FIRE SAFETY STRATEGY

Fortis South Steyne

34-35 South Steyne, Manly

Report Number:

222007_FSS_02

Date:

05/07/2022

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REPORT DETAIL

Project:	Fortis South Steyne
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Report Revision History

Rev	Date	Comment	Prepared By	Reviewed By
01	01/07/2022	Draft Issue	**Joshua Raines** *BEng Civil* *MEng Fire Safety*	**Thomas Newton** *MEng Fire Safety* *Certifier Fire Safety – BDC 3149*
02	05/07/2022	Final Issue	**Joshua Raines** *BEng Civil* *MEng Fire Safety*	**Thomas Newton** *MEng Fire Safety* *Certifier Fire Safety – BDC 3149*

EXECUTIVE SUMMARY

Affinity Fire Engineering Pty Ltd has been engaged by Fortis to develop a preliminary Fire Safety Strategy for the proposed commercial development located at 34-35 South Steyne, Manly. The project consists of a mixed-use commercial building also containing food & beverage, carparking and end of trip facilities.

This Fire Safety Strategy (FSS) outlines the fire engineering principles that will be utilised in ensuring that the prescriptive non-compliances with the Deemed-to-Satisfy (DTS) provisions of the Building Code of Australia 2019 Amendment 1 (BCA) [1], as noted herein, are resolved through a fire engineered Performance Solution 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 does however outline 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.

CONTENTS

1 INTRODUCTION & SCOPE

1.1 Overview

This Fire Safety Strategy has been undertaken and nominates Performance Solutions for assessing compliance with the nominated Performance Requirements of the BCA [1] in accordance with the methodologies defined in the AFEG [3] and provide a workable and safe Fire Safety Strategy.

1.2 Fire Safety Objectives

The objective of the Fire Engineering Assessment is to develop a Fire Safety System, which satisfied the Performance Requirements of the NCC 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 NCC, *"Compliance with the NCC is achieved by satisfying the Performance Requirements"*. In addition to this, certain non-regulatory objectives exist as detailed below.

1.2.1 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) [13] as per the Fire Services State and Territory Acts and Regulations.

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

1.2.2 Building Regulatory Objectives

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

- **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.

1.2.3 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. The client and stakeholders for the design have not requested any additional nonprescribed objectives are required to be met through the preparation of the FER.

1.3 Regulatory Framework of the Fire Engineering Assessment

1.3.1 National Construction Code Series - Building Code of Australia

One of the goals of the BCA [1] 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 A2.1 of the BCA [1] outlines how compliance with the Performance Requirements can be satisfied. These are as follows:

1. Performance Solution; or
2. Deemed-to-Satisfy Solution; or
3. Combination of (1) and (2).

Sections A2.2 of the BCA provides several different methods for determining that a Performance Solution complies with the Performance Requirements. These methods are summarised as follows:

1) A Performance Solution is achieved by demonstrating-

   (a) Compliance with all relevant Performance Requirements; or

   (b) The solution is at least equivalent to the Deemed-to-Satisfy Provisions.

2) A Performance Solution must be shown to comply with the relevant Performance Requirements through one or a combination of the following Assessment Methods:

   (a) Evidence of suitability in accordance with Part A5 that shows the use of a material, product, plumping and drainage product, form of construction or design meets the relevant Performance Requirements.

   (b) Verification Methods including the following:

      (i) The Verifications Methods in the NCC

      (ii) Other Verification Methods accepted by the appropriate authority that show compliance with the relevant Performance Requirements.

   (c) Expert Judgment.

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

3) Where a Performance Requirement is satisfied entirely by a Performance Solution, in order to comply with (1) the following method must be used to determine the Performance Requirement or Performance Requirements relevant to the Performance Solution:
    (a) Identify the relevant Performance Requirements from the Section or Part to which the Performance Solution applies.
    (b) Identify Performance Requirements from the other Section or Parts that are relevant to any aspects of the Performance Solution proposed or that are affected by the application of the Performance Solution.
4) Where a Performance Requirement is proposed to be satisfied with a Performance Solution, the following steps must be undertaken:
    (a) Prepare a performance-based design brief in consultation with relevant stakeholders.
    (b) Carry out analysis, using one or more of the Assessment Methods listed in (2), as proposed by the performance-based design brief.
    (c) Evaluate results from (b) against the acceptance criteria in the performance-based design brief.
    (d) Prepare the final report that includes-
        (i) All Performance Requirements and/or Deemed-to-Satisfy Provisions identified through A2.2(3) or A2.4(3) as applicable: and
        (ii) Identification of all Assessment Methods used; and
        (iii) Details of steps (a) and (c); and
        (iv) Confirmation that the Performance Requirement is met; and
        (v) Details of conditions or limitations, if any exist, regarding the Performance Solution.

Section A2.3 of the BCA states that a solution that complies with the Deemed-to-Satisfy Provisions is deemed to have met the Performance Requirements. A Deemed-to-Satisfy Provision can be shown compliance with the Deemed-to-Satisfy Provisions through one or more of the following Assessment Methods:

(a) Evidence of suitability in accordance with Part A5 that shows the use of a material, product, plumping and drainage product, form of construction or design meets the relevant Performance Requirements.
(b) Expert Judgement.

As described in Section A2.4 a combination of Performance Solutions and Deemed-to-Satisfy Solutions may be used to satisfy the Performance Requirements. When using a combination of solutions, compliance can be shown through the following, as appropriate:

(a) Section A2.2 for assessment against the relevant Performance Requirements.
(b) Section A2.3 for assessment against the relevant Deemed-to-Satisfy Provisions.

Where a Performance Requirement is satisfied by a Performance Solution in combination with a Deemed-to-Satisfy Solution, in order to comply with (1), the following method must be used to determine the Performance Requirement or Performance Requirements relevant to the Performance Solution:

(a) Identify the relevant Deemed-to-Satisfy Provisions of each Section or Part that are to be the subject of the Performance Solution.

(b) Identify the Performance Requirements from the same Sections or Parts that are relevant to the identified Deemed-to-Satisfy Provisions.

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

1.3.2 Australian Fire Engineering Guidelines (AFEG)

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

The document is particularly useful in providing guidance in the design and assessment of Performance Solution against the Performance Requirements of the BCA. The prescribed methodology set out in the AFEG shall be generally adopted in the Fire Engineering Report (FER) for the assessment of each individual deviation from the prescriptive provisions as identified by the Principal Certifier. With the design of each deviation developed with a holistic understanding of the impact of the requirements and deviations assessed on the overall risk of fire spread, and occupant and fire fighter life safety.

The AFEG is not adopted in whole as there are professionals employed in the building process that determine the level of compliance with the building code. Conformation of compliance with the applicable BCA is the role of the BCA consultant / Principal Certifier. Where not commented on within this report it is the expectation that the design complies with the BCA

1.3.3 Stakeholders

The Performance Solution has been developed collaboratively with the relevant stakeholders as identified in the table below:

Table 1-1: Relevant Stakeholders

Role	Organisation	Contact
Developer	Fortis	Charlie Wyer Jess Elvish
Architecture	Durbach Block Jaggers	Nathan Dawes David Jaggers
Fire Services Consultant	IGS	Oudai Awad
BCA Consultant	Blackett Maguire + Goldsmith	Tony Heaslip Georgia Griffin
Fire Safety Engineer	Affinity Fire Engineering	Thomas Newton

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, Environmental Protection Authority (EPA), 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 client's 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.

1.4 Sources of Information

The following sources of information have been relied upon in the preparation of this document:

- BCA Compliance Review prepared by Blackett Maguire + Goldsmith dated 30/06/2022.
- Architectural plans prepared by Durbach Block Jaggers Architects as listed below.

Drawing List	Drawing No	Drawing Name	Scale
	A-DA-001-001	Title Sheet	
	A-DA-001-002	Architect's Statement	
	A-DA-001-003	Architect Bio	
100 Site Plans			
	A-DA-100-001	Site Plan	1:200
	A-DA-100-002	Site Plan Analysis	1:200
101 Demolition Plans			
	A-DA-101-001	Demolition Plan	1:100
102 Excavation Plans			
	A-DA-102-001	Bulk Excavation	1:100
110 GA Plans			
	A-DA-110-000	Basement 2 Plan	1:100
	A-DA-110-001	Basement 1 Plan	1:100
	A-DA-110-003	Ground Plan	1:100
	A-DA-110-004	Level 1 Plan	1:100
	A-DA-110-005	Level 2 Plan	1:100
	A-DA-110-006	Level 3 Plan	1:100
	A-DA-110-007	Roof Plan	1:100
210 GA Elevation			
	A-DA-210-001	North & South Elevations	1:100
	A-DA-210-002	East & West Elevation	1:100
310 GA Sections			
	A-DA-310-001	Section AA, BB & EE	1:100
	A-DA-310-002	Section CC	1:100
	A-DA-310-003	Section DD	1:100
710 GFA & NLA Diagrams			
	A-DA-710-001	GFA Diagrams Sheet 1	1:200
	A-DA-710-003	ESD Diagram	
720 Shadow Diagrams			
	A-DA-720-001	Shadow Diagrams Sheet 1	1:300
730 View Analysis			
	A-DA-730-002	RL 21.96	
810 Materials & Finishes			
	A-DA-810-001	Materials & Finishes	
820 Signage			
	A-DA-820-001	Signage Strategy	1:100
900 Photomontage			
	A-DA-900-001	South Steyne View	
	A-DA-900-002	Rialto Lane Perspective	
A4 Notification Plans			
	A-DA-A4-01	A4 Notification Sheet 01	1:500
	A-DA-A4-02	A4 Notification Sheet 02	1:200
	A-DA-A4-03	A4 Notification Sheet 03	1:200

1.5 Limitations and assumptions

In this instance, this Fire Safety Strategy has been developed based on applicable limitations and assumptions for the development which are listed as follows:

- This report is specifically limited to the project described in Section 2.
- This report is based on the information provided by the team as listed in Section 1.4.
- Building and occupant characteristics are as per Section 2 and 3 of this document. Variations to these assumptions may affect the Fire Engineering Strategy and therefore they should be reviewed by Affinity Fire Engineering should they differ.
- As per any building design, DtS or otherwise, the report is limited to the fire hazards and fuel loads as prescribed in Section 5. In line with the methodology and overarching strategy with the BCA, this report does not provide guidance in respect of multiple fire ignitions or sabotage of fire safety systems.
- This does not provide guidance on the storage of Dangerous Goods, flammable liquids, explosive materials or high temperature production equipment. Where present expert advice from an accredited Dangerous Good Risk Consultant must be sort.
- The development complies with the DtS provisions of the NCC [1] with all aspects relating to fire and life safety unless otherwise specifically stated in this report. Where not specifically mentioned, the design is expected to meet the NCC 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 NCC 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 NCC. 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.
- This Fire Safety Strategy (FSS) 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 Section 1.3.2 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.

2 BUILDING CHARACTERISTICS

2.1 Overview

Building characteristics are assessed as part of the Fire Safety Strategy 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, classification and height will dictate passive and active fire safety systems.

2.2 Site Location

The development is located at 34-35 South Steyne in Manly NSW. The site occupies Lot B of DA102407 and Lot 2 of DP861591; which are to be amalgamated as part of these development works.

The site is afforded street frontage along South Steyne to the east, Rialto Lane to the west and neighbouring allotments to the north-west and south-east.

Figure 2-1 illustrates the existing allotment boundaries in context to neighbouring sites and public roads.

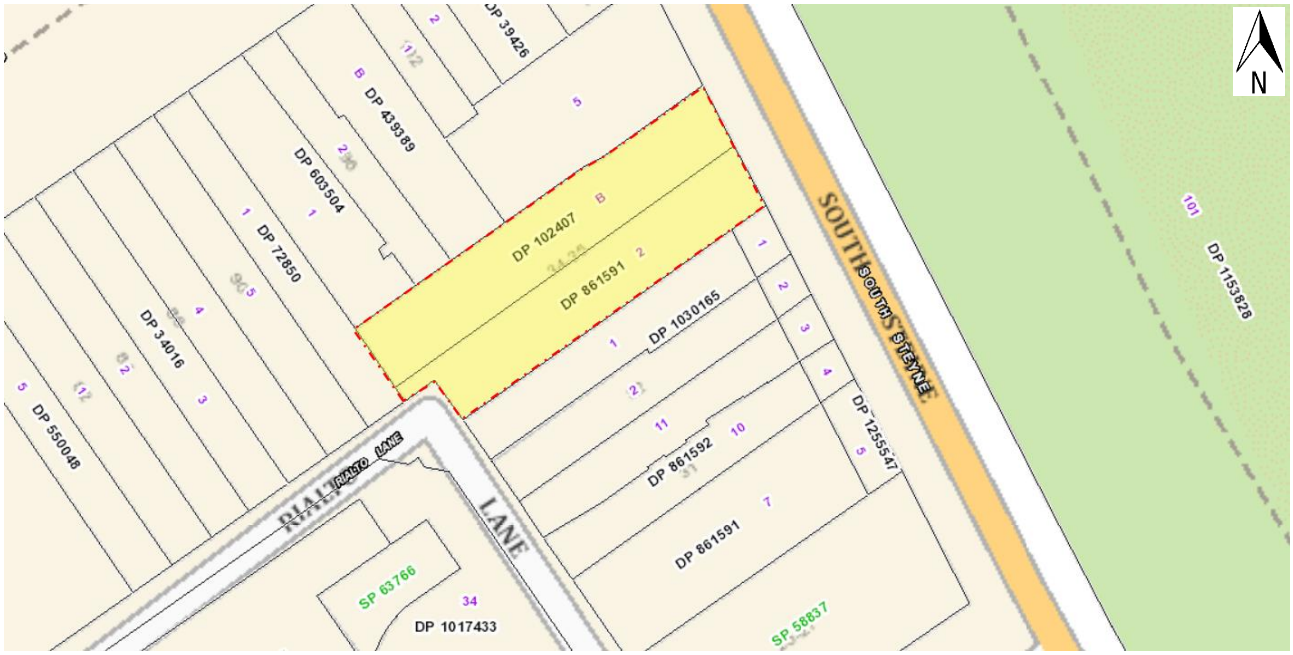

Figure 2-1: Development Site Location Relative to Existing Local Setting (SixMaps 2022)

2.3 Building Description

The development consists of six (6) storeys, with three (3) of those levels being above the ground floor retail level and an additional two (2) subterranean basement levels.

The building shall contain Class 7a Carparking, Class 5 Commercial, Class 6 Retail (food & beverage) and a Class 10b Swimming Pool. The key aspects of each storey is described below with the floorplans for each storey detailed thereafter.

Basement Level 2

A Class 7a car park is provided on Basement Level 2. Vehicular access to this level is via the driveway entry off Rialto Lane at the rear of the site. Egress from this level is via two fire-isolated stairs that both discharge at ground floor level.

Basement Level 1

Basement Level 1 contains the building's end of trip facilities and a commercial suite with associated amenities. Similar to the Basement Level 2, this level is afforded egress via the same two fire-isolated stairs that discharge at ground floor level.

Ground Floor

The ground floor plan is occupied primarily by a retail tenancy that extends from the eastern to western frontage. The two frontages of this tenancy would allow the division of the space to accommodate two separate tenants in the future should that be optimal for leasing. Additional to this the retail tenancy, ground floor also incorporates a separate communal Through-Site-Link that facilitates pedestrian movement through the building from Rialto Lane to South Steyne towards Manly Beach.

Egress from the ground floor is via egress doors into the Through-Site-Link where occupants can then travel either east or west to discharge to outside.

Levels 1-3

The upper levels are commercial floorplates which are afforded a single exit route via a central circular stairway. The circular stair is separated from the adjoining floorplates by a glazed element that affords both smoke sealing and acoustic control between the different commercial levels.

Unique to Level 3 is a terrace area with a private lap pool.

The floorplans of each level are depicted in the following figures.

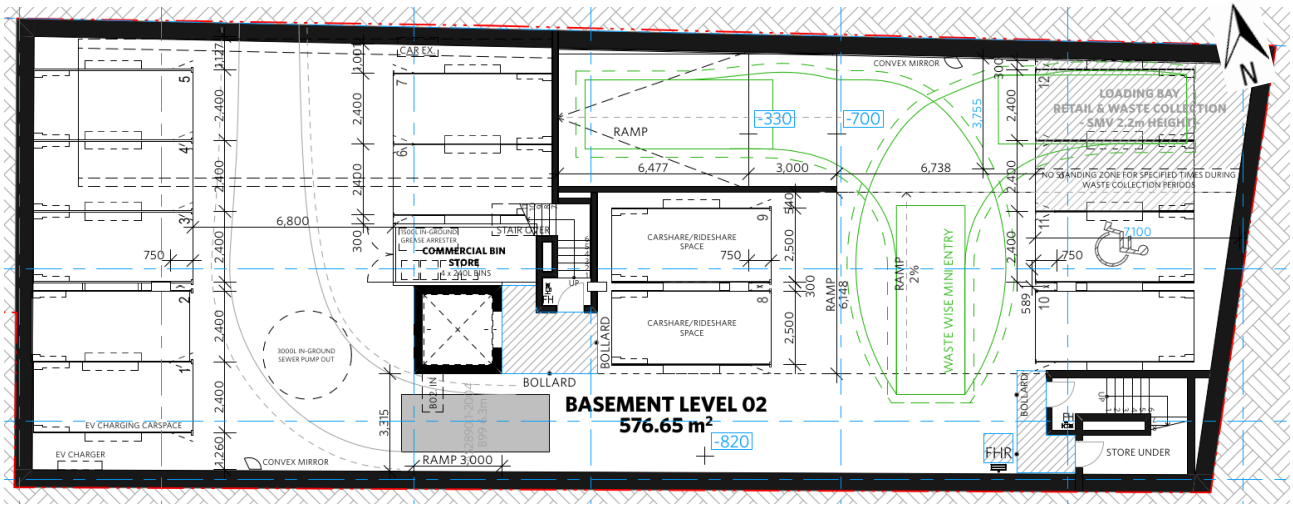

Figure 2-2: Basement Level 2 Floor Plan

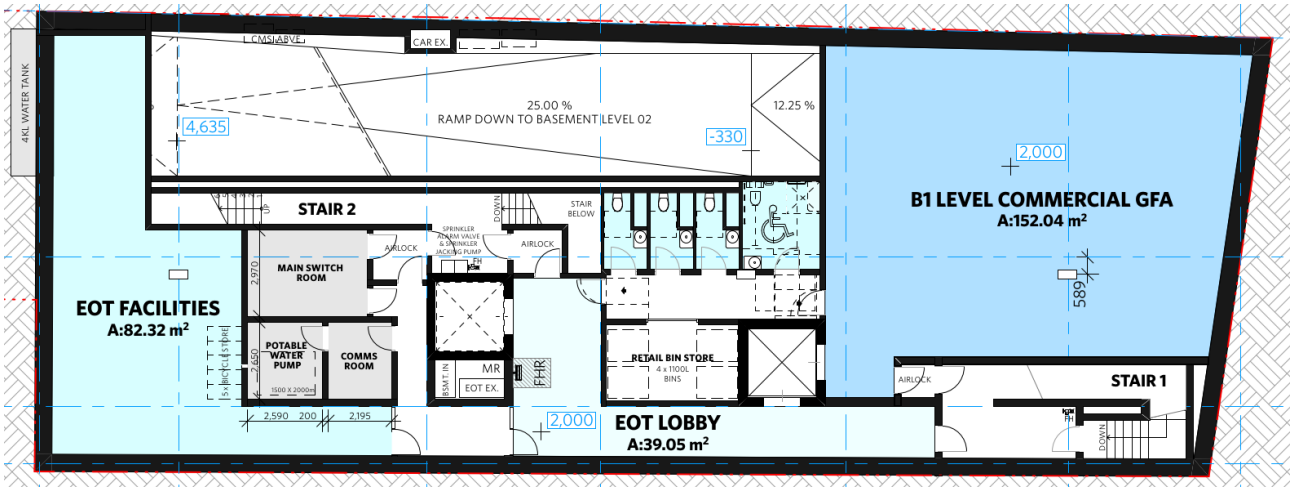

Figure 2-3: Basement Level 1 Floor Plan

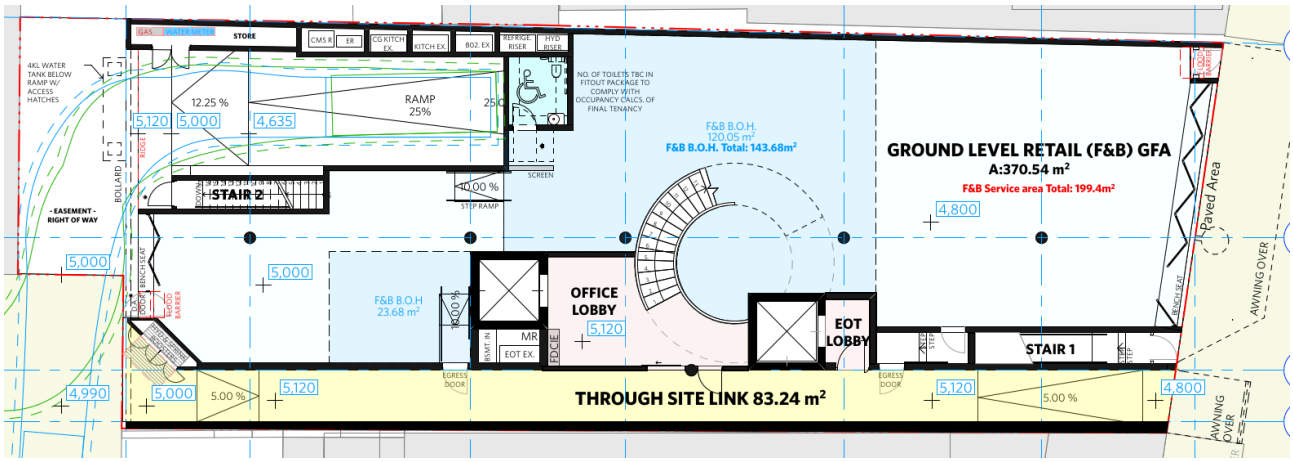

Figure 2-4: Ground Floor Plan

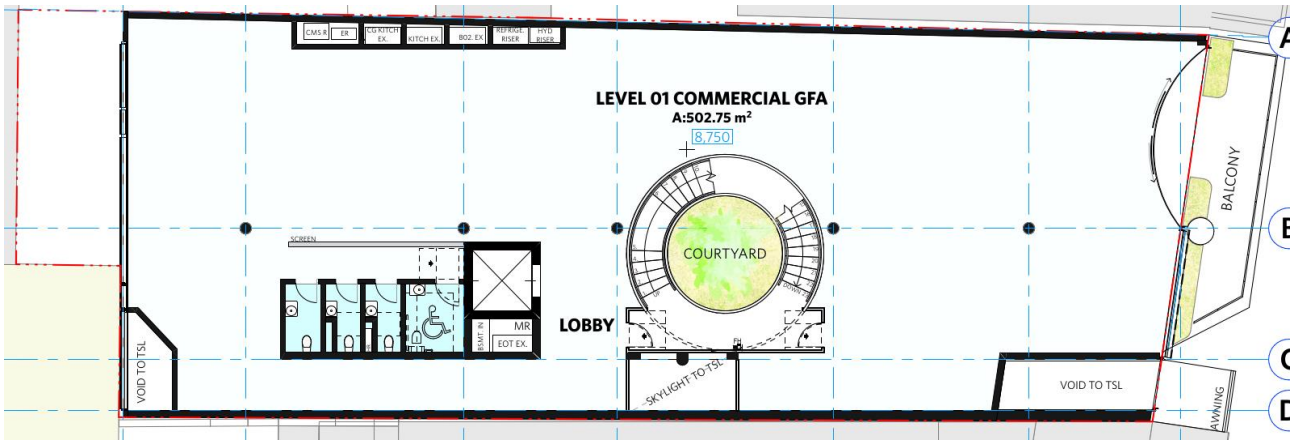

Figure 2-5: Level 1 Floor Plan

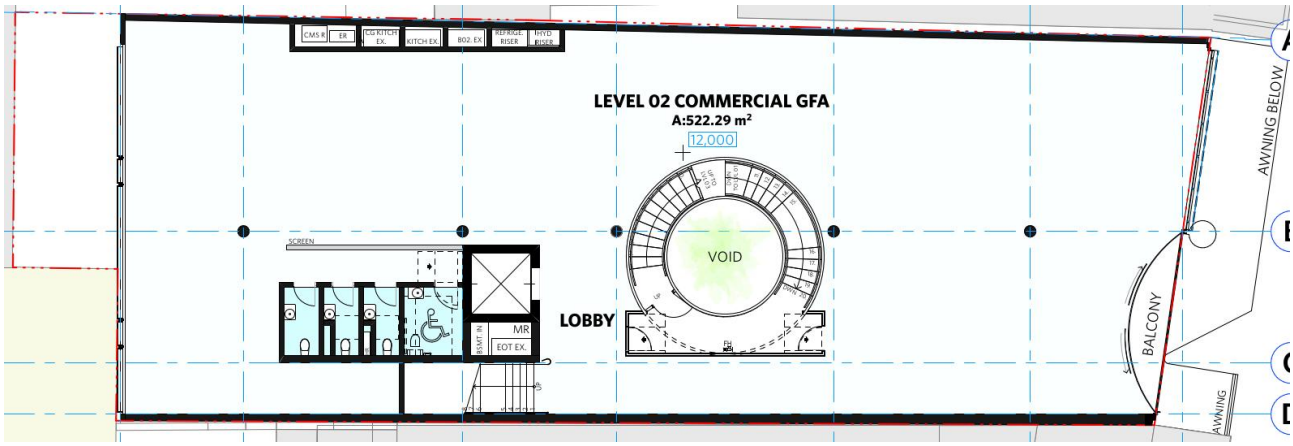

Figure 2-6: Level 2 Floor Plan

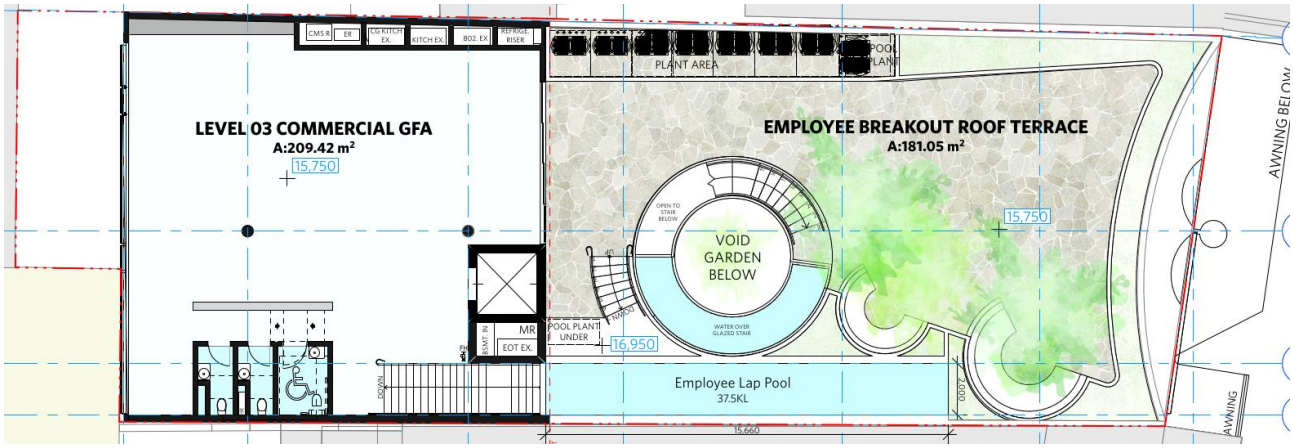

Figure 2-7: Level 3 Floor Plan

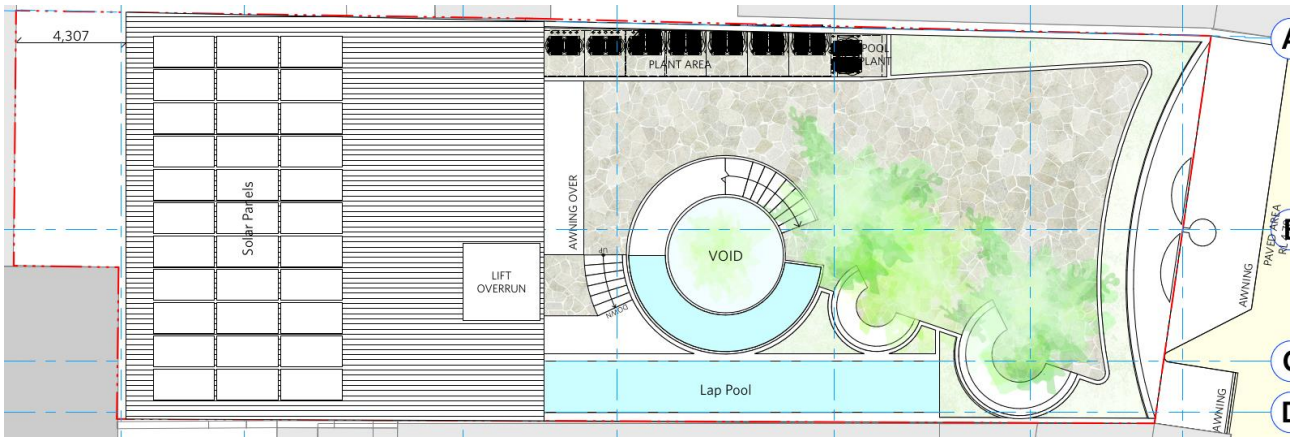

Figure 2-8: Roof Plan

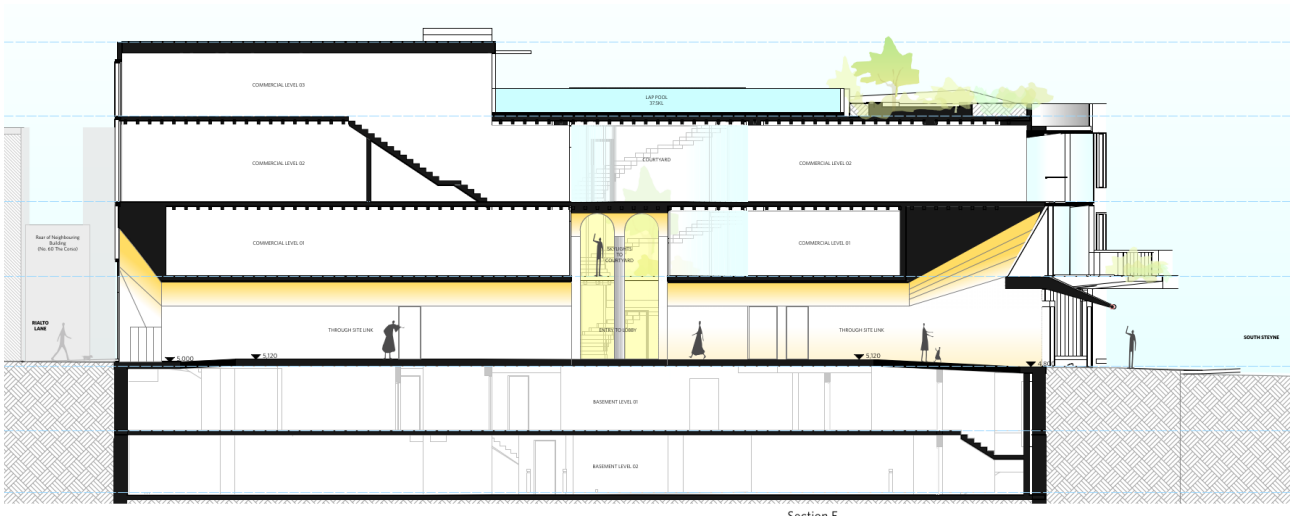

Figure 2-9: East-West Section through the Building

2.4 Building Structure

All materials used in the construction will conform with the testing methodology outlined in the DTS provisions so to mitigate the spread of fire and smoke in turn minimising the fire related risks to occupants and firefighters.

The building has a rise in storeys of four, effective height of 10.95m and therefore necessitates Type A Construction.

2.5 Building Characteristic Assessment

The following table summarises the characteristics of the subject building, relevant to fire and life safety.

Table 2-1: Building Characteristics Assessment

CHARACTERISTIC	BUILDING A
BCA Classification	▸ Class 7a Carpark (Basement Level 2) ▸ Class 5 Commercial (Basement L1, Levels 1, 2 & 3) ▸ Class 6 Food & Beverage (Ground Level) ▸ Class 10b Swimming Pool (Level 3)
Rise in Storeys	Four (4)
Type of Construction	Type A
Total GFA	1,757m^2

3 OCCUPANT CHARACTERISTICS

3.1 Overview

The occupant characteristics are assessed as part of the Fire Engineering Review 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.

3.2 Dominant Occupant Characteristics Assessment

Characteristic	Description
Population numbers	Generally, the occupant numbers in the building are expected to less than the occupant densities (m^2/person) listed in the NCC Table D1.13 for the various areas and the building layout. Following review of the proposed design and the intended purpose of the development, the BCA consultant has listed the following population numbers: ▸ Basement Level 2: 10people ▸ Basement Level 1: 32 people ▸ Ground Floor: 39 people ▸ Level 1: 50 people ▸ Level 2: 50 people ▸ Level 3: 20 People
Physical and mental attributes	**Staff** Staff in the building are expected to be awake and alert at all times. Staff are expected to have a level of understanding where they can recognise an emergency situation and have the ability to take and implement decisions independently. In addition, staff are expected to respond at all times, and to be unaffected by physical or sensory disabilities. Staff are not expected to be mentally impaired by drugs, alcohol, fatigue or other adverse conditions to degrees greater than in other business places.

Characteristic	Description
	Visitors This occupant group is expected to be awake and alert. Visitors may also exhibit physical and mental disabilities to the degree and frequency of the general public. It should be noted that some visitors may consist of young children as well as elderly occupants and these occupant groups are expected to be accompanied by an adult. **Firefighters** This occupant group will be equipped with breathing apparatus and specialist equipment to prevent them from being adversely affected by fire hazards. They are expected to be trained in emergency response and be capable of undertaking fire suppression and coordination of evacuation of the building. **Maintenance personnel** This occupant group is expected to awake and alert at all times. Maintenance personnel are expected to be able-bodied individuals who are capable of making independent decisions and evacuate themselves.
Familiarity with the building	**Staff** Staff are expected to have a complete knowledge of the building layout and be able to coordinate evacuation of other occupant groups in an emergency. **Visitors** Visitors may not have complete knowledge of evacuation routes in the subject building and are likely to choose to exit via the route they entered the building if not directed/guided by staff to the nearest exit. **Firefighters** This occupant group is 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. **Maintenance personnel** 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.
Pre-movement time	Pre-movement times can vary and is highly dependent on a combination of a variety of factors [5] such as:

Characteristic	Description
	▸ Familiarity with building ▸ Commitment to activity being undertaken at the time of fire ignition ▸ Mental capabilities (ability to assess risks and make appropriate decisions, alertness) ▸ Physical capabilities ▸ Group dynamics ▸ Occupant relationships / social affiliations ▸ Frequency of false alarms Documents such as PD7974-6:2004 [8] and CIBSE Guide E [11] provide guidance on estimating pre-movement times for various occupancies.
Travel speed	Travel speeds for individuals can vary depending on factors such as: ▸ Age and sex, ▸ Physical capabilities (ambulant, semi-ambulant, bed-ridden) ▸ Occupant density / crowding ▸ Perceived danger Based on a literature review of work carried out by Boyce et al. [14], Nelson and Mowrer [15], Pauls [15], Milinskii, Pelecheno [16], Pretechskii [17] and Shi et al. [18], the following travel speeds are adopted for an average horizontal travel speed: ▸ 1.2m/s is assumed for an able-bodied adult where congestion is unlikely [11] such as in the carpark areas; and ▸ 1.0m/s is assumed for an able-bodied adult where congestion is likely [11]; and ▸ 0.8m/s for semi-ambulant occupants requiring assistance to evacuate, walking aid or wheelchair users [15].

4 HAZARDS AND PROTECTIVE MEASURES

4.1 Overview

The fire hazard analysis forms the basis for the review of non-compliances within the buildings. In assessing expected and statistically validated hazards, preventative and protective measures are developed commensurate with those expected risks. The following section reviews applicable hazards and recommends possible measures to address those risks. Furthermore, hazards identified can form a justified basis for selected scenarios in fire engineering assessments.

4.2 Fire Hazards

4.2.1 Building Layout and Egress

Exits are provided from each level with the Basement Levels each being afforded two (2) fire-isolated exits and the above ground floor level being afforded a single non-fire-isolated exit route. The ground floor is unique and afforded multiple egress paths due to the relative ease of access to the street level and also the increased population expected on that level.

4.3 Fuel Loads

Quantity of Materials

Due to the nature of the facility the fire loads within the building will vary over time as tenants change or business structure of the same tenant evolves. The fire load densities with the carparking areas should however remain consistent. The following fire load densities are estimated for the various areas and shall be utilised in the fire engineering analysis where suitable.

The office areas may exhibit mean fire load densities of approximately 800MJ/m^2 with isolated peak values reaching up to 1600MJ/m^2, whereas the carparking areas may exhibit mean fire load densities of approximately 200MJ/m^2 with isolated peak values reaching up to 400MJ/m^2.

4.4 Dangerous Goods

Dangerous goods are not expected to be stored on the site in significant quantities. It is however noted that all commercial buildings will contain a degree of flammable materials for maintenance purposes (i.e. paints, oil, aerosols etc.) and where DGs are stored, they shall be stored in accordance with the Regulatory requirements.

4.5 Rooftop Solar Panels

Solar photovoltaic systems contribute to an increased probability of a fire event, primarily due to electrical risks [7]. Additionally, should the solar panels be subjected to a fire event, attending fire brigade can be exposed to hazardous toxins from the combustion of the panel materials.

Storage battery systems pose a significant risk to attending brigade with coming in to contact with the photovoltaic system. Drenching with hoses may disconnect or expose wiring to water in which create live current exposure to personnel or possibly additional fires through sparks or short circuits.

As the design incorporates provisions for rooftop solar panels to offset the building's energy requirements, the following design measures shall be included to mitigate the risk to the attending fire fighters in the event of a fire as per FRNSW requirements.

- A minimum of an A3 sized block plan shall be provided at the FDCIE to alert the attending fire fighters of the presence of all key components inclusive, but not limited to, the following-
    - the location of the solar panels, inverters,
    - details of the operating voltage and current
    - the location of storage equipment and respective battery type
    - the location of the all-associated isolation switches, AC and DC isolators for the shut-off of generated electricity.
    - Notification of whether the solar panels are designed to be automatically isolated on fire trip, or alternatively whether manual isolation is required by attending fire fighters.
- The above signage is to be constructed of a weatherproof and fade resistant material.

4.6 Review of Relevant Fire Statistics

The following discussion is based on the fire statistics attached in APPENDIX A.

4.6.1 Offices

NFPA statistics published for the years 2007-2011 estimates an average of 3,340 structure fires in office properties per year. Fires in office properties accounted for less than one in every 100 (0.7%) reported structure fires from 2007-2011. These fires caused annual averages of 4 civilian deaths and 44 civilian injuries. One in every four fires was caused by cooking. Electrical distribution and lighting equipment was the second leading major cause. The percentage of fires, civilian injuries and deaths that occurred in 2007-2011 at different times of the day are presented in the figure below.

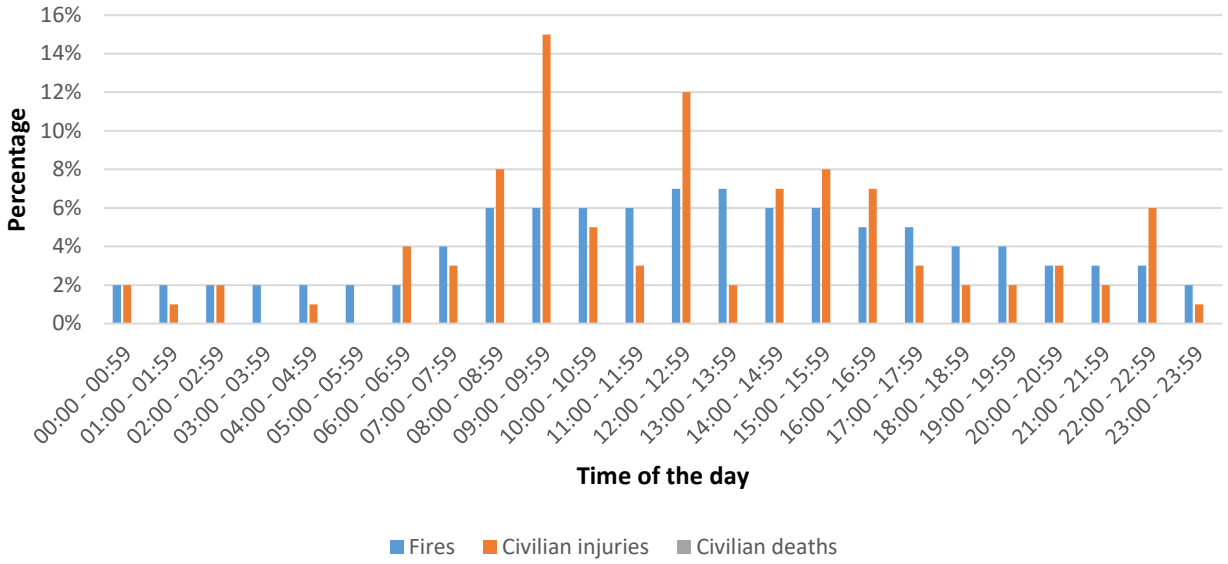

Figure 4-1: Percentage Of Fires, Civilian Injuries And Deaths At Different Times Of The Day (Offices)

The following graph that shows the ratio of injuries and deaths to total number of fires has been developed from the data presented in the previous figure. It can be noted that the number of fires during the day is almost four times as many as those during the night. The number of fires peak at midday and are the lowest in the night. This is likely due to the fact that office tenancies are generally unoccupied during the night.

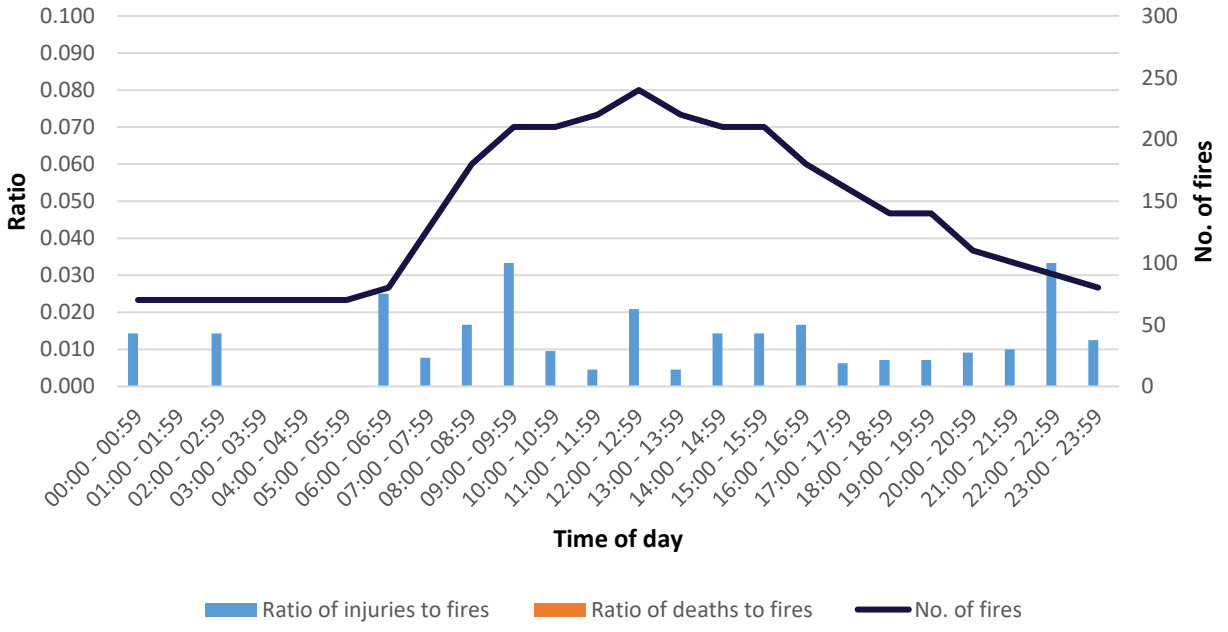

Figure 4-2: Number Of Fires, Ratio Of Injuries/Fires And Deaths/Fires For Different Times Of The Day (Offices)

The most common ignition sources in order of likelihood in office structure fires are:

- Cooking equipment (29%)
- Electrical distribution and lighting equipment (12%)
- Heating equipment (11%)

- Intentional (10%)
- Smoking materials (9%)

The most common fire origins in order of likelihood in office structure fires are:

- Kitchen or cooking area (22%)
- Unclassified outside area (4%)
- Lavatory, bathroom, locker room (4%)
- Lobby or entrance way (3%)
- Attic or ceiling/roof assembly or concealed space (2%)
- Duct for HVCA, cable, exhaust, heating or AC (2%)
- Machinery room or elevator machinery (2%)
- Unclassified storage area (2%)

5 BCA DTS NON-COMPLIANCE REVIEW

5.1 Overview

In this instance the BCA DTS non-compliances have been formulated based on a regulatory review undertaken by the project building surveyor and / or design team. Where not listed herein the building is required to achieve compliance with relevant DTS provisions and relevant codes, reports and Standards.

The following table lists the proposed departures from the DTS provisions of the BCA for the development as determined by the project's BCA Consultant.

5.2 BCA DTS Non-Compliance Assessment

Table 5-1: Summary of Performance Solutions

VARIATIONS, ASSOCIATED METHODOLOGY
Item 1: Protection of Openings
Relevant Regulatory Requirement: BCA Clause C3.2 requires that openings within an external wall that is required have an FRL must be protected in accordance with BCA C3.4 if the distance between the opening and a fire source feature is less than 3m from a side or rear boundary. **Performance Requirement** The relevant Performance Requirement is CP2 **Non-compliance with DTS provisions:** The following openings are not provided with a compliant method of protection: ▸ Levels 1, 2 & 3: Western elevation where situated less than 3m from northern allotment boundary. ▸ Level 3: Eastern elevation where situated less than 3m from southern and northern allotment boundaries. ▸ Ground Floor: Western elevation driveway opening where situated less than 3m from the northern allotment boundary. ▸ Ground Floor: Southern end of Western elevation where situated less than 6m from the far boundary of Rialto Lane. **Relevant IFEG Sub-Systems:** ABCDEF

VARIATIONS, ASSOCIATED METHODOLOGY

Item 2: Fire Separation of Stairs

Relevant Regulatory Requirement:

BCA Clause D1.3 states that all required stairs must be fire-isolated if the connect or pass through more than three (3) consecutive storeys in a sprinkler protected building.

Performance Requirement

The relevant Performance Requirements are CP2, DP5 & EP2.2.

Non-compliance with DTS provisions:

The exit serving upper commercial levels connects more than three (3) storeys in a sprinkler protected building however is not proposed to be fire isolated. The central circular stair connects Ground floor up to Level 3 (four storeys).

Relevant IFEG Sub-Systems:

ABCDEF

Item 3: Travel via Non-Fire-Isolated Stairs

Relevant Regulatory Requirement:

BCA Clause D1.9 requires;

- The total travel distance to reach a final exit via a non-fire-isolated stair to be no greater then 80m total distance.
- A required non-fire-isolated stair must discharge to ground floor in a location that is no greater than 20m from a final exit, or no more than 40m from the nearest alternative exit where two or more exits direct to outside are available; and
- The flights and landings of a non-fire-isolated stair must be continuous to the point where it discharges to the level of egress to a road or open space.

Performance Requirement

The relevant Performance Requirements are CP2, DP4, DP5 & EP2.2.

Non-compliance with DTS provisions:

The internal stair connecting Level 2 and Level 3 (southern side of the lift) does not provide a continuous means of travel by its own flights and landings from every storey served to a level at which egress to a road or open space is provided.

Relevant IFEG Sub-Systems:

ABCDEF

VARIATIONS, ASSOCIATED METHODOLOGY

Item 4: Egress Provisions

Relevant Regulatory Requirement:

BCA Clause D1.4 states that in a Class 5, 6 and 7 building the travel distance to the point of choice must not exceed 20m and to the nearest exit must not exceed 40m where more than one exit is available.

BCA Clause D1.5 states that the travel distance between alternative exits must not exceed 60m.

Performance Requirement

The relevant Performance Requirements are DP4 & EP2.2.

Non-compliance with DTS provisions:

The following non-compliant travel distances have been identified;

Basement Level 2:

- Maximum of 23m to a point of choice between alternative exits in lieu of 20m

Level 1 and Level 2:

- Maximum of 30m to a single exit in lieu of 20m (Based on open floor plan)

Relevant IFEG Sub-Systems:

ABCDEF

Item 5: Discharge of Fire-Isolated Stairs

Relevant Regulatory Requirement:

BCA Clause D1.7 requires fire isolated exits to discharge directly, or via a fire-isolated passageway, to outside.

Performance Requirement

The relevant Performance Requirements are DP5 & EP2.2.

Non-compliance with DTS provisions:

Fire stair 2 discharges into a covered area that does not comply with BCA clause D1.7(b) as the covered area is not open for at least 1/3 of the it's perimeter.

Relevant IFEG Sub-Systems:

ABCDEF

VARIATIONS, ASSOCIATED METHODOLOGY

Item 5: Fire and Sprinkler Booster Assemblies

Relevant Regulatory Requirement:

BCA Clause E1.3 requires that a fire hydrant system be provided and installed in accordance with AS2419.1:2005 which in turn requires;

- The booster assembly be located within sight of the main entrance of the building; and
- The hose connections for the booster assembly to be located between 750mm and 1200mm above FFL.

BCA Clause E1.5 requires that fire sprinklers to be installed in accordance with AS2118.1:2017 which in turn requires under Clause 4.14.1 that the sprinkler booster to be located in accordance with the above mentioned requirements of AS2419.1:2005.

Performance Requirement

The relevant Performance Requirement is EP1.3 and EP1.4.

Non-compliance with DTS provisions:

The following non-conformances have been identified;

- The hydrant and sprinkler booster assemblies are accessed off Rialto Lane and therefore not located within sight of the building's main entrance off South Steyne.
- The hydrant and sprinkler booster assemblies shall adopt the I-Pattern arrangement detailed within AS2419.1:2021, and therefore the lower valve connections shall be 600mm above FFL in lieu of 750mm.

Relevant IFEG Sub-Systems:

ABCDEF

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.

The specified fire safety strategy will undergo analysis as part of a Fire Engineering Report to ascertain whether the relevant Performance Requirements of the BCA are satisfied. The information herein is therefore pending completion of the fire engineering analysis and as such is possible to change and or modification through the detailed design phase of the project.

6.1 Passive Fire Construction

6.1.1 Fire Resisting Construction

The building structure (including but not limited to the floors, walls, columns and shafts) shall be constructed in accordance with the requirements of BCA Clause C1.1, Specification C1.1 for Type A Construction.

Additional to the prescriptive DtS provisions, the following additional measures are to be incorporated into the design as part of the fire engineered Performance Solution;

- The Through-Site-Link shall be separated from the ground floor retail tenancy by a 180/180/180 FRL firewall as indicated in Figure 6-1.
- Any doors within the firewall shall be;
    - AS1905.1:2015 compliant fire doors achieving a --/180/60 FRL; and
    - Fitted with medium temperature smoke seals to all four sides of the door leaf/frame.
        - The medium temperature smoke seals shall be capable of resisting smoke in accordance with BCA Specification C3.4 (200°C smoke for 30 minutes, tested in accordance with AS1530.7:2007 and meet the smoke leakage rates specified in AS6905:2007.
    - The above doors must also be fitted with magnetic hold-open devices that are connected to the FDCIE to release on power failure and fire trip.

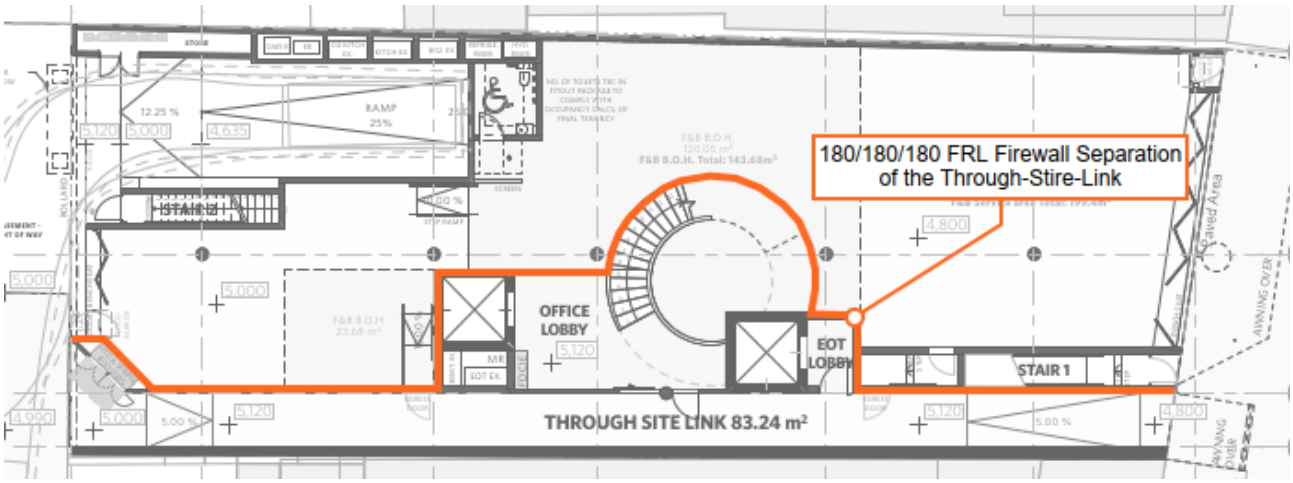

Figure 6-1: Fire Rated Wall Separating the Through-Site-Link at Ground Floor Level (180/180/180 FRL)

6.1.2 Smoke Proof Construction

In addition to the prescriptive DtS requirements, the following shall be provided as part of the fire engineered Performance Solution;

- The central circular stair serving the above ground floor levels shall be separated from the Level 1 and Level 2 floor plates by smoke proof construction.
    - The smoke separation shall be in accordance with Clause 3 of BCA Specification C2.5 – noting however that any mechanical ducts penetrating the smokeproof walls are not required to be fitted smoke dampers provided the system is designed to shut down on general fire trip.
    - All doors within the smoke proof wall must be smoke doors compliant with BCA Specification C3.4 and fitted with self-closing devices and medium temperature smoke seals.
        - The medium temperature smoke seals shall be capable of resisting smoke in accordance with BCA Specification C3.4 (200°C smoke for 30 minutes, tested in accordance with AS1530.7:2007 and meet the smoke leakage rates specified in AS6905:2007.

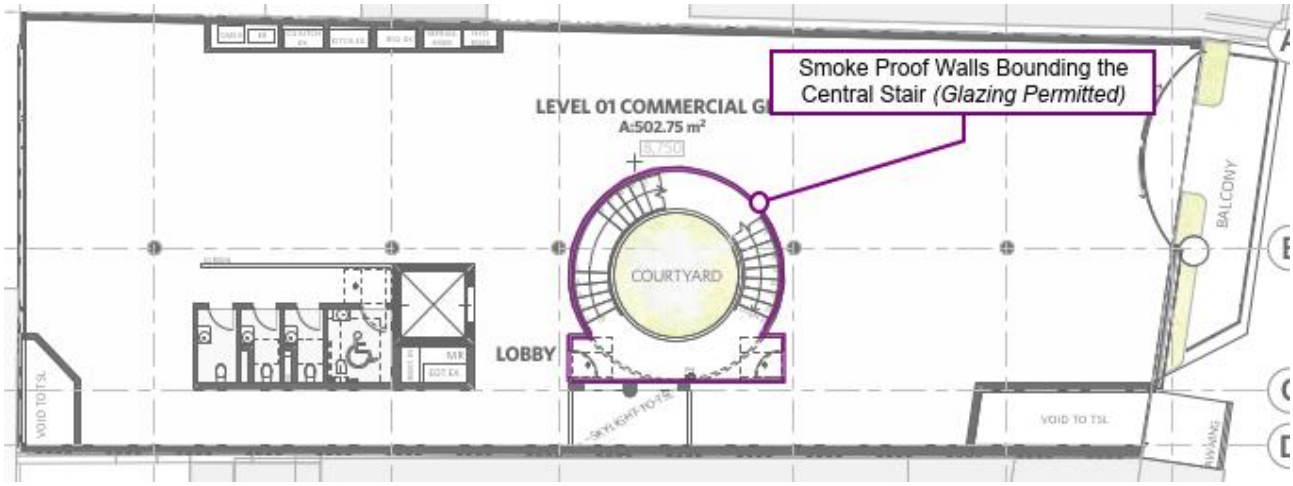

Figure 6-2: Smoke Separation of the Central Circular Stair – Level 1

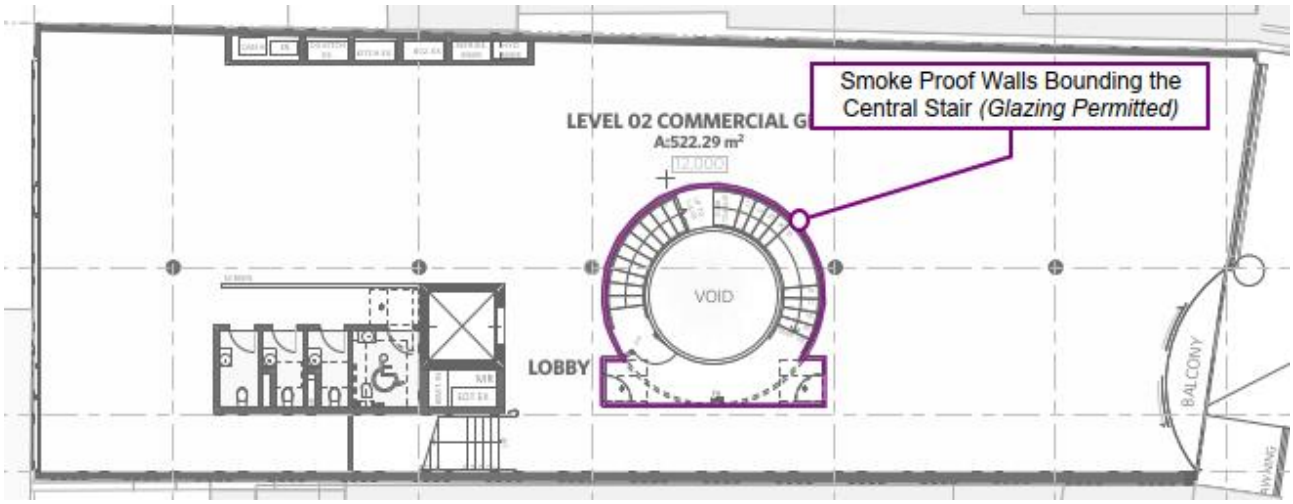

Figure 6-3: Smoke Separation of the Central Circular Stair – Level 2

6.1.3 Protection of Openings and External Walls

External walls and any openings within those walls that are exposed to a fire source feature shall be protected in accordance with the prescriptive requirements of BCA Clause C3.2, C3.4 and Specification C1.1 with the following exceptions;

- Levels 1, 2 & 3: Western elevation where situated less than 3m from northern allotment boundary.
- Level 3: Eastern elevation where situated less than 3m from southern and northern allotment boundaries.
- Ground Floor: Western elevation driveway opening where situated less than 3m from the northern allotment boundary.
- Ground Floor: Southern end of Western elevation where situated less than 6m from the far boundary of Rialto Lane.

The above openings shall be addressed through a fire engineered Performance Solution. The required protection to these openings and any necessary fire rating shall be established through the detailed design phase of the project prior to issue of the applicable Construction Certificate. The likely outcome of that analysis will incorporate;

- A combination of fire rated construction in close proximity to the boundary, fixed closed toughened glazing where windows open into commercial tenancies and fuel load restrictions to the Through-Site-Link and carpark driveway.

6.1.4 Separation of Equipment

Rooms containing equipment listed below must be fire separated from the remainder of the building by construction in accordance with Specification C1.1 or 120/120/120 FRL construction, whichever is greater, with any door opening into that room consisting of a --/120/30 FRL self-closing fire door.

- Lift motors and lift control panels (unless the lift installation does not have a machine-room); or
- Emergency generators used to sustain emergency equipment operating in emergency mode; or

- Central smoke control plant (other than smoke exhaust systems designed for high temperature operation); or
- Boilers; or
- A battery system installed in the building that have a total voltage of 12 volts or more and a storage capacity of 200kWh or more.

Electricity supply systems inclusive of electricity substations located within a building and main switchboard located within the building which sustains emergency equipment operating in the emergency mode must meet the requirements of BCA Clause C2.13. This includes the requirements of being separated from any other part of the building by construction having:

- An FRL of not less than 120/120/120: and
- Any doorway in that construction protected with a self-closing fire door having an FRL of not less than --/120/30.

6.1.5 Finishes and Linings

Where practicable, internal finishes, internal linings and internal materials used throughout the building should be non-combustible to reduce the spread of fire and the generation of toxic smoke products. All 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 Clause C1.10 and Specification C1.10.

In addition to the prescriptive DtS requirements, the following shall be provided as part of the fire engineered Performance Solution;

- The two (2) lift lobbies and Through-Site-Link on Ground Floor shall have wall and ceiling linings achieving fire hazard properties compliant with a Group 1 or Group 2 rating.

6.1.6 External Walls and Claddings

The external walls and any associated cladding materials must comply with the DTS provisions of the BCA as defined by BCA Specification C1.1.

As part of the requirements for Type A Construction, external walls including their components and any attachments, both internal and external, are to be non-combustible and/or compliant with BCA Clause C1.9. Where non-combustible materials and their supporting members are required by the BCA, these must be fully DtS compliant.

6.2 Egress Provisions

6.2.1 Alarm & Evacuation Strategy

Activation of any sprinkler head, smoke detector or manual call point shall initiate the building occupant warning alarm tones throughout the building. A cascading alarm must not be incorporated.

Dedicated fire wardens from each tenancy shall ensure that all clients, visitors, maintenance contractors and staff are promptly evacuated if a fire is identified anywhere in that building.

6.2.2 Egress Provisions

With exception of the following items being addressed through a fire engineered Performance Solution, travel distances to a point of choice or single exit to be not more than 20m, the distance to the nearest of two or more alternative exits must not exceed 40m and the distance between alternative exits must be no closer than 9m and no further apart than 60m.

The fire engineering assessment shall address travel distances in the following listed locations.

Basement Level 2:

- Maximum of 23m to a point of choice between alternative exits in lieu of 20m

Level 1 and Level 2:

- Maximum of 30m to a single exit in lieu of 20m (Based on open floor plan)

6.2.3 Travel Via Non-Fire-Isolated Stairs

Travel distances and egress provisions via non-fire-isolated stairs shall be compliant with the prescriptive DtS provisions of BCA Clause D1.9 and D1.12 with exception of the following;

- The internal stair connecting Level 2 and Level 3 (southern side of the lift) does not provide a continuous means of travel by its own flights and landings from every storey served to a level at which egress to a road or open space is provided.

6.2.4 Fire-Isolation of Exits

All exits must incorporate fire-rated construction compliant with the prescriptive DtS provisions of BCA Clause D1.3, D1.7 and D1.12 with exception of the following;

- The central circular stair serving the upper commercial levels of the building connects more than three (3) storeys in a sprinkler protected building, however the stair is not proposed to be fire isolated. The central circular stair connects Ground floor up to Level 3 (4 storeys).
- Fire stair 2 serving the Basement Levels discharges into a covered area that does not comply with BCA clause D1.7(b) as the covered area is not open for at least 1/3 of the it's perimeter.

As part of the fire engineered performance solution the following shall be incorporated into the design;

- The two (2) lift lobbies and Through-Site-Link on Ground Floor must be maintained sterile through building management controls.
    - The areas must not incorporate any combustible furniture, decorations or storage. This shall be detailed within a Building Management Plan.
    - Regular inspections shall be undertaken, not less than 6-monthly with the records of those inspections kept on site to allow annual certification of the management control.

6.2.5 Door Hardware, Operation and Mechanisms

All doors serving as required exits shall have hardware, door swings, latch operations and signage in accordance with the prescriptive requirements of BCA Clauses D2.19, D2.20, D2.21 and D2.23.

6.2.6 Signage and Lighting

Exit and emergency lighting is to be provided throughout the building in accordance with the prescriptive DTS provisions of BCA Clause E4.2, E4.4, E4.5, E4.6, E4.8 and AS2293.1:2018.

- Exit signs are to be pictograph 'running man' signs as per the prescriptive requirements of AS2293.1:2018.
- All exit and directional exits signs are to be power operated illuminated signs.

6.3 Active Fire Protection Systems

6.3.1 Fire Control & Indicating Equipment

The site will be provided with a Main FDCIE located in the commercial lift lobby on Ground Floor.

To assist with fire fighter way finding during an emergency, signage shall be provided at the entry to the Through-Site Link off South Steyne to indicate the location the FDCIE. This must be located in a readily identifiable location that is in close proximity (i.e. directly below) the Visual Alarm Device (VAD).

The FDCIE shall incorporate the following minimum capabilities;

- The ability to enable, disable & reset all zones and alarms.
- Contain the building occupant warning system controls .
- The site ASE shall be located at this FDCIE.

6.3.2 Fire Brigade Alarm Signalling Equipment

An automatic link shall be provided directly to an approved monitoring centre on activation of any fire alarm signal in compliance with the prescriptive DtS Provisions and AS1670.3:2018.

The Alarm Signalling Equipment (ASE) shall be programmed to incorporate a turnout address at the South Steyne street address.

- To assist fire fighter navigation throughout the site, the fire hydrant, fire sprinkler and fire detection blockplans are to be provided at the Main FDCIE.

6.3.3 Building Alarm and Communication System

A building occupant warning system shall be provided the building in accordance with the prescriptive DtS requirements of Clause E1.5, Specification E1.5, Clause 6 of Specification E2.2a and AS1670.1:2018.

Activation of any fire sprinkler head, smoke detector or manual call point shall initiate the building occupant warning system throughout the building. No cascade function shall be incorporated into the building.

In additional to any AS1670.1 requirements, the following must also be incorporated into the building design as part of the fire engineered performance solution;

- Externally located occupant warning speakers shall be installed to the terrace area of Level 3 such that no less than 75dBA is achieved on the most remote area of the terrace/pool deck.

6.3.4 Automatic Smoke Detection System

An automatic smoke detection system shall be provided throughout the building, inclusive of the basement and carparking levels, in accordance with AS1670.1:2018. The system shall have smoke detectors spacing in accordance with Section 5 of AS1670.1.

In additional to any AS1670.1 requirements, the following must also be incorporated into the building design as part of the fire engineered performance solution;

- A red Visual Alarm Device (VAD) must be installed above the fire booster cabinet in Rialto Lane. This shall be connected to the FDCIE and activate on general fire trip.
- Red VADs must be installed to the external terrace area of Level 3 such that at least one (1) VAD is visible from all parts of the occupiable areas. This shall be connected to the FDCIE and activate on general fire trip.

6.3.5 Automatic Fire Sprinkler System

An automatic fire sprinkler system shall be provided throughout the building in accordance with AS2118.1:2017 with the conditional exception of the following;

- The sprinkler booster assembly are accessed off Rialto Lane and therefore not located within sight of the building's main entrance off South Steyne.
- The sprinkler booster assembly shall adopt the I-Pattern arrangement detailed within AS2419.1:2021, and therefore the lower valve connections shall be 600mm above FFL in lieu of 750mm.

As part of the fire engineered performance solution, the following must be incorporated into the building design;

- The fire sprinkler booster assembly must ensure adequate staging area for pumping appliances as per FRNSW Fire Guideline requirements *"Access for fire brigade vehicles and firefighters"* available at https://www.fire.nsw.gov.au/ and AS2118.1:2017.
- The staging hardstand must accommodate simultaneous staging of the fire hydrant booster while also maintaining fire fighter entry and pedestrian egress to/from the building.
- The fire sprinkler block plans must be provided at the FDCIE and within the booster assembly cupboard.
- The fire sprinkler booster assembly shall be designed in accordance with the I-Pattern arrangement detailed in AS2419.1:2021 (Figure 6-4) and those specification listed below.
    - The maximum height of the fire brigade booster inlets shall be not more than 1200mm to the centre of the fire brigade booster inlet connection.
    - The minimum height of the fire hydrant valve outlets shall be not less than 600mm above the floor or standing surface in front of the fire brigade booster assembly to the centre of the fire hydrant valve outlets.
    - The minimum distance between fire hydrant valve outlets, measured between centres, shall be not less than 225mm.
    - The minimum distance between fire brigade booster inlets, measured between centres, shall be not less than 225mm.
    - The centres of fire hydrant valve outlets shall be aligned horizontally.
    - The centres of the fire brigade booster connections shall be aligned horizontally.

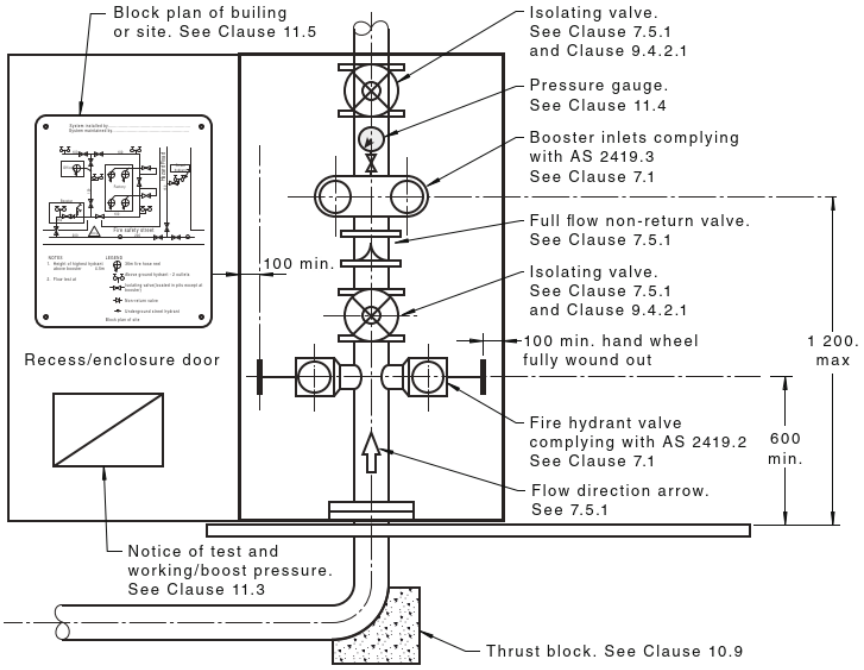

Figure 6-4: Typical I-Pattern Fire Brigade Booster Assembly Arrangement (as detailed within AS2419.1)

Fire & Rescue NSW Hardstand Requirement

As detailed in FRNSW Fire Guideline requirements *"Access for fire brigade vehicles and firefighters"*, any hardstand serving a suction-connection outlet is to have a working space which extends a minimum 18m from the point of connection to allow a semi-rigid suction hose to be connected to the rear of the fire appliance. This is demonstrated in Figure 6-5.

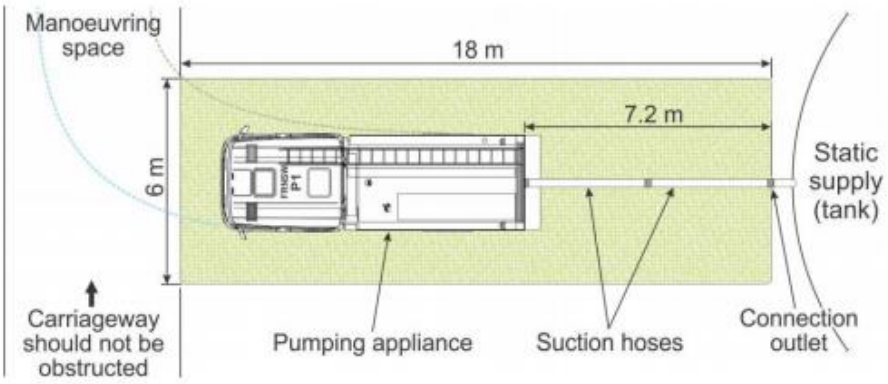

Figure 14 Hardstand area serving a suction-connection outlet

Figure 6-5: FRNSW Access For Fire Brigade Vehicles & Firefighters Excerpt (State Govt NSW 2019)

The preliminary fire engineering assumes that the fire sprinkler suction point is located inward facing to the hardstand and hence necessitate an appliance to back up against it. The orientation of the suction point may be adjusted so long as the design reflects the FRNSW requirements for as detailed in FRNSW Fire Guideline requirements *"Access for fire brigade vehicles and firefighters"*. Connection orientations are as per excerpt from the aforementioned FRNSW document per Figure 6-6.

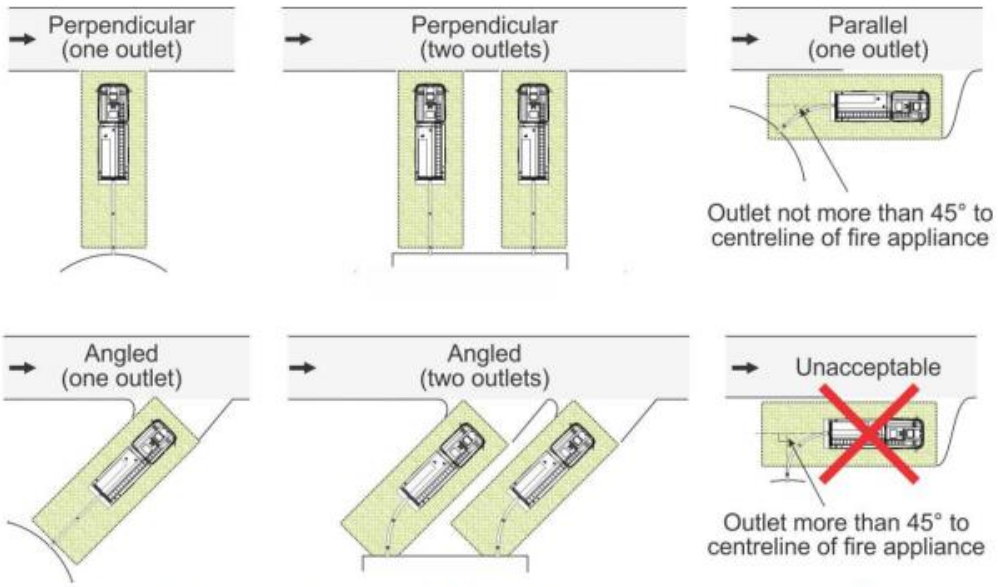

Figure 15 Example of orientation of hardstand area for suction-connection outlets

Figure 6-6: FRNSW Access For Fire Brigade Vehicles & Firefighters Excerpt (State Govt NSW 2022)

Notwithstanding, a detailed design of the fire sprinkler suction connection point and booster assembly respectively must be undertaken by the fire sprinkler design consultant to meet the desired requirements.

6.4 Occupant Fire Fighting Facilities

6.4.1 Fire Hose Reel

Fire hose reels are to be provided in accordance with the prescriptive DtS provisions of BCA Clause E1.4 and AS2441:2005.

Locations should be signposted and readily accessible to occupants. Use of facilities should be monitored for abuse, mistreatment and servicing. The fire hose reels shall be located within 4m of an exit and provide coverage to all required areas of the building based on a 36m hose length with a 4m water stream.

6.4.2 Portable Fire Fighting Equipment

Portable fire extinguishers are to be provided in accordance with Table E1.6 of the BCA.

The type of extinguisher should be selected in accordance with the prescriptive DtS provisions with consideration for the guidelines detailed in AS2444:2001.

General office areas	Dry Powder (ABE type)	2.5Kg
Computer/server rooms	CO_2	3.5 Kg
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

6.5.1 Fire Hydrant System

A fire hydrant system shall be provided to serve the entire site in accordance with the prescriptive DtS requirements of BCA Clause E1.3 and AS2419.1:2005 with the following exceptions conditionally permitted;

- The hydrant booster assembly are accessed off Rialto Lane and therefore not located within sight of the building's main entrance off South Steyne.
- The hydrant booster assembly shall adopt the I-Pattern arrangement detailed within AS2419.1:2021, and therefore the lower valve connections shall be 600mm above FFL in lieu of 750mm.

As part of the fire engineered performance solution, the following must be incorporated into the building design;

- The fire hydrant booster assembly must ensure adequate staging area for pumping appliances as per FRNSW Fire Guideline requirements *"Access for fire brigade vehicles and firefighters"* available at https://www.fire.nsw.gov.au/.
- The staging hardstand must accommodate simultaneous staging of the fire sprinkler booster while also maintaining fire fighter entry and pedestrian egress to/from the building.
- The fire hydrant block plans must be provided at the FDCIE and within the booster assembly cupboard.
- The fire hydrant booster assembly shall be designed in accordance with the I-Pattern arrangement detailed in AS2419.1:2021 (Figure 6-4) and those specification listed below.
    - The maximum height of the fire brigade booster inlets shall be not more than 1200mm to the centre of the fire brigade booster inlet connection.
    - The minimum height of the fire hydrant valve outlets shall be not less than 600mm above the floor or standing surface in front of the fire brigade booster assembly to the centre of the fire hydrant valve outlets.
    - The minimum distance between fire hydrant valve outlets, measured between centres, shall be not less than 225mm.
    - The minimum distance between fire brigade booster inlets, measured between centres, shall be not less than 225mm.
    - The centres of fire hydrant valve outlets shall be aligned horizontally.
    - The centres of the fire brigade booster connections shall be aligned horizontally.
- All connection points must be fitted with Storz hose couplings which comply with Clause 7.1 and 8.5.11 of AS2419.1:2005, as well as comply with FRNSW Technical Information D15/45534 for *"FRNSW compatible Storz hose connections"*. Further information is available from FRNSW available at www.fire.nsw.gov.au.

6.6 Building Management Procedures

The ongoing management of the building is as important in maintaining a high level of life safety as the provisions recommended during the design phase of the building.

6.6.1 Maintenance of Fire Safety Equipment

The fire detection systems, fire sprinkler systems, emergency warning systems, fire hydrants, hose reels, portable fire extinguishers, emergency lighting and any other fire safety equipment shall be tested and maintained in accordance with Australian Standard AS1851 or other relevant testing regulatory.

6.6.2 No Smoking Policy

A no-smoking policy shall be implemented and enforced through all internal areas of the building.

6.6.3 Fire Safety Manual

A fire safety manual shall be developed for the site to provide an overview of all fire safety procedures and systems within the building. The manual should also record false alarms, outcomes from fire drills and provide details of the ongoing maintenance and inspection procedures. The manuals should be reviewed annually and a lessons learned exercise undertaken. Any conclusions drawn from this exercise should be implemented into the fire safety procedures.

6.6.4 Emergency Management Plan

An Emergency Management Plan (EMP) must be developed in accordance with AS3745:2010. The EMP must;

- Developed by an emergency planning committee (EPC).
- Implement emergency control organisation (ECO) procedures for the building.
- Specifically address the types of emergencies that may arise from the industry and/or activities associated with the business operations.
- Ongoing training, education and execution of the emergency management procedures to be regularly conducted with all building occupants.
- An evacuation plan should be developed for the site in accordance with AS3745:2010 and standard fire orders should be displayed throughout the building.

6.6.5 Hot Works Policy

A hot works policy should be put in place and rigorously enforced to ensure that all hot works, including grinding and welding, are managed to avoid the accidental ignition of fires.

6.6.6 Fire Drills and General Fire Safety Training

All fire wardens are to be trained in first-aid firefighting and emergency response. All staff shall be inducted with a fire safety brief including the actions necessary on the activation of the building emergency warning system and the location of all emergency egress paths and fire exits. In addition periodic fire drills should be undertaken and any lessons learned included in future fire safety procedures.

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APPENDIX A FIRE STATISTICS

PROBABILITY OF FIRE STARTS

The probability of a fire start in a range of building uses, based on UK data, can be established using the data presented in Table 7-1 [9]; the applicable occupancy type is highlighted.

Table 7-1: Overall probability of fire starts for various occupancies, UK data

Occupancy	Probability Of Fire Starts (% Per Year)
Industrial	4.4
Storage	1.3
Offices	0.6
Assembly entertainment	12.0
Assembly non-residential	2.0
Hospitals	30.0
Schools	4.0
Dwellings	0.3

PROBABILITY OF CIVILIAN INJURY AND FATALITY

The probability of injuries and deaths for various occupancy types based on UK data [9] is presented in the following table.

Table 7-2: Probability of occupant injury and fatality by occupancy type, UK data averages for the years 1995 and 1997-1999

Type Of Occupancy	No Of Fires	Probability Of Occupant Injury Per Fire Event (%)	Probability Of Occupant Death Per Fire Event (%)
Further education	535	3.18	0.00
Schools	1669	3.06	0.00
Licensed premises	3317	7.90	0.08
Public recreational buildings	2581	1.86	0.05
Shops	5671	5.01	0.06
Hotels	1021	11.36	0.24
Hostels	1338	4.48	0.04
Hospitals	3063	3.69	0.11
Care homes	1616	8.04	0.28
Offices	1988	11.02	0.02
Factories	5299	5.40	0.08

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APPENDIX B FIRE BEHAVIOUR

FIRE GROWTH RATE

As the fire increases in size, the rate of fire growth accelerates. The growth rate of a fire can result in various hazards for occupants due to the following:

- Protective and preventative measures may not be adequate
- Occupants may have insufficient time to evacuate
- Occupants may perceive a reduced threat from slow growing fires

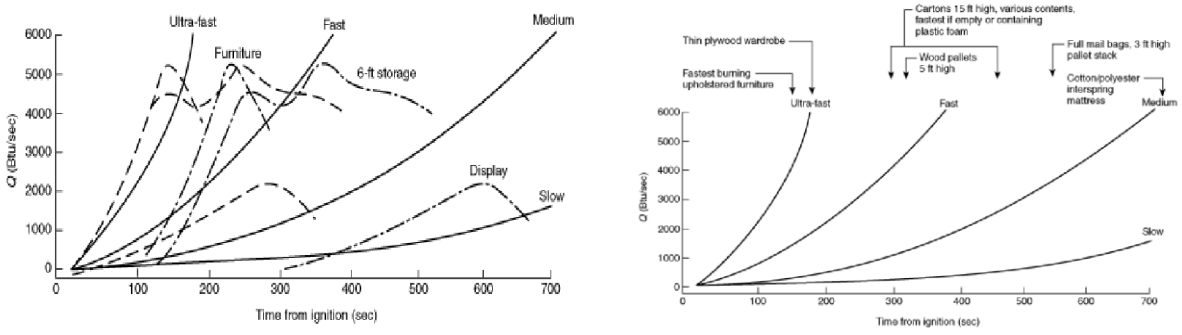
The rate of fire growth is generally expressed in terms of an energy release rate. The most commonly used relationship is what is commonly referred to as a quadratic t-squared fire. In such a fire, the rate of heat release is given by the expression:

$$Q = \left(\frac{t}{k}\right)^2$$

Where; t is time from ignition of the fire (seconds) and k is the growth time (seconds) for the fire to reach a heat output of 1.055 MW.

The continued growth of a fire defined by the above equation relies on both a sufficient source of fuel and air and assumes that flashover has not been reached. The rate of fire growth can be estimated from the results of a number of fire tests that have been performed on various fuel commodities.

National Fire Protection Association Standard NFPA 92B, provides information on the relevance of t-squared approximation to real fire as depicted in Figure 7-1.



(a) t-squared fire, rates of energy release (b) Relation of t-squared fires to some fire tests

Figure 7-1: NFPA 92B design fires and heat release rates

A slow fire growth is not considered to be the most challenging in terms of fire and life safety or fire brigade intervention. The continued growth of a fire defined by the above equation relies on both a sufficient source of fuel and air and assumes that flashover has not been reached. The rate of fire growth can be estimated from data published in CIBSE Guide E [11] and BS9999:2008 are listed below:

- Assembly hall seating : Medium-Fast
- Dwelling : Medium
- Office : Medium
- Hotel bedroom : Medium
- Hotel reception : Medium
- Meeting room : Medium
- Picture Gallery : Slow
- Reception area : Slow
- Restaurant/Canteen : Medium
- Shop : Fast
- Teaching laboratories : Fast
- Warehouse : Medium/Fast/Ultra-fast
- Waiting Room : Slow

From the above list, it can be concluded that the likely fire scenarios in the building may be approximated by the standard Medium to Fast time-squared fire growth rate curve in the various different areas of the building.

APPENDIX C FIRE LOADS

The fire load within a room or compartment will influence the duration and severity of a fire and resultant hazard to occupants. The effective fire load for the building has been estimated by consideration of the typical spaces within the building.

The IFEG has published further fire load densities for broad occupancy groupings (extracted from CIB 1983) as provided in the table below. The CIB compilation emphasises that at least the 95% fractile should be selected for design purposes. The following fire loads have been extracted from the IFEG and are considered applicable to the subject building:

Table 7-3: Fuel load densities for different occupancy groups

Densities in mega-joules per square metre				
Occupancy	Mean	Percent fractile		
	(MJ/m^2)	80	90	95
Dwelling	780	870	920	970
Hospital	230	350	440	520
Hospital storage	2000	3000	3700	4400
Hotel bedroom	310	400	460	510
Offices	420	570	670	760
Shops	600	900	1100	1300
Manufacturing	300	470	590	720
Manufacturing and storage <150kg/m^2	1180	1800	2240	2690
Libraries	1500	2250	2550	-
Schools	285	360	410	450