FIRE SAFETY STRATEGY

Oakdale East Industrial Estate (SSD-37486043)

Concept Plan and Stage 2 Works

2-10 Wallgrove Road, Horsley Park

Report Number:

212171_FSS_04

Date:

30/05/2022

Goodman Property Services (Aust) Pty Ltd
1-11 Hayes Road, Rosebery NSW 2018

AFFINITY FIRE ENGINEERING

Affinity Fire Engineering (UK) Ltd
40 Bowling Green Lane
London, EC1R 0NE
+44 (0) 20 3384 0050
enquiries@affinity-eng.com

Affinity Fire Engineering
Suite 6.06, 6A Glen Street
Milsons Point NSW 2061
+61 2 9194 0590
enquiries@affinity-eng.com

Affinity Fire Engineering
Suite 123, 757 Bourke Street
Docklands VIC 3008
+61 3 8616 0686
enquiries@affinity-eng.com

REPORT DETAIL

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Report Revision History

Rev	Date	Comment	Prepared By	Reviewed By
01	04/03/2022	Draft Issue	**Thomas Newton** *MEng Fire Safety* *Certifier Fire Safety BDC 3149*	**Norman Boustany** *BEng (Civil)(Hons)*
02	06/03/2022	Draft Issue A		
03	12/04/2022	Final Issue	**Norman Boustany** *BEng (Civil)(Hons)*	**Thomas Newton** *MEng Fire Safety* *Certifier Fire Safety BDC 3149*
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EXECUTIVE SUMMARY

Affinity Fire Engineering Pty Ltd has been engaged by Goodman Property Services (Aust) Pty Ltd (Goodman) to develop a preliminary Fire Safety Strategy for theConcept Plan across Goodman's Oakdale East Industrial Estate ("Estate") and approval for Stage 2 of works at the Estate.

The site is located within the Fairfield Local Government Area and is legally described as Lot 102 and Lot 103 in DP1268366. Stage 1 of the works were completed in September 2021 and included Precinct 1 building and infrastructure works as indicated on the proposed Estate Masterplan.

The Concept Plan is proposed to set the development controls for the Estate which will override the Development Control Plan ("DCP") that is currently with Department of Planning and Environment (DPE) for consideration. This DCP has been lodged with DPE to support the Rehabilitation Development Application that is currently with Fairfield City Council for consideration.

The Rehabilitation Development Application seeks approval for works only to Precinct 1 expansion, Precincts 2, 3 and 4 as detailed herein (this application excludes works to Precinct 5).

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 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 has been generally adopted in this 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	Name	Organisation
Developer	Guy Smith Stephanie Partridge	Goodman Properties (Aust) Pty Ltd
Architect	Greg Baird	SBA Architects
Bushfire Consultant	Corey Shackleton	Blackash Bushfire Consulting
BCA Consultant	Dean Goldsmith	Blackett Maguire + Goldsmith
Traffic Consultant	Ali Rasouli Andrew Johnson	Ason Group

Role	Name	Organisation
Dangerous Goods	Renton Parker	Riskcon Engineering
Accredited Fire Safety Engineer / Fire Safety Consultant	Thomas Newton Norman Boustany	Affinity Fire Engineering Pty Ltd

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:

- Bushfire Hazard Assessment Report prepared by Blackash Bushfire Consulting (version 1.2, dated 20/05/2022).
- BCA Compliance Report prepared by Blackett Maguire + Goldsmith dated 30/03/2022 (Ref: 210569 – revision 0).
- Architectural plans provided by SBA Architects as indicated in Table 1-2.

Table 1-2: Referenced Architectural Drawings

Drawing no.	Description	Issue	Date
OAKDALE EAST INDUSTRIAL ESTATE			
OAK E MP01	COVER SHEET / LOCATION PLAN	H	23/05/2022
OAK E MP01	ESTATE MASTERPLAN	L	23/05/2022
OAK E MP03	PRECINCT PLAN	G	23/05/2022
OAK E MP04	INDICATIVE ULTIMATE LOT LAYOUT	F	23/05/2022
OAK E MP05	SITE ANALYSIS PLAN	H	23/05/2022
OAK E MP06	EXISTING ZONING PLAN	G	23/05/2022
OAK E MP07	INFRASTRUCTURE STAGING PLAN	F	23/05/2022
OAK E MP08	BUILDING STAGING PLAN – STAGE 1 WORKS	J	23/05/2022
OAK E MP10	BUSHFIRE PROTECTION PLAN	J	23/05/2022
OAK E MP11	BIODIVERSITY MANAGEMENT PLAN	H	23/05/2022
OAK E MP12	INTERSECTION UPGRADE PLANS	D	23/05/2022

Drawing no.	Description	Issue	Date
PROPOSED WAREHOUSE EXTENSION - WAREHOUSE 1			
OAK 1 DA101	PRECINCT 1 - SITE & WAREHOUSE PLAN	A	07.04.2022
OAK 1 DA102	PRECINCT 1 - ROOF PLAN	A	07.04.2022
OAK 1 DA201	PRECINCT 1 - ELEVATIONS & SECTIONS	A	07.04.2022
OAK 1 DA202	PRECINCT 1 - OFFICE PLANS & ELEVATIONS	A	07.04.2022
PRECINCT 3 – PROPOSED INDUSTRIAL FACILITY			
OAKE 3 – DA301	SITE PLAN	D	13/05/2022
OAKE 3 – DA302	ROOF PLAN	B	13/05/2022
OAKE 3 – DA303	PRECINCT 3 - ELEVATIONS	C	06/05/2022
OAKE 3 – DA304	PRECINCT 3 – SECTIONS	A	07/04/2022
OAKE 3 – DA305	PRECINCT 3 – OFFICE PLANS	C	13/05/2022
OAKE 3 – DA306	PRECINCT 3 – OFFICE ROOF PLANS	A	07/04/2022
OAKE 3 – DA307	PRECINCT 3 – OFFICE ELEVATIONS	C	13/05/2022
OAKE 3 – DA308	PRECINCT 3 – OFFICE PERSPECTIVES	A	07/04/2022
OAKE 3 – DA309	PRECINCT 3 – PERIPHERAL AREAS - 1	D	13/05/2022
OAKE 3 – DA310	PRECINCT 3 – PERIPHERAL AREAS – 2	D	13/05/2022
OAKE 3 – DA311	PRECINCT 3 – PERIPHERAL AREAS – 3	C	13/05/2022
OAKE 3 – DA312	PRECINCT 3 – MEZZANINE LEVEL 1 & 2	C	13/05/2022
OAKE 3 – DA313	PRECINCT 3 – MEZZANINE LEVEL 3, 4 & 5	C	13/05/2022
OAKE 3 – DA315	PRECINCT 3 – GUARDHOUSE & TRUCK FUEL/WASH BAY	A	07/04/2022
OAKE 3 – DA316	PRECINCT 3 – FITOUT PLAN	F	13/05/2022
OAKE 3 – DA317	PRECINCT 3 – SIGNAGE PLAN	e	13/05/2022

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 Development Proposal

This application seeks approval for a Concept Plan across Goodman's Oakdale East Industrial Estate ("Estate") and approval for Stage 2 of works at the Estate.

The site is located within the Fairfield Local Government Area and is legally described as Lot 102 and Lot 103 in DP1268366.

Stage 1 of the works were completed in September 2021 and included Precinct 1 building and infrastructure works as indicated on the proposed Estate Masterplan.

The Concept Plan is proposed to set the development controls for the Estate which will override the Development Control Plan ("DCP") that is currently with Department of Planning and Environment (DPE) for consideration. This DCP has been lodged with DPE to support the Rehabilitation Development Application that is currently with Fairfield City Council for consideration.

The Rehabilitation Development Application seeks approval for works only to Precinct 1 expansion, Precincts 2, 3 and 4 and includes the following (this application excludes works to Precinct 5):

- Cut and Fill works to provide bulk pad levels;
- Provision of Estate stormwater infrastructure including completion of detention basins and swales;
- Removal of 2.58 ha of vegetation;
- Demolition of the Brick Factory and rehabilitation of the surrounding land;
- Installation of 1 x retaining wall on the eastern portion of Precinct 3;
- Consideration for Aboriginal Heritage and Geotech assessments

The proposed Concept Plan approval seeks approval for:

- The proposed Estate masterplan allowing development of 303,009 sqm of GLA;
- 24/7 hours of operation;
- Building Height of 43m for Precinct 3 (excluding roof-top plant and solar) and 15m (excluding roof-top plant and solar) to the remainder of the Estate;

- Estate subdivision;
- Estate wide planning controls as shown in the EIS
- Construction hours 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday
- Geotech and Aboriginal heritage considerations for Precinct 5

The Stage 2 works considered under this application include the following:

- Cut and fill works to Precinct 5 only to provide bulk pad level;
- Completion of lead-in infrastructure works including intersection upgrades at Millner Ave / Old Wallgrove Road and Lenore Drive / Old Wallgrove Road
- Clearing of 2.28 ha of vegetation
- Completion of the internal road network (excl. the proposed private driveway providing access to Precinct 5 but including all other roads shown on the proposed masterplan);
- Reticulation of services infrastructure to provide serviced development pads to all precincts;
- Completion of retaining walls across the entire Estate;
- Completion of Building works to Precinct 1 expansion and Precinct 3 including any ancillary on lot infrastructure and detailed civil works required;

Precinct 1 expansion:

- Construction, operation, fit-out and use approval of a warehouse with ancillary office spanning 3,122 sqm of GLA;
- 24/7 hours of operation;
- 15m building height (excluding solar and rooftop plant)

Precinct 3:

- Construction, operation, fit-out and use approval of a temperature controlled automated distribution centre;
- Total GLA of 96,810 sqm including 10,009 sqm of which is for future expansion;
- In addition to this, 38,050 sqm of mezzanines will be installed within the premises;
- 43m building height (excluding solar and rooftop plant)
- Storage of dangerous goods and flammable goods that exceed the SEPP33 threshold; and
- 24/7 hours of operation.

2.3 Site Location

The Oakdale East Estate is located within Horsley Park NSW 2175 and is listed as Lot 102 and Lot 103 of DP1268366 in the Fairfield City Local Government Area (LGA).

The Estate incorporates five (5) industrial precincts as shown in Figure 2-2; of which Precinct 1 has been completed as part of the Stage 1 works as defined previously. As shown in the Estate Masterplan (Figure 2-1), the site is bound to the north by the Water NSW Pipeline, to the east by the Reedy Creek riparian corridor, and to the west by Old Wallgrove Road. The southern side of the estate fronts the future Southern Link Road.

Figure 2-1: Allotment Location relative to Existing Local Setting (SixMaps 2022)

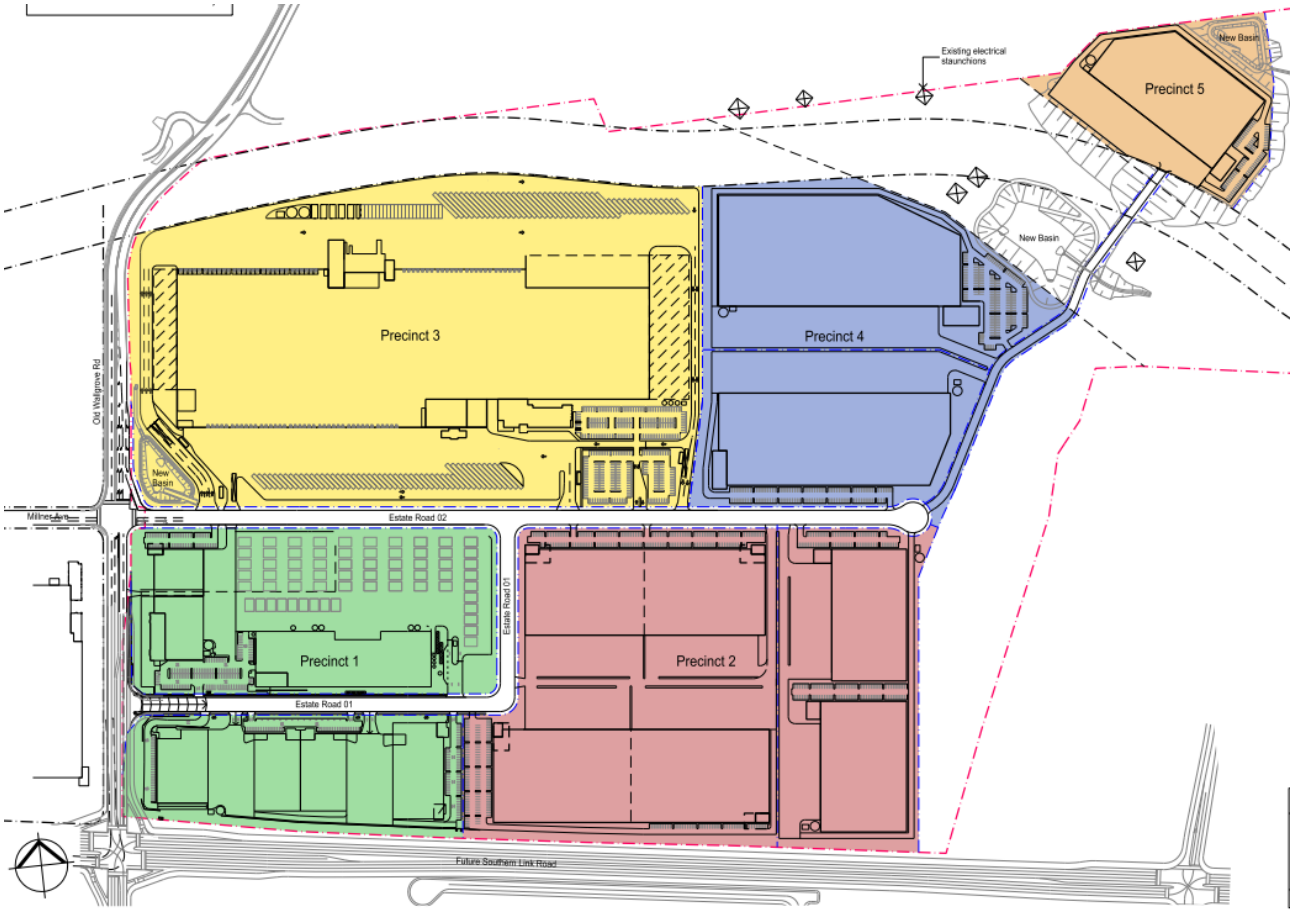


Figure 2-2: Estate Precinct Plan

In regard to Fire and Rescue operations, the site influences the likely fire brigade intervention times and given the close proximity to nearby FRNSW fire stations, the local fire authority is expected to facilitate relatively convenient and prompt fire brigade response. The site is located in a rural suburb of an outer

city however is expected to be provided with services and facilities expected in a developed setting. The likely two nearest fire brigade stations provided with permanent staff are Huntingwood and Mount Druitt station approximately 10km from the site respectively when considering actual driving directions.

2.4 Stage 2 Works Building Description

The Stage 2 works are as described above and include the extension of the storage and dispatch facility in Precinct 1, and the new build works associated with construction, operation, use and fitout of the temperature controlled storage facility in Precinct 3.

Precinct 1 Expansion

The Precinct 1 expansion incorporates the extension of industrial warehouse facility that was constructed as part of the Stage 1 Masterplan works.

The new extension incorporates an additional 3,122m^2 of GLA consisting of single level warehouse space with a 2-storey office. Within the warehouse it is anticipated that future tenants will incorporate high bay racking running in the east-west direction feeding towards a series of western dispatch docks.

An external dispatch hardstand shall be provided to the west of the building with a high level awning providing weather protection to the dispatch roller doors.

For compliance purposes the new extension shall be considered an extension of the existing building and hence upon completion the new and old portions shall be deemed a single large isolated building of approximately 8,000m^2 and a volume exceeding 108,000m^3.

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 completed building shall contain two (2) storeys resulting in a rise-in-storey of two (2), and effective height of approximately 3.6m. The assessed building exceeds the compartment limitations under BCA Clause C2.2 to be classified as a large isolated building and thus necessitating Type C Construction.

The following table summarises the characteristics of the Precinct 1 building extension, relevant to fire and life safety.

Table 2-1: Building Characteristics Assessment

CHARACTERISTIC	DESCRIPTION
BCA Classification	▸ Class 5 – Offices ▸ Class 7b – Warehouse
Rise in Storeys	Two (2)
Type of Construction	Type C Construction
Building Volume	**New Expansion** ▸ Approx. 40,000m^3

CHARACTERISTIC	DESCRIPTION
	Existing Building ▸ Approx. 50,000m^3

Precinct 3

The Precinct 3 works incorporate the construction of a storage and dispatch facility operating as a single tenancy with provision for future expansion.

The main warehouse portion is rectangular in footprint extending in the east-west direction with dispatch loading docks on the northern and southern sides of the building. Several minor dock offices are located across the floorplate with the main administration office situated centrally on the southern façade adjacent the external staff carparking area.

The warehouse has varying roof heights to accommodate the internal operational needs of the tenant, with the highest roof ridge being 43m above ground floor excluding the provision for roof top mounted solar array and plant equipment. Due to the internal fitout there are a number of elevated mezzanines and floors which triggers a rise in storeys exceeding 4, a volume exceeding 108,000m^3 and hence triggering Type A Construction requirements.

Additional to the main warehouse building structure are several smaller standalone structures such as the Class 5 guard houses, and Class 10 fire pump room. Each of these ancillary structures are all single storey and shall be constructed in accordance with Type C construction measures.

The following table summarises the characteristics of the subject buildings on Precinct 3, relevant to fire and life safety.

Table 2-2: Building Characteristics Assessment

CHARACTERISTIC	DESCRIPTION
BCA Classification	**Main Warehouse Building** ▸ Class 5 – Offices ▸ Class 7b – Warehouse **Ancillary Structures** ▸ Class 5 – Guard Houses ▸ Class 10 – Fire Pump Room
Rise in Storeys	**Main Warehouse Building** ▸ Greater than four (4) **Ancillary Structures** ▸ One (1)
Type of Construction	**Main Warehouse Building** ▸ Type A Construction

CHARACTERISTIC	DESCRIPTION
	Ancillary Structures ▸ Type C Construction
Building Volume	**Main Warehouse Building** ▸ >108,000m^3 **Ancillary Structures** ▸ <108,000m^3

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. However for conservatism and allow flexibility in future tenant uses, all fire engineering shall conservatively adopt population numbers per the following densities from NCC Table D1.13: ▸ 1 person per 30m^2 in the storage spaces ▸ 1 person per 10m^2 in the office areas
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. **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.

Characteristic	Description
	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: ▸ 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

Characteristic	Description
	▸ 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] such as in the warehouse areas; and ▸ 0.8m/s for semi-ambulant occupants requiring assistance to evacuate, walking aid or wheelchair users [15] such as in the administration and office areas.

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

Precinct 1 Extension

Exits are provided around the new warehouse extension on the eastern, western and northern sides with the southern side being the intertenancy wall separating the existing built structure. As a result of the available exit paths, there are no dead-end travel paths and multiple alternative egress opportunities are available to allow occupants to avoid potential fire hazards.

Precinct 3

Exits are provided around the main warehouse building's perimeter to allow for multiple alternative egress opportunities. At ground floor level there are limited dead end travel routes to exits, however due to the expected internal fitout the elevated areas will result in various locations where a specific gantry or mezzanine has only access to a single exit from that area. Generally exits and egress provisions will be afforded to ensure safe occupant evacuation and fire fighter intervention; even though extended travel distances are present.

4.2.2 General Activities

Both warehouse sites will be used for general goods storage and distribution and is not expected that regular hot work processes, use of highly flammable materials, manufacturing processes or operation of high friction or high temperature machinery will be performed within the building.

Precinct 1 Extension

Precinct 1 is expected to incorporate typical high-bay racking running I the east/west direction and incorporate a passive storage arrangement.

Precinct 3

Specific to the fitout of Precinct 3, the warehouse will incorporate a temperature-controlled environment with internal automated racking. As a result, there will be numerous enclosures within the space with

multiple mezzanine and gantry levels to facilitate daily staff activities and ongoing maintenance access through the volume of the building.
On the site there is also a separate structure facilitating the truck wash and fuelling facilities.

4.3 Fuel Loads

Precinct 1 Extension & Precinct 3

Due to the nature of the facility the fire loads within the warehouse will change over time as the tenant changes or the business structure of the same tenant evolves. As such it is not suitable to provide specific fire load densities for the product and materials being stored within the facility.

The fire load densities within the office and carparking areas should however remain consistent and as such the following fire load densities in those parts 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.

4.4 Dangerous Goods

Precinct 1 Extension

Dangerous goods are not expected to be stored within Precinct 1 extension 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.

This Fire safety Strategy has been developed based on there being no Dangerous Goods stored within Precinct 1 other those required for daily maintenance purposes. Any storage of Dangerous Goods will require review and assessment by a suitably qualified Risk Consultant to determine the associated hazards and required preventive measures to meet BCA Clause E1.10 and E2.3.

Precinct 3

There will be a degree of Dangerous Goods stored on the site. While the proportion of stock consisting of flammable and hazardous materials is minimal, due to the vast quantity of overall materials on site the total quantity is anticipated to exceed the SEPP33 threshold.

A Preliminary Hazard Analysis (Ref: RCE-21232_Goodman_PHA_Final_21Mar22_Rev(0), dated 21/03/2022) and Dangerous Goods Report (Ref: RCE-21232_Goodman_DGReport_Final_21Mar22_Rev(0), dated 21/03/2022) have been prepared by Dangerous Goods Consultant, Riskcon Engineering. The requirements and recommendations of these reports shall be incorporated into the design and are additional to the requirements of this building fire strategy.

4.5 Insulated Sandwich Panels

Precinct 1 Extension & Precinct 3

Should any of the tenancies be adopted for future use as a temperature-controlled storage facility or, where future tenancy fit outs will contain temperature controlled areas with freezers and cool rooms and the like, these enclosures shall be constructed using Insulated Sandwich Panels (ISPs) that meet the following requirements to ensure a suitable degree of fire protection and life safety is incorporated into the design;

- All sandwich panels must be installed in accordance with the "Insulated Panel Council Australasia (IPCA) Code of Practice (CoP) - Version 4.3".
- The panels must be installed by an accredited installer as recognised by the Code of Practice prepared by IPCA (refer website: http://www.insulatedpanelcouncil.org/code-compliant-companies).
- Certification must be provided from the accredited installer prior to final occupation certificate being issued for the building.
- All future works, modifications or repairs must be completed using ISP with the same core and material type (i.e. the panel must not be substituted with a product having an EPS or PUR core).
- Signage and block plans will be required around the site adjacent to each sprinkler and hydrant block plan to alert fire fighters to the;
    - Location of all sandwich panels installed.
    - Type of sandwich panels installed (commercial brand and core material).

4.6 Rooftop Solar Panels

Precinct 1 Extension & Precinct 3

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.

The designs for both Precinct 1 and Precinct 3 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 all Fire Indicating Panels to alert the attending fire fighters of the presence of all key components inclusive, but not limited to the location of the solar panels, inverters, operating voltage and current, 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 shall be displayed at all Fire Indicating Panels with brief instructions of the safe process to subdue the hazard.

4.7 Review of Relevant Fire Statistics

Precinct 1 Extension & Precinct 3

The following discussion is relative to buildings within the Precinct 1 and Precinct 3; of which the commentary is based on the fire statistics attached in APPENDIX A.

4.7.2 Warehouse

From the National Fire Protection Association (NFPA) report on 'Structure Fires in U.S. Warehouses' [30] statistics specific to warehouses can be analysed.

A total of 1,270 structure fires were reported in warehouses between 2007 and 2011. The fires recorded resulted in 4 occupant fatalities, 23 occupant injuries and $188 million in direct property damage per year. Overall, 19% of fires were intentionally set, however no civilian injuries were reported from these fires. Shop tools and industrial equipment caused 8% of fires; however these fires resulted in 27% of the civilian injuries recorded annually. The leading area of fire origin in warehouses comes from unclassified storage areas, resulting in 13% of fires and 18% civilian injuries.

Figure 4-1 illustrates the leading cause of structure fires in warehouses, while Figure 4-2 indicates the leading areas of origin.

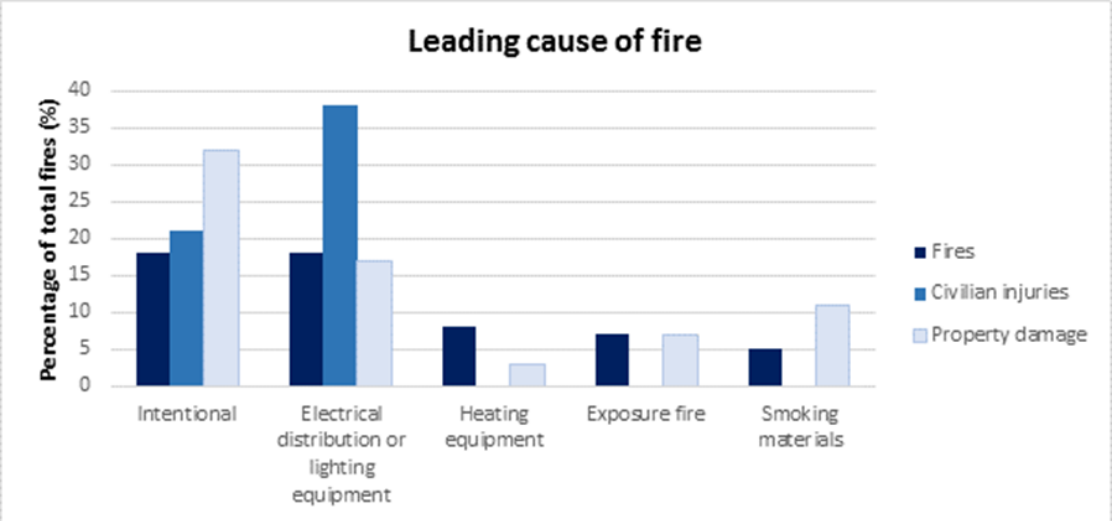


Figure 4-1: Leading Causes of Structure Fires in Warehouses

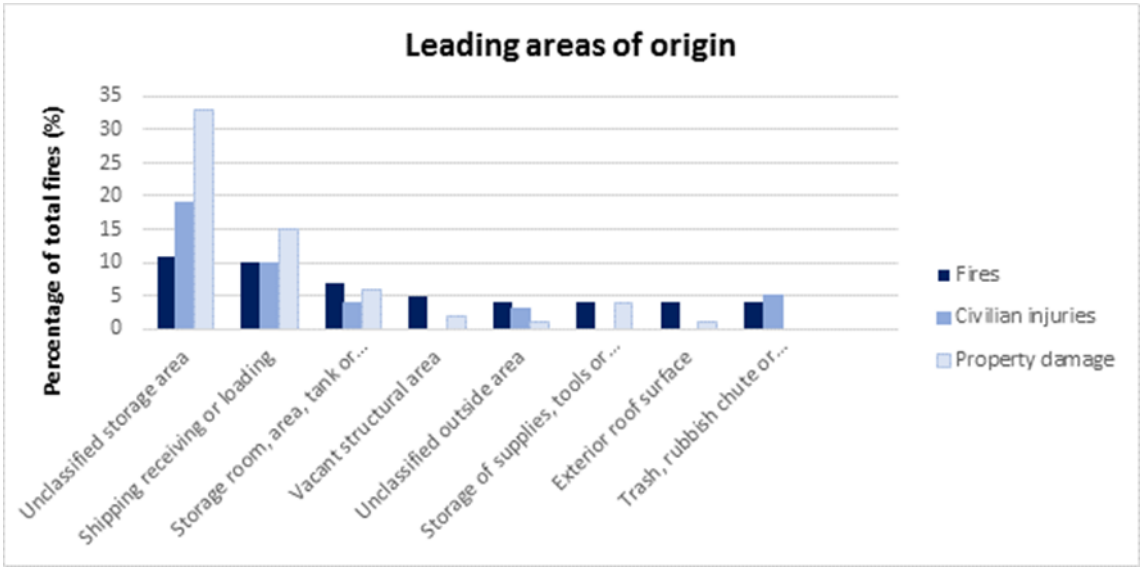


Figure 4-2: Structure Fires In Warehouses By Area Of Origin

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

- Intentional (18%)
- Electrical distribution or lighting equipment (18%)
- Heating equipment (8%)
- Exposure fire (7%)
- Smoking materials (5%)

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

- Unclassified storage area (11%)
- Shipping receiving or loading(10%)
- Storage room, area, tank or bin (7%)
- Vacant structural area (5%)
- Unclassified outside area (4%)
- Storage of supplies, tools or dead storage (4%)
- Exterior roof surface (4%)
- Trash, rubbish chute or container (4%)

4.7.3 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.

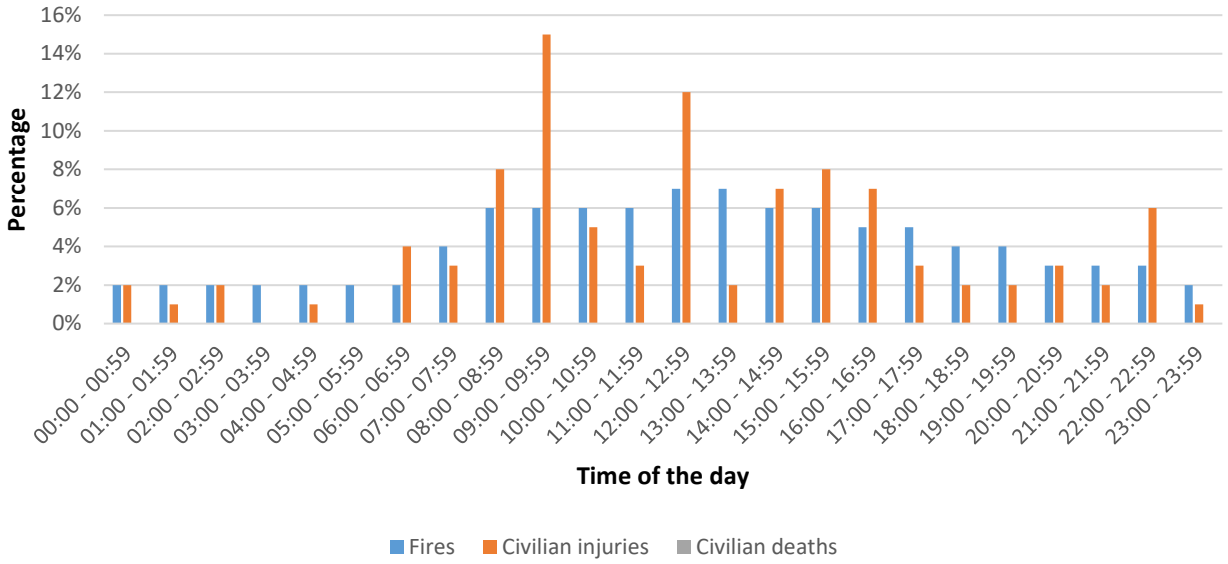


Figure 4-3: Percentage Of Fires, Civilian Injuries And Deaths At Different Times Of The Day (Offices)

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.

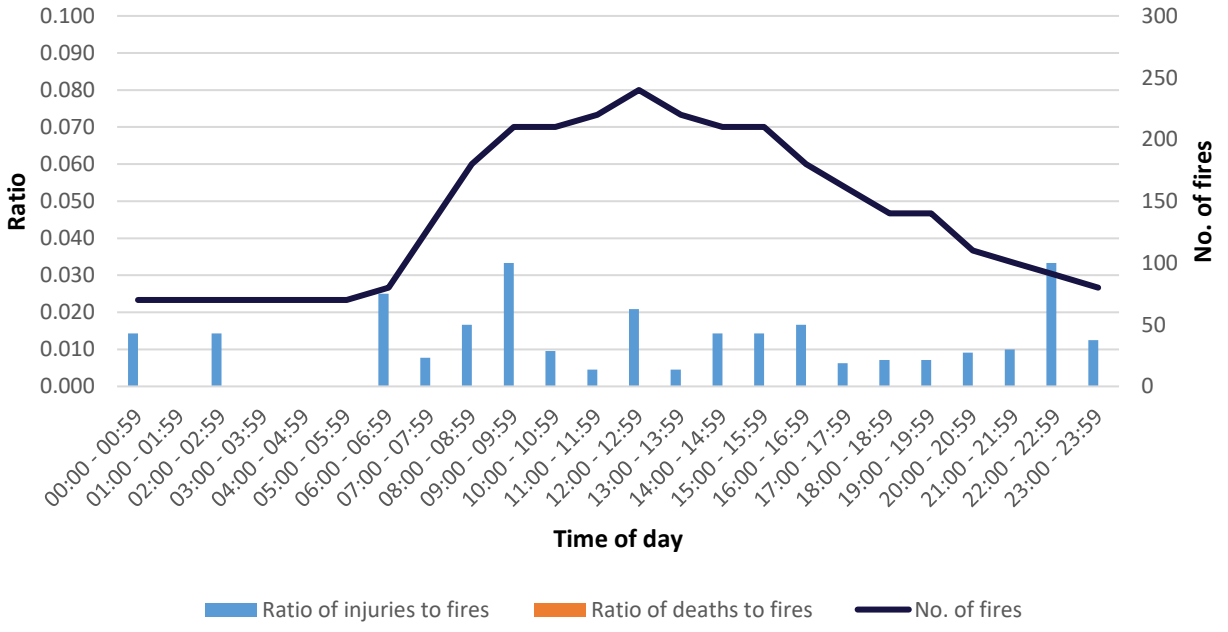


Figure 4-4: Number Of Fires, Ratio Of Injuries/Fires And Deaths/Fires For Different Times Of The Day (Offices)

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 and through Affinity Fire Engineering experience of similar buildings of the size and nature as the subject development. 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 and the analysis methodology proposed for the Fire Engineering assessment, which is to be generally in accordance with the IFEG [4].

5.2 BCA DTS Non-Compliance Assessment and Acceptance Criteria

Table 5-1: Summary of Performance Solutions

VARIATIONS, ASSOCIATED METHODOLOGY AND ACCEPTANCE CRITERIA
Fire Rated Construction
Relevant Regulatory Requirement: BCA Clause C1.1 requires through Specification C1.1 for a building of Type A Construction to have fire rated elements achieve the following overarching Fire Resistance Levels (FRL); ▸ Floors and all supporting structure achieve a 240/240/240 FRL ▸ Columns in the external walls achieve a 240/--/-- FRL. **Performance Requirement** The relevant Performance Requirements are CP1 and CP2 **Non-compliance with DTS provisions:** Precinct 3 The fire rating applied to the main warehouse building in Precinct 3 shall be subject to bespoke fire rating based on the exposure to potential fire hazards and consequence of failure. ▸ Full design FRLs and details of any non-compliance is to be determined through the detailed design phase of the project prior to the applicable construction certificate.

VARIATIONS, ASSOCIATED METHODOLOGY AND ACCEPTANCE CRITERIA

Perimeter Vehicular Access

Relevant Regulatory Requirement:

BCA Clause C2.4 requires vehicular access as a continuous means of passage for emergency vehicles in a forward direction around the entire building. Further to this, the roadway is required to have a width of no less than 6m, be located within 18m of the building and have nothing constructed on the pathway that obstructs passage.

Performance Requirement

The relevant Performance Requirement is CP9

Non-compliance with DTS provisions:

Vehicular perimeter access has been identified as non-compliant in the following areas;

Precinct 1 Extension

- During construction of the new expansion building, the perimeter access path around the northern side of the existing building will be unavailable creating a discontinuous vehicular travel.
- Upon completion of the new expansion building, the perimeter access path will be more the 18m from the building on the northern, western and southern sides where travel is along a public road.

Precinct 3

- The vehicular perimeter path navigates more than 18m from the building in various locations.

Egress Provisions

Relevant Regulatory Requirement:

BCA Clause D1.4 states that in a Class 5 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.

BCA Clause D1.9 requires internal non-fire-isolated stairs be located such the total travel distance to reach an exit from all parts of the building does not exceed 80m, and also that the stair discharges to the level providing direct access to a road or open space whereby the nearest of two or more alternative exits is available within 40m.

Performance Requirement

The relevant Performance Requirements are DP4 & EP2.2

Non-compliance with DTS provisions:

Preliminary assessment of travel distances have been identified as being non-compliant in the following locations:

Precinct 1 Extension

- Up to 45m to an exit in lieu of 40m.

VARIATIONS, ASSOCIATED METHODOLOGY AND ACCEPTANCE CRITERIA

- Up to 90m between alternative exits in lieu of 60m.

Precinct 3

- Up to 100m to an exit in lieu of 40m.
- Up to 200m between alternative exits in lieu of 60m.
- Up to 100m travel via a non-fire-isolated stair to reach a final exit in lieu of 80m. This will also in some cases be a fire-isolated exit in lieu of being direct to outside.
- The discharge point of internal non-fire-isolated stairs will be up to 80m to the nearest alternative exit in lieu of 40m.

Fire Hydrant System Design

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 that:

- All portions of the building are within reach of a 10m hose stream issuing from a 60m length of hose for external hydrants and 30m length of hose from internal hydrants.
- External hydrants located at the wall of the building must be provided with a radiant heat shield (90/90/90 FRL) a minimum 2m each side of the hydrant and 3m above the base of the hydrant.

Also, the hydrant booster assembly must be located as follows when remote from the building:

- At the boundary of the site
- Within sight of the main entrance of the building; and
- Adjacent to the principal vehicular access to the site; and
- Not less than 10m from the external wall of any building served.

Performance Requirement

The relevant Performance Requirement is EP1.3

Non-compliance with DTS provisions:

The following non-conformances have been identified and intended to be addressed through a Performance Based Solution:

Precinct 1 Extension

- The existing hydrant booster is not in sight of the main entrance to the new expansion and is therefore deemed a non-compliant location.
- The required 90/90/90 FRL protecting wall behind each external hydrant is to be omitted through the Performance Solution with the design relying on the sprinkler system installed throughout the building.
- Hydrants located beneath the dispatch awnings shall be classified as external hydrants for the purposes for system coverage and thus allowance for the use of two hose lengths.

VARIATIONS, ASSOCIATED METHODOLOGY AND ACCEPTANCE CRITERIA

Precinct 3

- The hydrant booster is not in sight of all entrances to the building and is therefore deemed a non-compliant location.
- The required 90/90/90 FRL protecting wall behind each external hydrant is to be omitted through the Performance Solution with the design relying on the sprinkler system installed throughout the building.
- Hydrants located beneath awnings shall be classified as external hydrants for the purposes for system coverage and thus allowance for the use of two hose lengths.
- Due to the temperature controlled nature of the building, there are locations where wet pipe installations are not suitable, and as such coverage within the internal areas may rely on coverage being achieved by multiple hose lengths.

Fire Hose Reel System Design

Relevant Regulatory Requirement:

BCA Clause E1.4 requires that fire hose reels are installed in accordance with AS2441:2005 within a building having a fire compartment greater than 500m^2. This requires that all points on the floor are to be within reach of a 4m hose stream issuing from a nozzle at the end of the hose, with the hose length not exceeding 36m.

Performance Requirement

The relevant Performance Requirement is EP1.1

Non-compliance with DTS provisions:

Precinct 3

- Due to the temperature controlled nature of the building, there are locations where wet pipe installations are not suitable, and as such shortfalls in fire hose reel coverage are expected. These shortfalls shall be addressed through a Performance Solution.
- Fire hose reels with 50m length hoses may be utilised to achieve coverage in the warehouse in lieu of 36m length fire hoses.

Fire Sprinkler System Design

Relevant Regulatory Requirement:

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 and suction be located in accordance with AS2419.1:2005 requirements.

AS2419.1:2005 requires the booster assembly must be located as follows when remote from the building:

- At the boundary of the site; and
- Within sight of the main entrance of the building; and

VARIATIONS, ASSOCIATED METHODOLOGY AND ACCEPTANCE CRITERIA

- Adjacent to the principal vehicular access to the site; and
- Not less than 10m from the external wall of any building served.

Performance Requirement

The relevant Performance Requirement is EP1.4

Non-compliance with DTS provisions:

Precinct 1 Extension

- The existing sprinkler booster is not in sight of the main entrance to the new expansion and is therefore deemed a non-compliant location.

Precinct 3

- The fire sprinkler booster assembly shall not be located on the site boundary, shall not be in sight of all building main entrances and not be adjacent to the principle vehicular access to the site.
- The warehouse high hazard fire sprinkler system shall be designed and installed in accordance with FM Global Datasheets to accommodate the internal fitout and maximum warehouse ridge height of 40m.

Rationalised Automatic Smoke Exhaust System

Relevant Regulatory Requirement:

BCA Clause E2.2 (Table 2.2a) requires large isolated buildings which have floor area or volume greater than 18,000m^2 or 108,000m^3 respectively to be equipped with an automatic smoke exhaust system in compliance with the requirements of BCA Specification E2.2b.

Performance Requirement

The relevant Performance Requirements are DP4 & EP2.2

Non-compliance with DTS provisions:

Precinct 3

An automatic smoke exhaust system shall be provided to the main warehouse building in accordance with DTS provisions and AS1668.1:2015 with the following exceptions conditionally permitted:

- The smoke exhaust capacity in each area / zone shall have a bespoke extraction capacity determined through fire engineering analysis in lieu of BCA Spec E2.2b requirements.
- The smoke exhaust system serving each area / zone shall automatically initiated by fire sprinkler activation in lieu of automatic smoke detection.
- The various smoke zones for the exhaust system shall have smoke reservoirs exceeding 2,000m^2.
- No automatic smoke exhaust shall be provided to the ancillary areas such as the Main Office, dock offices, workshop, amenities, plant rooms, waste room etc.

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 structures including floors, walls, columns and shafts shall be constructed in accordance with the requirements of BCA Clause C1.1, Specification C1.1 for the type of construction methodologies outlined below.

Precinct 1 Extension

- The new extension works shall be fully compliant with the prescriptive BCA requirements for Type C construction.

Precinct 3

- The new building shall be compliant with the prescriptive BCA requirements for Type A Construction noting that the fire rating of specific elements in Precinct 3 will be rationalised through a fire engineered solution as part of the construction certificate approval.
    - The final design solution for the fire rating of the structure and any compartmentation shall incorporate a combination of Deemed-to-Satisfy provisions and Performance Solution design whereby the fire engineering analysis shall ensure compliance with the relevant Performance Requirements of the BCA at the detailed design phase of the project prior to the applicable construction certificate.

6.1.2 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 (i.e. smoke exhaust fan switchboards) 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.

6.1.3 Finishes and Linings

Precinct 1 Extension & Precinct 3

Where practicable, all internal finishes, internal linings and internal materials used throughout the new building works should be non-combustible to reduce the spread of fire and the generation of toxic smoke products.

All new 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.

6.1.4 External Walls and Claddings

Precinct 1 Extension & Precinct 3

Any external cladding forming the building must comply with the DTS provisions of the BCA as defined by BCA Specification C1.1. Aluminium composite panels (ACP) containing a polyethylene (PE) core should not be used on the façade.

6.1.5 Insulated Sandwich Panels

Precinct 1 Extension & Precinct 3

Where future tenancy fit outs contain temperature-controlled areas with Freezers and Cool Rooms and the like, these enclosures shall be constructed using Insulated Sandwich Panels (ISP) that meet the following requirements to ensure a suitable degree of fire mitigation.

- All sandwich panels must be installed in accordance with the “Insulated Panel Council Australasia (IPCA) Code of Practice (CoP) - Version 4.3”.
- The panels must be installed by an accredited installer as recognised by the Code of Practice prepared by IPCA (refer website: http://www.insulatedpanelcouncil.org/code-compliant-companies).

- Certification must be provided from the accredited installer prior to final occupation certificate being issued for the building.
- All future works, modifications or repairs must be completed using ISP with the same core and material type.
- Signage and block plans will be required around the site adjacent to each sprinkler and hydrant block plan to alert fire fighters to the following:
    - Location of all sandwich panels installed.
    - Type of sandwich panels installed (commercial brand and core material).

6.1.6 Rooftop Solar Panels

Precinct 1 Extension & Precinct 3

Where solar panels are installed on the roof of the building, the following measures shall be provided:

- A minimum A3 sized block plan shall be provided at the Main FDCIE and Fire Pump Room to alert attending FRNSW personnel and be inclusive of the following as a minimum:
    - Large warning test stating "WARNING: SOLAR PANELS ON WAREHOUSE ROOF" to alert attending fire fighters.
    - Signage shall be constructed of all-weather fade resistant material with red lettering not less than 25mm in height with contrasting coloured background.
    - Signage shall identify the presence and location of the solar electrical generation system.
    - Location of all associated isolation switches, AC and DC isolators for the shut-off generated electricity should be displayed at the Main FDCIE and Fire Pump Room.
    - Block plans shall clearly indicate the location and type of any inverters, storage equipment type and operating voltage and current.
- Where solar panels are designed to be automatically isolated on fire trip, signage shall be provided at the Main FDCIE and Fire Pump Room detailing this provision that can clearly be identified by attending fire brigade.

6.1.7 Separation of Office Areas

As part of the Performance Solution to omit automatic smoke exhaust from the main administration office areas of the Precinct 1 Extension & Precinct 3 main warehouse building structure, each of these new offices shall be separated from the warehouse parts of the building per the following design requirements:

Precinct 1 Extension

- All shared walls and ceilings/roofs between the 2-storey office and the adjacent warehouse part of the building shall meet the smoke-proof construction requirements of BCA Specification C2.5 – Clause 3 except smoke dampers are not required to be installed.
- All doors opening from the office into the warehouse part of the building shall be smoke doors in accordance with BCA Specification C3.4.

Precinct 3

- All shared walls and ceilings/roofs between the Main Office on the southern side of the building and the warehouse parts of the building shall be fire rated to achieve 120/120/120 FRL and have openings and penetrations meet the smoke proofing construction requirements of BCA Specification C2.5 – Clause 3 except smoke dampers are not required to be installed.
- All doors opening from the office into the warehouse part of the building shall be fire rated doors achieving a --/120/30 FRL. The fire doors shall be fitted with medium temperature smoke seals as per the requirements for a smoke door as specified in accordance with BCA Specification C3.4.

Note: The degree of fire and smoke separation from the remaining ancillary areas which are not afforded automatic smoke exhaust (e.g. dock offices, workshop, amenities, plant rooms, waste room etc.) shall be determined through the detailed design of the project prior to the applicable construction certificate.

6.2 Egress Provisions

6.2.1 Alarm & Evacuation Strategy

Activation of the fire sprinkler system or fire detection system shall initiate the building occupant warning alarm tones throughout the building of fire origin. Dedicated fire wardens from each building shall ensure that all clients, visitors, maintenance contractors and staff are promptly evacuated if a fire is identified anywhere in that building.

Precinct 1 Extension

The fire alarm system within the Precinct 1 extension shall be connected into the existing fire safety systems and FDCIE for the existing Precinct 1 building. Any fire detection shall initiate alarm tones through the completed Precinct 1 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 internal non-fire-isolated stairs shall also be located such the total travel distance to reach an exit exceeds 80m and the discharge point of several stairs at ground floor level discharge in a location more then 40m from the nearest alternative exit.

The fire engineering assessment shall address travel distances that have been identified as being non-compliant in the following listed locations based on a speculative internal fitout; noting the final design and distances shall be determined through the detailed design phase of the project.

Precinct 1 Extension

- Up to 45m to an exit in lieu of 40m.
- Up to 90m between alternative exits in lieu of 60m.

Precinct 3

- Up to 100m to an exit in lieu of 40m.
- Up to 200m between alternative exits in lieu of 60m.
- Up to 100m travel via a non-fire-isolated stair to reach a final exit in lieu of 80m. This will also in some cases be a fire-isolated exit in lieu of being direct to outside.
- The discharge point of internal non-fire-isolated stairs will be up to 80m to the nearest alternative exit in lieu of 40m.

Design Note: Additional exits, egress doors, stairs and platforms may be required in future fitout applications to ensure the travel distance limitation defined by Fire & Rescue NSW of "*no point in a fire compartment is to be more than 100m from a hydrant external to that compartment*". This shall be determined though the detailed design phase on the project.

6.2.3 Door Hardware, Operation and Mechanisms

Precinct 1 Extension & Precinct 3

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.

6.2.4 Signage and Lighting

Precinct 1 Extension & Precinct 3

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

Overarching Strategy for the Precinct 1 Extension

The fire safety systems within the existing building on Precinct 1 shall be extended throughout the new extension. Any new works, and any portions of existing systems serving the Precinct 1 Extension shall be compliant with the regulatory requirements at the time of a construction certificate being issued. This may require upgrading the existing system and must be taken into consideration when designing the fire safety system extensions.

6.3.2 Fire Control & Indicating Equipment

Precinct 1 Extension

A Sub-FDCIE shall be installed to the main entry of the new office being constructed as part of the extension.

- The Sub-FDCIE shall be linked into the existing FDCIE, with the Sub-FDCIE afforded capacity to reset of the alarm signals within the new extension tenancy.

A red strobe shall be installed externally above the entry point into the new office;

- Upon fire detection within the expansion tenancy the new strobe light and also the existing above the Main FDCIE shall activate; and
- Upon fire detection within the existing building, the design need only have the strobe light at the entry point to the Main-FDCIE activate.

All fire safety system blockplans and fire safety advice notices at the FDCIE must be updated to capture the new building expansion.

Precinct 3

The site shall be served by a Main-FDCIE (Fire Detection Control and Indicating Equipment) which shall be positioned within the main entry lobby of the office. This shall also form the Fire Control Centre for the facility and as such shall be sized appropriately to accommodate a dedicated fire control room for attending fire fighters.

- The FDCIE must have the following controls and capabilities:
    - Capable of isolated, resetting and determining the fire location anywhere in the building.
    - Contain a manual call point.
    - Incorporate controls for the operation of the automatic smoke exhaust system and any ancillary fire system controls.
- A red strobe shall be installed externally above the Fire Control Centre room and be visible from two approaches to alert arriving fire brigade to the FDCIE location in accordance with AS1670.1:2018.

Mimic Fire Panels shall also be provided at the following locations to assist in fire brigade intervention and information gathering;

- The Outbound Exit Guardhouse.
- The fire pump room.

6.3.3 Fire Brigade Alarm Signalling Equipment

Precinct 1 Extension & Precinct 3

An automatic link shall be provided directly to an approved monitoring centre on activation of any fire sprinkler system and fire detection system installed in the buildings.

- The ASE unit shall ensure compliance with DTS Provisions and AS1670.3:2018 and programmed to have to have a call out address to the Main FDCIE for each Precinct.
- To assist fire fighter navigation throughout the site additional site plans are to be provided at the FDCIE. These block plans must meet the block plan requirements of AS2118.1:2017, AS2419.1:2005 and AS1670.1:2018 as a minimum and include:
    - An illustration the entire allotment and surrounding roads and hardstands that are to be used for fire brigade perimeter access
    - The location of all sub-stations and electrical MSBs
    - The location of the fire services pumps, tanks and booster assemblies.

6.3.4 Building Alarm and Communication System

Precinct 1 Extension

The existing building occupant warning system shall be extended throughout the new extension. Any new works, and any portions of existing system serving the Precinct 1 Extension, shall be compliant with the prescriptive requirements of Specification E1.5 and Clause 6 of Specification E2.2a of DTS provisions and AS1670.1:2018.

Precinct 3

A building occupant warning system shall be provided throughout all parts of the main warehouse building and the Fuel and Wash Shed. The alarm system is not required to be extended to the guardhouses or the fire pump room.

The system shall be in accordance with the prescriptive requirements of Specification E1.5 and Clause 6 of Specification E2.2a of DTS provisions and AS1670.1:2018.

6.3.5 Automatic Fire Detection System

Precinct 3

An automatic fire detection system shall be installed throughout the warehouse areas of the building in accordance with AS1670.1:2018.

Due to the temperature controlled nature of the building and expected internal fitout, the detection system shall consist of an aspirated smoke detection designed suitably for the function, use and environment within each specific area of the facility.

6.3.6 Automatic Fire Sprinkler System

Precinct 1 Extension

The existing fire sprinkler system shall be extended throughout the new extension. Any new works, and any portions of the existing system serving the Precinct 1 Extension, shall be compliant with the prescriptive requirements of BCA Specification E1.5 and AS2118.1:2017 with the conditional exception of the following:

- The existing sprinkler booster is not in sight of the main entrance to the new expansion and is therefore deemed a non-compliant location.

Precinct 3

A fire sprinkler system shall be provided throughout all parts of the main warehouse building and the Fuel and Wash Shed. The fire sprinkler system is not required to be extended to the guardhouses or the fire pump room.

The sprinkler systems shall be in accordance with the prescriptive requirements of BCA Clause E1.5, Specification E1.5, AS2118.1:2017 and where permitted FM Global Data Sheet 8-9 with the conditional exception of the following:

- The fire sprinkler booster assembly shall not be located on the site boundary, shall not be in sight of all building main entrances and not be adjacent to the principle vehicular access to the site.
- The warehouse high hazard fire sprinkler system shall be designed and installed in accordance with FM Global Datasheets to accommodate the internal fitout and maximum warehouse ridge height of 40m.

As part of the fire sprinkler system design, the following must be incorporated:

- 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 onsite sprinkler pumps, water storage tanks and associated infrastructure must ensure compliance with DTS provisions and AS2118.1:2017 to facilitate the system demands listed in the FM Global Datasheet requirements.
- Stored warehouse commodities must be confirmed by the tenants to ensure the fire sprinkler system designed for the building suitably accommodates the fire risk.
- The sprinkler block plans must be provided at the FDCIE and highlight the perimeter vehicular access provisions around the building through to the fire sprinkler infrastructure.

The general arrangement of the fire sprinkler infrastructure for the site is illustrated in Figure 6-1.

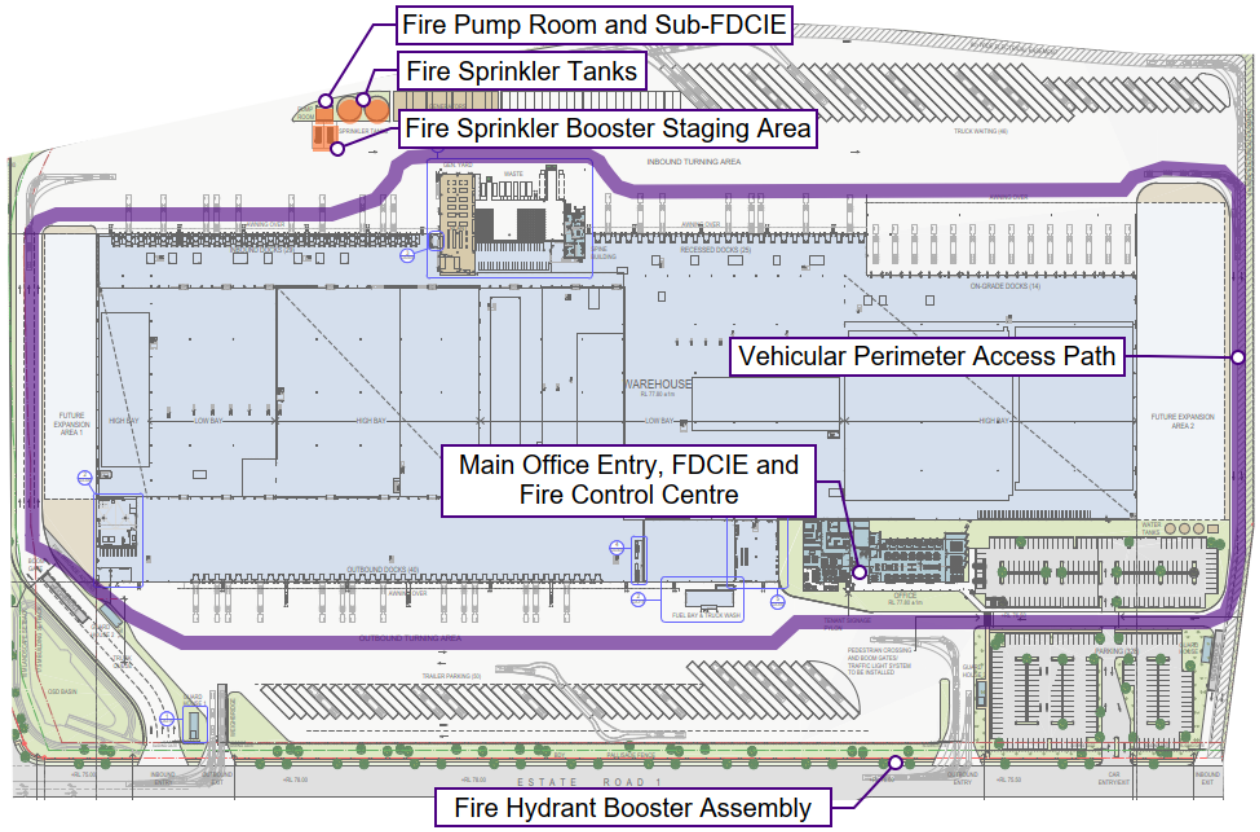


Figure 6-1: Fire Sprinkler Infrastructure & FDCIE Location

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 6-2.

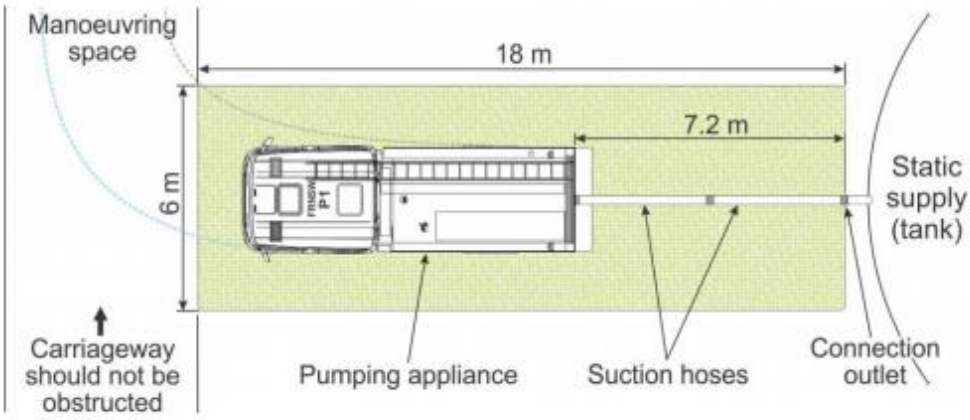


Figure 14 Hardstand area serving a suction-connection outlet

Figure 6-2: 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 6-3.

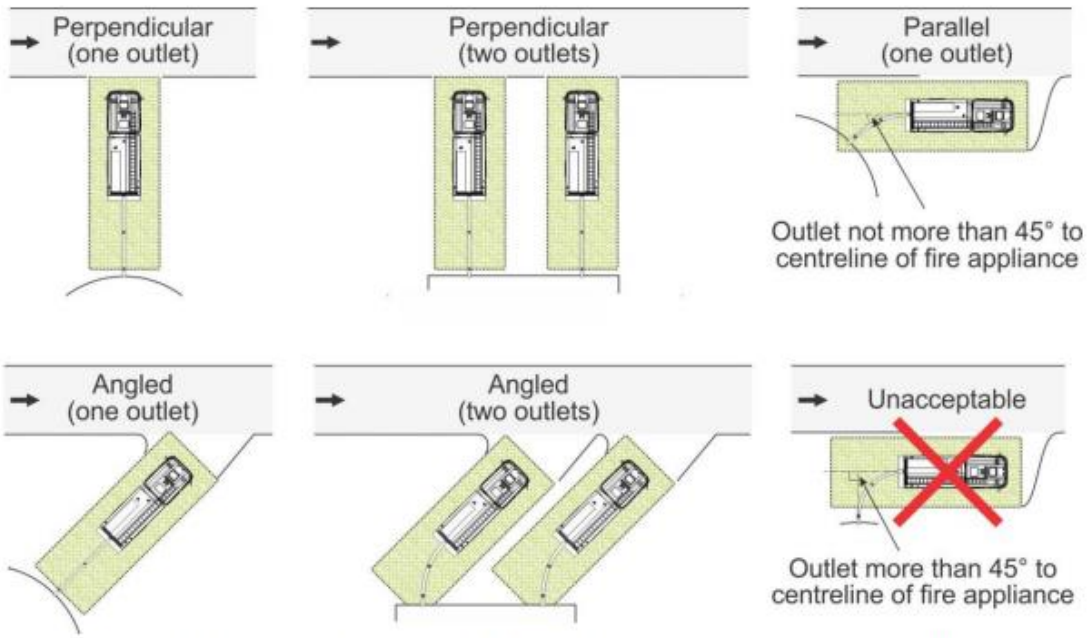


Figure 15 Example of orientation of hardstand area for suction-connection outlets

Figure 6-3: FRNSW Access For Fire Brigade Vehicles & Firefighters Excerpt (State Govt NSW 2019)

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. Note that a minimum 6m clear width must be maintained past any appliance staging area to meet the requirements of BCA Clause C2.4.

6.3.7 Automatic Smoke Hazard Management Systems

Precinct 1 Extension

The completed building including the expansion has been determined by the design team to be less than 108,000m^3 and as such not prescriptively required automatic smoke exhaust.

A detailed calculation of the building volume is to be completed to confirm that this accurate, and where determined to exceed 108,000m^3, an automatic smoke exhaust system shall be installed throughout the expansion and the exiting building (subject to any fire engineered performance solution requirements).

Precinct 3

An automatic smoke exhaust system shall be provided to the main warehouse building in accordance with DTS provisions and AS1668.1:2015 with the following exceptions conditionally permitted:

- The smoke exhaust capacity in each area / zone shall have a bespoke extraction capacity determined through fire engineering analysis in lieu of BCA Spec E2.2b requirements.
- The smoke exhaust system serving each area / zone shall automatically initiated by fire sprinkler activation in lieu of automatic smoke detection.
- The various smoke zones for the exhaust system shall have smoke reservoirs exceeding 2,000m^2.
- No automatic smoke exhaust shall be provided to the ancillary areas such as the Main Office, dock offices, workshop, amenities, plant rooms, waste room etc.

As part of the fire engineered Performance Solution for Smoke Hazard Management, the following must be provided;

- The automatic smoke exhaust system must be designed in accordance with BCA Specification E2.2b and AS1668.1:2015 unless noted otherwise herein.
- A system blockplan shall be provided at the FDCIE and incorporate;
    - Signs alerting the Fire Brigade to the operation of the smoke exhaust system.
    - A schematic of the system detailing fan extraction rates, and make-up air locations and free area requirements.
    - Reference the Fire Engineering Report.
    - Make notification that the system is automatically initiated by sprinkler activation.
    - Make notification that no smoke exhaust is provided to the office areas.
- Automatic smoke exhaust system must be connected to the site's essential power source.

6.4 Occupant Fire Fighting Facilities

6.4.1 Fire Hose Reel

Precinct 1 Extension

The existing fire hose reel system shall be extended throughout the new extension. Any new works, and any portions of the existing system serving the Precinct 1 Extension, shall be compliant with the prescriptive requirements of BCA Clause E1.4 and AS2441:2005.

Precinct 3

Fire hose reels are to be provided throughout the building in accordance with the prescriptive DTS provisions of BCA Clause E1.4 and AS2441:2005 with the following exceptions conditionally permitted:

- Due to the temperature controlled nature of the building, there are locations where wet pipe installations are not suitable, and as such shortfalls in fire hose reel coverage are expected. These shortfalls shall be addressed through a Performance Solution *(see fire extinguisher requirements)*.
- Fire hose reels with 50m length hoses may be utilised to achieve coverage in the warehouse. Where 50m long hoses are used;
    - They must be tested to meet the requirements of AS1221:1997 other than the specification of a maximum hose length of 36m.
    - Coverage to any part of the warehouse by a 50m long hose line must be achieved with no more than 2 bends.
    - To ensure that the provision of 50m hose reels does not impact on life safety, on-site staff training in the use of the hose reels is to be undertaken by the nominated fire wardens.

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 areas of the building based on a 50m or 36m hose length with a 4m water stream.

6.4.2 Portable Fire Fighting Equipment

Precinct 1 Extension

Portable fire extinguishers are to be provided throughout the area of new works in accordance with BCA Table E1.6 with the type of extinguisher selected in accordance with AS2444:2001.

Precinct 3

Portable fire extinguishers are to be provided throughout the buildings in accordance with BCA Table E1.6 with the type of extinguisher selected in accordance with 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

As part of the Performance Solution additional portable fire extinguishers will be installed to address the areas of fire hose reel shortfall and non-compliant travel distances from dead end locations. The location

of these shall be determined through the detailed design phase of the project and prior to the applicable construction certificate.

6.5 Fire Brigade Intervention

6.5.1 Fire Hydrant System

Precinct 1 Extension

The existing fire hydrant system shall be extended throughout the new extension. Any new works, and any portions of the existing system serving the Precinct 1 Extension, shall be compliant with the prescriptive requirements of BCA Clause E1.3 and AS2419.1:2005 with the following exceptions conditionally permitted:

- The existing hydrant booster is not in sight of the main entrance to the new expansion and is therefore deemed a non-compliant location.
- The required 90/90/90 FRL protecting wall behind each external hydrant is to be omitted through the Performance Solution with the design relying on the sprinkler system installed throughout the building.
- Hydrants located beneath the dispatch awnings shall be classified as external hydrants for the purposes for system coverage and thus allowance for the use of two hose lengths.

As part of the Performance Solution and typical Fire & Rescue NSW requirements, the system shall incorporate the following measures:

- 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.
- Hydrants located beneath dispatch awnings shall have alternative external fall-back hydrants available to provide full coverage under the entire awning where a hydrant is located beneath.
    - A fall back hydrant shall be located more than 10m away from the awning, in open space, and provide full coverage of the dispatch awning under which the non-compliant hydrants are located.

Precinct 3

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

- The hydrant booster is not in sight of all entrances to the building and is therefore deemed a non-compliant location.
- The required 90/90/90 FRL protecting wall behind each external hydrant is to be omitted through the Performance Solution with the design relying on the sprinkler system installed throughout the building.
- Hydrants located beneath awnings shall be classified as external hydrants for the purposes for system coverage and thus allowance for the use of two hose lengths.

- Due to the temperature controlled nature of the building, there are locations where wet pipe installations are not suitable, and as such coverage within the internal areas may rely on coverage being achieved by multiple hose lengths. These shortfalls shall be addressed through a Performance Solution with the extent, locations and suitability determined during the detailed design phase prior to the applicable construction certificate.

As part of the Performance Solution and typical Fire & Rescue NSW requirements, the system shall incorporate the following measures:

- The system shall incorporate a ring main and associated isolated valves as required for a large isolated building. Isolation valves shall be numbered with those corresponding numbers indicated on the hydrant block plan.
- 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.
- Hydrants located beneath dispatch awnings shall have alternative external fall-back hydrants available to provide full coverage under the entire awning where a hydrant is located beneath.
    - A fall back hydrant shall be located more than 10m away from the awning, in open space, and provide full coverage of the dispatch awning under which the non-compliant hydrants are located.
- Per the request of FRNSW, as far as possible the hydrant system should consist of external hydrant points, with internal hydrants only provided to where there are shortfalls in coverage from external hydrants.
    - Where internal hydrants are required at ground floor level, they must be designed to allow progressive movement through the building such that an internal hydrant is within 50m of an external hydrant and 25m of an internal hydrant.
    - A localised block plan must also be provided at every hydrant pictorially and numerically illustrating the location of the next available additional hydrant. These localised block plans should be of a size appropriate to their notice and location and be of all-weather fade resistant construction.

6.5.2 Vehicular Perimeter Access

Precinct 1 Extension

The existing vehicular perimeter access path shall be extended around the new extension to allow fire appliances to travel in a continuous forward direction compliant with the prescriptive requirements of BCA Clause C2.3 and C2.4 with the following exceptions conditionally permitted:

- During construction of the new expansion building, the perimeter access path around the northern side of the existing building will be unavailable creating a discontinuous vehicular travel.
- Upon completion of the new expansion building, the perimeter access path will be more the 18m from the building on the northern, western and southern sides where travel is along a public road.

The vehicular perimeter path for emergency vehicles during construction and also at completion of the new works are indicated in Figure 6-6 and Figure 6-5 respectively. In these figures the purple line

represents BCA DTS compliant portions, and the orange indicating sections being addressed through a Performance Solution.

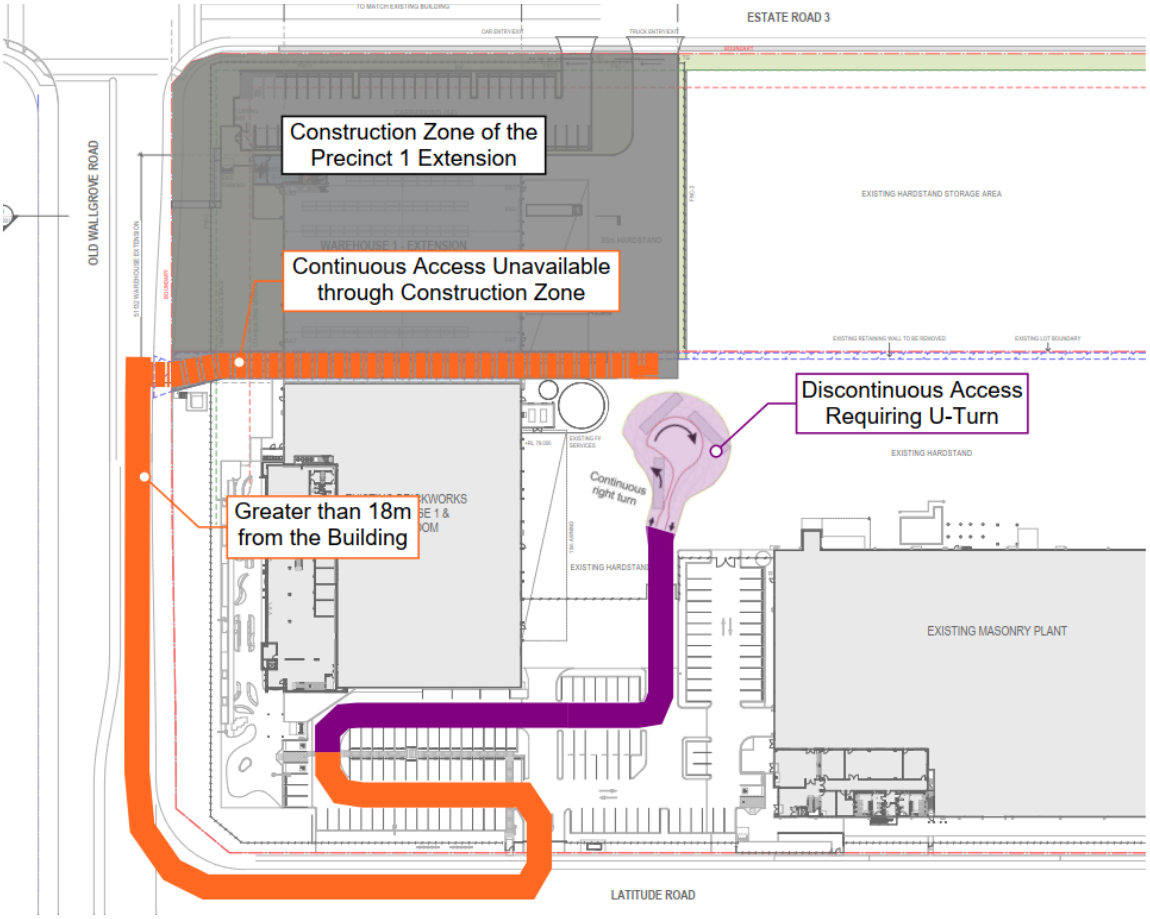


Figure 6-4: Vehicular Perimeter Path & Non-Compliant Portions – During Construction of the Precinct 1 Expansion

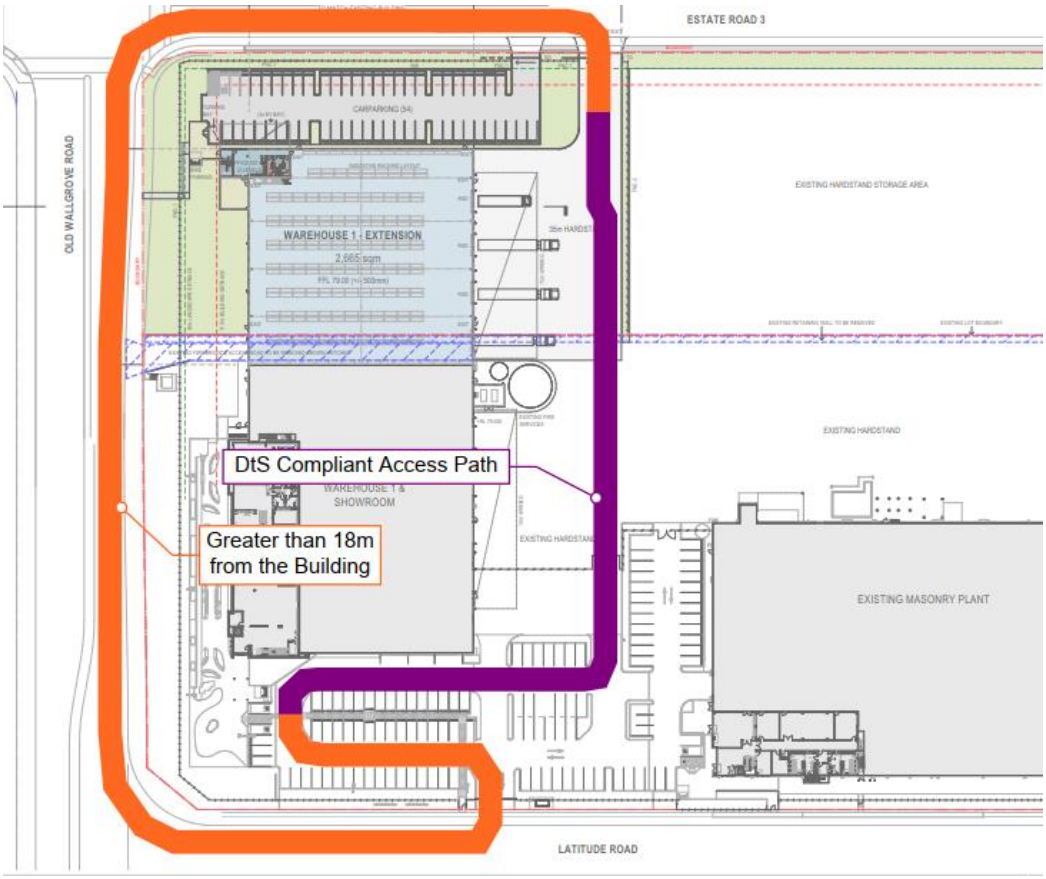


Figure 6-5: Vehicular Perimeter Path & Non-Compliant Portions – Upon Completion of the Precinct 1 Expansion

Precinct 3

Emergency vehicular perimeter access pathway shall be provided around the whole of the large isolated building. This shall be designed and constructed in all-weather surface capable of supporting all FRNSW appliances in accordance with BCA Clause C2.4 and FRNSW Fire Guideline requirements *"Access for fire brigade vehicles and firefighters"* (available from www.fire.nsw.gov.au) with the following exceptions conditionally permitted:

- The vehicular perimeter path navigates more than 18m from the building in various locations.

The vehicular perimeter path for emergency vehicles is as indicated in Figure 6-6 where the purple line represents BCA DTS compliant portions, and the orange indicate sections being addressed through a Performance Solution.

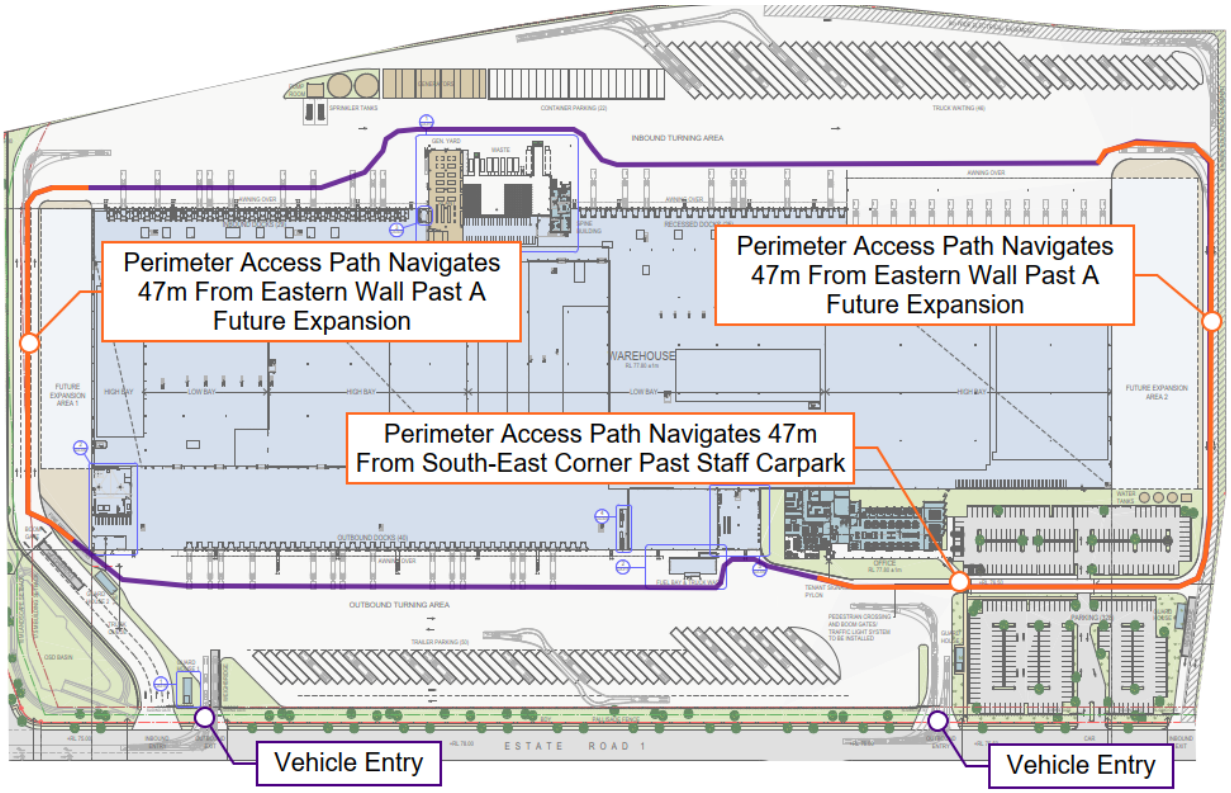


Figure 6-6: Vehicular Perimeter Path & Non-Compliant Portions

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

Precinct 1 Extension & Precinct 3

An Emergency Management Plan (EMP) must be developed in accordance with AS3745:2010 for each site. 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.

7 REFERENCES

1. Australian Building Codes Board, "NCC - Building Code of Australia – Volume One, 2019 – Amendment 1", Canberra ACT 2020."
2. Australian Building Codes Board, "NCC - Guide to Volume One – Amendment 1", Canberra ACT 2020.
3. Australian Building Codes Board, "Australian Fire Engineering Guidelines", Canberra, 2021.
4. Australian Building Codes Board, "International Fire Engineering Guidelines", Canberra ACT 2005.
5. Society of Fire Protection Engineers, "The SFPE Handbook of Fire Protection Engineering", 4th edition, 2008.
6. Drysdale D, "An Introduction to Fire Dynamics", 3rd edition, John Wyley & Sons, UK, 2011.
7. Davis R. (2014), "Fire Concerns With Roof-Mounted Solar Panels", SFPE Fire Protection Engineering Emerging Trends Newsletter, Issue 92, 2014.
8. PD7974-6:2004, "The application of fire safety engineering principles to fire safety design of buildings – Part 6: Human factors", BSI British Standards.
9. PD7974.7:2003, "Application of fire safety engineering principles to the design of buildings – Part 7: Probabilistic risk assessment", BSI British Standards.
10. Spearpoint, M., "Fire Engineering Design Guide", 3rd edition, New Zealand Centre for Advanced Engineering, May 2008.
11. The Chartered Institute of Building Services Engineers, "Fire Safety Engineering CIBSE Guide E", 3rd Edition, May 2010.
12. Drysdale D, "An Introduction to Fire Dynamics", 3rd edition, John Wiley & Sons, UK, 2011.
13. "Fire Brigade Intervention Model V3.0", Australasian Fire Authorities Council, June 2020.
14. Boyce, K., Shields, T., and Silcock, G., "Toward the Characterization of Building Occupancies for Fire Safety Engineering: Capabilities of Disabled People Moving Horizontally and on an Incline", Fire Technology, Vol. 35, No. 1, February 1999, pp. 51-67.
15. Nelson, H.E. "BUD" and Mowrer, F.W., "Emergency Movement", The SFPE Handbook of Fire Protection Engineering (3rd Edition), National Fire Protection Association, Quincy, MA 02269, 2002 pp. 3/367-380.
16. Pauls, J. L. "Movement of People in Building Evacuations", Human Response to Tall Buildings, Chap 21. Dowden, Hutchinson and Ross, Stroudsburg, PA, 1977.
17. Pelecheno N, Malkawi A, "Evacuation simulation models: Challenges in modelling high rise building evacuation with cellular autometa approaches", Automation in Construction Journal 2008 (Vol. 17), pp.377-385.
18. Predtechenskii, V.V. and Milinskii, A.I., Planning for foot traffic in buildings (translated from Russian). Stroizdat publishers, Moscow, 1969. English translation published for National Bureau of

Standards and the National Science Foundation, Washington, by Amerind Publishing Co. Pvt. Ltd, New Delhi, India, 1978.

19. Shi, L, Xie, Q, Cheng, X, Chen, L, Zhou, Y, Zhang, R, "Developing a database for emergency evacuation model", pp. 1724-1729 Building and Environment, 2009.
20. Hall, J.R. "U.S. Experience with Sprinklers", National Fire Protection Association, June 2013.
21. Turner, M. "Fire Brigade's Fight for Sprinklers in New Underground Car Park." Fire, 79 (972): 32-34, 1986.
22. Thomas, IR., "Fires in Carparks", Fire Australia February 2004, Eastside Printing, 2004.
23. BHP Steel: Structural steel Development Group, Report No MRL/Ps69/89/006. "Fire Safety in Car Parks".
24. Li, Y and Spearpoint, M. Analysis of vehicle fire statistics in New Zealand parking buildings. Fire Technology, Vol. 43, No. 2, 2007, pp.93-106.
25. BS EN 1991-1-2:2002, 'Eurocode 1: Actions on structures – Part 1-2: General actions – Actions on structures exposed to fire', British Standards, March 2009.
26. AS 1530.4, "Methods for fire tests on building materials, components and structures, Part 4: Fire resistance tests of elements of construction", Standards Australia, 2005.
27. Bushfire CRC, "Window and Glazing Exposure to Laboratory-Simulated Bushfires", Doc: 2006-205, May 2006.
28. Rakic J, "The Performance of Unit Entry Doors when Exposed to Simulated Sprinkler Controlled Fires", Lorient International, Lindfield, NSW, Australia.
29. England JP, Chow V, Yunlong Liu, (2007) Modelling Smoke Spread through Barrier Systems Retrieved from http://www.yunlong.com.au/pdf/PEngland.pdf
30. Campbell, R., 'Structure Fires in Warehouse Properties', NFPA Research, January 2016.

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

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

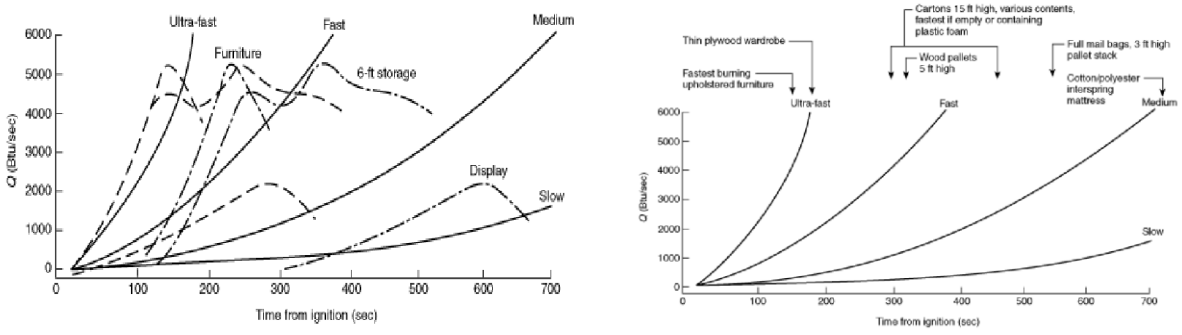
The rate of fire growth is generally expressed in terms of an energy release rate. The most commonly used relationship is what is commonly referred to as a quadratic t-squared fire. In such a fire, the rate of heat release is given by the expression:

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

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 Ultra-fast time-squared fire growth rate curve.

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

WAREHOUSES (U.S.A.)

The following data has been extracted from the fire statistics data published by the NFPA for the years 2009-2013. The sum of each column of data may not equal totals due to rounding errors.

Table 7-4: Leading causes of structure fires in warehouse properties (2009-2013 annual averages)

Cause	Fires	Civilian Injuries
Intentional	220 (18%)	4 (21%)
Electrical distribution and lighting equipment	220 (18%)	8 (38%)
Heating equipment	90 (8%)	0 (0%)
Exposure fire	90 (7%)	0 (0%)

Cause	Fires	Civilian Injuries
Smoking materials	60 (5%)	0 (0%)
Cooking equipment	50 (4%)	0 (0%)
Lightning	20 (2%)	0 (0%)

Based on the table above, it can be noted that the leading cause is generally equipment used by the building occupants. Electrical distribution and lighting equipment is the leading cause of fires and civilian injuries, accounting for over a third of civilian injuries (38%). The following table indicates the majority of deaths and injuries occur in storage and loading bays of warehouse buildings.

Table 7-5: Structure fires in warehouse properties by area of origin (2009-2013 annual averages)

Cause	Fires	Civilian Injuries
Unclassified storage area	140 (11%)	4 (19%)
Shipping receiving or loading area	120 (10%)	2 (10%)
Storage room, area, tank or bin	80 (7%)	1 (4%)
Vacant structural area	60 (5%)	0 (0%)
Unclassified outside area	50 (4%)	1 (3%)
Storage of supplies or tools or dead storage	50 (4%)	0 (0%)
Exterior roof surface	50 (4%)	0 (0%)
Trash or rubbish chute, area or container	40 (4%)	0 (0%)
Unclassified equipment or service area	40 (4%)	0 (2%)
Processing or manufacturing area, or workroom	40 (3%)	1 (5%)
Unclassified area of origin	40 (3%)	1 (5%)
Office	40 (3%)	1 (7%)
Exterior wall surface	40 (3%)	0 (0%)
Maintenance or paint shop area	30 (3%)	1 (5%)

Cause	Fires	Civilian Injuries
Unclassified structural area	30 (2%)	0 (0%)
Garage or vehicle storage area	30 (2%)	1 (6%)
Kitchen or cooking area	20 (2%)	0 (0%)
Wall assembly or concealed space	20 (2%)	0 (0%)
Machinery room or area or elevator machinery room	20 (2%)	0 (0%)
Other known area of origin	280 (23%)	6 (27%)

The following table lists the extent of fire spread in warehouse properties and the corresponding number of civilian injuries.

Table 7-6: Structure fires in warehouse properties by extent of flame (2009-2013 annual averages)

Extent Of Fire Spread	Fires	Civilian Injuries
Confined fire identified by incident type	280 (23%)	0 (0%)
Confined to object of origin	170 (14%)	6 (32%)
Confined to room of origin	260 (21%)	4 (19%)
Confined to floor of origin	70 (6%)	1 (6%)
Confined to building of origin	370 (31%)	7 (38%)
Beyond building of origin	60 (5%)	1 (5%)