (i.e. no additional protection provided).
- Configuration view factor,  $\Phi$   
This factor takes into account the intensity of radiation received by a surface remote from the emitter based on the distance and angle between the emitter and receiver.

- Resultant emissivity,  $\varepsilon$

Although the resultant emissivity is a function of the emission power of the emitter and the absorptivity of the receiving surface, a value of 0.9 will be used. This is a "reasonable" assumption as detailed in Section 7.5 of the Fire Engineering Design Guide.

- Temperature of the emitting surface,  $T_e$

ED Expansion building: For the emitting surface is the opening area of the building or fire compartment where the building or fire compartment is fire sprinkler protected, a surface temperature of 300 °C will be used at the openings. This is considered to be a conservative assumption in calculating the radiant heat flux, as research conducted by CIBSE [14] and Warrington [7] showed that the upper layer temperatures are not likely to exceed 100°C during a fire sprinkler controlled fire and 200°C for a fire sprinkler shielded fire.

Link Bridge: Where the building or fire compartment is not protected with a fire sprinkler system, a surface temperature of 900°C (flame temperature) will be used at the openings [17]. Peak external plume temperatures of 900°C, maintained for short periods of time, are reported by Fire Code Reform Centre [18] and Babrauskas [17]. This temperature is considered appropriate for the virtual radiant panel created by an opening on the subject building.

### **CRITICAL HEAT FLUX**

The critical heat flux ( $q_{cr}$ ) causing ignition of fuels is based on Appendix G3 of AS3959-2009 [19], and is as follows:

- **13 kW/m<sup>2</sup> for piloted ignition** (i.e. where a spark is present to ignite the material (e.g. the glazing of the window has failed or a window is operable)).
- **25 kW/m<sup>2</sup> for non-piloted ignition** (i.e. where a spark is absent to ignite the material (e.g. the glazing of the window remains intact or a window is fixed closed)).

# APPENDIX D

## RESEARCH ON HEAT FLUX ATTENUATION OF GLAZING

A series of experiments [20] have been performed exposing annealed, laminated and toughened glass to series of radiation profiles with maximum incident heat flux applied ranging from 40 kW/m<sup>2</sup> to 65 kW/m<sup>2</sup>. These experiments included unframed glass as well as glass within timber and aluminium frames. Window sealants and window sash positions were also varied in the experiment.

Beside failure modes and peak temperatures, the test results provide peak incident heat flux of the glass back face. In Table 29 incident heat flux of the glass back face is compared to a maximum radiant heat flux applied, and minimum, maximum and average attenuation levels have been extracted.

**Table D.1 Incident heat flux attenuation of toughened glass**

| Framing                           | Thickness [mm] | Minimum attenuation [%] | Maximum attenuation [%] | Average attenuation [%] |
|-----------------------------------|----------------|-------------------------|-------------------------|-------------------------|
| Unframed                          | 4*             | 61.9                    | 63.4                    | 62.7                    |
|                                   | 5**            | 84.8                    | 84.8                    | 84.8                    |
| Timber                            | 4              | 55.6                    | 63.8                    | 58.6                    |
|                                   | 5              | 54.8                    | 79.5                    | 71.1                    |
|                                   | 6**            | 63.0                    | 63.0                    | 63.0                    |
| Aluminium                         | 3              | 38.5                    | 64.0                    | 51.5                    |
|                                   | 4              | 40.0                    | 76.7                    | 57.5                    |
|                                   | 5              | 34.4                    | 73.9                    | 59.8                    |
|                                   | 6**            | 68.6                    | 68.6                    | 68.6                    |
| * Only two experiments undertaken |                |                         |                         |                         |
| ** Only one experiment undertaken |                |                         |                         |                         |

In total of 68 experiments that considered toughened glass, only in two cases attenuation level was below 40% (34.4% and 38.5%). Average attenuation across all experiments was 62%. Therefore, for the purpose of engineering assessments it is found reasonable to assume that toughened-safety glass will, with high reliability, attenuate incident heat flux for 40

# APPENDIX E

## CALCULATIONS

### E1. Separation between buildings

#### Radiation to Parallel Receiver

Fire Engineering Design Guide, Third Edition

##### Inputs

|               |                                        |        |
|---------------|----------------------------------------|--------|
| $T_e$         | Temperature of radiator                | 900 °C |
| $T_r$         | Temperature of emitter                 | 20 °C  |
| $\varepsilon$ | Emissivity of radiator                 | 0.90   |
| a             | Width of radiator body                 | 4.5 m  |
| b             | Height of radiator body                | 3.1 m  |
| c             | Distance between radiator and receiver | 4 m    |

##### Parameters

|          |                           |                                           |
|----------|---------------------------|-------------------------------------------|
| $\sigma$ | Stefan-Boltzmann constant | 5.67E-11 kW/m <sup>2</sup> K <sup>4</sup> |
|----------|---------------------------|-------------------------------------------|

##### Calculations

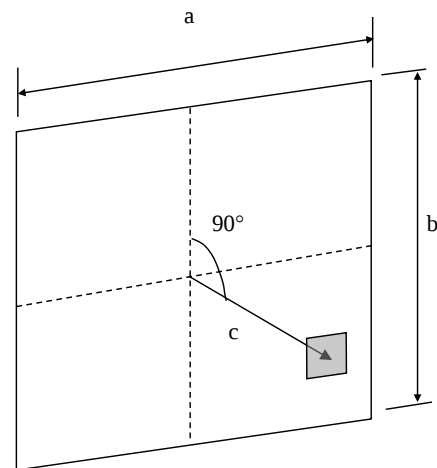
$$X = 0.5625$$

$$Y = 0.3875$$

$$\phi \quad \text{Configuration factor} \quad 0.2128$$

##### Output Results

|                    |                               |
|--------------------|-------------------------------|
| Radiation emitted  | <b>96.23 kW/m<sup>2</sup></b> |
| Radiation received | <b>20.48 kW/m<sup>2</sup></b> |



Term considered negligible and ignored

$$\dot{q}_R'' = k_f \Phi \varepsilon \sigma \left[ (273 + T_e)^4 - (273 + T_r)^4 \right] \quad [7.4]$$

where  $k_f$  is the radiation reduction factor

$\Phi$  is the configuration factor (value between 0 and 1.0)

$\varepsilon$  is the emissivity of emitter and absorptivity of receiving surface (value between 0 and 1.0). It is conservative to take  $\varepsilon = 1.0$ .

$\sigma$  is the Stefan-Boltzmann constant =  $56.7 \times 10^{-12}$  (kW/m<sup>2</sup> K<sup>4</sup>)

$T_e$  is the temperature of emitting surface (maximum firecell temperature) (°C)

$T_r$  is the temperature of receiving surface (°C)

# APPENDIX F

## QFES FEB MEETING MINUTES



## MEETING AGENDA

### W/- QFES

|                  |                                                                          |
|------------------|--------------------------------------------------------------------------|
| <b>Date:</b>     | Tuesday 26 <sup>th</sup> October 2021                                    |
| <b>Time:</b>     | 1:30pm                                                                   |
| <b>Location:</b> | QFES Community Safety Offices<br>Cnr Prince and Nerang Street, Southport |

| Attendees         |                                         |
|-------------------|-----------------------------------------|
| Name              | Organisation                            |
| Lex Mildren       | QFES                                    |
| Rohan Wilschefski | QFES                                    |
| Jack Partridge    | WSP (Fire Engineer)                     |
| Neil Carter       | DWP (Architect)                         |
| Ray Dillon        | Queensland Health (Fire Safety Advisor) |
| Kylie Rowlands    | Hendry Group (Building Surveyor)        |
| Zach Troeger      | Hendry Group (Building Surveyor)        |

|                      |                  |
|----------------------|------------------|
| <b>Distribution:</b> | All of the above |
|----------------------|------------------|

|            |                                                                                                             |
|------------|-------------------------------------------------------------------------------------------------------------|
| <b>Re:</b> | Gold Coast University Hospital - Secure Mental Health Rehabilitation Unit<br>Fire Engineering Brief Meeting |
|------------|-------------------------------------------------------------------------------------------------------------|

| Item | Subject                                                                                                                                                                                                                                                                                                                                                          | Action |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1.0  | Meeting Introduction                                                                                                                                                                                                                                                                                                                                             |        |
| 1.1  | Overview of the BCA Parameters: <ul style="list-style-type: none"><li>• Class of Building(s) – 7a &amp; 9a</li><li>• Effective Height – 8.62 (approx.)</li><li>• Rise in Storeys – 3</li><li>• Applicable BCA Edition – 2019 (Amendment 1)</li><li>• Existing Buildings – GCUH</li><li>• Other items – Specialised use = secure mental health building</li></ul> | Note   |
| 1.2  | Overview of the development (architectural design & program)                                                                                                                                                                                                                                                                                                     | Note   |
| 2.0  | Fire Services Infrastructure                                                                                                                                                                                                                                                                                                                                     |        |
| 2.1  | <ul style="list-style-type: none"><li>• QFES Access Point to Site &amp; Within Building</li><li>• Booster Location</li></ul>                                                                                                                                                                                                                                     | Note   |



|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|            | <ul style="list-style-type: none"> <li>• Fire Pump Room Location</li> <li>• Fire Indicator Panel Location</li> <li>• Separate Hydrant and Sprinkler Systems</li> <li>• Smoke detection to AS1670.1 &amp; MASDS (VESDA) system to SOUs</li> <li>• Emergency Warning and Intercom System (EWIS)</li> <li>• Mechanical Air Handling System</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |
| <b>3.0</b> | <b>Performance Solutions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
| 3.1        | Review of the proposed Performance Solutions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Note |
| 3.2        | <p><b>Fire Resistance Levels (FRLs) associated with the proposed linkway between the existing hospital and the new building are to be rationalised to be in accordance with the requirements for Type C construction</b></p> <p>The bridge will be made of completely non-combustible construction &amp; naturally vented. The bridge will be treated as Type C construction (in lieu of Type A). There will be no storage of goods and no combustible materials to burn making the bridge a relatively sterile environment.</p> <p>LM queried the point of connection to the existing building – It was confirmed that the point of connection is at an existing link way which is provided with Fire Doors to separate the two buildings that are currently joined by the linkway.</p>                                                                                                                                  | Note |
| 3.3        | <p><b>Plywood linings to be used for both internal fire-rated walls and the internal linings of external walls, in lieu of non-combustible construction.</b></p> <p>This solution will address both the Internal lining of external walls (which is noted to be a technicality) as well as internal fire-rated walls. The strategy will be to assess the proposed timber construction against the 6 key QFES combustibility criteria (for combustible cladding) to demonstrate that the construction is suitable.</p> <p>It was also noted that the wall construction that includes the plywood will be constructed from slab to slab (not continuous) which will severely limit the chance of vertical fire spread.</p> <p>It was also confirmed that the External cladding is CFC Sheet fixed to metal studs with the plywood installed internally for impact resistance behind the internal wall lining.</p>           | Note |
| 3.4        | <p><b>Smoke compartments within the Class 9a Ward Areas to be as follows:</b></p> <ul style="list-style-type: none"> <li>▪ Up to 640 m<sup>2</sup> in lieu of 500 m<sup>2</sup>.</li> <li>▪ Smoke proof construction and achieve an inherent FRL, in lieu of being fire rated to achieve 60/60/60.</li> </ul> <p>It was noted that the majority of the extra floor area within the smoke compartments come from staff areas and corridors and that the fire compartments will meet the DTS criteria of the BCA. Only 10 resident occupants will be located within each smoke compartment and the increase in floor area doesn't result in an increase in occupants.</p> <p>The proposed smoke walls (provided with impact resistance) will achieve an inherent FRL when installed as per the nominated wall-type specification however, they are permitted to only achieve an inherent FRL in lieu of a required FRL.</p> | Note |



|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|     | It was noted that staged evacuation into the adjoining fire and smoke compartments will occur and will be managed by the on-site staff. Additionally, it was noted that the building occupants will be long-stay residents that are under staff supervision with a low volume of visitors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
| 3.5 | <p><b>Doors within the walls forming part of the smoke compartmentation walls to be solid core smoke doors, in lieu of achieving -/60/30 FRL.</b></p> <p>In accordance with the above walls being permitted to achieve an inherent FRL, the doors within those walls are permitted to be solid core construction in lieu of achieving an FRL.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Note |
| 3.6 | <p><b>Fire separation of the linkway between the between the existing hospital and the new building to be rationalised on the existing hospital building side.</b></p> <p>As noted under item 3.2, the link-bridge is to be constructed to achieve FRLs in accordance with Type C construction due to the proposed low fire-load presented by the bridge. Fire doors to be provided at the point of connection into the existing building linkway to separate the building in accordance with the existing separation of buildings within the existing linkway.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Note |
| 3.7 | <p><b>Stair 4 (connecting Basement Level 1 to Lower Ground) is permitted to be provided as a non-fire-isolated non-required stair within a <i>Treatment Area</i>, in lieu of being fire-isolated.</b></p> <p>It was noted that the stairway is required to be fire-isolated due to being located within a Treatment Area however the proposed design will not isolate the stair. Fire separation between storeys is maintained on the LG level by a fire-rated door being provided at the top of the stairway. The stairway will not form an exit to either storey.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Note |
| 3.8 | <p><b>Exit travel distance to be as follows:</b></p> <p><b>Level B2</b></p> <ul style="list-style-type: none"> <li>To the nearest exit where travel in different directions to two exits is available to be not more than 45 m, in lieu of 40 m.</li> </ul> <p><b>Level B1</b></p> <ul style="list-style-type: none"> <li>To a point from which travel in different directions to two exits is available to be not more than 13 m from the Secure Court, in lieu of 12 m.</li> <li>To the nearest exit where travel in different directions to two exits is available to be not more than 39 m from the family visiting courtyard, in lieu of 30 m.</li> </ul> <p><b>Level LG</b></p> <ul style="list-style-type: none"> <li>To the nearest exit where travel in different directions to two exits is available to be not more than 33 m from the external walkway, in lieu of 30 m.</li> </ul> <p>B2 – Slight increase in plant &amp; storage area – low population<br/> B1 – naturally ventilated external area<br/> LG – Naturally ventilated external area</p> <p>The proposed extended travel distances will be addressed under a qualitative analysis based on minor extensions of required travel distances.</p> | Note |
| 3.9 | <p><b>Distance between alternative exits to be as follows:</b></p> <ul style="list-style-type: none"> <li>Up to 77 m on Level B1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Note |



|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|      | <ul style="list-style-type: none"> <li>▪ <b>Up to 65 m on Level LG</b></li> </ul> <p><b>in lieu of 45 m.</b></p> <p><i>Note: These are considered to be technical non-compliances due to the number of alternative egress paths available and the NCC DtS requirement to measure the distance between alternative exits through the first point of choice.</i></p> <p>The extended separation between exits occurs due to a technicality of measuring the distance through Point of Choice (POC). The extended separation only occurs when measured via the POC whereas direct separation between exits is not extended.</p> <p>The proposed extended separation between alternative exits will be addressed under a qualitative assessment based on anticipated occupant behaviour and staff assisted evacuation.</p> |      |
| 3.10 | <p><b>Internal sliding doorway to be installed within the following areas that do not open directly to a road or open space:</b></p> <ul style="list-style-type: none"> <li>▪ <b>Level B1 and Level LG courtyards.</b></li> <li>▪ <b>Single use rooms</b></li> </ul> <p>Sliders to non-secure areas are to be programmed to auto-open upon alarm/power failure – they will also have a press to open button &amp; manually operable under 110N. Secure areas will not open on alarm/power failure but will be openable under a manual force of 110N. The proposed solution will be justified based on the proposed staff assisted evacuation and low building population to demonstrate that the proposed sliding doors will not present a significant risk of crushing.</p>                                           | Note |
| 3.11 | <p><b>Fire and smoke doors forming horizontal exits between fire and smoke compartments to swing in a single direction, in lieu of swinging in both directions.</b></p> <p>The double doors (fire and smoke) provided between fire compartments cannot swing in both directions whilst achieving both an FRL and being impervious to smoke. It is permitted to allow the doors to swing in a single direction due to the low building population and staff assisted evacuation.</p>                                                                                                                                                                                                                                                                                                                                    | Note |
| 3.12 | <p><b>Secured exit doors within the building (i.e. required exits) to be not readily openable without a key or swipe card from the side that faces the person seeking egress, in lieu of being readily openable.</b></p> <p>It was noted that staff are provided swipe cards &amp; manual key override (Mental Health standard issue key &amp; master key) to manage evacuation via the required exits. It was further noted that the staff will facilitate a staged evacuation strategy through the courtyards, assembling in the courtyards before preceding down the nearest fire stairs. This proposed egress strategy will be consistent with the other mental health building on the site.</p>                                                                                                                   | Note |
| 3.13 | <p><b>Where occupants pose a risk of tampering in Patient Care areas, internal floor plate fire hydrants are permitted to be located within secure cupboards (automatically unlocking on fire sprinkler activation).</b></p> <p>The cupboards will unlock upon alarm and also be provided with a manual 003 key lock.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Note |



|            |                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 3.14       | <p><b>Provision of portable additional fire extinguishers throughout the building, in lieu of compliant fire hose reel coverage.</b></p> <p>It was noted that the staff will not use fire hose reels as they are not trained in first response firefighting and their priority will be to manage / assist in the staged evacuation strategy of the building consumers.</p>                                                          | Note |
| 3.15       | <p><b>Portable fire extinguishers are permitted to be located within secure cupboards, in lieu of being located in a conspicuous and readily accessible position in accordance with AS2444.</b></p> <p>The cupboards will be provided with a manual 003 key lock only but if co-located with a hydrant, the cupboard will auto open upon the activation of the alarm system.</p>                                                    | Note |
| 3.16       | <p><b>Fire sprinklers to be obviated from the top of lift shafts.</b></p> <p>The required sprinkler heads will be replaced with a heat detector to achieve the same outcome without damaging the electrical equipment within the lift shaft.</p>                                                                                                                                                                                    | Note |
| 3.17       | <p><b>Manual Call points within ward compartments are permitted to be '003' key activated and located within nurse/staff stations, in lieu of every 30 m.</b></p> <p>It was noted that this proposal is consistent with the existing mental health building on site. It was also noted that as an additional option, 003 key activated call points may be used for any MCP that is not located within the nurse/staff stations.</p> | Note |
| 3.18       | <p><b>Requirements for occupant warning speakers within Consumer Bedrooms to be obviated.</b></p> <p>The proposal will be to rely upon the sound of the alarm system coming through the door provided to each bedroom. It was also noted that evacuation will be staff assisted.</p>                                                                                                                                                | Note |
| 3.19       | <p><b>Exit and directional exit signage to be mounted at 3.0m throughout, in lieu of 2.7 m above the finished floor level.</b></p> <p>It was noted that the ceilings are generally greater than 2.7m above the finished floor level and that exit signs would be ceiling mounted.</p>                                                                                                                                               | Note |
| <b>4.0</b> | <b>Conclusion</b>                                                                                                                                                                                                                                                                                                                                                                                                                   |      |
| 4.1        | <p>Booster within sight of the main entrance to the building – technically the proposed location is not within sight of the 'main entrance' however it is within sight of the main QFES entrance to the building.</p> <p>Include an additional performance solution to address this technicality.</p>                                                                                                                               | WSP  |
| 4.2        | <p>Loadbearing capacity of the roadway passing through the link bridge – confirming that the height of the ceiling is at least 4.5m and the bearing capacity of the roadway is to be as per the existing roadway.</p>                                                                                                                                                                                                               | Note |

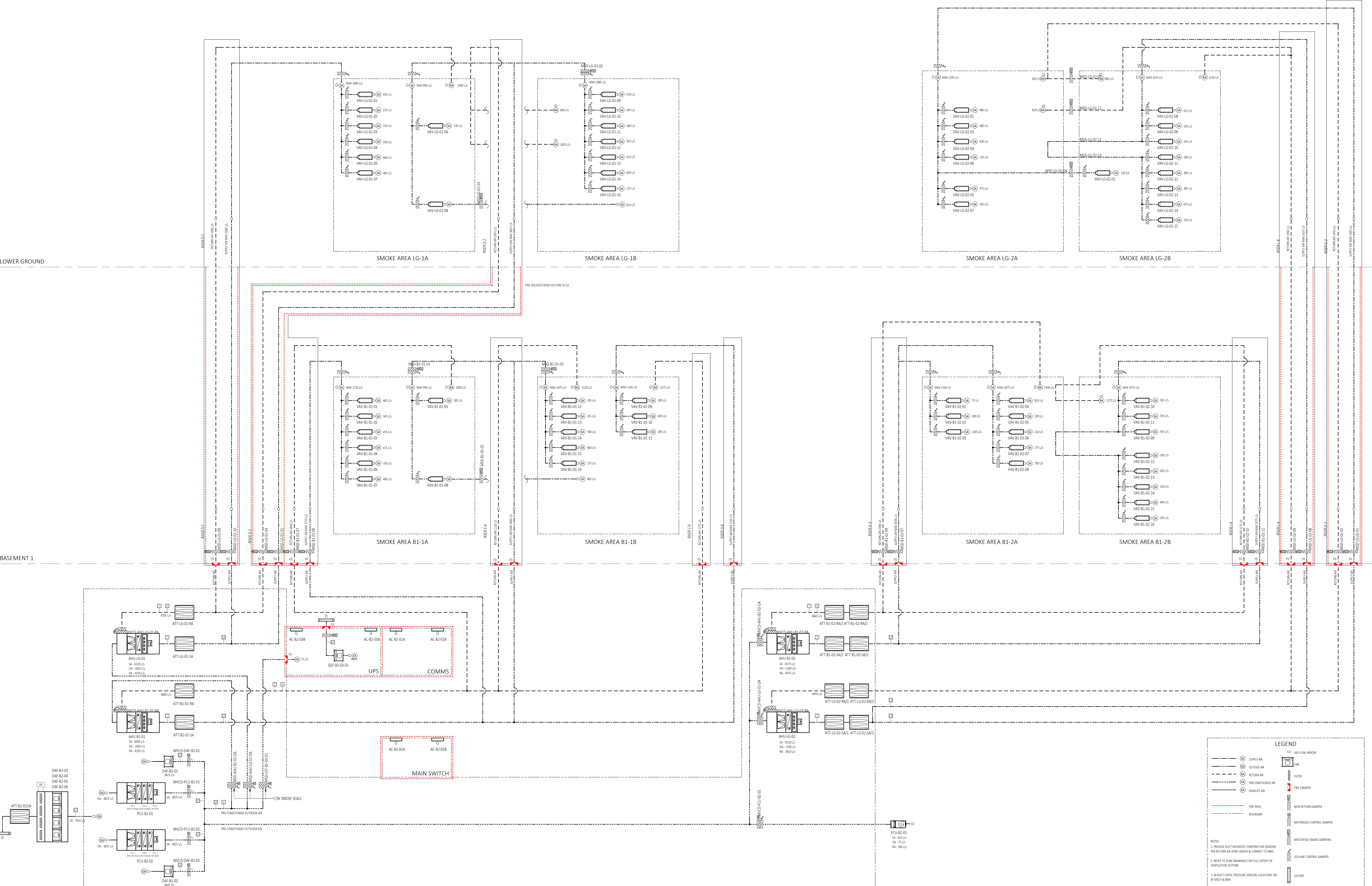


|     |                                                                                                                             |                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------|---------------------|
| 4.3 | Confirm whether an Auto Delay Function (ADF) or Auto Acknowledgement Function (AAF) is to be used within the building.      | QLD Health / Hendry |
| 4.4 | Confirm the proposed separation strategy between the triage building and the new bridge link.                               | QLD Health / Hendry |
| 4.5 | The QFES confirmed their understanding and general support for the strategy presented.                                      | Note                |
| 4.6 | It was agreed that a further FEB meeting was not warranted and that the FEB may be progressed to a Fire Engineering Report. | WSP                 |

Meeting closed at 2:30pm

# APPENDIX G

## MECHANICAL SERVICES AIR SCHEMATIC



Specifically, to be installed provided the following conditions are met:

1. The smoke dampers can be removed from duct in smoke walls where the following conditions are met:
  - a. The duct does not serve the compartment being passed through.
  - b. The duct is a solid metal duct.
  - c. No flexible duct is connected to the duct run in the compartment being passed through.

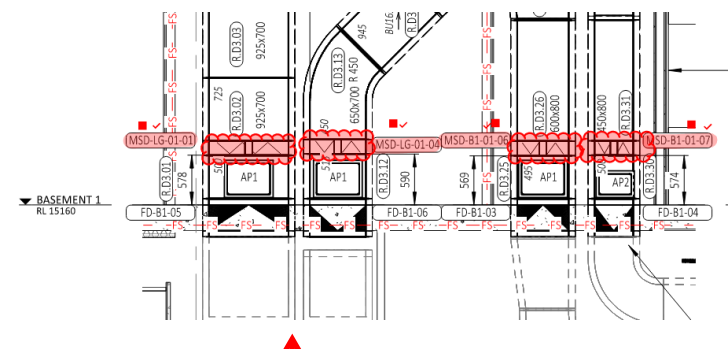
BOTH DAMPERS ARE ABLE TO BE REMOVED, IF MAIN RISER MSD'S REMAIN TO MAINTAIN SEPARATION. KEEP:  
MSD-LG-01-01  
MSD-LG-01-04  
MSD-LG-01-09  
MSD-LG-01-10

MSD-LG-01-02 REQUIRED HERE NOT SHOWN ON SCHEMATIC

SMOKE DAMPER MUST REMAIN. DUCTWORK IS CONNECTED AND SERVING BOTH SMOKE ZONES LG-2A AND LG-2B.

SMOKE DAMPER MUST REMAIN

MSD-LG-01-06 DAMPER NAME APPEARS ON MULTIPLE DAMPERS.



SMOKE DAMPERS MSD-LG-01-07 AND LG-01-06 ARE LABELLED INCORRECTLY ON SYSTEM AHU-B1-01. THESE SHOULD BE LABELLED MSD-B1-01-06 & MSD-B1-01-07. REFER TO SECTION SHOWN ABOVE SHOWING THESE DAMPERS LABELLED CORRECTLY.

ALL SMOKE DAMPERS IN RISER REQUIRED TO REMAIN TO MAINTAIN SEPARATION BETWEEN LG-1A & LG-1B AND B1-1A AND B1-1B.

THIS DAMPER IS REQUIRED TO STAY AS VAV-B1-01-05 IS SERVING SMOKE ZONE B1-1A

DAMPER IS NOT SHOWN ON THE MECH PLANS. WITH RISER DAMPER MSD-B1-01-07 INSTALLED, THIS ONLY SERVES SMOKE ZONE B1-1B SO MSD-B2-01 CAN BE DELETED.

ALL SMOKE DAMPERS REQUIRED TO REMAIN TO MAINTAIN SEPARATION BETWEEN B1-2A & B1-2B

ALL SMOKE DAMPERS REQUIRED TO REMAIN TO MAINTAIN SEPARATION BETWEEN B1-2A & B1-2B

ALL SMOKE DAMPERS REQUIRED TO REMAIN TO MAINTAIN SEPARATION BETWEEN LG-2A & LG-2B

LOWER GROUND

BASEMENT 1

UNDERCROFT/BASEMENT 2

MECHANICAL PLANTROOM

| REV | DESCRIPTION         | ISSUED FOR APPROVAL |
|-----|---------------------|---------------------|
| A   | ISSUED FOR APPROVAL |                     |

NOTES:  
REFER TO DRAWING M-DPA-000 FOR LEGEND AND DETAILS.  
BEND EXTENSIONS TO BE 50mm U.N.O.  
REFER TO DEWPOINT GROUP MANUFACTURING & CONSTRUCTION STANDARDS FOR ALL INSTALLATION DETAILS



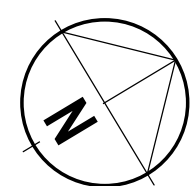
BUILDER:



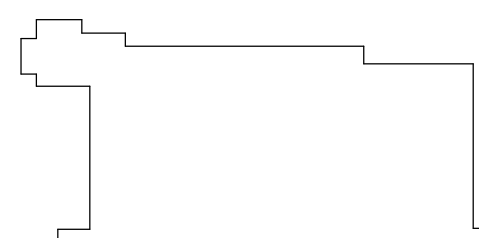
CLIENT:



PROJECT NORTH:



KEY PLAN:



24 Webster Road  
Stifford  
Brisbane  
Qld 4053  
T: (07) 3352 4446  
W: dewpointgroup.com.au

PROJECT

**GOLD COAST SECURE MENTAL HEALTH**  
1 Hospital Boulevard,  
SOUTHPORT QLD 4215

DRAWING TITLE

**MECHANICAL SERVICES AIR SCHEMATIC**

ISSUED FOR APPROVAL

| SCALE             | BY                           | DATE | REVISION |
|-------------------|------------------------------|------|----------|
| SCALE: NM         | DATE: 06/19/23               |      |          |
| PROJECT No: 11149 | DRAWING No: M-DPA-SMH-500-02 |      |          |

# APPENDIX H

## LEGRAND FIRE AND ACOUSTIC RATED WALL BOXES

# Sample Submission and Approval Form

QA-FRM-022



|                                      |                                                                                                                                                                                                                                                                                                   |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project:</b>                      | A511 – Gold Coast Secure Mental Health Rehabilitation Unit                                                                                                                                                                                                                                        |
| <b>Sample Reference Number:</b>      | QE0093 Rev 1                                                                                                                                                                                                                                                                                      |
| <b>Sample Description:</b>           | Fire and acoustic wall box                                                                                                                                                                                                                                                                        |
| <b>Physical Sample or Tech Data:</b> | See attached by Legrand                                                                                                                                                                                                                                                                           |
| <b>Sample Make / Model Number:</b>   | CAT. NO. 435, 435BU20, CM435/2                                                                                                                                                                                                                                                                    |
| <b>Specified or Alternative:</b>     | Not Specified                                                                                                                                                                                                                                                                                     |
| <b>Product Details:</b>              | See attached                                                                                                                                                                                                                                                                                      |
| <b>Sample Supplied by:</b>           | Mark Ashworth                                                                                                                                                                                                                                                                                     |
| <b>Date of Submission:</b>           | 28/11/23                                                                                                                                                                                                                                                                                          |
| <b>Date Approval Required By:</b>    | 20/12/23                                                                                                                                                                                                                                                                                          |
| <b>Comments:</b>                     | Please note: tests report has been completed with 2 x 2.5mm 2 core and earth cables. We are currently unaware of any fire box that exceeds these tests. An exception to the building fire report would need to be given for additional cables run into these for light switches and data cabling. |

|                                   |                                                       |                                            |                                       |  |              |  |
|-----------------------------------|-------------------------------------------------------|--------------------------------------------|---------------------------------------|--|--------------|--|
| <b>ARCHITECT</b>                  | <b>Company:</b>                                       |                                            | <b>Name:</b>                          |  | <b>Date:</b> |  |
| Endorsed <input type="checkbox"/> | Endorsed subject to comments <input type="checkbox"/> | Rejected/Resubmit <input type="checkbox"/> | Not Required <input type="checkbox"/> |  |              |  |
| Comments:                         |                                                       |                                            |                                       |  |              |  |
| Signature:                        |                                                       |                                            |                                       |  |              |  |

|                                   |                                                       |                                            |                                       |  |              |  |
|-----------------------------------|-------------------------------------------------------|--------------------------------------------|---------------------------------------|--|--------------|--|
| <b>CONSULTANT</b>                 | <b>Company:</b>                                       |                                            | <b>Name:</b>                          |  | <b>Date:</b> |  |
| Endorsed <input type="checkbox"/> | Endorsed subject to comments <input type="checkbox"/> | Rejected/Resubmit <input type="checkbox"/> | Not Required <input type="checkbox"/> |  |              |  |
| Comments:                         |                                                       |                                            |                                       |  |              |  |
| Signature:                        |                                                       |                                            |                                       |  |              |  |

|                                   |                                                       |                                            |                                       |  |              |  |
|-----------------------------------|-------------------------------------------------------|--------------------------------------------|---------------------------------------|--|--------------|--|
| <b>CLIENT'S REP</b>               | <b>Company:</b>                                       |                                            | <b>Name:</b>                          |  | <b>Date:</b> |  |
| Approved <input type="checkbox"/> | Approved subject to comments <input type="checkbox"/> | Rejected/Resubmit <input type="checkbox"/> | Not Required <input type="checkbox"/> |  |              |  |
| Comments:                         |                                                       |                                            |                                       |  |              |  |
| Signature:                        |                                                       |                                            |                                       |  |              |  |

# Datasheet

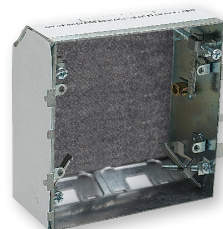
## Fire and Acoustic Rated Wall Boxes



CAT. NO. 435, 435BU20, CM435/2



435



CM435/2

| Cat. No.                            | 435                                                                                                                  | 435BU20                                                    | CM435/2                                                                 |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------|
| Description                         | Wall Box 1 Gang<br>Fire and Acoustic rated                                                                           | Wall Box 1 Gang Fire<br>and Acoustic rated<br>(Pack of 20) | 2 Gang Wall Box<br>Fire and Acoustic rated                              |
| Fire resistance Level (FRL)         | Back-to-back configuration: - /120/60 (1-hour applications)<br>- /180/120 (2-hour application)                       |                                                            |                                                                         |
|                                     | Single-sided configuration: - /120/120 (2-hour applications)<br>- /180/180 (3-hour applications)                     |                                                            |                                                                         |
|                                     | Single-sided configuration: - /60/60 (1-hour applications)                                                           |                                                            | N/A                                                                     |
| Weighted Sound Reduction Index (Rw) | 62                                                                                                                   |                                                            |                                                                         |
| Sound Transmission Class (STC)      | 59                                                                                                                   |                                                            |                                                                         |
| Wall type                           | Suitable for 10 mm to 32 mm thick plaster board walls                                                                |                                                            |                                                                         |
| Material                            | Galvanized Steel                                                                                                     |                                                            |                                                                         |
| Cut-out size                        | 102 x 58 mm                                                                                                          |                                                            | 104 x 104 mm                                                            |
| Box Dimensions (WxHxD)              | 101 x 57 x 51mm                                                                                                      |                                                            | 103 x 103 x 51mm                                                        |
| Mounting Centres                    | 84 mm                                                                                                                |                                                            |                                                                         |
| Applications                        | Suitable for all Single switchplates or powerpoints                                                                  |                                                            | Suitable for COM0 Double<br>plate devices only<br>(ie: CM777 & CM940SF) |
| Compliance                          | ASTM E413-87, AS1530.4 in conjunction with AS4072.1 (Fire rating)<br>AS1191, AS1276.1 and ISO717.1 (Acoustic rating) |                                                            |                                                                         |

# Fire and Acoustic Rated Wall Boxes

CAT. NO. 435, 435BU20, CM435/2



435



CM435/2

## FEATURES

Fire and Acoustic rated wall box suitable for residential and commercial applications such as hospitals, hotels, public buildings and multi-dwelling apartments.

- Back-to-back configuration:
  - /120/60 (1-hour applications)
  - /180/120 (2-hour applications)
- Single-sided configuration:
  - /120/120 (2-hour applications)
  - /180/180 (3-hour applications)
- Weighted sound reduction index (Rw) 62
- Sound Transmission Class 59
- 84 mm centre installations.
- Corrosion resistant.
- Robust design.
- Suitable for plaster wall 10 mm to 32 mm thick.
- Knockouts for easy cable access.
- ASTM E413-87, AS1530.4 in conjunction with AS4072.1 (Fire rating)  
AS1191, AS1276.1 and ISO717.1 (Acoustic rating)

| Single product |                    |        |               |
|----------------|--------------------|--------|---------------|
| Cat. No.       | Dimensions (WxHxD) | Weight | Barcode       |
| 435            | 120 x 70 x 60mm    | 250 g  | 9321001392224 |
| CM435/2        | 112 x 105 x 60mm   | 320 g  | 9321001435181 |

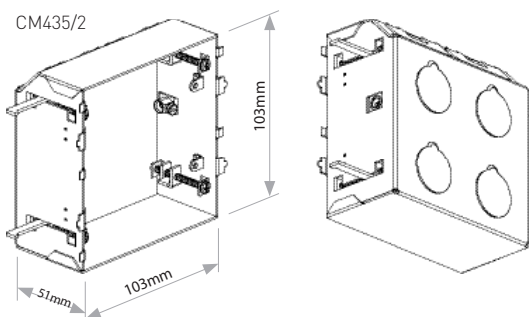
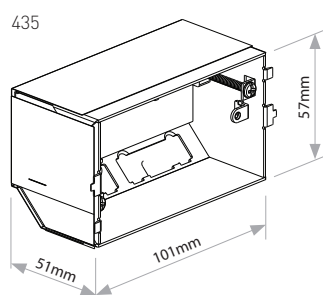
| Single product (Pack of 20) |                    |        |               |
|-----------------------------|--------------------|--------|---------------|
| Cat. No.                    | Dimensions (WxHxD) | Weight | Barcode       |
| 435BU20                     | 380 x 310 x 330mm  | 8.9 kg | 9321001488637 |

| Inner box (QTY 4) |                    |        |               |
|-------------------|--------------------|--------|---------------|
| Cat. No.          | Dimensions (WxHxD) | Weight | Barcode       |
| CM435/2           | 163 x 163 x 131mm  | 1.4 kg | 9321001435198 |

| Outer box (QTY 60) |                    |        |               |
|--------------------|--------------------|--------|---------------|
| Cat. No.           | Dimensions (WxHxD) | Weight | Barcode       |
| 435                | 380 x 310 x 330mm  | 16 kg  | 9321001392248 |

| Outer box (QTY 48) |                    |         |               |
|--------------------|--------------------|---------|---------------|
| Cat. No.           | Dimensions (WxHxD) | Weight  | Barcode       |
| CM435/2            | 500 x 333 x 262mm  | 17.8 kg | 9321001435204 |

## DIMENSIONS



### General Note:

1. Vertical wall penetrations shall not be positioned above one another, unless they have a vertical height separation of at least 600 mm and a horizontal strut/noggin in between the penetrations.
2. Fire tests have been performed in framed plasterboard wall systems. Test results are applicable to the performance of the wall box in concrete/cement or brick walls of the same or greater thickness as in the tested prototype. (Reference: AS 1530.4 clause 10.12)
3. Any gaps > 1 mm in size between edge of wall box and wall shall be filled with fire-stopping mastic. Gaps < 1 mm do not require mastic.

Legrand - Australia  
1300 369 777  
www.legrand.com.au  
ABN 31 000 102 661

Refer to your group buying office, Legrand Sales Representative or Legrand Sales Office for pricing.

Legrand - New Zealand  
0800 476 009  
www.legrand.co.nz

Please note: specifications are subject to change without prior notice.



# Fire assessment report

Legrand products in accordance with  
AS 1530.4:2014

Sponsor: Legrand Australia Pty Ltd

Report number: FAS210125 Revision: R1.4

Issued date: 12 May 2022 Expiry date: 30 June 2026

## Quality management

| Version | Date                  | Information about the report |                                                                                          |                                                                                      |                                                                                       |
|---------|-----------------------|------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| R1.0    | Issue:<br>2/06/2021   | Reason for issue             | Report issued to Legrand Australia Pty Ltd for review and comment.                       |                                                                                      |                                                                                       |
|         |                       |                              | <b>Prepared by</b>                                                                       | <b>Reviewed by</b>                                                                   | <b>Authorised by</b>                                                                  |
|         |                       | <b>Name</b>                  | Sashini Sue                                                                              | Imran Ahamed                                                                         | Mahmoud Akl                                                                           |
| R1.1    | Issue:<br>6/08/2021   | Reason for issue             | Re-issued after addressing minor comments.                                               |                                                                                      |                                                                                       |
|         |                       |                              | <b>Prepared by</b>                                                                       | <b>Reviewed by</b>                                                                   | <b>Authorised by</b>                                                                  |
|         |                       | <b>Name</b>                  | Sashini Sue                                                                              | Imran Ahamed                                                                         | Imran Ahamed                                                                          |
| R1.2    | Issue:<br>14/04/2022  | Reason for issue             | Revised report to update the orientation of the wall box and number of cables connected. |                                                                                      |                                                                                       |
|         |                       |                              | <b>Prepared by</b>                                                                       | <b>Reviewed by</b>                                                                   | <b>Authorised by</b>                                                                  |
|         |                       | <b>Name</b>                  | Sashini Sue                                                                              | Imran Ahamed                                                                         | Imran Ahamed                                                                          |
| R1.3    | Issue:<br>26/04/2022  | Reason for issue             | Re-issued after addressing minor comments.                                               |                                                                                      |                                                                                       |
|         |                       |                              | <b>Prepared by</b>                                                                       | <b>Reviewed by</b>                                                                   | <b>Authorised by</b>                                                                  |
|         |                       | <b>Name</b>                  | Sashini Sue                                                                              | Imran Ahamed                                                                         | Imran Ahamed                                                                          |
| R1.4    | Issue:<br>12/05/2022  | Reason for issue             | Re-issued after addressing minor comments and typographical amendments.                  |                                                                                      |                                                                                       |
|         | Expiry:<br>30/06/2026 |                              | <b>Prepared by</b>                                                                       | <b>Reviewed by</b>                                                                   | <b>Authorised by</b>                                                                  |
|         |                       | <b>Name</b>                  | Sashini Sue                                                                              | Imran Ahamed                                                                         | Imran Ahamed                                                                          |
|         |                       | <b>Signature</b>             | Sashini Hegunacheli                                                                      |  |  |

## Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various GPO and light switch systems in minimum 90 mm thick plasterboard wall systems with a single layer of 13 mm FR plasterboard on both sides – if tested in accordance with AS 1530.4:2014.

The analysis in section 5 of this report found that the proposed systems are expected to achieve an FRL as shown in Table 1, if tested in accordance with AS 1530.4:2014.

**Table 1 Assessment outcome**

| ID | GPO/switch<br>Unexposed side | GPO/switch<br>Exposed side | Aperture and perimeter gap<br>dimensions for GPOs                                                                                                   | Distance between GPOs                                                         | Sealant<br>fillet | Height from<br>the bottom of<br>the wall (mm) | FRL     |
|----|------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------|-----------------------------------------------|---------|
| 1  | ED777WE                      | ED777WE                    | Hole size not greater than 60 mm high x 104 mm wide. Perimeter gaps not more than 1 mm from the top, 1 mm from the sides, and 1 mm from the bottom. | 145 mm horizontal spacing between the exposed and unexposed side wall box.    | Yes               | 1300                                          | -/60/60 |
| 2  | 1 x ED770/1WE                | 2 x ED777WE                | Hole size not greater than 61 mm high x 104 mm wide. Perimeter gaps not more than 2 mm from the top, 1 mm from the sides, and 1 mm from the bottom. | 50 mm spacing between the GPO boxes on the exposed side as shown in Figure 2. | No                | 200                                           | -/60/60 |
| 3  | ED777WE                      | ED777WE                    | Hole size not greater than 60 mm high x 104 mm wide. Perimeter gaps not more than 2 mm from the top, 1 mm from the sides, and 0 mm from the bottom. | 145 mm horizontal spacing between the exposed and unexposed side wall box.    | No                | 200                                           | -/60/60 |
| 4  | ED777WE                      | ED777WE                    | Hole size not greater than 62 mm high x 106 mm wide. Perimeter gaps not more than 4 mm from the top, 2 mm from the sides, and 0 mm from the bottom. | 142 mm horizontal spacing between the exposed and unexposed side wall box.    | No                | 200                                           | -/60/60 |

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 6 of this report. The results of this report are valid until 30 June 2026.

## Contents

|            |                                                                              |    |
|------------|------------------------------------------------------------------------------|----|
| 1.         | Introduction                                                                 | 5  |
| 2.         | Framework for the assessment                                                 | 5  |
| 2.1        | Assessment approach                                                          | 5  |
| 2.2        | Compliance with the National Construction Code                               | 6  |
| 2.3        | Declaration                                                                  | 6  |
| 3.         | Limitations of this assessment                                               | 6  |
| 4.         | Description of the specimen and variations                                   | 7  |
| 4.1        | System description                                                           | 7  |
| 4.2        | Referenced test data                                                         | 7  |
| 4.3        | Variations to the tested systems                                             | 7  |
| 4.4        | Assessment standard                                                          | 7  |
| 4.5        | Schedule of components                                                       | 8  |
| 5.         | Assessment of GPO and light switch systems in accordance with AS 1530.4:2014 | 12 |
| 5.1        | Description of variation                                                     | 12 |
| 5.2        | Methodology                                                                  | 12 |
| 5.3        | Assessment                                                                   | 12 |
| 5.4        | Conclusion                                                                   | 14 |
| 6.         | Validity                                                                     | 15 |
| Appendix A | Summary of supporting test data                                              | 16 |

## 1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various GPO and light switch systems – if tested in accordance with AS 1530.4:2014<sup>1</sup>.

This report may be used as Evidence of Suitability in accordance with the requirements of the relevant National Construction Code (NCC) to support the use of the material, product, form of construction or design as given within the scope of this assessment report. It also references test evidence for meeting deemed to satisfy (DTS) provisions of the (NCC) as applicable to the assessed systems.

This assessment was carried out at the request of Legrand Australia Pty Ltd.

The sponsor details are included in Table 2.

**Table 2 Sponsor details**

| Sponsor                   | Address                                                    |
|---------------------------|------------------------------------------------------------|
| Legrand Australia Pty Ltd | 4, 43 -47, Lyn Parade<br>Prestons<br>NSW 2170<br>Australia |

## 2. Framework for the assessment

### 2.1 Assessment approach

An assessment is an opinion about the expected performance of a component or element of structure if it was subject to a fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2021<sup>2</sup>.

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

This assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

<sup>1</sup> Standards Australia, 2014, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2014, Standards Australia, NSW.

<sup>2</sup> Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

This assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

## 2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the evidence of suitability requirements of the National Construction Code Volumes One and Two – Building Code of Australia (NCC) 2019 including amendments<sup>3</sup> under A5.2 (1) (d).

This assessment has been written in accordance with the general principles outlined in EN 15725:2010<sup>4</sup> for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provisions of the NCC under A5.4 for fire resistance levels as applicable to the assessed systems.

This assessment report may also be used to demonstrate compliance with the requirements for evidence of suitability under NCC 2016 including amendments<sup>5</sup>.

## 2.3 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPP in the UK requires a declaration from the client. By accepting our fee proposal on 21 April 2021, Legrand Australia Pty Ltd confirmed that:

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

## 3. Limitations of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results that are expected if the systems were tested in accordance with AS 1530.4:2014.
- This assessment is applicable to wall systems exposed to fire from each side for services 1, 3 and 4 and from one side for service 2 in accordance with the requirements of AS 1530.4:2014 where vertical elements must be exposed to heat from the direction required to resist fire exposure.
- This report is only valid for the assessed system/s and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).
- The documentation that forms the basis for this report is listed in Appendix A.

<sup>3</sup> National Construction Code Volumes One and Two - Building Code of Australia 2019 including Amendments, Australian Building Codes Board, Australia

<sup>4</sup> European Committee for Standardization, 2010, Extended application reports on the fire performance of construction products and building elements, EN 15725:2010, European Committee for Standardization, Brussels, Belgium.

<sup>5</sup> National Construction Code Volumes One and Two - Building Code of Australia 2016 including Amendments, Australian Building Codes Board, Australia

- The opening within the wall box to allow passage of cables could be either on top, bottom or sides.
- Up to 6 conductors can be connected to the wall box and passed through the openings into the cavity of the wall system.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and the expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

## 4. Description of the specimen and variations

### 4.1 System description

The referenced system consisted of a nominal 1600 mm wide × 1600 mm high × 90 mm thick steel stud plasterboard wall with different GPO and light switch systems mounted on both the exposed and unexposed sides in various configurations.

### 4.2 Referenced test data

The assessment of the variation to the tested system and the determination of the expected performance is based on the results of the fire tests documented in the reports summarised in Table 3. Further details of the tested system are included in Appendix A.

**Table 3 Referenced test data**

| Report number   | Test sponsor              | Test date        | Testing authority                                                       |
|-----------------|---------------------------|------------------|-------------------------------------------------------------------------|
| EWFA 39437600.3 | Legrand Australia Pty Ltd | 23 December 2015 | Warringtonfire Australia<br>(Formerly known as Exova<br>Warringtonfire) |

### 4.3 Variations to the tested systems

An identical system has not been subject to a fire test to the latest testing standard. We have therefore assessed the systems using baseline test information for similar systems. The variations to the tested systems – together with the referenced standard fire tests – are described in Table 4.

**Table 4 Variation to tested systems**

| Item                         | Reference test  | Description                                                                                                     | Variations                                                                                                                                                                                                                                                                    |
|------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GPO and light switch systems | EWFA 39437600.3 | The tested system consisted of different GPO and light switch systems tested in accordance with AS 1530.4:2005. | <ul style="list-style-type: none"> <li>• Update the referenced test results to be in accordance with AS 1530.4:2014.</li> <li>• Variation in the orientation and location of the openings in the wall box</li> <li>• Number of cables passing through the wall box</li> </ul> |

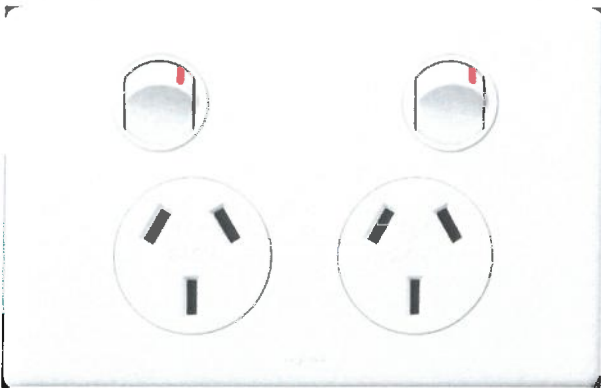
### 4.4 Assessment standard

AS 1530.4:2014 sets out the methods for conducting fire tests on building materials, components and structures, specifically, section 2 of this standard contains the general requirements for these tests. Section 10 addresses the fire resistance of service penetrations.

## 4.5 Schedule of components

Table 5 outlines the schedule of components for the assessed systems subject to a fire test. Figure 1 and Figure 2 show the horizontal view of the assessed systems.

**Table 5 Schedule of components of assessed systems**

| Item | Description       |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <b>GPO</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|      | Product name      | ED777WE, Excel Life™ Dedicated Plate - Double Powerpoint, 10A<br>                                                                                                                                                                                                                                                                                        |
|      | GPO dimensions    | Overall dimension of the GPO must not be greater than 121 mm wide x 77 mm high x 10 mm deep                                                                                                                                                                                                                                                                                                                                                |
|      | GPO material      | Polycarbonate (PC)                                                                                                                                                                                                                                                                                                                                                                                                                         |
|      | Cut out dimension | The cut out behind the GPO must not be greater than 62 mm high x 106 mm wide. (See Table 1 for requirements)                                                                                                                                                                                                                                                                                                                               |
| 2    | <b>Wall box</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|      | Product Name      | 435 Fire Rated Acoustic Wall Box                                                                                                                                                                                                                                                                                                                                                                                                           |
|      | GPO wall box size | Overall dimension of the wall box must be nominal 102 mm wide x 57.2 mm high x 33.2 mm deep on the top and side edge and 49.2 mm on the bottom edge.<br><br>The shell of the wall box must be made from 1.1 mm (nominal) thick galvanized steel.<br><br>There are TWO holes located at the top edge plate with dimension 13.9 mm wide x 8 mm deep.<br> |
|      | Location          | The location of GPOs and the wall boxes to be as mentioned in Table 1.                                                                                                                                                                                                                                                                                                                                                                     |
|      | Intumescent       | A piece of Intumescent must be installed at the back of the wall box. The overall dimension of the intumescent must be 95.4 mm wide x 41.3 mm high x 7.5 mm thick. The density of the intumescent must be 981 kg/m³.                                                                                                                                                                                                                       |
|      | Perimeter gaps    | As in Table 1.                                                                                                                                                                                                                                                                                                                                                                                                                             |

|   |                                |                                                                                                                                                                        |
|---|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Fixing                         | The wall box must be fixed to the plasterboard behind the opening with pair of 35 mm wide × 6.5 mm high × 1.4 mm metal strips and Ø3.3 mm × 42.1 mm long screws.       |
|   | Orientation                    | The opening within the wall box to allow passage of cables could be either on top, bottom or sides.                                                                    |
|   | Sealant fillet                 | Selleys Fireblock mastic must be applied in the gap between the wall box and the separating element on both exposed and unexposed side. (See Table 1 for requirements) |
| 3 | <b>Cable</b>                   |                                                                                                                                                                        |
|   | Product Name                   | General 2 cores + Earth 2.5 mm <sup>2</sup> cable (3 conductors)                                                                                                       |
|   | Cable exit location            | The cables must be exiting the wall box through the openings on the wall box.                                                                                          |
|   | Installation                   | Up to 6 conductors with a maximum conductor area of 15 mm <sup>2</sup> could be connected to the GPO/switch. The cables must be connected to the GPO/switch.           |
| 4 | <b>Switch (Unexposed side)</b> |                                                                                                                                                                        |
|   | Product name                   | ED770/1WE, Excel Life™ Dedicated Plate - 1 Gang Switch, 16A<br>                      |
|   | Switch dimensions              | Overall dimension of the wall switch must be 77 mm wide × 121 mm high × 10 mm deep                                                                                     |
|   | Switch material                | Polycarbonate (PC)                                                                                                                                                     |
|   | Cut out dimension              | The cut out behind the wall switch must be 104 mm high × 61 mm wide.                                                                                                   |

|                           |                         |                                                                                                                                                                                                                                                                                                                                                                                              |  |
|---------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                           |                         |                                                                                                                                                                                                                                                                                                             |  |
| <b>Separating element</b> |                         |                                                                                                                                                                                                                                                                                                                                                                                              |  |
| 5                         | Name                    | Boral Firestop 13 mm Plasterboard                                                                                                                                                                                                                                                                                                                                                            |  |
|                           | Size                    | 90 mm thick wall incorporating a single layer of 13 mm thick sheets on both sides with 64 mm wide steel studs and 64 mm deflection head.                                                                                                                                                                                                                                                     |  |
|                           | Density of plasterboard | 894 kg/m <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                        |  |
|                           | Specification           | <p>64 mm perimeter studs and tracks are to be fixed to the concrete blockwork using Ø6.5 mm x 55 mm Sleeve Anchor Hex head fasteners.</p> <p>Selleys Fireblock mastic to be applied on the unexposed and exposed side of the Boral Firestop board strip,</p> <p>Outer sheets to be fixed to metal framing using 6 g x 40 mm Bugle Head Needle Point Fine Thread screws at 300 mm centres</p> |  |

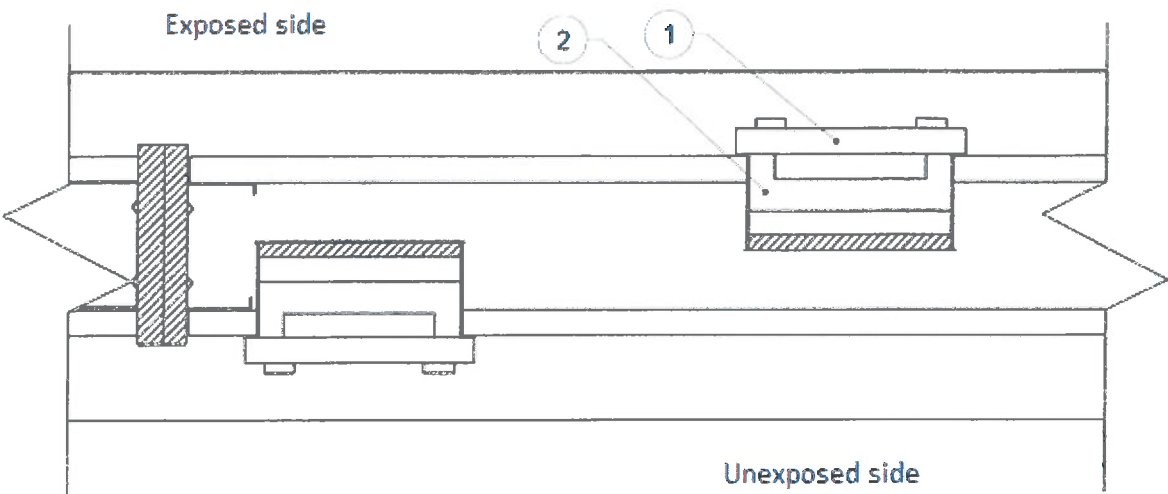


Figure 1 Horizontal view of specimens 1, 3 and 4

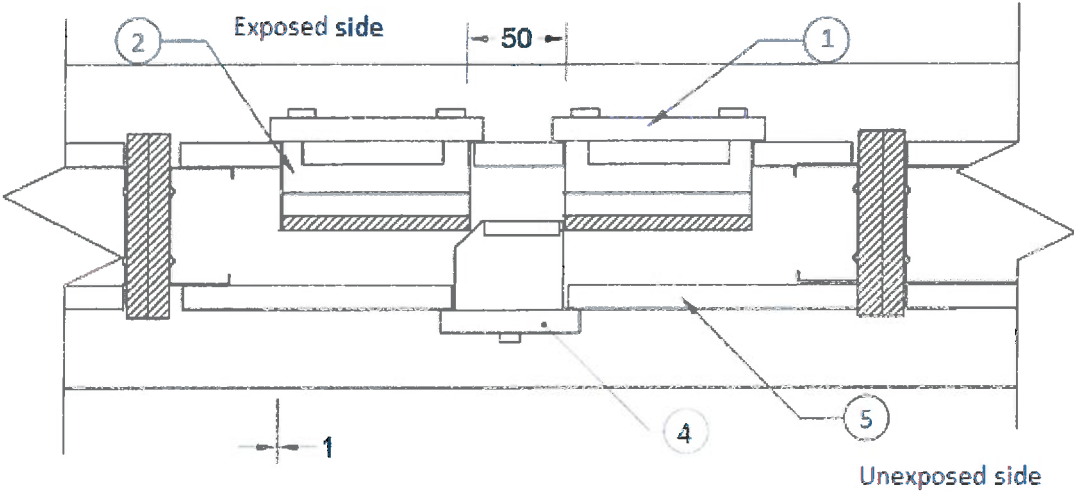


Figure 2 Horizontal view of specimen 2

## 5. Assessment of GPO and light switch systems in accordance with AS 1530.4:2014

### 5.1 Description of variation

The tested systems in the referenced test report EWFA 39437600.3 consisted of GPO and light switch systems in a 90 mm thick wall incorporating a single layer of 13 mm thick fire rated plasterboard on both sides with 64 mm deep steel studs. The test was conducted in accordance with AS 1530.4:2005<sup>6</sup>.

It is proposed to assess the fire performance of A, C, F and I penetrations – of EWFA 39437600.3 test report – in accordance with AS 1530.4:2014.

It is also proposed to assess the orientation of the wall boxes installed, location of the openings and the number of cables passing through the wall box.

### 5.2 Methodology

The method of assessment used is summarised in Table 6.

**Table 6 Method of assessment**

| Assessment method   |                             |
|---------------------|-----------------------------|
| Level of complexity | Intermediate assessment     |
| Type of assessment  | Qualitative and comparative |

### 5.3 Assessment

#### 5.3.1 Relevance of AS 1530.4:2005 test data with respect to AS 1530.4:2014

The fire resistance test EWFA 39437600.3 was conducted in accordance with AS 1530.4:2005, which differs from AS 1530.4:2014. The effect these differences have on fire resistance performance of the referenced test specimens is discussed below.

##### Furnace temperature

The furnace heating regime in fire resistance tests conducted in accordance with AS 1530.4:2014 follows a similar trend to that in AS 1530.4:2005.

The specified specimen heating rate in AS 1530.4:2005 is given by:

$$T_t - T_0 = 345 \log(8t + 1) + 20$$

Where:

$T_t$  = furnace temperature at time  $t$ , in degrees Celsius.

$T_0$  = initial furnace temperature, in degrees Celsius.

$t$  = the time into the test, measured in minutes from the ignition of the furnace.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

##### Furnace pressure

The furnace pressure conditions for single and multiple penetration sealing systems in AS 1530.4:2005 and AS 1530.4:2014 are not appreciably different.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

<sup>6</sup> Standards Australia, 2005, Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2005, Standards Australia, NSW.

## Performance criteria

AS 1530.4:2014 specifies the following performance criteria for building materials and structures:

- Integrity.
- Insulation.

### Integrity

AS 1530.4:2014 stipulates in addition to the 20 mm thick × 100 mm × 100 mm cotton pads, additional cotton pads shall be provided with a reduced 30 mm × 30 mm × 20 mm with additional wire frame holder and shall be used to determine integrity failure.

Apart from the above variation, the failure criteria for integrity in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

After review of the test photos, it was observed that despite the detaching of the GPO and switches due to the expansion of the intumescent, the intumescent was sufficient to close off the gap behind the switches. No glowing was noticed behind GPOs and the switches. Based on this observation, it is reasonable to consider that applying additional cotton pads will not likely result in a different outcome. Hence, no integrity failure is expected to occur for the duration of 60 minutes similar to the tested systems.

### Insulation

The positions of thermocouples and failure criteria for insulation in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### Conclusion

Based on the above discussion and in absence of any foreseeable integrity and insulation risk, it is concluded that the results relating to the integrity and insulation performance of the specimens A, C, F and I tested in EWFA 39437600.3 – can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

## 5.3.2 Orientation of wall boxes

In the tested systems in EWFA 39437600.3 the orientation of the installed wall boxes was such that the opening for cables were on the top of the installation. When exposed to fire, the intumescent material in the wall box is expected to seal all openings regardless of them being located at the top or bottom. Therefore, installing the wall boxes with the openings at sides or bottom are not expected to affect the performance of the specimens detrimentally, hence is positively assessed in this assessment.

## 5.3.3 Number of cables passing through the wall box

In the tested systems, a set of general 2 cores + Earth (2.5 mm<sup>2</sup>) cable (three conductors) was connected to the GPO/switch and passed through the openings of the wall box into the cavity of the wall systems. As this cable is not directly penetrating to the other side of the wall, having two sets of the power cables are not expected to result in any significant adverse impact on the performance of the systems. Therefore, up to two sets of the tested cables (up to 6 conductors) with a maximum conductor area of 15 mm<sup>2</sup> are positively assessed in this assessment report.

## 5.4 Conclusion

Based on the above discussion and in absence of any foreseeable integrity and insulation risk, it is concluded that the results relating to the integrity and insulation performance of the specimens shown in Table 7 – tested in EWFPA 39437600.3 – can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

**Table 7 Assessment outcome**

| ID | GPO/switch<br>Unexposed side | GPO/switch<br>Exposed side | Aperture and perimeter gap<br>dimensions for GPOs                                                                                                   | Distance between<br>GPOs                                                      | Sealant<br>fillet | Height from<br>the bottom of<br>the wall (mm) | FRL     |
|----|------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------|-----------------------------------------------|---------|
| 1  | ED777WE                      | ED777WE                    | Hole size not greater than 60 mm high x 104 mm wide. Perimeter gaps not more than 1 mm from the top, 1 mm from the sides, and 1 mm from the bottom. | 145 mm horizontal spacing between the exposed and unexposed side wall box.    | Yes               | 1300                                          | -/60/60 |
| 2  | 1 x ED770/1WE                | 2 x ED777WE                | Hole size not greater than 61 mm high x 104 mm wide. Perimeter gaps not more than 2 mm from the top, 1 mm from the sides, and 1 mm from the bottom. | 50 mm spacing between the GPO boxes on the exposed side as shown in Figure 2. | No                | 200                                           | -/60/60 |
| 3  | ED777WE                      | ED777WE                    | Hole size not greater than 60 mm high x 104 mm wide. Perimeter gaps not more than 2 mm from the top, 1 mm from the sides, and 0 mm from the bottom. | 145 mm horizontal spacing between the exposed and unexposed side wall box.    | No                | 200                                           | -/60/60 |
| 4  | ED777WE                      | ED777WE                    | Hole size not greater than 62 mm high x 106 mm wide. Perimeter gaps not more than 4 mm from the top, 2 mm from the sides, and 0 mm from the bottom. | 142 mm horizontal spacing between the exposed and unexposed side wall box.    | No                | 200                                           | -/60/60 |

## 6. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on, or before, the stated expiry date.

This assessment represents our opinion about the performance of the proposed systems expected to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

This assessment is provided to Legrand Australia Pty Ltd for their own specific purposes. This report may be used as Evidence of Suitability in accordance the requirements of the relevant National Construction Code. Building certifiers and other third parties must determine the suitability of the systems described in this report for a specific installation.

## Appendix A Summary of supporting test data

### A.1 Test report – EWFA 39437600.3

**Table 8 Information about test report**

| Item                                   | Information about test report                                                                                                                                                                                                                                                                             |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Report sponsor                         | Legrand Australia Pty Ltd                                                                                                                                                                                                                                                                                 |
| Test laboratory                        | Warringtonfire Australia, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. Formerly known as Exova Warringtonfire.                                                                                                                                                                              |
| Test date                              | The fire resistance test was done on 23 December 2015.                                                                                                                                                                                                                                                    |
| Test standards                         | The test was done in accordance with AS 1530.4:2005.                                                                                                                                                                                                                                                      |
| Variation to test standards            | None                                                                                                                                                                                                                                                                                                      |
| General description of tested specimen | The test assembly comprised a nominal 1600 mm wide x 1600 mm high x 90 mm thick steel stud plasterboard wall with different GPO and light switch systems mounted on both the exposed and unexposed sides in various configurations. Only services A, C, F and I are referenced in this assessment report. |
| Instrumentation                        | The test report states that the instrumentation was in accordance with AS 1530.4:2005.                                                                                                                                                                                                                    |

The test specimen achieved the following results – see Table 9.

**Table 9 Results summary for this test report**

| Service | Criteria   | Time to failure          | FRL     |
|---------|------------|--------------------------|---------|
| A       | Integrity  | No failure at 61 minutes | -/60/60 |
|         | Insulation | No failure at 61 minutes |         |
| C       | Integrity  | No failure at 61 minutes | -/60/60 |
|         | Insulation | No failure at 61 minutes |         |
| F       | Integrity  | No failure at 61 minutes | -/60/60 |
|         | Insulation | No failure at 61 minutes |         |
| I       | Integrity  | No failure at 61 minutes | -/60/60 |
|         | Insulation | No failure at 61 minutes |         |

# warringtonfire

Proud to be part of  element



Warringtonfire Australia Pty Ltd  
ABN 81 050 241 524

#### Perth

Unit 22, 22 Railway Road  
Subiaco WA 6008  
Australia  
T: +61 8 9382 3844

#### Canberra

Unit 10, 71 Leichhardt Street  
Kingston ACT 2604  
Australia  
T: +61 2 6260 8488

#### Melbourne

Level 9, 401 Collins Street  
Melbourne VIC 3000  
Australia  
T: +61 3 9767 1000

#### Sydney

Suite 802, Level 8, 383 Kent Street  
Sydney NSW 2000  
Australia  
T: +61 2 9211 4333

#### Brisbane

Suite 6, Level 12, 133 Mary Street  
Brisbane QLD 4000  
Australia  
T: +61 7 3238 1700

#### Melbourne – NATA accredited laboratory

409-411 Hammond Road  
Dandenong South VIC 3175  
Australia  
T: +61 3 9767 1000

#### General conditions of use

The data, methodologies, calculations and results documented in this report specifically relate to the tested specimen/s and must not be used for any other purpose. This report may only be reproduced in full. Extracts or abridgements must not be published without permission from Warringtonfire.

All work and services carried out by Warringtonfire are subject to, and conducted in accordance with our standard terms and conditions. These are available on request or at <https://www.element.com/terms/terms-and-conditions>.

# APPENDIX I ACONEX CORRESPONDENCE

**Secure Mental Health Rehabilitation Unit**

1 Hospital Blvd  
Southport  
QLD 4215 Australia



MAIL TYPE  
General Correspondence

MAIL NUMBER  
StantecA-GCOR-000523

REFERENCE NUMBER  
HG Vic-GCOR-000115

---

**Re: Smoke dampers**

---

From Mr Benjamin King - Stantec Australia

To (6) Mr Brad Azzopardi - Gold Coast Hospital & Health Services (+5 more...)

Cc (6) Grant Cormack-Thomson - AECOM (+5 more...)

Sent Tuesday, 19 December 2023 11:39:41 AM AEDT (GMT +11:00)

Status N/A

**MESSAGE**

Hi Jack,

There is no flexible ductwork in the return air systems.

All instances where smoke dampers are proposed for removal consist of **rigid ductwork** passing through another smoke compartment (but not serving).

Just to clarify, we are not proposing the removal of smoke dampers in all instances.

- If ductwork passes through a smoke wall and serves multiple smoke compartments then the smoke damper must remain to mitigate undue smoke spread

There is flexible ductwork throughout the project however this generally is only serving supply systems.

- We consider flexible ductwork to be indifferent to the grilles on the system; provided the use of flexible ductwork is within single smoke compartments we would not consider these to be a factor which affects the feasibility of a performance solution.

I trust this satisfies.

Kind regards,

Ben

Stantec

Direct: +61 7 3029 5129

benjamin.king@stantec.com

Level 3, 52 Merivale Street, South Brisbane QLD 4101

**From:** J Partridge

**Sent:** 15/12/2023 5:24:45 PM AEDT (GMT +11:00)

**To:** Neil Carter, Brad Azzopardi, Sean Middleton, Kylie Beckett, Patrick Chambers

**Cc:** Grant Cormack-Thomson, Andrew Jackson, Bill Perry, Sean Logue, Benjamin King, Clare Moore

**Mail Number:** WSP ANZ-CADV-000002