Tamworth Hospital Redevelopment (Acute Services Building)
Dean Street, Tamworth NSW 2340

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Neutral Bay NSW 2089

8 June 2012 | Final Issue (Revision 1) | Report No. s121003_Tamworth Hospital_FSS_03

Fire Safety Strategy

Tamworth Hospital Redevelopment

Acute Services Building

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Report Details

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Report Revision History

REV	DATE ISSUED	COMMENT	PREPARED BY	REVIEWED BY	VERIFIED BY
01	4 May 2012	Draft Issue	**Thanh Vuong** *BE (Mechanical) Grad Dip (Performance Based Building & Fire Codes)* **Trent De Maria** *Grad Cert Performance Based Bdg & Fire Codes, Grad Dip Building Fire Safety & Risk Engineering*	**Sandro Razzi**	
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**This issue consolidates the Fire Engineering Strategy prepared for the Acute Services Building which previously had been addressed in a report which combined the services for the Brudelin and '1883' buildings. Due to the regulatory approval process for project the report has been separated to address the relevant issues associated with each stage (Stage 1 being the construction of the Acute Services Building and Stage 2 being the refurbishment of Brudelin and '1883'). Stage 1 does not need to be read in conjunction to the Stage 2 works.*

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1 INTRODUCTION

1.1 OVERVIEW

RAWFire Safety Engineering have been engaged by Aurecon to prepare a comprehensive and fully cohesive fire safety strategy for a major new-build hospital facility at Tamworth in New South Wales. This Fire Safety Strategy has been undertaken to nominate proposed Alternative Solutions for assessing compliance with the nominated performance requirements of the BCA (Building Code of Australia) [1] in accordance with the methodologies defined in the IFEG (International Fire Engineering Guidelines) [3].

In order to develop and assess the nominated non-compliances the following process is to be adopted.

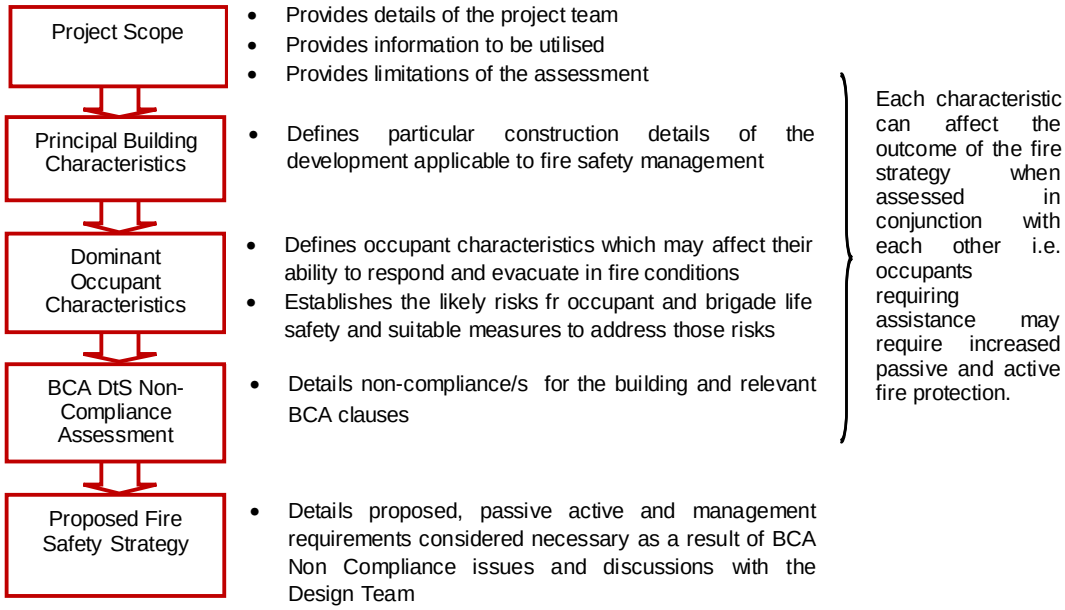


Figure 1-1: Fire Safety Strategy Process

The scope of the Fire Safety Strategy is to detail the nominated non-complying BCA DtS provisions with the performance requirements of the BCA and provide methodologies for establishing a workable and safe Fire Safety Strategy through a trial design.

1.2 FIRE SAFETY OBJECTIVES

The objective of a Fire Engineering Assessment is to develop a Fire Safety System, which satisfies the performance requirements of the BCA whilst maintaining an acceptable level of life safety, protection of adjacent property and adequate provisions for Fire Brigade intervention. At a community level, fire safety objectives are met if the relevant legislation and regulations are complied with. As stated in the BCA, “A Building Solution will comply with the BCA if it satisfies the Performance Requirements”. In addition to this certain non-regulatory objectives exist as detailed below.

1.2.1 Building regulatory objectives

The following items are a summary of the fire and life safety objectives of the BCA:

- **Life safety of occupants -** the occupants must be able to leave the building (or remain in a safe refuge) without being subject to hazardous or untenable conditions. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would minimise the risk of exposing building occupants to hazardous or untenable conditions in an event of a fire.
- **Life safety of fire fighters -** fire fighters must be given a reasonable time to rescue any remaining occupants before hazardous conditions or building collapse occurs. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would facilitate fire brigade intervention and minimise the risk of exposing fire fighters to hazardous or untenable conditions in an event of a fire.
- **Protection of adjoining buildings** - structures must not collapse onto adjacent property and fire spread by radiation should not occur. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would minimise the risk of fire spreading from one building to another.

1.2.2 Fire Brigade objectives

The overall philosophical Fire Brigade objectives throughout Australia are to protect life, property and the environment from fire according to the Fire Brigade Intervention Model (FBIM) [4] as per the Fire Services State and Territory Acts and Regulations.

Over and above the requirements of the BCA, the Fire Brigade has functions with regard to property and environmental protection and considerations regarding occupational health and safety for its employees.

1.2.3 Non-prescribed objectives

Fire Engineering has an overarching benefit to many facets of the built environment where non-prescribed objectives can have an influence on the Fire Safety Strategy adopted. Although not assessed within, the following can be considered if requested.

- **Business continuity -** will the loss of a particular facility due to fire / smoke damage result in excessive financial impact on the client? For example, is the facility critical to business continuity?
- **Public perception -** should a fire occur within the facility is there likely to be questionable public perception about the safety and operation of the facility?
- **Environmental protection –** fires of excessive sizes can have significant effects on the environment which may require a detailed risk assessment to minimise such outcomes.
- **Risk mitigation / insurance limitations -** are there specific limitations on insurance with respect to risk mitigation and fire safety design? i.e. Does the relevant insurer have concerns with respect to open atriums through the building?
- **Future proofing (isolation of systems) -** what flexibility is required in the overall design to allow for future development or changes in building layout?
- **OHS requirements -** buildings may have specific fire safety requirements pertaining to OHS requirements.

1.3 REGULATORY FRAMEWORK OF THE FIRE ENGINEERING ASSESSMENT

1.3.1 Building Code of Australia

One of the goals of the BCA is the achievement and maintenance of acceptable standards of safety from fire for the benefit of the community. This goal extends no further than is necessary in the public interest and is considered to be cost effective and not needlessly onerous in its application.

Section A0.5 of the BCA [1] outlines how compliance with the Performance Requirements can be achieved. These are as follows:

(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 or

(c) a combination of (a) and (b).

Section A0.9 of the BCA provides several different methods for assessing that an Alternate Solution complies with the Performance Requirements. These methods are summarised as follows:

(d) Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision.

(e) Verification Methods such as:

  (i) the Verifications Methods in the BCA; or

  (ii) such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements.

(f) Comparison with the Deemed-to-Satisfy Provisions.

(g) Expert Judgment.

Section A0.10 of the BCA provides methods for complying with provisions A1.5 (to comply with Sections A to J of the BCA inclusive). The following method must be used to determine the Performance Requirements relevant to the Alternative Solution: These methods are summarised as follows:

  (i) Identify the relevant Deemed-to-Satisfy Provision of each Section or Part that is to be the subject of the Alternative Solution.

  (ii) Identify the Performance Requirements from the same Section or Part that are relevant to the identified Deemed-to-Satisfy Provisions.

  (iii) Identify Performance Requirements from the other Sections and Parts that are relevant to any aspects of the Alternative Solution proposed or that are affected by the application of the Deemed-to-Satisfy Provisions that are the subject of the Alternative Solution.

1.3.2 International Fire Engineering Guidelines

The IFEG [3] document has been developed for use in fire safety design and assessment of buildings and reflects world's best practice. The document is intended to provide guidance for fire engineers as they work to develop and access strategies that provide acceptable levels of safety.

The document is particularly useful in providing guidance in the design and assessment of Alternative Solutions against the Performance Requirements of the BCA. The prescribed methodology set out in the IFEG has been generally adopted in the Fire Engineering Brief.

2 PROJECT SCOPE

2.1 PROJECT SCOPE

RAWFire Safety Engineering has been engaged to undertake a fire safety strategy for the Tamworth Hospital redevelopment.

The purpose of this fire safety strategy is to outline the fire engineering principles that will be utilised in ensuring that the DtS non-compliances noted herein are resolved in order to conform to the building regulations. The complete fire engineered analysis will form the Fire Engineering Report, and as such is not documented herein.

This Fire Safety Strategy outlines the construction and management requirements considered necessary to achieve an acceptable level of life safety within the building and satisfy the performance requirements of the BCA RAWFire's scope of works having regard to the development is proposed to address the following departures from the BCA DtS Provisions:-

- The extension of travel distances in the lower ground floor of the Acute Services building; and
- The protection of openings between adjoining buildings on the site that are within 6-metres of one another; and
- Engineering the internal discharge and connection of rising and descending flights of stairs in the Acute Services building.

2.2 RELEVANT STAKEHOLDERS

This Alternative Solution has been developed collaboratively with the relevant stakeholders as identified below:

Table 2-1: Relevant Stakeholders

ROLE	NAME	ORGANISATION
Client Representative	Peter Le May Tony Burg	Aurecon
Architect	Ian Moon	McConnel Smith & Johnson
Principal Certifying Authority	Vanessa Hinge Eric Bailey	McKenzie Group Consulting
Fire Safety Consultant(s)	Thanh Vuong Trent De Maria	RAW Fire Safety Engineering
Fire Safety Engineers	Sandro Razzi	

It should be noted that at times some parties may have a vested interest in the outcome of the Fire Engineering assessment. Such parties can include local fire brigades, insurers, project control groups, end users and community representatives. Although not always a legislative requirement, the design team should give due consideration to their inclusion in the Fire Engineering process. Where not required by legislation it is the clients' decision to involve such parties, especially local fire brigade, to ensure a transparent and adequate fire safety solution for all. Where we are not notified of the inclusion of such parties it is assumed the client / representative has given due consideration to the above.

2.3 SOURCES OF INFORMATION

The following sources of information have been provided by the design team:

- Preliminary Building Code of Australia Report prepared by McKenzie Group Consulting (NSW) Pty Ltd:
  - Acute Services Building – REF: 06844-02 BCA dated 30th March 2012.
- Architectural Plans provided by McConnel Smith & Johnson Pty Ltd, as indicated in Table 2-2.

Table 2-2: Drawings

DRAWING NO.	DESCRIPTION	ISSUE	DATE
SD-AR-NZ-00-01011	Site Plan – Proposed	5	13-04-2012
SD-AR-NZ-FG-02010	Area Plan-Lower Ground	2	13-04-2012
SD-AR-NZ-GF-02011	Area-Ground Floor	2	13-04-2012
SD-AR-NZ-00-02012	Area Plan-Level 1	2	13-04-2012
SD-AR-NZ-00-02013	Area Plan-Level 2	2	13-04-2012
SD-AR-NZ-00-02014	Area Plan-Level 3	2	13-04-2012
SD-AR-NZ-RF-02015	Area Plan-Roof	2	13-04-2012
SD-AR-NZ-LG-02110	Lower Ground Floor Plan	6	22-03-2012
SD-AR-NZ-GF-02111	Ground Floor Plan	6	22-03-2012
SD-AR-NZ-00-02113	Level 2 Floor Plan	6	22-03-2012
SD-AR-NZ-03-02114	Level 3 Floor Plan	5	22-03-2012
SD-AR-NZ-RF-02115	Roof Plan	6	22-03-2012
SD-AR-NZ-GF-02021	Area Plan-Brudelin Ground Floor	2	13-04-2012
SD-AR-NZ-01-02022	Area Plan-Brudelin Level 1	2	13-04-2012

2.4 LIMITATIONS AND ASSUMPTIONS

In this instance the Fire Engineering Strategy is developed based on applicable limitations and assumptions for the development which are listed as follows:

- The report is specifically limited to the project described in Section 2.1.
- The report is based on the information provided by the team as listed above in Section 2.2.
- Building and occupant characteristics are as per Section 3 and 0 respectively of this report. Variations to these assumptions may affect the Fire Engineering Strategy and therefore they should be reviewed by a suitably qualified Fire Engineer should they differ.
- As per any building design, DtS or otherwise, the report is limited to the fire hazards and fuel loads internally and externally of the building. The report does not provide guidance in respect of areas, which are used for bulk storage, processing of flammable liquids, explosive materials, multiple fire ignitions or sabotage of fire safety systems.
- The development complies with the DtS provisions of the BCA [1] with all aspects unless otherwise specifically stated in this report. Where not specifically mentioned, the design is expected to meet the BCA DtS requirements of all relevant codes and legislation at the time of construction and / or at the time of issue of this report.
- The assessment is limited to the objectives of the BCA and does not consider property damage such as building and contents damage caused by fire, potential increased insurance liability and loss of business continuity.
- Malicious acts or arson with respect to fire ignition and safety systems are limited in nature and are outside the objectives of the BCA. Such acts can potentially overwhelm fire safety systems and therefore further strategies such as security, housekeeping and management procedures may better mitigate such risks.
- This report is prepared in good faith and with due care for information purposes only, and should not be relied upon as providing any warranty or guarantee that ignition or a fire will not occur.
- The Fire Engineering Strategy is only applicable to the completed building. This report is not suitable, unless approved otherwise, to the building in a staged handover.
- Where parties nominated in Table 2-1 have not been consulted or legislatively are not required to be, this report does not take into account, nor warrant, that fire safety requirements specific to their needs have been complied with.

3 PRINCIPAL BUILDING CHARACTERISTICS

3.1 OVERVIEW

Principal Building Characteristics

Building characteristics are assessed as part of the Fire Engineering Review due the following:

1. The location can affect the time for fire brigade intervention and potential external fire exposure issues.
2. The structure will impact on the ability to resist a developing fire and support condition to allow occupants to escape the building and the fire brigade to undertake fire fighting to the degree necessary.
3. The floor area determines the potential fire size and area required to be evacuated in the event of a fire.
4. BCA details such as Type of Construction, Class and Height will dictate passive and active fire safety systems.

3.2 SITE DESCRIPTION

The site is located north of the central business district on the corner of Dean and Johnson Street in North Tamworth, approximately 1.5km from the Tamworth city centre. The site location is illustrated in Figure 1.

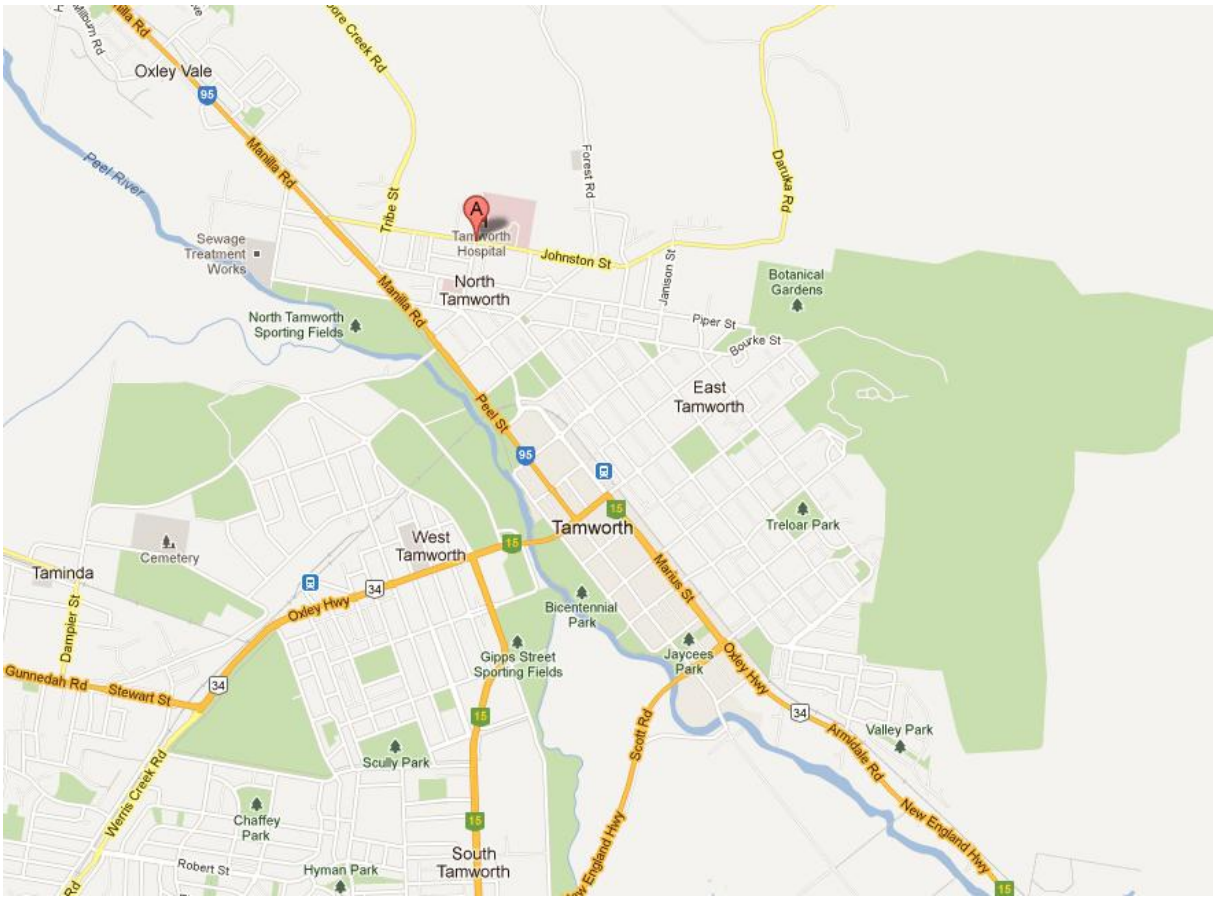


Figure 3-1: Local context, the letter 'A' marks the location of the site. Source: Google maps.

The subject site is known as Tamworth Hospital and the construction zone is expected to have a total area of approximately 20,000m^2. The land upon which the site is contained is irregular shaped and comprises a number of separate allotments. The site is bounded by Dean Street to the west and Johnson Street to the south. An aerial view of the site is provided in the figure below.

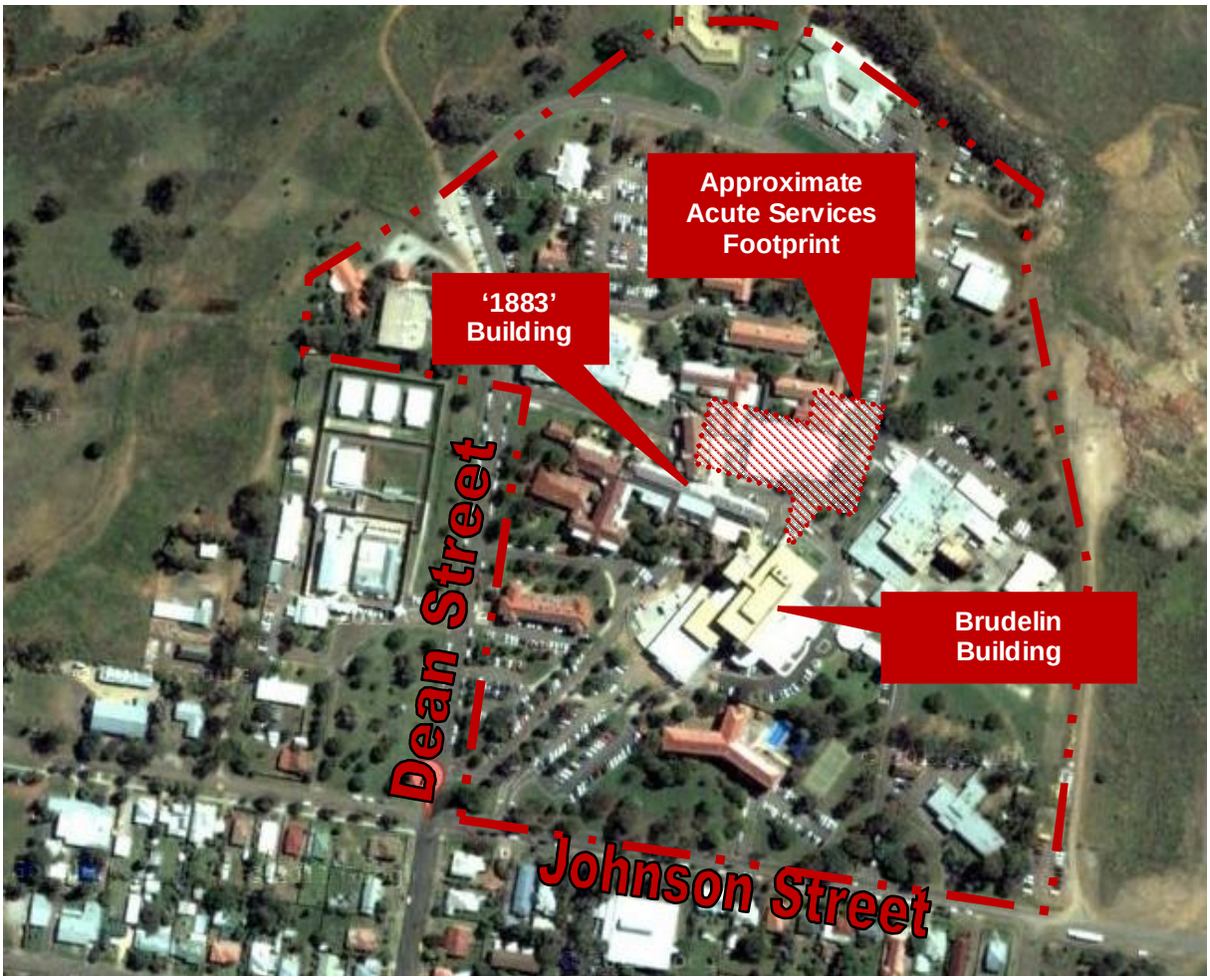


Figure 3-2: Aerial view of the site, the approximate site boundary is confined by the red dashed line. **Source: Google maps.**

The proposed development is the "Tamworth Hospital Redevelopment", involving demolition of existing structures; construction of a new acute services building including a new four storey specialist facility to contain health care services.

The primary core of the project is a new-build acute healthcare premises contained over four storeys (levels 01 to 03) with the lower level (basement) containing plant/services and mortuary, with the remaining floors containing patient accommodation and ancillary staff rooms.

The new acute services building is connected by way of an enclosed link way to the existing four storey Brudelin building to the south. The Brudelin building is also connected to the single storey eastern wing of the '1883' building. This fire safety strategy provides no comment on the level of fire safety in either the Brudelin or '1883' buildings which for the purposes of assessment under the Building Code of Australia are considered to be separate buildings. A site plan of the development and the proximity of the three buildings is provided in the figure below.

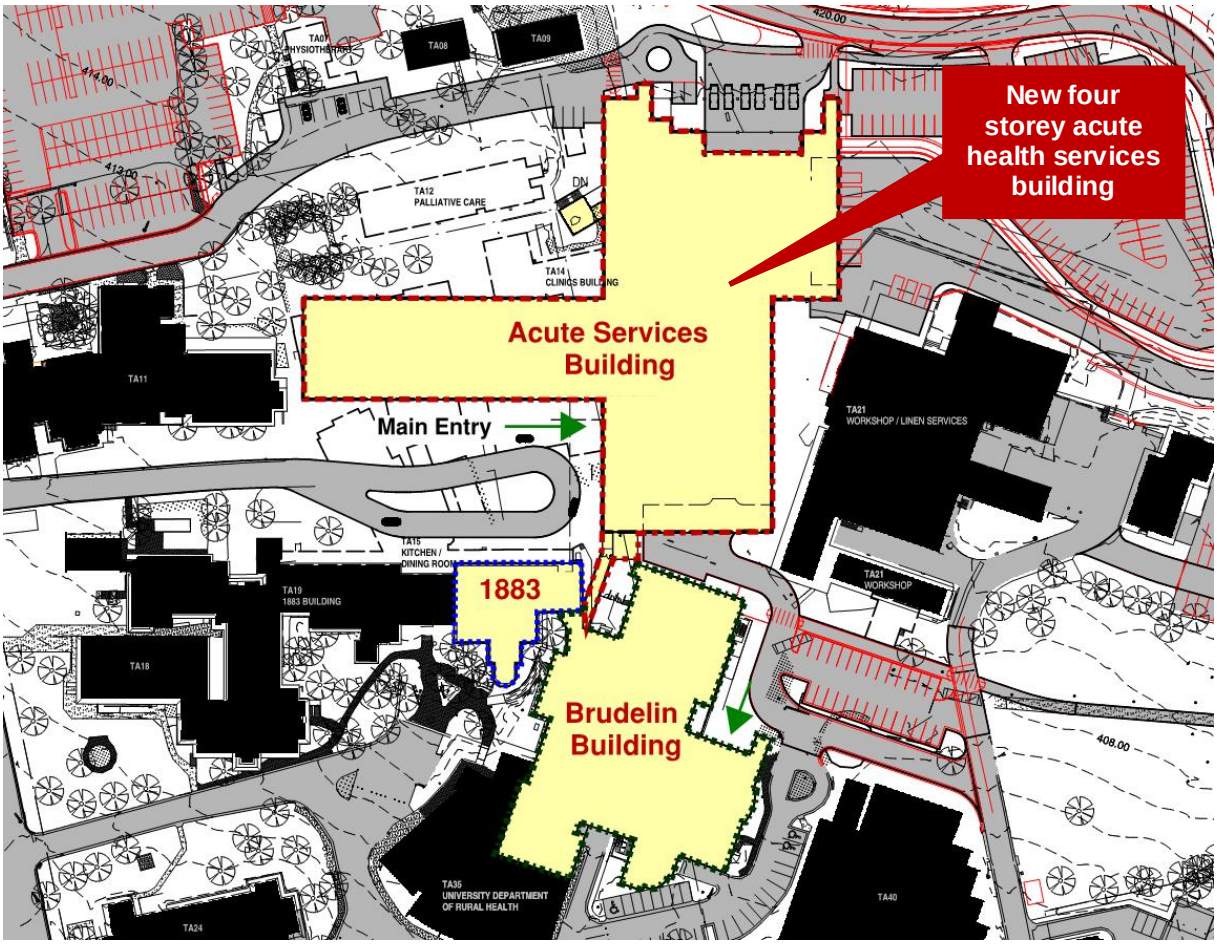


Figure 3-3: Site plan of the area of new works

3.3 SITE AND BUILDING ASSESSMENT

Table 3-1: Site and Building Assessment

CHARACTERISTIC	DESCRIPTION
Location	The existing Tamworth Hospital is located at Dean Street, Tamworth NSW 2340.
Layout	The existing Tamworth Hospital site consists of multiple buildings across the allotments. The proposed works entail the demolition of a number of buildings and construction of a new four storey Acute Services building. The new Acute Services building will contain five levels consisting of a lower ground level through to Level 3. For the purposes of certification the Acute Services, Brudelin and '1883' building are to be considered as separate buildings.
Structure	Materials and finishes are likely to include precast concrete, masonry and steel construction, and glazing throughout. The design of the development is such that it incorporates a combination of contrasting materials and elements so to provide visual interest to the new building and complement the existing buildings on the site. Materials used in construction will conform with the testing methodology outlined in the DtS provisions so as to avoid the spread of smoke and fire and minimise the risk to occupant and Fire Brigades safety.

CHARACTERISTIC	DESCRIPTION	
Total Floor area	Each level of the new Acute Services building has a floor area of less than 7,500m^2. Throughout the development the following prescriptive compartmentation requirements are to be adhered to:- < Patient care areas must be divided into fire compartment not more than 2,000m^2. < Treatment areas must be divided into floor areas not more than 1000m^2 by smoke-proof walls complying with specification C2.5. The ward areas shall be separated in accordance with the following: § Where the floor area exceed 1,000m^2, the ward area must be divided into floor areas not more than 1,000m^2 by walls with an FRL of not less than 60/60/60; and § Where the floor areas exceeds 500m^2, the ward area must be divided into areas not more than 500m^2 by smoke proof walls complying with specification C2.5; and § Where division of ward areas by fire-resisting walls is not required as above, any smoke-proof wall required above must have an FRL of not less than 60/60/60.	
BCA Assessment	Classification	Class 5 – Office building Class 9a – Health-care building
	Construction Type	Type A Construction
	Rise in Storeys	New Acute Services building – 4 storeys (five levels contained within).
	Effective Height	All building subject to the redevelopment have an effective height of less than 25m

4 DOMINANT OCCUPANT CHARACTERISTICS

4.1 OVERVIEW

The occupant characteristics are assessed within the Fire Engineering Strategy due to the following:

1. Population numbers can dictate the time required to evacuate the building and the required life safety systems to be provided due to evacuation times.
2. Physical and mental attributes affects the occupants capacity to respond to various fire cues and react accordingly.
3. Familiarity of occupants can affect the time taken to evacuate the building and subsequent active / passive requirements.

4.2 OCCUPANT CHARACTERISTIC ASSESSMENT

Table 4-1: Occupant Characteristics Assessment

CHARACTERISTIC	DESCRIPTION
Population numbers	The number of occupants expected within the subject building is considered to be generally consistent with the occupant densities listed in BCA Table D1.13 [1]. The maximum number of occupants within the building are assumed to generally be as follows: < 10 m^2 per person within the patient care areas, laundries, kitchens and offices; and < 30 m^2 per person within storage areas, workshops and plant rooms;
Population location	The population is expected to be distributed throughout the buildings with the plant rooms and store areas less heavily populated than both staff and public areas. Time of day will influence the expected location for occupants with the building likely to be more densely populated during the day, particularly the office areas and less staff likely at night.
Physical and mental attributes	< **Staff -** Staff are expected to consist of healthcare professionals (11% doctors, 43% nurses, 19% diagnostic and allied health), support staff (16% administrative and clerical staff) and facility staff (10% domestic and other staff - e.g. cleaners, maintenance workers, trade workers). Note: where percentages are given above, they represent proportion of hospital staff expected; this data does not account for total building population (i.e. including visitors, research and teaching). This occupant group are expected to be mobile with normal hearing and visual abilities, and occupants in this group are considered to take and implement decisions independently, and require minimal assistance during evacuation in a fire emergency. This occupant group is expected to be awake and fully conscious at all times when inside the buildings; and < **Patients –** Expected to consist of inpatients (admitted to hospital) and outpatients (not admitted to hospital). Inpatients should account for approximately 10% of all patients. Inpatients are generally expected to have a higher degree of care requirements (e.g. people that are bedbound, connected to equipment or receiving surgery). However, approximately 50% of inpatients consist of same-day admissions (i.e. are admitted and discharged in the same day) and are

CHARACTERISTIC	DESCRIPTION
	therefore expected to have lower care needs than overnight admissions/inpatients. Outpatients should account for approximately 90% of all patients. Outpatients are generally expected to have a lower degree of care requirements (e.g. people coming into the hospital just for imaging). Patients will be at various degrees of physical and mental capabilities. As such, it is expected that patients may be dependent on staff for their well being at all times, regardless of the additional circumstance of a fire emergency. < ***Visitors*** – are expected to be awake and alert. Visitors may also exhibit physical and mental disabilities to the degree and frequency of the general public. It must also be considered that some individuals (other than the patients) may at times be under the influence of alcohol, drugs or medication. It should be noted that some visitors may consist of young children as well as elderly occupants. Any young children as well as some elderly occupants (if required) within the hospital are expected to be accompanied by an adult. < ***External Maintenance Contractors*** – are expected to be mobile with normal hearing and visual abilities and occupants in this group are considered to take and implement decisions independently and require minimal assistance during evacuation in a fire emergency. The contractors are expected to be awake and aware of their surroundings at all times when inside the building; and < ***Fire & Rescue NSW*** – are expected to be equipped with safety equipment and will be educated in fire fighting activities and the dangers associated with fire incidents. This occupant group would be expected to be in a position to assist other occupants requiring assistance to evacuate. It is not expected that this occupant group would be present in the building at the time of fire ignition; however, they are expected to enter the building at a later stage to assist with the evacuation of occupants, if required, and to undertake fire suppression activities.
Familiarity with the building	< ***Staff and Security*** – can be expected to have a good familiarity with the building and the fire safety systems provided and may be trained in emergency procedures; and < ***Patients / visitors*** – may or may not be familiar with the layout of the building and may require assistance in locating the exits For overnight inpatients (~5% of all patients) the average length of stay is 6 days; therefore, some familiarity with the building layout and escape route is expected. Same-day inpatients and outpatients (~95% of all patients) may have never been in the building previously; therefore they are expected to be familiar with the route by which they entered the unit only [1]; and < ***External Maintenance Contractors*** – this occupant group is expected to have a reasonable familiarity with the building as they would have to undergo site specific induction prior to commencement of work on site; and < ***Fire & Rescue NSW*** – are not expected to have any familiarity of the building layout, however are assumed to obtain the required information from the site block plans and tactical fire plans available prior to entering the building. Notwithstanding this they will be equipped with breathing apparatus and specialist equipment to prevent them from being adversely affected by fire hazards.

5 BCA DTS NON-COMPLIANCE ASSESSMENT

5.1 OVERVIEW

In this instance the BCA DtS non-compliances have been formulated based on the regulatory review as provided by the project building surveyor and / or design team. Where not listed herein the building is required to achieve compliance with relevant DtS provisions or if existing, comply with relevant codes, reports and / or Standards approved at the time of consideration.

The following table lists the departures from the DtS provisions of the BCA for the proposed building and the analysis methodology proposed for the Fire Engineering assessment, which is to be generally in accordance with the IFEG [3].

Table 5-1: Summary of Alternative Solutions

BCA DTS PROVISIONS & PERFORMANCE REQUIREMENT	PERFORMANCE BASED SOLUTION
Separation by fire walls **BCA DtS Provisions** Clause C2.7 – Separation by fire walls **Performance Requirement** CP2	***BCA DtS Provision*** Clause C2.7(b) requires buildings which are considered to be separate for the purposes of the BCA to be separated by a vertical fire wall which separates all connected storeys. ***Non Compliance*** In the subject development the Brudelin and Acute Services building may be treated as separate buildings for the purpose of Sections C, D and E of the BCA despite the fire wall not extending through all storeys to the roof overhead.The buildings will be separated by a combination of horizontal and vertical fire resisting construction such that the buildings may be considered as separate buildings for the purpose of Section C, D and E of the BCA. ***Assessment methodology*** The assessment methodology will adhere to Clauses A0.5(b)(i), A0.9(b)(ii), A0.9(c) and A0.10 of the BCA. The analysis will be comparative and quantitative using both a deterministic assessment where the results of the assessment are measured against a comparable DtS design, with a supporting qualitative argument.
Protection of Openings **BCA DtS Provisions** C3.2 – Protection of openings in external walls **Performance Requirement** CP2	***BCA DtS Provision*** Clause C3.2 requires the openings in a fire-rated external wall to be located no less than 6-metres from another building on the same allotment; otherwise the openings are required to be protected in accordance with C3.4. ***Non Compliance*** The minimum separation distance between the new Acute Services and Brudelin building and existing buildings (including the '1883' building will be approximately 4.5m which is less than the BCA allowed minimum separation distance of 6m. ***Assessment Methodology*** The assessment methodology will adhere to Clauses A0.5(b)(i), A0.9(b)(ii), A0.9(c) and A0.10 of the BCA. The analysis will be absolute and quantitative using a deterministic assessment of the radiant heat, with a supporting qualitative argument.

BCA DTS PROVISIONS & PERFORMANCE REQUIREMENT	PERFORMANCE BASED SOLUTION
Access and Egress **BCA DtS Provisions** Clause D1.4: Distance to the nearest exit. **Performance Requirement** DP4	***BCA DtS Provision*** Clause D1.4 states that the distance to a point of choice between exits shall not exceed 12-metres in patient care areas and 20-metres in other areas. The total travel distance shall not exceed 30-metres in patient care areas and 40-metres in other areas. ***Non-Compliance*** The total travel distance to an exit is proposed to exceed the BCA DtS prescribed limits as follows: < Travel distances from the plant areas of the lower ground floor are to be confirmed, but are expected to be up to 59-metres. ***NB:*** *Travel distances are subject to detailed design through which both the distance to an exit and distance between an exit (Clause D1.5) in non-patient care areas may be extended in areas other than those mentioned above.* ***Assessment Methodology*** The assessment methodology will adhere to Clauses A0.5(b)(i), A0.9(b)(ii), and A0.10 of the BCA. The analysis will be absolute, quantitative, and deterministic where the results of the deterministic assessment are measured directly against the agreed acceptance criteria, with a supporting qualitative argument.
Fire-Isolated Stairway **BCA DtS Provisions** D1.7 – Travel via fire-isolated exits D2.4 – Separation of rising and descending stair flights **Performance Requirement** DP4	**BCA DtS Provision** Clause D1.7 requires a fire-isolated stairway to discharge directly to a road or open space. Clause D2.4 (a) requires that there is no direct connection between the rising and descending flight of a stairway at the level from which the egress is obtained. **Non-compliance** The fire isolated stair within the new Acute Services building has a direct connection between the lower ground floor and ground floor. Furthermore, this stairway discharges directly into the lower ground level lobby in lieu of open atmosphere. **Method of assessment** The analysis will be comparative with a supporting qualitative argument in accordance with Clause A0.5(b)(ii), A0.9(c) and A0.10, where the results of the assessment are shown to be equivalent to a deemed to satisfy solution, with a supporting qualitative argument.

6 PROPOSED FIRE SAFETY STRATEGY

The fire safety strategy outlined below has been proposed to satisfy the fire and life safety objectives specified for this project by the relevant stakeholders.

In addition, the fire safety strategy is required to adequately address the specific fire and life safety hazards identified for the proposed development, and as such have been generally derived from the preventative and protective measures outlined within the BCA, and fire engineering literature and research. Where items of non-compliance have not been identified by the design team in the concept design it is considered that those items are expected to be deemed-to-satisfy solutions.

The specified fire safety strategy will undergo analysis as part of the Fire Engineering Report to ascertain whether the relevant Performance Requirements of the BCA are satisfied. The fire safety strategy will incorporate the following elements:-

6.1 FIRE RESISTING & PASSIVE CONSTRUCTION

6.1.1 Fire Resistance & Compartmentation

General Design Guidance:

Elements of construction that perform a separating function in case of fire should maintain their integrity and insulation for the required duration. Horizontal and vertical elements should be used to limit the spread of fire between fire-separated areas.
All primary structural concrete and steel elements should be protected as required to:-

- Maintain life safety;
- Allow for fire brigade intervention;
- Mitigate structural damage and prevent progressive collapse;
- Minimise economic impact; and
- Allow reasonable 'return to service time'.

Design Requirement:

- The Acute Services building shall be constructed in accordance with the requirements of BCA Clause C1.1, Spec C1.1, Table 3 as applicable to Type A construction.
- Compartment floor areas and volumes are to comply with the requirements of BCA Clause C2.2 and C2.5.

  Patient care areas must be divided into fire compartment not more than 2,000m^2.

  The ward areas shall be compartmented in accordance with the following:

  - Where the floor area exceed 1,000m^2, the ward area must be divided into floor areas not more than 1,000m^2 by walls with an FRL of not less than 60/60/60; and
  - Where the floor areas exceeds 500m^2, the ward area must be divided into areas not more than 500m^2 by smoke proof walls complying with specification C2.5; and
  - Where division of ward areas by fire-resisting walls is not required as above, any smoke-proof wall required above must have an FRL of not less than 60/60/60.

  Treatment areas must be divided into floor areas not more than 1000m^2 by smoke-proof walls complying with specification C2.5.
- Fire doors need be installed in accordance with BCA Clause C2.12, C2.13, C3.5, C3.8 and C3.10.
- Openings for services and penetrations are to be installed in accordance with BCA Clause C3.12, C3.13 and C3.15.
- Both the '1883' and Brudelin building are to be separated from the new Acute Services Building and one another by a fire wall having an FRL of 120/120/120 and constructed in accordance with Clause C2.7(b).

That fire wall is required to extend from ground level to the underside of the roof above. Where the roof of one building (i.e. the Acute Services Building) is lower than that of the adjoining building (i.e. Brudelin and 1883) the fire wall must extend to the underside of:-

- The covering of the higher roof, or not less than 6-metres above the covering of the lower roof; or
- The lower roof if it has an FRL of not less than 120/120/120 and no openings closer than 3-metres to any wall above the lower roof;
- Or the lower roof if its covering is non-combustible (in addition to a sprinkler system).

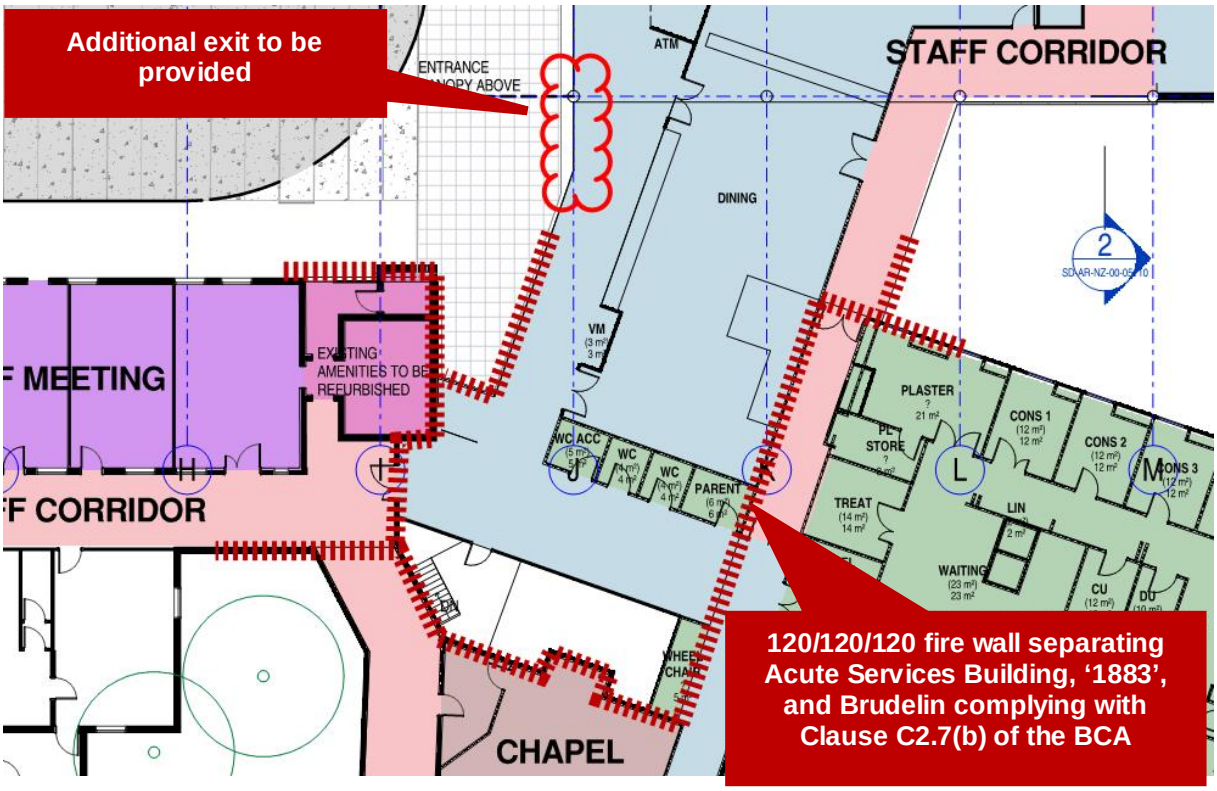


Figure 6-1: Ground floor of Acute Services Building existing buildings

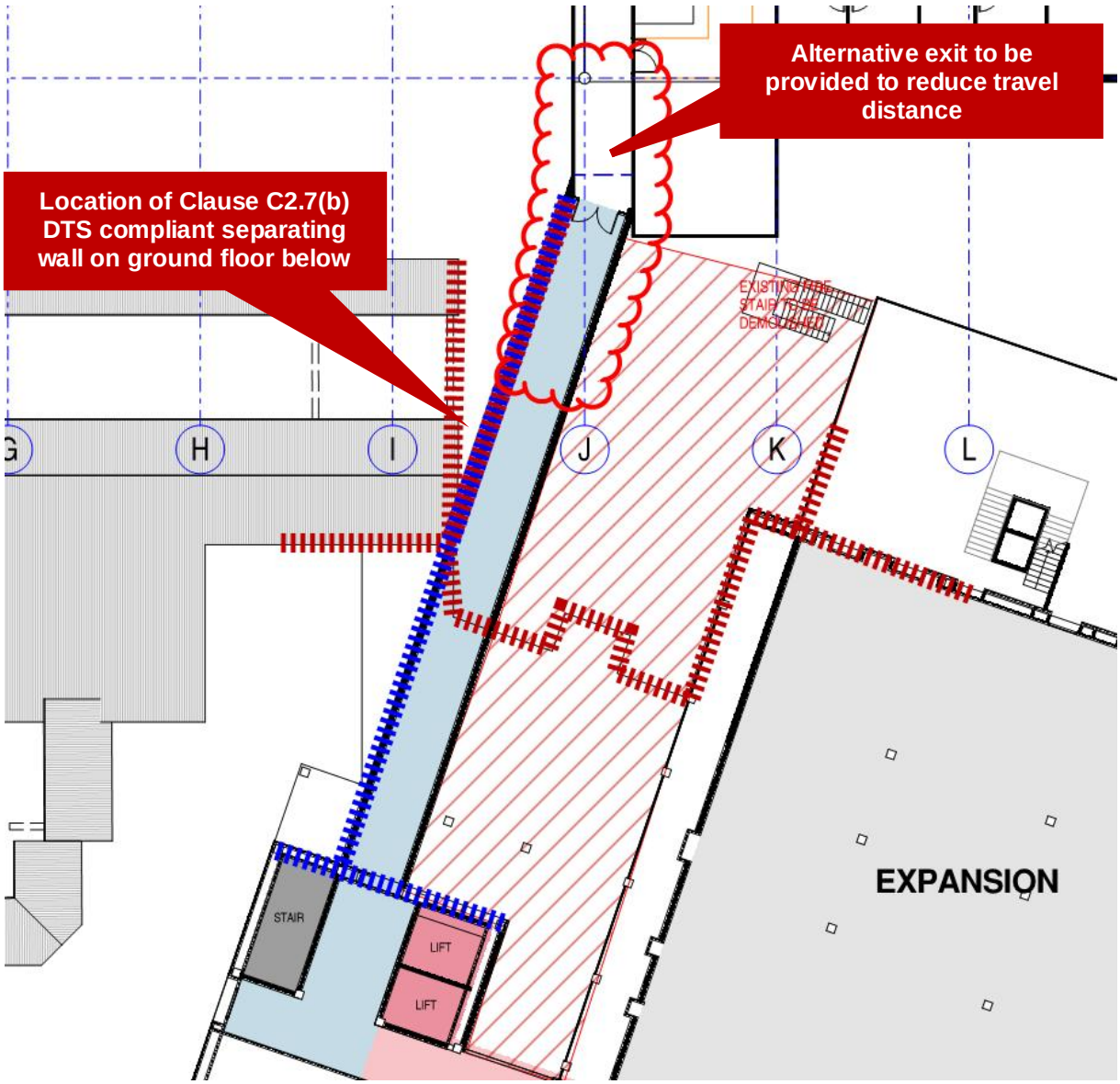


Figure 6-2: Level 1 connection between Acute Services Building and Brudelin Building

In addition the Acute Services Building is sited such that it will be located within 6-metres of existing buildings on the allotment. Any openings located within this 6-metre separation prescriptively require protection in accordance with Clause C3.2 of the BCA. The location of those openings is indicated in the Figure below. The method of protection proposed for the prevention of fire spread is as follows:-

- The external wall of the new building is to have non-combustible lining (externally) to resist the spread of fire from adjoining buildings to the Brudelin and Acute Services Building; and
- Any windows in the Acute Services Building are to be protected with external wall wetting drenchers (over fixed windows) in accordance with AS 2118.2 to resist the spread of fire from adjoining buildings. Where radiant heat calculations demonstrate the openings can be unprotected those drenchers will be permitted to be omitted.
- To resist the spread of fire from the subject building to the adjoining buildings the Acute Services Building shall be equipped with a sprinkler system in accordance with AS 2118.1:1999.

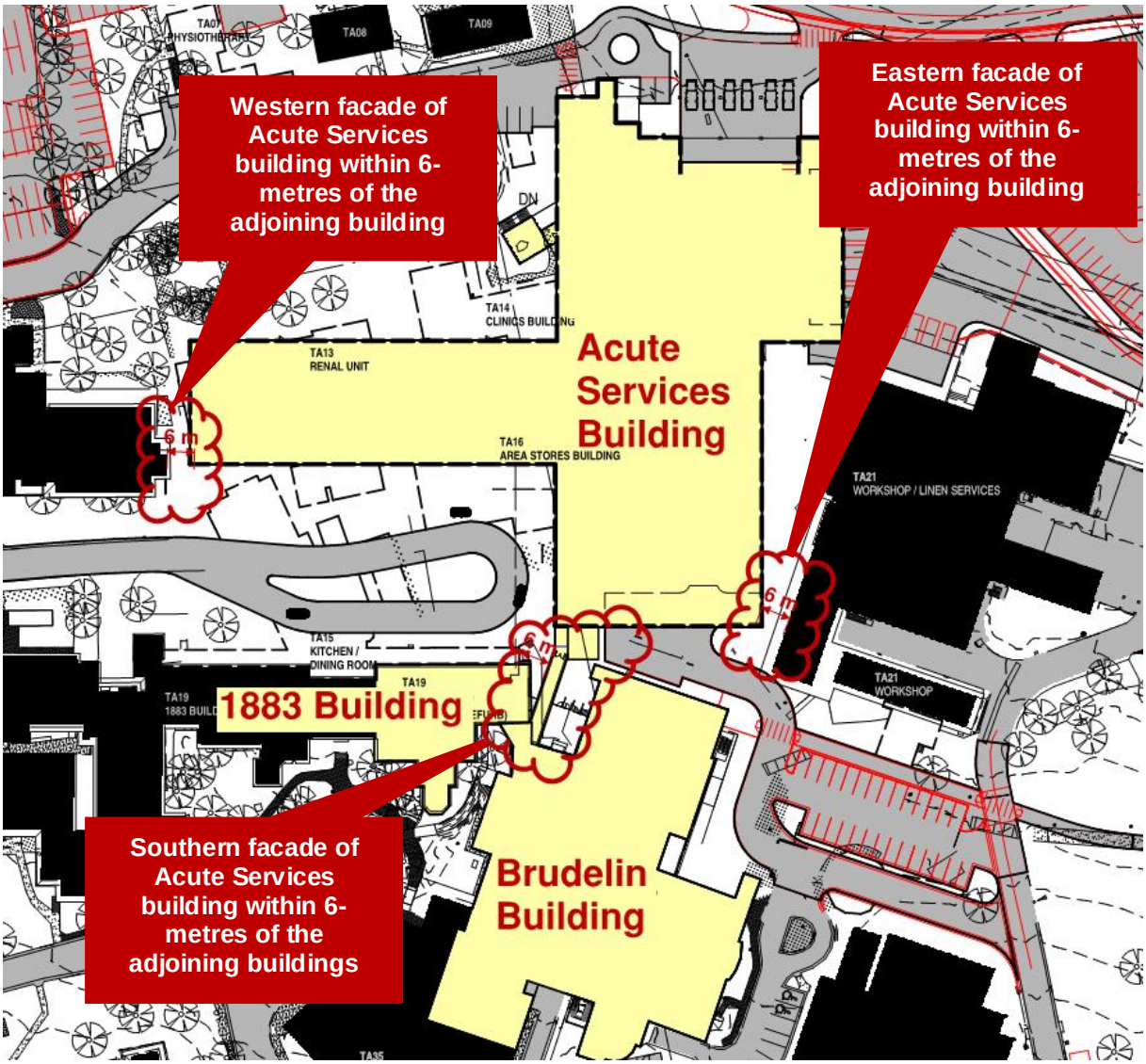


Figure 6-3: Site plan showing the proximity of the Acute Services Building within 6-metres of the adjoining buildings

6.1.2 Finishes and linings

General Design Guidance:

Where practicable finishes, linings and materials used throughout the building should be non-combustible.

Design Requirement:

Wall, floor and ceiling, and roof and ceiling assemblies must be tested and rated for their fire hazard properties in accordance with the prescriptive requirements of BCA Specification C1.10.

6.1.3 Protection of the lower ground floor egress corridor

General Design Guidance:

Occupants potentially affected by extended travel distances (either directly or indirectly) shall be protected to:-

- Limit the spread of smoke from a sole occupancy unit into common areas;
- Provide occupants with improved conditions at the construction interface.
- Occupants shall be able to travel pass by an enclosure involved in fire with improved conditions to promote evacuation.

Design Requirement:

Where the fire stair discharges internally on the ground floor of the Acute Services building the lower ground floor corridor is to be enclosed in construction achieving an FRL of 60/60/60. Any door which opens directly onto the corridor shall be a solid core fire rated door with full perimeter smoke seals. The doors shall be self-closing -/60/30 fire doors with smoke seals for medium temperatures as per BCA Spec. C3.4, Clause 3.2 to resist 200^0C smoke for at least 30 minutes with a smoke leakage rate of less than $5m^3$/hour when tested in accordance with AS 1530.7.

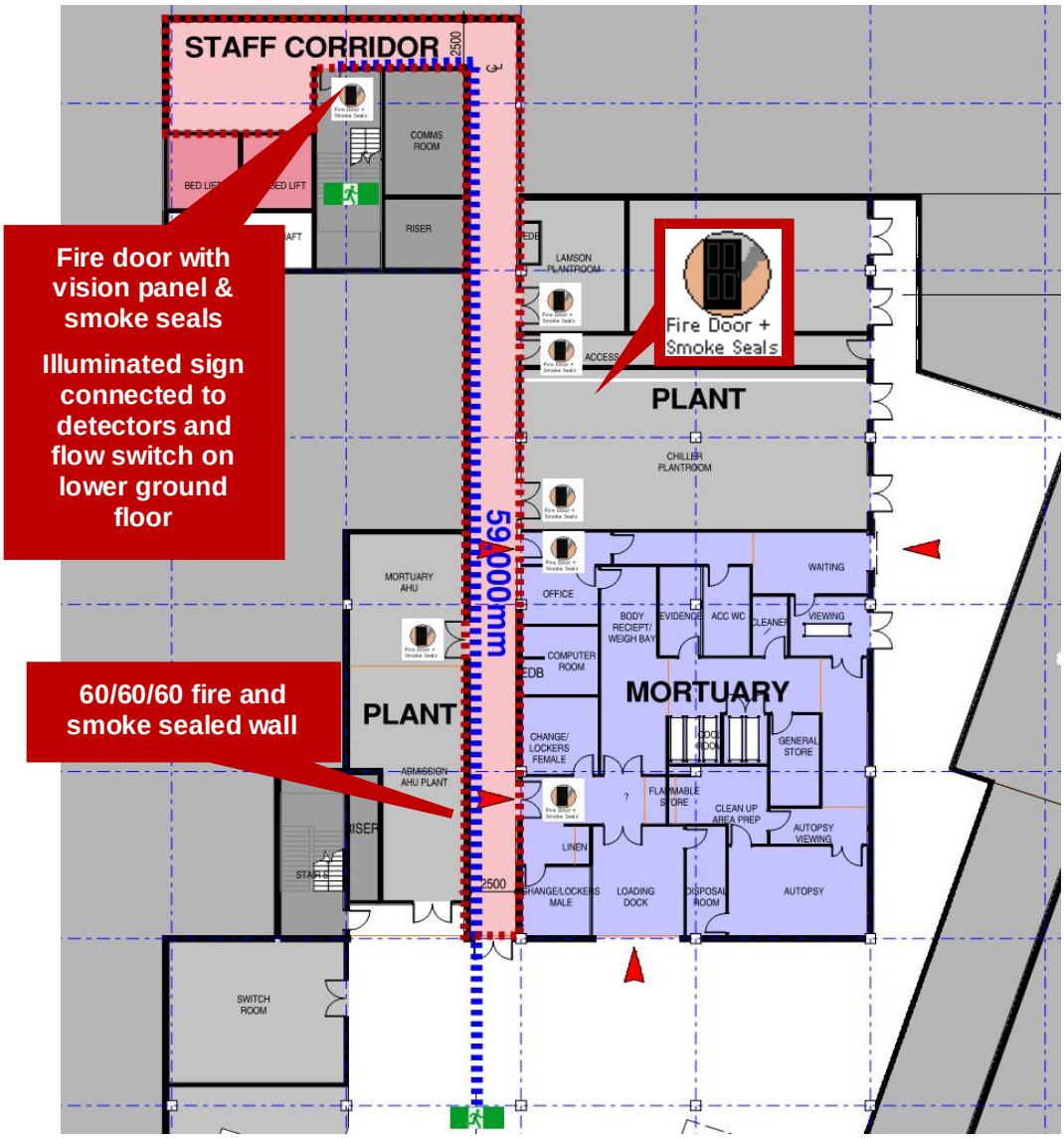


Figure 6-4: Acute services building lower ground floor egress corridor

The smoke seals shall be equal to Raven RP10 SI for the sides and the top, and a Raven RP38 SI drop seal at the bottom. Where the doors that open onto that corridor are not automatic closing, a magnetic switch complete with local piezoelectric alarm, should be provided to any room which opens onto the egress corridor. If the door is open for a period of time (i.e. more than 120 seconds), the device will emit a local alarm until the door is closed. A manual key locked override function (or similar approved system) is permitted for maintenance durations which are likely to exceed this time period.

6.2 EGRESS PROVISIONS

General Design Guidance:

The system should exhibit the following general design principles:-

- Walking surfaces, paths of travel, doorways provided and their dimensions and operation, where practical, and unless specified herein, are to be in accordance with the BCA prescriptive provisions;
- Spacing between exits and travel distances should typically be in accordance with the BCA prescriptive provisions unless specified herein.

Design Requirement:

Walking surfaces, paths of travel, doorways provided and their dimensions and operation, where practical, and unless specified below, are to be in accordance with the BCA prescriptive provisions. Travel distances in the patient care areas are to be designed in accordance with the prescriptive requirements. The currently nominated variations throughout the development are as follows:-

- Travel distances from the plant areas of the lower ground floor are to be confirmed, but are expected to be up to 59-metres.
- As stipulated in Figure 6-1 and Figure 6-2 where the line of compartmentation adversely affects the travel distances required to be travelled by occupants the installation of additional exits will need be considered once detailed quantitative analysis has been undertaken.

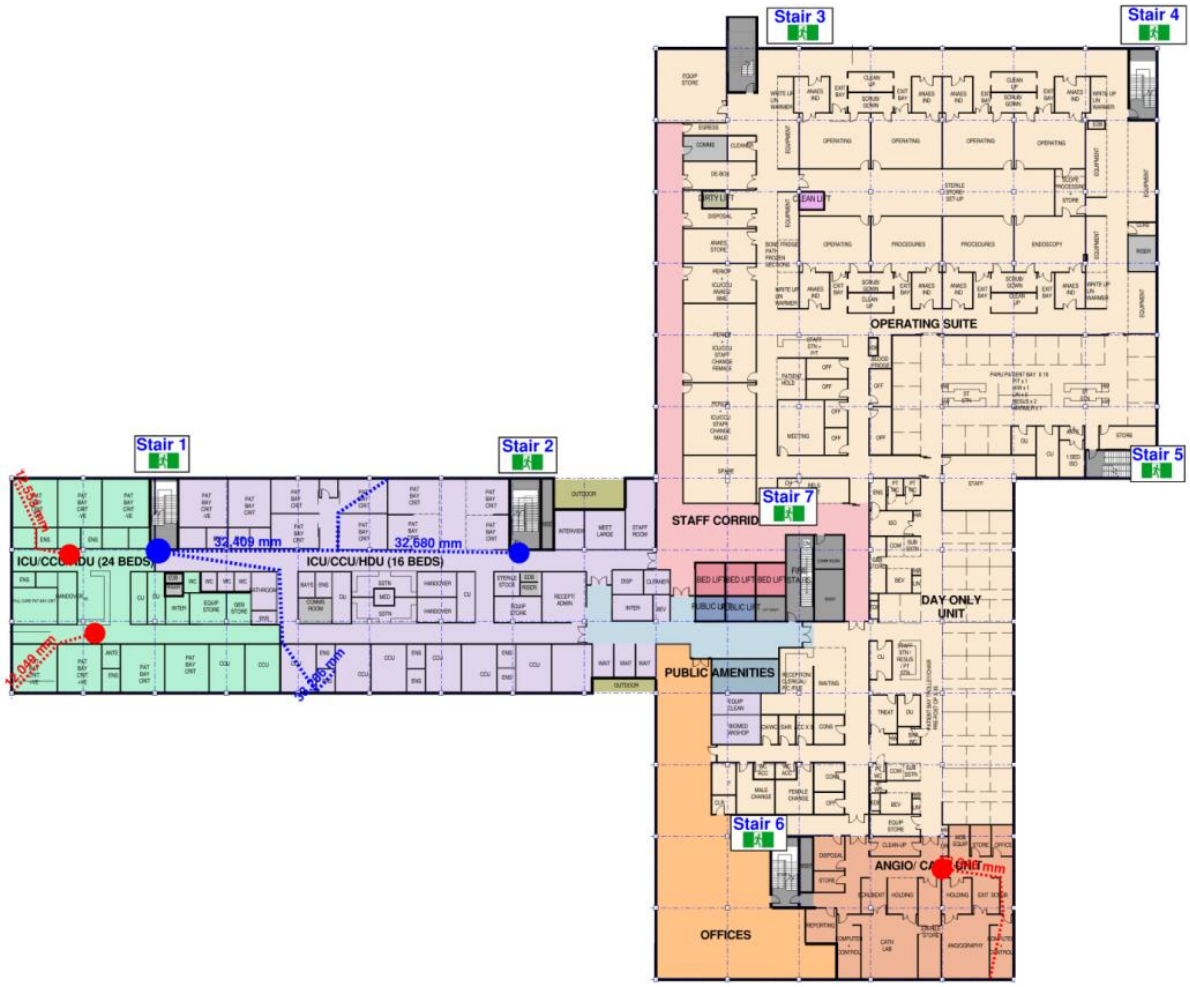


Figure 6-5: Indicative required exit (fire isolated stairs) for the Acute Services building (horizontal exits not shown)

Note: Travel distances have been assessed on nominal block layouts and a further assessment by the PCA and Fire Engineer will be required upon confirmation of final layouts and internal fit out designs.

In order to reduce the likelihood of occupants in the Acute Services building discharging to the lower ground level (when there is a fire event on that level), an illuminated sign is to be installed to indicate when fire detection (or sprinklers) have activated on the ground floor. The sign at ground level should read **"EXIT"**. In addition a sign shall be installed on the Lower Ground Floor which reads "**FIRE ALARM DO NOT ENTER**" prior to occupants discharging into the fire isolated egress passage. The signs are to be designed and installed in accordance with AS 1603.11:2010 for visual warning devices.

Figure 6-6: Example of Mk 2 AVI illuminated sign

The signs must be interfaced to illuminate upon activation of the smoke detection and/or the sprinkler system on the lower ground floor activating.

In the unlikely event that occupants fail to recognise or ignore the illuminated signage further safety measures are to be provided. The doors to the fire stair (-/60/30 fire door) which discharge into the lower ground and upper ground levels are to be provided with a vision panel so that occupants are provided with the opportunity to view conditions in the enclosure before exiting.

The fire rated vision panel shall be at least equivalent to the technical sheet provided in APPENDIX A.

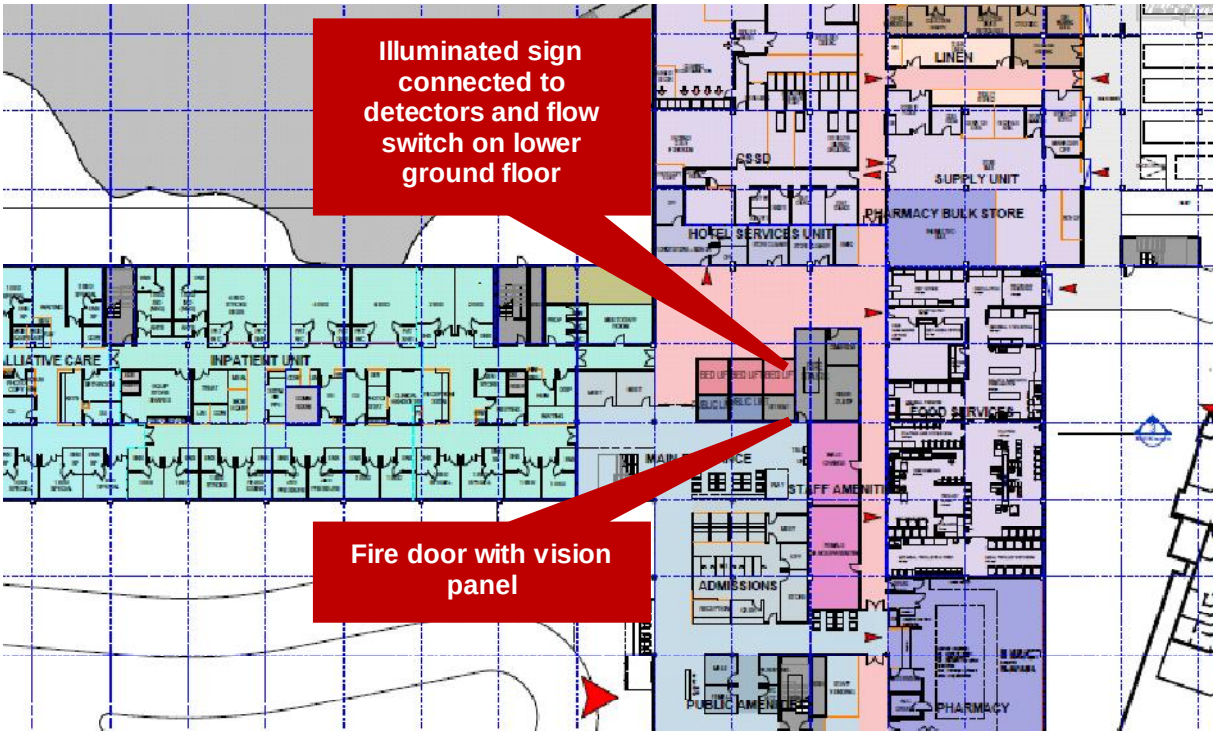


Figure 6-7: Acute Services Building Ground floor plan

6.3 SERVICES & EQUIPMENT

6.3.1 Fire Detection System

General Design Guidance:

The system should exhibit the following general design principles:-

- The system shall be configured to permit localisation of the fire incident as required for appropriate emergency response and activation of other systems;
- A fault in one zone must not render all other zones inoperative
- Installation and configuration should be designed to minimise false or spurious activations
- Systems and components must be suitable for the environment and normal operating atmosphere.

Design Requirement:

The Acute Services building shall be provided throughout with an addressable automatic smoke detection and alarm system complying with Specification E2.2a of the BCA and AS 1670.1:2004. The smoke detectors shall be connected by to the fire authority by an automatic monitoring link. In accordance with the prescriptive requirements the following design elements need be met:-

- Photoelectric type smoke detectors must be installed in all patient care areas and in paths of travel to exits from patient care areas.
- Further manual call points must be installed in evacuation paths so that no point on the floor is more than 30-metres from a manual call point.
- The activation of the smoke detection system on the lower ground floor of the Acute Services building shall trip the illumination of the emergency signage referenced in Section 6.3.

6.3.2 Fire Suppression

General Design Guidance:

The system should exhibit the following general design principles:-

- The system shall provide adequate discharge density and coverage to contain and control potential design fire scenarios for the purpose of life safety and/or asset protection;
- The system should be zoned as appropriate to operate effectively with other complementary fire safety management systems where applicable;
- Spray droplet, velocity, trajectory orifice sizing and supply filtration to prevent blockages should be considered as part of the system design; consideration should be given to the corrosive nature of environmental and external contaminant build up, determining material selection, protective coating selection along with any additional maintenance program requirements and or constraints.

Design Requirement:

An automatic fire sprinkler system is required to be fitted throughout the Acute Services building in accordance with BCA DtS Provisions E1.5 and AS 2118.1:1999.

The sprinkler system shall at least meet the following requirements:-

- Sprinkler activation temperature no greater than 68°C below the ceiling throughout;
- Sprinkler response time index (RTI) of less than $50m^{1/2}s^{1/2}$ (i.e. fast response type)
- Class A fault monitoring devices shall be provided in accordance with AS 2118.1 except that Class B devices shall be permitted where the monitored devices are located within a secure area or room with security restricted access which matches that required for Type A devices.
- An automatic link shall be provided directly to an approved monitoring centre on activation of any sprinkler head.
- A separate flow switch shall be required to permit monitoring of any activation of sprinklers in the lower ground floor of the Acute Services building. Activation of any sprinkler head in the lower ground floor shall trip the illumination of the emergency signage referenced in Section 6.3.
- The water supply shall be provided in accordance with the requirements of the BCA and as approved by the local fire authority.

6.3.3 Emergency Lighting & Exit Signage

General Design Guidance:

Emergency lighting and exit signage should be provided in accordance with the Australian Standard and take into account the familiarity (or lack thereof) of the occupants within the building. Lighting need take into consideration any unique design elements.

Design Requirement:

Emergency lighting is to be provided throughout in accordance with BCA DtS Provisions E4.2 and E4.4 and AS 2293.1:2005. Exit signage is to be provided throughout the Acute Services building in accordance with the BCA DtS Provisions E4.5, E4.6 and E4.8 and AS 2293.1:2005.

6.3.4 Sound System and Intercommunication System for Emergency Purposes

General Design Guidance:

The system should exhibit the following general design principles:-

- It must be sufficiently audible and intelligible so that it is appropriate to the particular enclosure within which it is installed;
- The speakers shall be spaced appropriately;
- Messages delivered by the system should be simple, clear and informative to encourage appropriate occupant behaviour and response;
- Full coverage of evacuation paths and routes need be provided;
- Messaging should be appropriate for the incident and location

Design Requirement:

In accordance with the prescriptive requirements of the BCA sound system and intercommunication system for emergency purposes is required to be installed throughout Acute Services building in accordance with Clause E4.9, Specification E1.5 and Clause 6 of Specification E2.2a.

The system is to be interfaced with the sprinkler system and smoke detection system such that the activation of any sprinkler head or detector in the common areas will initiate the occupant warning system.

6.3.5 Mechanical Smoke Management

General Design Guidance:

Mechanical smoke management should be designed to improve environmental conditions for evacuating occupants if necessary, and where possible fire fighters during a fire emergency.

Design Requirement:

The fire isolated stairs in the Acute Services building are to be provided with stair pressurisation in accordance with AS/NZS 1668.1:1998.

Miscellaneous air handling systems not forming part of a smoke hazard management system in accordance with Table E2.2a or E2.2b of the BCA need operate in accordance with the requirements of Clause E2.2, Table E2.2a and table E2.2b as required.

6.4 FIRST AID FIRE FIGHTING FACILITIES

6.4.1 Fire Hose Reels & Portable Fire Extinguishers

General Design Guidance:

Equipment should be provided based on the potential storage hazards to be installed within the building. Locations should be signposted and readily accessible to occupants. Use of facilities should be monitored for abuse, mistreatment and servicing.

Design Requirement:

- Fire Hose Reels are to be installed to serve the Acute Services building in accordance with the provisions within the BCA and AS 2441:2005.
- Portable fire extinguishers are to be provided throughout in accordance with BCA Table E1.6 and selected, located and distributed in accordance with AS 2444-2001 (See section 4). Sufficient extinguishers of an appropriate type should be provided throughout the building with regard to the

hazards that can be expected in the various areas. Typically the following extinguishers should be used for standardisation and shall be provided.

General office areas & Nurses Stations	Dry Powder (ABE type)	2.5Kg
Commercial Cooking Areas	Wet Chemical	7.5 Litre
Plant Rooms	Dry Powder (ABE)	2.5 Kg
Designated Exits	Dry Powder (ABE)	4.5 Kg
Adjacent each fire hose reel cabinet	Dry Powder (ABE)	4.5 Kg

6.5 FIRE BRIGADE INTERVENTION

General Design Guidance:

Fire brigade access points should be provided and located to facilitate emergency response and the buildings fire safety systems should consider the fire brigades response times.

Design Requirement:

- A fire hydrant system (incorporating internal and external hydrant connections) must be installed to serve the Acute Services building in accordance with AS 2419.1:2005 and BCA Clause E1.3.
- All fire hydrants are to be fitted with Storz hose couplings which comply with Clause 7.1 and 8.5.11 AS2419.1:2005. Further information is available from the FRNSW Guide Sheet No.4 '*Hydrant system connectors*' available at www.fire.nsw.gov.au.
- The sprinkler and common area smoke detection system is to be interfaced with the Fire Indicator Panel and connected to a monitoring station via alarm signalling equipment.
- Clear block plans (not less than A1 in size) shall be provided at the fire hydrant booster assembly and in the fire control centre and at each sub-FIP.

6.6 MANAGEMENT CONTROLS AND PROCEDURES

General Design Guidance:

Emergency and operational management plans should be prepared and developed in conjunction with emergency response agencies and centre operators. Regulator training exercises should be conducted to reflect the most likely fire incidents.

Design Requirement:

- No smoking policy throughout all public areas of the building.
- A hot work permitting system shall be established for works undertaken within the building.
- Keep unnecessary combustible loads to a minimum in public areas via regular housekeeping, including the removal of random storage and accumulated debris.
- The recommended fire safety systems must be replaced with equivalent systems in all future works and the recommended fire safety systems must be applied to any renovations or new works.
- Periodic inspection, testing and maintenance of all fire safety systems, fire hydrants, fire hose reels, emergency lighting, exit signage, doors, fire resistance, portable fire extinguishers, etc. should be implemented. Under all circumstances it is important to keep as much of the system fully operational as is practical. Should any building works extend over a number of days, the system must be re-instated as far as practical at the end of each day.
- Scaffolding, wire fencing, barricades and the like must not prevent fire brigade access for vehicles or personnel to essential fire safety components (hydrants, boosters, FIP, etc.) or prevent fire brigade personnel from intervening in the event of a fire.

7 REFERENCES

1. ABCB, “Building Code of Australia, Volume One”, CanPrint Communications, Canberra 2011.
2. ABCB, “Guide to the BCA 2011”, CanPrint Communications, Canberra 2011.
3. ABCB, “International Fire Engineering Guidelines”, ABCB, Canberra, 2005.
4. Australasian Fire Authorities Council, ‘Fire Brigade Intervention Model V2.2’, November 2002.
5. The Chartered Institute of Building Services Engineers, ‘CIBSE Guide E, “Fire engineering’, 3rd Edition, May 2010.

APPENDIX A FIRE RATED VISION PANEL

ACCESSORIES

Fire rated vision panel

TECH SHEET: ACC-07
Issue: 03-08-2010
Fire rated vision panels suitable for up to 4 hr fire rated doors

DESCRIPTION

Vision panels utilising Pilkington Pyrodur ™, Georgian wired glass and Pyroceram glass, mounted in aluminium, steel or stainless steel surrounds for up to 4 hours of fire rating.

APPLICATIONS

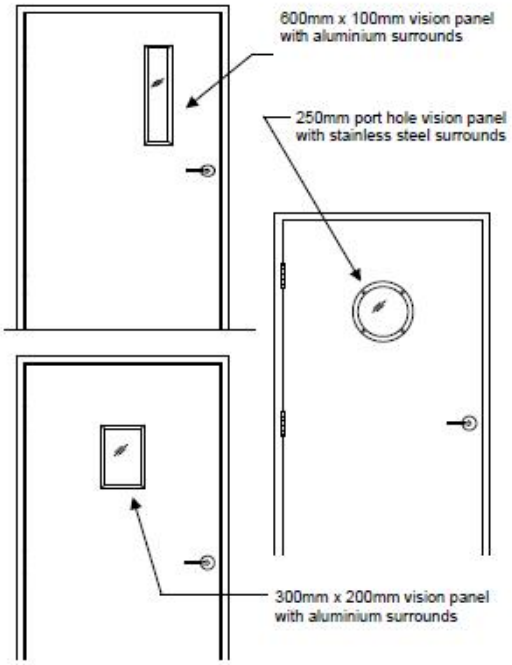
Fire doors located in car parks, factories schools, hospitals, or wherever there is a need to see through a fire door. Suitable for all Pyropanel timber and steel fire doors. *Note: Australian Standards 1530.4 and 1905.1 limit visible area for glass that has an insulation value less than 30 minutes to a maximum area 65,000mm2, when used in fire doors.*

FEATURES

- All options fully certified to Australian Standards
- Standard sizes: 300mm x 200mm (nom), 600mm x 100mm (nom) and 250mm (nom) diameter porthole
- 13mm Pilkington Pyrodur glass
  - Perfectly clear glass
  - Grade A safety glass (AS1288)
  - 2 hr fire rating
  - Maximum 65,000mm2 visible
  - Suitable for 38mm and 48mm doors
- 6mm Georgian wired glass
  - Clear in appearance
  - 10mm steel wires
  - Grade B safety glass (approved for use in doors)
  - 1 hr fire rated
  - Maximum 65,000mm2 visible
  - Suitable for 38mm and 48mm doors
- 5mm Pyroceram ceramic glass
  - Slightly bronze colour in appearance
  - Non safety glass (impact film must be applied to comply with AS1288)
  - 4 hr fire rated
  - Maximum 65,000mm2 visible
  - Suitable for 38mm and 48mm doors

OPTIONAL EXTRAS

- Custom sizes available
- For vision panels greater than 65,000mm2 visible area, please refer to "Glass fire doors" within the Fire Door section



HOW TO SPECIFY

Eg, "Door to have 600 x 100mm Pyropanel PVP-Pyrodur* vision panel including anodised aluminium surrounds..."*

* denotes example - delete or change or specify as required

MODELS AVAILABLE

Continued...

Model	Maximum fire rating	Glass	Light transmission	Thickness	Wires	Impact rated	Requires additional impact film?	Aluminium Surrounds?	Maximum Visible area
PVP-Georgian	1hr	Georgian wire	75% (approx)	6mm	Yes	Grade B	No	Yes	65,000mm2
PVP-Pyrodur	2hr	Pyrodur™	85%	13mm	No	Grade A	No	Yes	65,000mm2
PVP-Pyroceram	4hr	Pyroceram™	65% (approx)	5mm	No	No	Yes	Yes	65,000mm2

PYROPANEL
Protecting Life & Property

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