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1.0 EXECUTIVE SUMMARY

This Fire Engineering Report has been prepared by Impact Fire Pty Ltd for NSW Health Infrastructure, c/- Aurora Projects Pty Ltd, and relates to the new Rehabilitation Unit at Goulburn Hospital.

Impact Fire Pty Ltd has been commissioned to conduct a Fire Engineering Analysis of proposed variations from the Deemed to Satisfy (DTS) provisions of the Building Code of Australia 2011 (BCA) relating to the subject development.

Table 1 below summarises the Variations to the BCA DTS Provisions, the relevant BCA Performance Requirements, the Assessment Methods, and the Methods of Analysis and Acceptance Criteria that have been used in the Fire Engineering Analysis.

Table 1: Summary of Variations to BCA DTS Provisions, Relevant BCA Performance Requirements, Assessment Methods, and Methods of Analysis and Acceptance Criteria

Alternative Solution	BCA DTS Provisions	Variations to BCA DTS Provisions	BCA Performance Requirements
1	Clause C1.1, Specification C1.1 Fire resisting construction	To relocate an existing single storey demountable building of lightweight non fire rated construction, where it will be located less than 3m from an existing building.	CP1, CP2
	BCA Compliance and Assessment Method	A0.5(b)(i) and A0.9(b)(ii), as detailed in Section 9.	
	Method of Analysis and Acceptance Criteria	Qualitative analysis method based on the Design Fire Scenarios and Acceptance Criteria detailed in Section 10.	
2	Clause C2.7 Separation by fire walls	To construct a fire wall that is not continuous from the floor of the lowest level to the roof of the highest level.	CP2
	BCA Compliance and Assessment Method	A0.5(b)(i) and A0.9(b)(ii), as detailed in Section 9.	
	Method of Analysis and Acceptance Criteria	Qualitative analysis method based on the Design Fire Scenarios and Acceptance Criteria detailed in Section 10.	
3	Clause C3.3 Separation of external walls and associated openings in different fire compartments	To have the glazed wall of the link to the new Rehabilitation Unit located within 4m of the new Rehabilitation Unit, which are to be considered as different fire compartments.	CP2
	Clause C3.5 Doorways in fire walls	To have the doorway to the new Rehabilitation Unit from the link fitted with glazed doors, in lieu of self-closing fire doors with an FRL of at least -/120/30.	
		To have the glazed wall of a meeting room on ground floor located within 4m of the existing hospital, which are to be considered as different fire compartments.	
		To have parts of the glazed walls bounding the courtyard within 4m of	

		the 1 hour fire wall that separates the ward areas on ground floor.	
	BCA Compliance and Assessment Method	A0.5(b)(i) and A0.9(b)(ii), as detailed in Section 9.	
	Method of Analysis and Acceptance Criteria	Qualitative analysis method based on the Design Fire Scenarios and Acceptance Criteria detailed in Section 10.	
4	Clause D1.3 When fire-isolated stairways and ramps are required	To not construct the egress stair on the southern side of the Rehabilitation Unit as a fire-isolated exit.	DP5
	BCA Compliance and Assessment Method	A0.5(b)(i) and A0.9(b)(ii), as detailed in Section 9.	
	Method of Analysis and Acceptance Criteria	Qualitative analysis method based on the Design Fire Scenarios and Acceptance Criteria detailed in Section 10.	

Based on the Fire Engineering Analysis presented in this report, it is the opinion of Impact Fire Pty Ltd that the proposed variations to the BCA DTS provisions will satisfy BCA Performance Requirements CP1, CP2 and DP5, subject to the implementation of the following Fire Engineering Scope of Works.

1. All building works associated with the new Rehabilitation Unit shall comply with the relevant Deemed to Satisfy (DTS) provisions of Sections C, D and E of the BCA, except for the variations outlined in Table 1.
2. The southern external wall of the existing building to the north of the relocated demountable shall be upgraded as necessary to achieve an FRL of at least 120/120/120, to prevent the spread of fire between buildings.

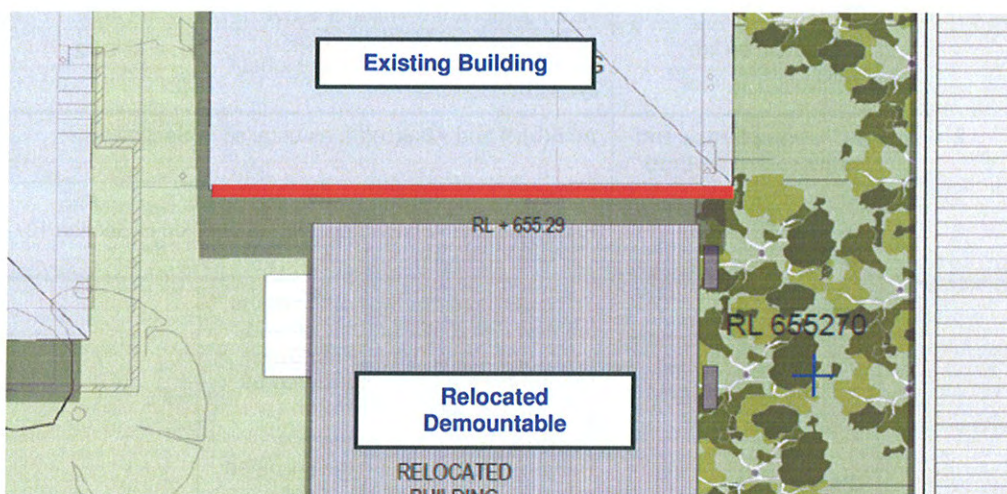


Figure 1: Part Site Plan

— 120/120/120 Fire Wall

3. The non-continuous fire wall between the existing hospital and the new Rehabilitation Unit shall achieve an FRL of at least 120/120/120.

Building elements, other than roof battens with a dimension of 75mm x 50mm or sarking, shall not penetrate through the fire wall.

Any services penetrations through the fire wall shall be protected in accordance with Clause C3.15 of the BCA. Any doorways through the fire wall shall be protected with self-closing fire doors that achieve an FRL of at least -/120/30.

4. The new link shall be fire separated from the new Rehabilitation Unit in construction that achieves an FRL of at least 120/120/120. The link shall form part of the same fire compartment as the existing building.

The glazed external wall to the new link shall be protected on both sides with wall wetting sprinklers.

The glazed doors from the new link to the new Rehabilitation Unit shall be protected on both sides with wall wetting sprinklers. These doors shall be fitted with self-closing devices that bring the doors to the fully closed and latched position. The doors shall also be fitted with approved smoke seals.

All glazing shall comprise of at least 6mm fixed toughened safety glass fitted in non-combustible frames.

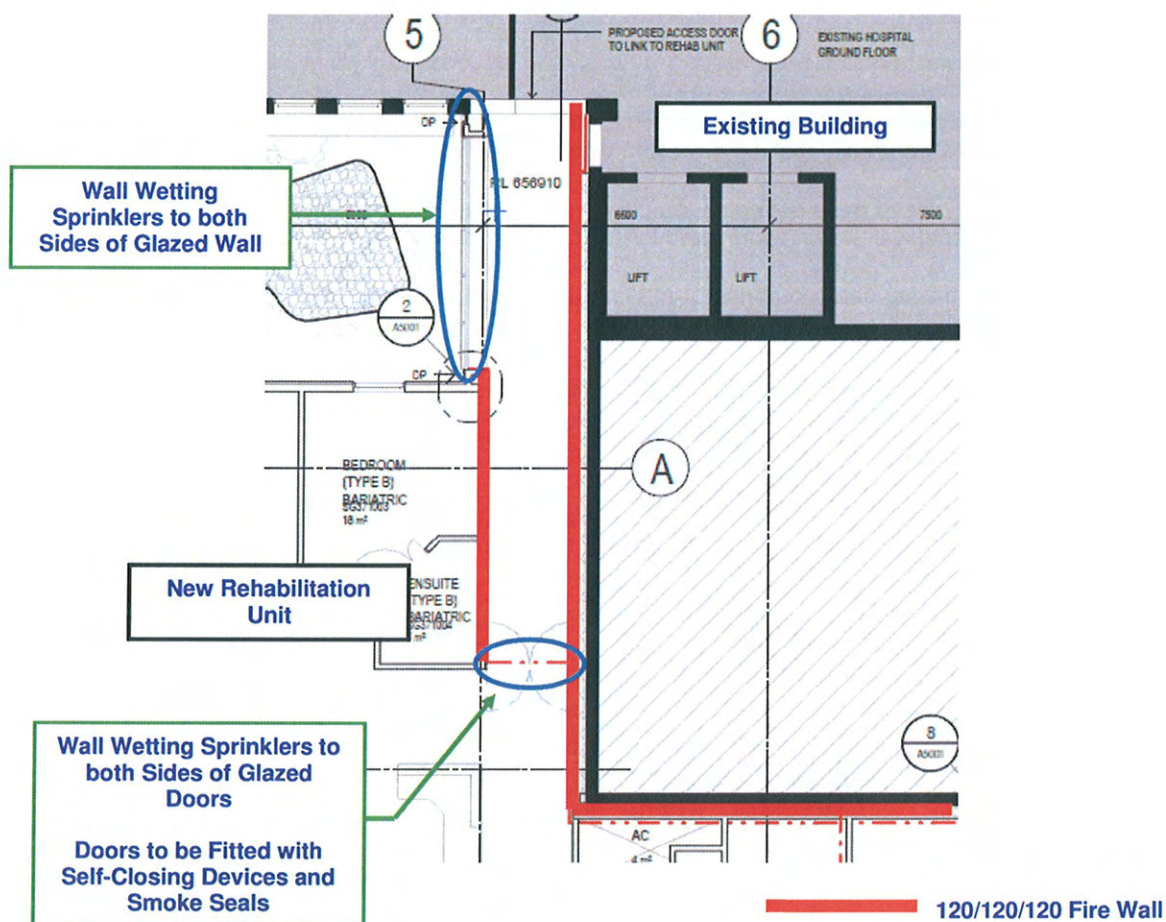


Figure 2: Part Ground Floor Plan

5. The external wall adjacent the meeting room (no. SG371068) on ground floor shall achieve an FRL of at least 120/120/120, for a distance of at least 4m past the glazing to the meeting room.

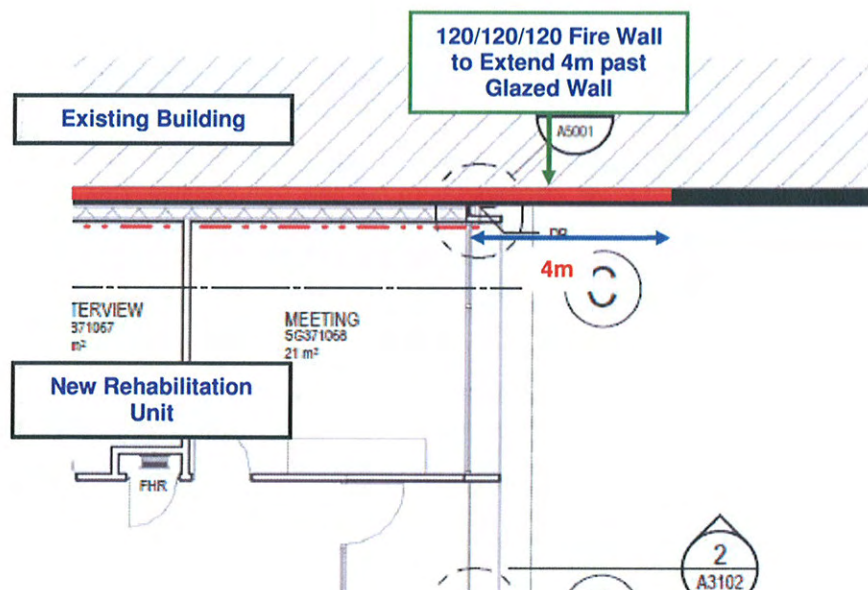


Figure 3: Part Ground Floor Plan

6. The glazed wall bounding the courtyard, which forms part of the fire wall separating the ward areas, shall be protected with internal wall wetting sprinklers.

The glazed walls bounding the courtyard adjacent the fire wall shall be protected with internal wall wetting sprinklers for a distance of at least 4m past the fire wall.

All glazing shall comprise of at least 6mm fixed toughened safety glass fitted in non-combustible frames.

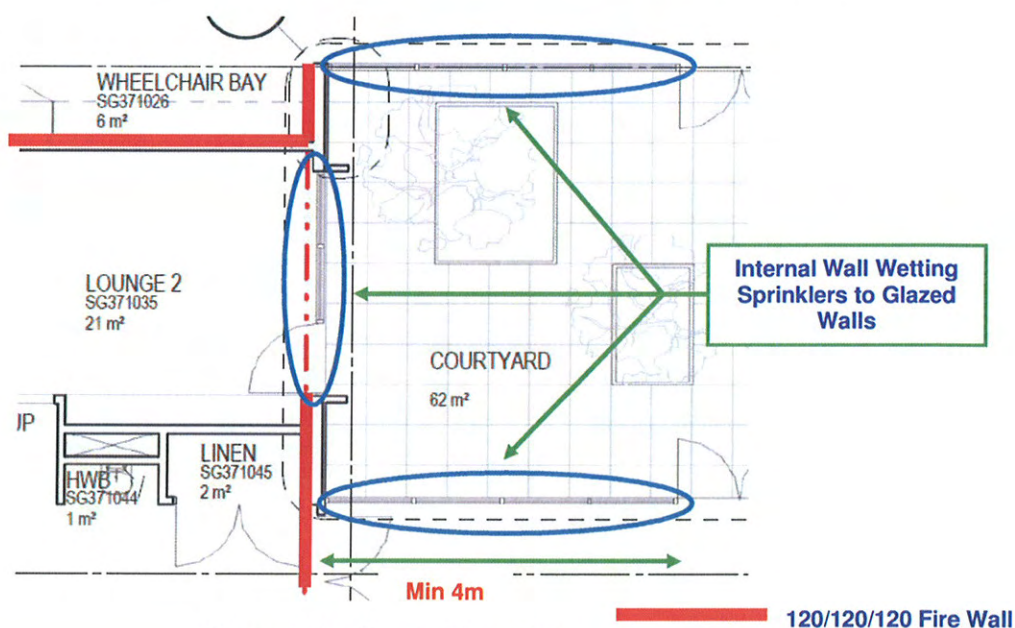


Figure 4: Part Ground Floor Plan

7. All Fire Safety Systems that are required for the new Rehabilitation Unit under the relevant DTS provisions of the BCA shall be provided and maintained in accordance with relevant Australian Standards. These fire safety systems include, but may not be limited to, the following:

- Wall Wetting Sprinklers - AS 2118.2 (2010).
- Fire Hydrants - BCA Clause E1.3, AS 2419.1 (2005).
- Fire Hose Reels - BCA Clause E1.4, 2441 (2005), and as varied within this Report.
- Portable Fire Extinguishers - BCA Clause E1.6, AS 2444 (2001), and as varied within this Report.
- Automatic Smoke Detection and Alarm System - BCA Spec E2.2a, AS 1670.1 (2004).
- Emergency Lighting - BCA Clauses E4.2 & E4.4, AS 2293.1 (2005).
- Exit Signs - BCA Clauses E4.5, E4.6 & E4.8, AS 2293.1 (2005).
- Sound System and Intercom System for Emergency Purposes - BCA Clause E4.9, AS 1670.4 (2004).

NOTE: Refer to BCA Assessment Report for complete list of required fire safety systems / measures.

2.0 INTRODUCTION

2.1 PURPOSE OF REPORT

The purpose of this report is to present a Fire Engineering Analysis of proposed variations from the Deemed to Satisfy (DTS) provisions of the Building Code of Australia 2011 (BCA) relating to the new Rehabilitation Unit at Goulburn Hospital.

2.2 SCOPE OF REPORT

This report is limited to an assessment of the subject development against the proposed variations to Clauses C1.1, C2.7, C3.3 and D1.3 of the BCA, and Specification C1.1 of the BCA only, as identified in Section 6 of this report.

This report is consistent with the objectives and limitations of the BCA. Therefore, effects of arson (e.g. from multiple fire starts), terrorism, explosive devices, and sabotage of fire safety systems are considered outside the scope of this report.

'Absolute' or '100%' safety is not attainable, and there will always be a finite risk of injury, death or property loss. Also, fire and its effects on people and property are complex and variable. Thus, all stakeholders should understand that a fire safety system may not effectively cope with all possible scenarios.

2.3 BASIS OF REPORT

The content of this report is based on the following Legislations:

- The Building Code of Australia 2011 (BCA).
- NSW Environmental Planning & Assessment Act 1979.
- NSW Environmental Planning & Assessment Regulation 2000.

The content of this report is based on the following texts and references:

- International Fire Engineering Guidelines, 2005 Edition.
- Guide to the BCA, ABCB 2011.

The content of this report is based on the following Documentation:

- Architectural drawings of the subject development prepared by Woods Bagot (refer Appendix A for list of referenced drawings).
- BCA Assessment Report prepared by Blackett Maguire + Goldsmith Pty Ltd (Ref: 110349, Revision 3, dated 9 November 2011).

2.4 EXCLUSIONS

This report does NOT cover the following:

- A detailed BCA assessment of the subject development.
- Access for people with disabilities (Part D3 of the BCA).
- System or engineering design of any part of the subject development.
- Arson (other than as a source of initial ignition), multiple ignition sources, acts of terrorism.
- Protection of property (other than adjoining property).

- Business interruption or losses or personal or moral obligations of the owner/occupier.
- Occupational Health and Safety, and Work Cover Authority Regulations.

2.5 ASSUMPTIONS

It is assumed that apart from the proposed variations presented in Section 6 of this report, all other fire safety aspects associated with the new Rehabilitation Unit will comply with the relevant DTS provisions of the BCA.

2.6 REGULATORY FRAMEWORK

A Building Solution will comply with the BCA if it satisfies the Performance Requirements of the BCA. Clause A0.5 of the BCA states that compliance with the Performance Requirements can only be achieved by:

- (a) *complying with the Deemed to Satisfy provisions; or*
- (b) *formulating an Alternative Solution which -*
 - (i) *complies with the Performance Requirements; or*
 - (ii) *is shown to be at least equivalent to the Deemed to Satisfy provisions;*
- (c) *a combination of (a) and (b).*

Clause A0.9 of the BCA states that the following Assessment Methods, or any combination of them, can be used to determine that a Building Solution complies with the Performance Requirements:

- (a) *Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed to Satisfy Provision as described in A2.2.*
- (b) *Verification methods such as -*
 - (i) *the Verification Methods in the BCA; or*
 - (ii) *such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.*
- (c) *Comparison with the Deemed to Satisfy provisions.*
- (d) *Expert judgment*

2.7 PROJECT STAKEHOLDERS

The relevant project stakeholders for the subject development are listed within Table 2 below.

Table 2: Project Stakeholders

Name	Company	Role
Alex Cooney	NSW Health Infrastructure	Client
Margaret Hardy	Woods Bagot	Architect
Brian Geddes Chris Watt	Aurora Projects Pty Ltd	Project Manager

Table 2: Cont'd

Name	Company	Role
David Blackett Matt Morrissey	Black Maguire + Goldsmith Pty Ltd	BCA Consultant
Jason Powell	Impact Fire Pty Ltd	Fire Safety Engineer

2.8 FIRE ENGINEERING BRIEF PROCESS

The purpose of the Fire Engineering Brief (FEB) process is to document the assumptions and parameters to be used in the Fire Engineering Analysis, so that an "in-principle" agreement can be reached between the relevant stakeholders.

For the subject development, the FEB process was conducted in the following way:

- Briefing with the Project Manager and BCA Consultant in regards to the proposed variations from the DTS provisions of the BCA.
- Liaison with all relevant stakeholders in regards to the proposed Alternative Solutions.
- In house discussions at Impact Fire Pty Ltd in regards to the Assessment Methods, and Methods of Analysis and Acceptance Criteria for the proposed Alternative Solutions.

NOTE: For the subject development, liaison with, and referral to, Fire & Rescue NSW under Clause 144 of the Environmental Planning and Assessment Regulation 2000 is not a legislative requirement.

3.0 DEVELOPMENT DESCRIPTION

3.1 DESCRIPTION OF PROPOSED DEVELOPMENT

The subject development relates to the new Sub-Acute Bed Program at the Goulburn Hospital.

The project includes the demolition of a number of existing buildings, the relocation of a demountable building, and the construction of a standalone 20 bed rehabilitation unit at Goulburn Hospital.



Figure 5: Part Site Plan

3.2 RELEVANT BCA REFERENCES

The relevant BCA References for the subject development are summarised in Table 3 below.

Table 3: Relevant BCA References

BCA Reference	BCA Assessment
Classification	Class 9a (health-care) Class 5 (administration)
Rise in Storeys	2
Minimum Type of Construction Required	Type B
Effective Height	Less than 12m
Maximum Fire Compartment Size	Complies

4.0 DOMINANT OCCUPANT CHARACTERISTICS

4.1 GENERAL

The subject building will primarily be occupied by Doctors, Nurses and other staff members, and patients.

It will be assumed that the population level associated with the subject building is based on the population densities given Table D1.13 of the BCA and / or as indicated on the referenced architectural drawings.

4.2 STATE, PHYSICAL AND MENTAL ATTRIBUTES

Doctors, Nurses and other staff members are expected to be awake, conscious, ambulatory and sober. It is assumed that relevant staff members require minimal response time in the event of an emergency.

Not all patients are expected to be awake, conscious and ambulatory.

NOTE: Emergency evacuation procedures in accordance with AS 3745 are to be developed and implemented for the subject building.

4.3 FAMILIARITY WITH THE BUILDING

Doctors, Nurses and other staff members are expected to be familiar with the primary access and egress routes from the building. With the provision of emergency evacuation procedures to AS 3745, all staff members are expected to be familiar with the location of all fire exits.

Patients are expected to be familiar with the route they entered the building, but are not necessarily expected to be familiar with the building configuration and the location of all fire exits without instructions from trained staff.

4.4 LEVEL OF ASSISTANCE AND EMERGENCY TRAINING

With the provisions of emergency evacuation procedures for the building to AS 3745, nominated staff members are expected to be trained as fire wardens in early fire fighting and emergency response. Furthermore, nominated staff members are also expected to be trained in the actions to be taken in the event of an emergency, especially in the actions to be undertaken when evacuating patients.

Patients are not expected to have any emergency evacuation training, and would generally rely on instructions and assistance from trained staff.

4.5 DISABLED OCCUPANTS

People with disabilities are considered to be assisted by able-bodied carers, staff members, family members and friends.

Managing the evacuation of people with disabilities relies on the individual building management systems, procedures and training, which are outside the scope of the BCA, but can substantially contribute to the overall evacuation efficiency. Therefore, disabled access and egress have not been specifically addressed in this report, and are assumed to be addressed in the emergency evacuation plan and management procedures that are to be developed for the subject building.

5.0 HAZARDS AND PREVENTATIVE & PROTECTIVE MEASURES

5.1 HAZARD IDENTIFICATION

In identifying potential fire hazards, the following factors are considered:

- General building layout and construction.
- Building activities.
- Potential ignition sources.
- Combustible contents.

General Building Layout Construction

Refer to Section 3 of this Report for a description of the subject building and the proposed development works.

Building Activities

The subject building is primarily used as a Class 9a health-care building, with associated administration and amenities.

Potential Ignition Sources

Statistics show that the leading ignition factors of fires within this type of building occupancy are electrical appliances, short circuits and other electrical failures.

Combustible Contents

The following items are considered highly combustible within this type of development, and these material forms are considered to be the most likely to be ignited first.

- Cooking materials / appliances.
- Furniture, furnishings and surface finishes.
- Bedding and linen.
- Clothing.
- Floor and wall linings.
- Electrical equipment, electrical wiring, and cable insulation.
- Storage of paper, cardboard and other combustible materials / goods.
- Books, papers and stationary.
- Rubbish, trash and waste.

5.2 PREVENTATIVE AND PROTECTION MEASURES

Preventative Measures

The subject development will be required to implement a Management in Use type system where all required fire safety systems / measures are subjected to the maintenance regimes nominated under the relevant provisions of AS 1851-2005.

The Management in Use system will also need to incorporate the following measures as a minimum:

- Routine maintenance of all plant and equipment.
- Regular emptying of rubbish bins.
- Ensuring paths of travel to exits are kept free of anything that may obstruct or impede the free passage of persons.

Protective Measures

The following fire safety systems will be provided throughout the new Rehabilitation Unit as required under the relevant DTS provisions of the BCA:

- Wall Wetting Sprinklers - AS 2118.2 (2010).
- Fire Hydrants - BCA Clause E1.3, AS 2419.1 (2005).
- Fire Hose Reels - BCA Clause E1.4, 2441 (2005), and as varied within this Report.
- Portable Fire Extinguishers - BCA Clause E1.6, AS 2444 (2001), and as varied within this Report.
- Automatic Smoke Detection and Alarm System - BCA Spec E2.2a, AS 1670.1 (2004).
- Emergency Lighting - BCA Clauses E4.2 & E4.4, AS 2293.1 (2005).
- Exit Signs - BCA Clauses E4.5, E4.6 & E4.8, AS 2293.1 (2005).
- Sound System and Intercom System for Emergency Purposes - BCA Clause E4.9, AS 1670.4 (2004).

NOTE: Refer to BCA Assessment Report for complete list of required fire safety systems / measures.

6.0 PROPOSED VARIATIONS TO BCA DTS PROVISIONS

6.1 FIRE RESISTANCE AND STABILITY

Fire Resisting Construction - BCA Clause C1.1, Specification C1.1

- It is proposed to relocate an existing single storey demountable building of lightweight non fire rated construction, where it will be located less than 3m from an existing building.

The external walls of the single storey demountable, which will be located within 3m of the existing building, will not achieve an FRL.

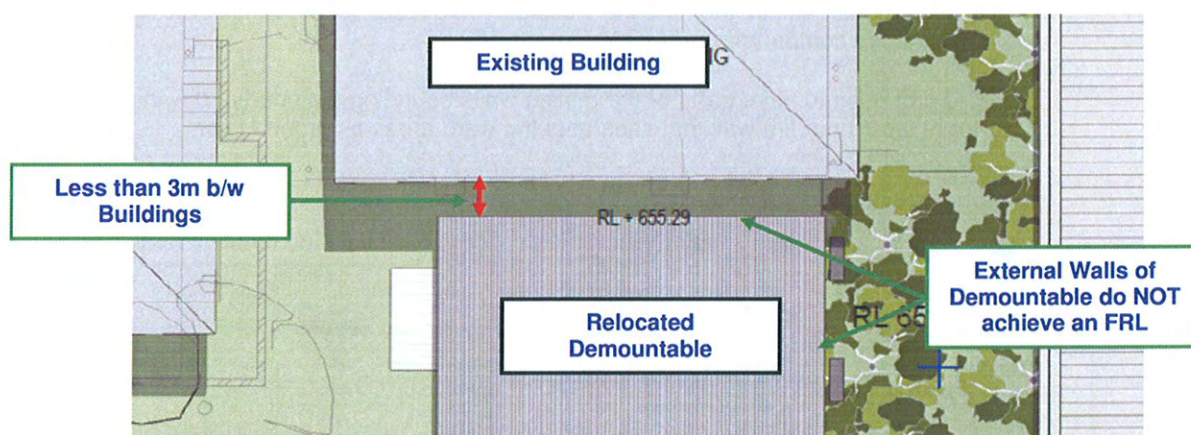


Figure 6: Part Site Plan

6.2 FIRE COMPARTMENTATION AND SEPARATION

Separation by Fire Walls - BCA Clause C2.7

- It is proposed to construct a fire wall that is not continuous from the floor of the lowest level to the roof of the highest level.

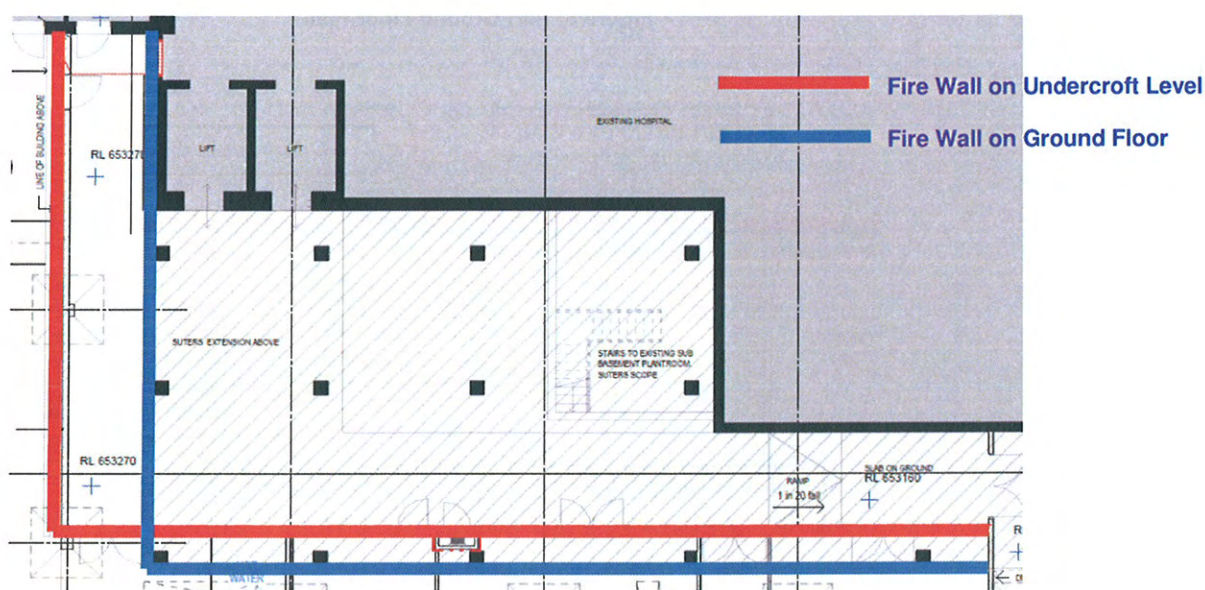


Figure 7: Part Undercroft Plan

6.3 PROTECTION OF OPENINGS

Separation of External Walls and Associated Openings in Different Fire Compartments - BCA Clause C3.3

- It is proposed to have the glazed wall of the link to the new Rehabilitation Unit located within 4m of the new Rehabilitation Unit, which are to be considered as different fire compartments.

It is also proposed to have the doorway to the new Rehabilitation Unit from the link fitted with glazed doors, in lieu of self-closing fire doors with an FRL of at least -/120/30.

- It is proposed to have the glazed wall of a meeting room on ground floor located within 4m of the existing hospital, which are to be considered as different fire compartments.
- It is proposed to have parts of the glazed walls bounding the courtyard within 4m of the 1 hour fire wall that separates the ward areas on ground floor.

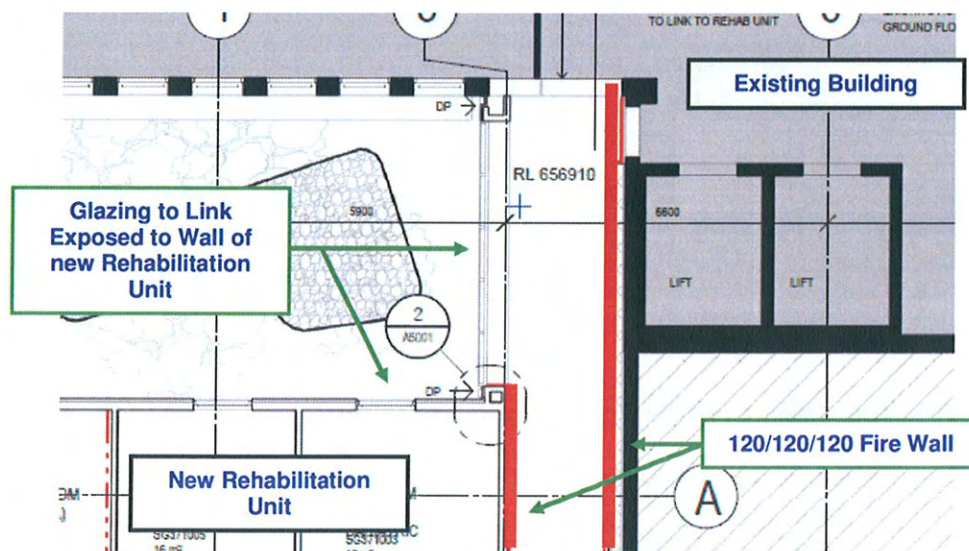


Figure 8: Part Ground Floor Plan

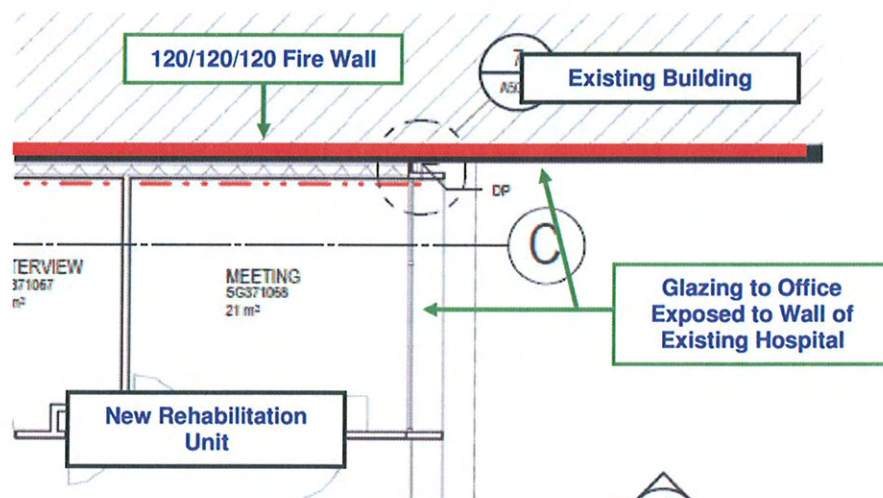


Figure 9: Part Ground Floor Plan

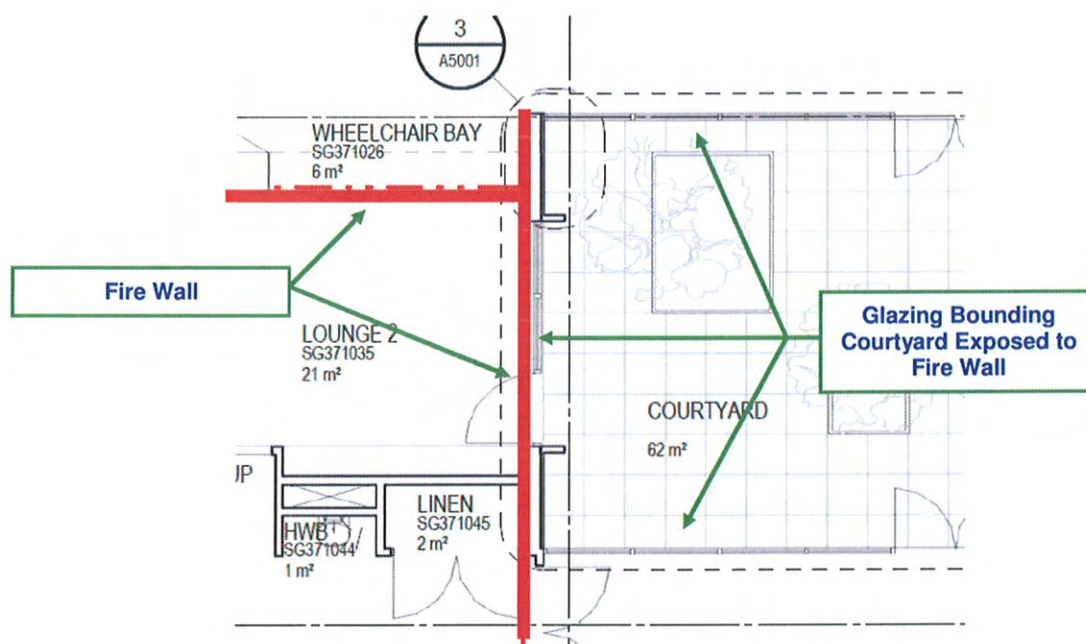


Figure 10: Part Ground Floor Plan

6.4 PROVISION FOR ESCAPE

When Fire-Isolated Stairways and Ramps are Required - BCA Clause D1.3

- It is not proposed to construct the egress stair on the southern side of the Rehabilitation Unit as a fire-isolated exit.

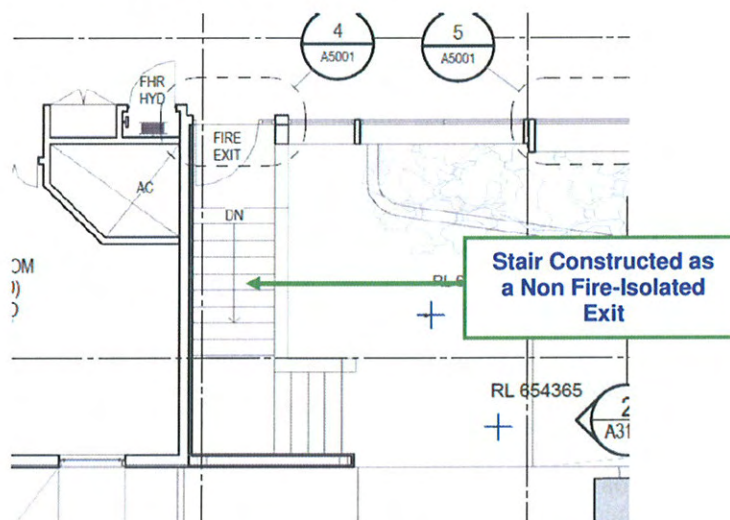


Figure 11: Part Ground Floor Plan

7.0 DESIGN OBJECTIVES

7.1 REGULATORY OBJECTIVES

The main objectives of the Building Code of Australia (BCA) include:

- Life safety of occupants.
- Facilitation of fire brigade operations.
- Protection of adjacent buildings.

The objectives of the BCA are met when the relevant Performance Requirements of the BCA are satisfied. Thus, an Alternative Solution will comply with the BCA if it satisfies the relevant Performance Requirements of the BCA.

7.2 RELEVANT PERFORMANCE REQUIREMENTS

Outlined below are the relevant Performance Requirements of the BCA in which the proposed variations to the DTS provisions of the BCA impact upon.

CP1 A building must have elements which will, to the degree necessary, maintain structural stability during a fire appropriate to -

- (a) the function or use of the building; and
- (b) the fire load; and
- (c) the potential fire intensity; and
- (d) the fire hazard; and
- (e) the height of the building; and
- (f) its proximity to other property; and
- (g) any active fire safety systems installed in the building; and
- (h) the size of any fire compartment; and
- (i) fire brigade intervention; and
- (j) other elements they support; and
- (k) the evacuation time.

CP2 (a) A building must have elements which will, to the degree necessary, avoid the spread of fire -

- (i) to exits; and
- (ii) to sole-occupancy units and public corridors; and
- (iii) between buildings; and
- (iv) in a building.

(b) Avoidance of the spread of fire referred to in (a) must be appropriate to -

- (i) the function or use of the building; and
- (ii) the fire load; and
- (iii) the potential fire intensity; and
- (iv) the fire hazard; and
- (v) the number of storeys in the building; and
- (vi) its proximity to other property; and
- (vii) any active fire safety systems installed in the building; and

- (viii) the size of any fire compartment; and
- (ix) fire brigade intervention; and
- (x) other elements they support; and
- (xi) the evacuation time.

DP5 To protect evacuating occupants from a fire in the building exits must be fire-isolated, to the degree necessary, appropriate to -

- (a) the number of storeys connected by the exits; and
- (b) the fire safety system installed in the building; and
- (c) the function or use of the building; and
- (d) the number of storeys passed through by the exits; and
- (e) fire brigade intervention.

7.3 FIRE BRIGADE OBJECTIVES

Each fire agency throughout Australia, including the NSW Fire Brigades, has a fundamental set of legal obligations, which are defined under the Fire Agency Act for each State or Territory.

The objectives of the fire brigades involve the protection of life, property and the environment. The BCA outlines Deemed to Satisfy (DTS) provisions for buildings in relation to fire resistance, egress, and services and equipment (such as fire hydrants) to enable the objectives of the fire brigades to be fulfilled during fire brigade intervention.

8.0 TRIAL DESIGN FOR EVALUATION

8.1 GENERAL DESIGN

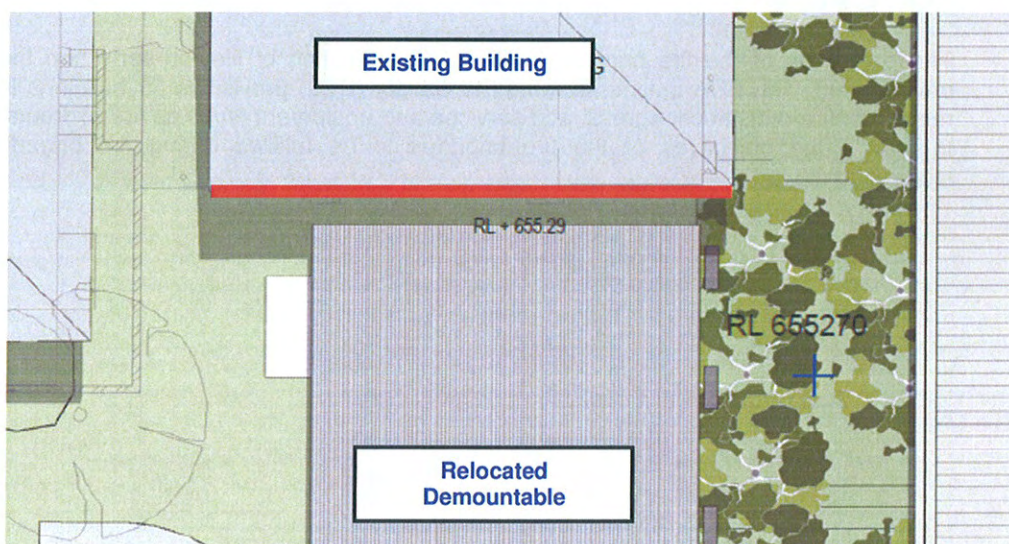
All building works associated with the new Rehabilitation Unit are to comply with the relevant Deemed to Satisfy (DTS) provisions of Sections C, D and E of the BCA, except for the variations outlined in Section 6.

8.2 ADDITIONAL REQUIREMENTS

The following additional requirements are to be implemented for the development as part of the fire safety strategy to address the proposed variations to the DTS provisions of the BCA.

Relocated Demountable

- The southern external wall of the existing building to the north of the relocated demountable is to be upgraded as necessary to achieve an FRL of at least 120/120/120, to prevent the spread of fire between buildings.



120/120/120 Fire Wall

Figure 12: Part Site Plan

Non-Continuous Fire Wall

- The non continuous fire wall between the existing hospital and the new Rehabilitation Unit is to achieve an FRL of at least 120/120/120.

Building elements, other than roof battens with a dimension of 75mm x 50mm or sarking, are not to penetrate through the fire wall.

Any services penetrations through the fire wall are to be protected in accordance with Clause C3.15 of the BCA. Any doorways through the fire wall are to be protected with self-closing fire doors that achieve an FRL of at least -/120/30.

Protection of Openings in Different Fire Compartments

- The new link is to be fire separated from the new Rehabilitation Unit in construction that achieves an FRL of at least 120/120/120. The link is to form part of the same fire compartment as the existing building.

The glazed external wall to the new link is to be protected on both sides with wall wetting sprinklers.

The glazed doors from the new link to the new Rehabilitation Unit are to be protected on both sides with wall wetting sprinklers. These doors are to be fitted with self-closing devices that bring the doors to the fully closed and latched position. The doors are to also be fitted with approved smoke seals.

All glazing is to comprise of at least 6mm fixed toughened safety glass fitted in non-combustible frames.

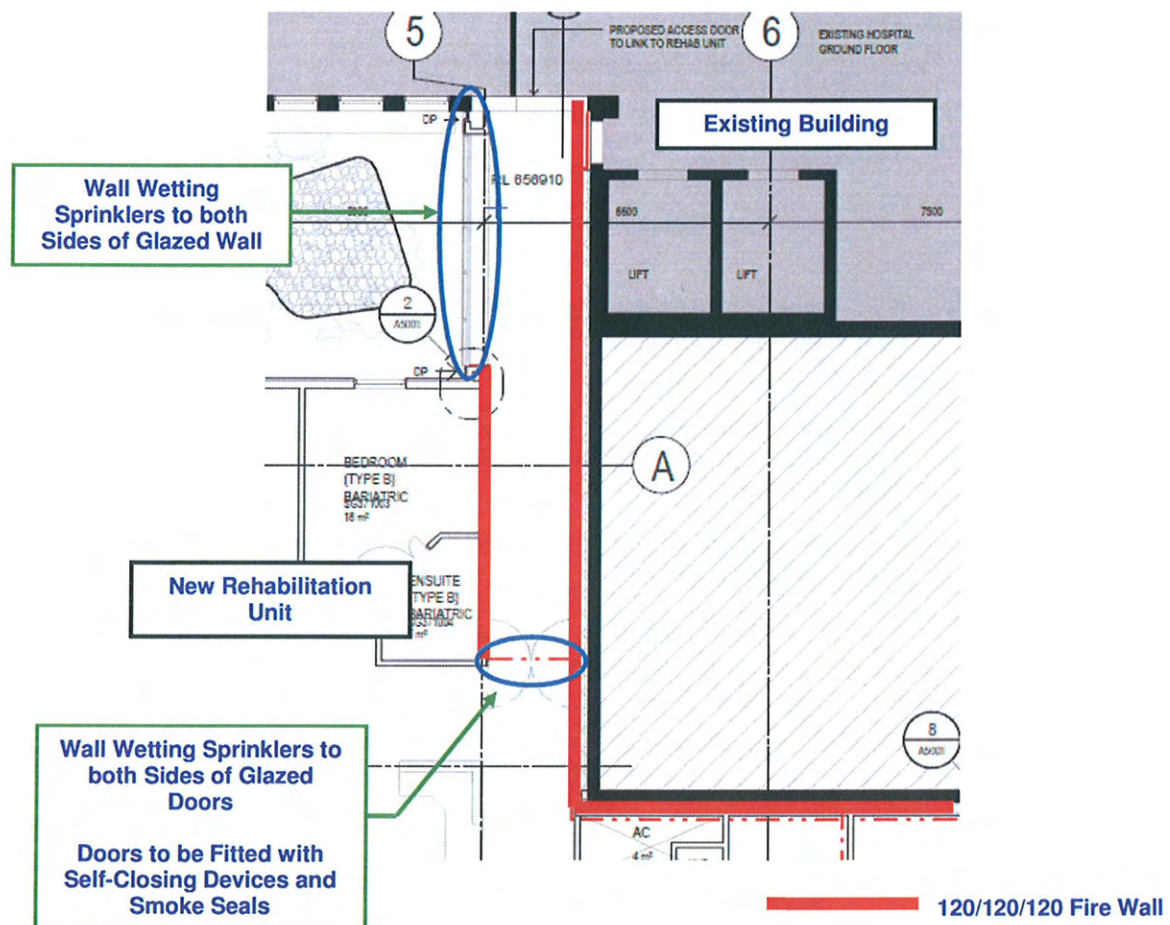


Figure 13: Part Ground Floor Plan