innova services
Fire Safety Engineering
Building Services Engineering
ABN 14 162 610 568

Fire Safety Strategy

Building 2B, Oakdale West Estate

SSD 7438 Mod 3 & SSD 10397 Stage 2 DA
Kemps Creek NSW 2178

Prepared For:
Goodman Property Services (Aust) Pty Ltd

Report No. 19378-R01
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QUALITY SYSTEM

Report Register

The following report register documents the development and issue of this Report as undertaken by this office.

Reference	Issue No.	Remarks	Date	Prepared By	Checked By
19378-R01	1	Initial Issue	18-11-2019	TDD	JDP
19378-R01	2	Revised Issue	28-11-2019	TDD	JDP
19378-R01	3	Revised Issue	12-12-2019	TDD	JDP
19378-R01	4	Revised Issue – Updated Site Plan	08-01-2020	TDD	JDP
19378-R01	5	Revised Issue – Updated Site Plan	14-01-2020	TDD	JDP

Prepared by

Trent De Maria
Senior Fire Engineer

Reviewed by

Jason Powell
Director
C10 Accredited Fire Engineer (BPB0801)
MIEAust, CPEng

innova services Pty Ltd
Sydney | Brisbane
Phone: 1300 88 22 62 Mobile: 0409 887 929
Post: PO Box K194, Haymarket NSW 1240; PO Box 4788, Forest Lake QLD 4078
Email: info@innovaservices.com.au Web: www.innovaservices.com.au

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1.0 EXECUTIVE SUMMARY

This Fire Safety Strategy has been prepared by Innova Services Pty Ltd for Goodman Property Services (Aust) Pty Ltd and relates to construction of the industrial warehouse building on Site 2B in the Oakdale West Industrial Estate. Building 2B comprises of a four (4) storey automated warehouse and distribution centre at Kemps Creek NSW 2178.

Innova Services Pty Ltd has been commissioned to prepare a preliminary fire safety strategy to provide confidence to project stakeholders that the documentation being readied for issuance of the planning permit is capable of achieving compliance with the Building Code of Australia 2019 (BCA).

The subject design has been observed to exhibit a number of non-conformances with the prescriptive provisions of the BCA. These non-conformances have been to date and will continue to be identified by the Authority Having Jurisdiction.

Subsequently, it will be necessary for the method of compliance with the building regulations to incorporate a Performance Based approach as supported by the BCA. Innova Services Pty Ltd have reviewed the architectural design drawings and proposes the following fire safety strategy for consideration.

We can confirm that based on the strategy documented herein, that an assessment can be undertaken by a C10 Accredited Fire Engineer in consultation with project stakeholders (including the Principal Certifying Authority), to demonstrate that the building will comply with the Performance Requirements of the BCA. This may be via a combination of the following:

- Becoming Deemed-to-Satisfy by way of design development.
- Comparison to the BCA Deemed-to-Satisfy Provisions to demonstrate equivalence.
- Compliance with the BCA Performance Requirements.

It is considered that the preparation of the Performance Solutions and corresponding fire safety measures that are likely to be documented therein will not result in significant changes to the building design presented in the schematic drawings reviewed for the feasibility stage and planning permit.

2.0 INTRODUCTION

2.1 PURPOSE OF REPORT

The purpose of this report is to present a Fire Safety Strategy of Performance Solutions to the Deemed to Satisfy (DTS) provisions of the Building Code of Australia 2019 (BCA). The report relates to the four (4) storey automated warehouse and distribution centre in the Oakdale West Industrial Estate at Kemps Creek NSW 2178.

2.2 OBJECTIVE AND SCOPE OF REPORT

This Fire Safety Strategy is intended for use in the design of the proposed building.

The Fire Safety Strategy outlines the construction and management requirements considered necessary to achieve an acceptable level of life safety with the building and satisfy the Performance Requirements of the BCA.

As a preliminary document the requirements are meant to assist with detailed design preparation. The complete fire engineering analysis will form the Fire Engineering Report and is to be developed as the design progresses. As such, no fire engineering analysis is documented herein.

The aim of the design is, subject to consultation with stakeholders, to provide an adequate level of fire safety for the building occupants, firefighters and maintenance and other emergency services personnel. The BCA's fire safety objectives are:

- Safety of occupants (reduce risk to an acceptable level).
- Facilitation of effective emergency services intervention.
- Protection of adjoining property and third parties.

At a community level, fire safety objectives are met if the relevant legislation and regulations are complied with. As stated in the BCA, "*A Building Solution will comply with the BCA if it satisfies the Performance Requirements*".

At a local level this Fire Safety Strategy should be consulted to inform decisions about fire safety design and application, and to help secure best value and sustainability in relation to the design and use of the premises.

This report is designed to be consistent with the objectives and limitations of the BCA. Effects of arson (e.g. from multiple fire starts), terrorism, explosive devices, use of accelerants, and sabotage of fire safety systems and equipment are considered outside the scope of this report.

The effective application of fire safety design and management principles should not be considered in isolation and this document should therefore be viewed alongside other relevant statutory requirements, management policies, guides and standards relating to the management of health and safety, procurement, environmental protection and quality.

2.3 BASIS OF REPORT

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

- The Building Code of Australia 2019(BCA).
- *NSW Environmental Planning & Assessment Act 1979.*
- *NSW Environmental Planning & Assessment Regulation 2000.*

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

- International Fire Engineering Guidelines, 2005 Edition (ABCB, 2005).
- Guide to the Building Code of Australia (NCC Vol. 1) (ABCB, 2019).
- Architectural plans of the subject development prepared by SBA Architects Pty Ltd.
- BCA Assessment for the subject development prepared by Blackett Maguire & Goldsmith Pty Ltd.

2.4 EXCLUSIONS

This report does NOT cover the following:

- A detailed BCA assessment of the subject development.
- Access for people with disabilities (Part D3 of the BCA).
- System or engineering design of any part of the subject development.
- 'Absolute' or '100%' safety is not attainable, and there will always be a finite risk of injury, death or property loss. Also, fire and its effects on people and property are complex and variable. Thus, all stakeholders should understand that a fire safety system is not designed to cope with all possible scenarios.
- Arson (other than as a source of initial ignition), multiple ignition sources, acts of terrorism.
- Dangerous Goods and Hazardous Materials Assessment.
- Explosion risk.
- Protection of property (other than adjoining property).
- Business interruption or losses, or personal or moral obligations of the owner/occupier.
- Workplace Health and Safety, and Work Cover Authority Regulations.

2.5 ASSUMPTIONS

It is assumed that apart from the identified variations presented in of the Executive Summary, all other fire safety aspects associated with the subject development will comply with the relevant DTS provisions of the BCA.

2.6 REGULATORY FRAMEWORK

Fire safety legislation, the National Construction Code Building Code of Australia and relevant Australian Standard documentation are in place to support designers in arriving at a suitable and sufficient final design solution. The reference to any relevant guides is not intended to be exhaustive but to provide an indication of the range of requirements that need to be taken into account when approaching fire safety design and management.

The design will comply with all relevant legislation relating to the design and construction and ensure that an appropriate and broadly acceptable standard of fire safety management is adopted, the guidance described in this document takes into consideration the requirements and recommendations contained in the following documents:

2.7 MEETING THE PERFORMANCE REQUIREMENTS

Compliance with the BCA is achieved by satisfying the Performance Requirements. Clause A2.1 of the BCA states that the Performance Requirements can be satisfied by:

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

Clause A2.2(1) of the BCA states that 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,

Clause A2.2(2) of the BCA states that a Performance Solution must be shown to comply with the relevant Performance Requirements through one or a combination of the following Assessment Methods:

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

(a) A verification Method including the following –

(i) The Verification Methods in the NCC; or

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

(b) Expert Judgment.

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

3.0 DEVELOPMENT DESCRIPTION

3.1 DESCRIPTION OF DEVELOPMENT

General

Building 2B is located within the Oakdale West Industrial Estate located in Kemps Creek, approximately 39 km west of the Sydney central business district (refer to Figure 1). The development relates to the construction of Building 2B, an automated warehouse and distribution centre located at Kemps Creek NSW 2178.

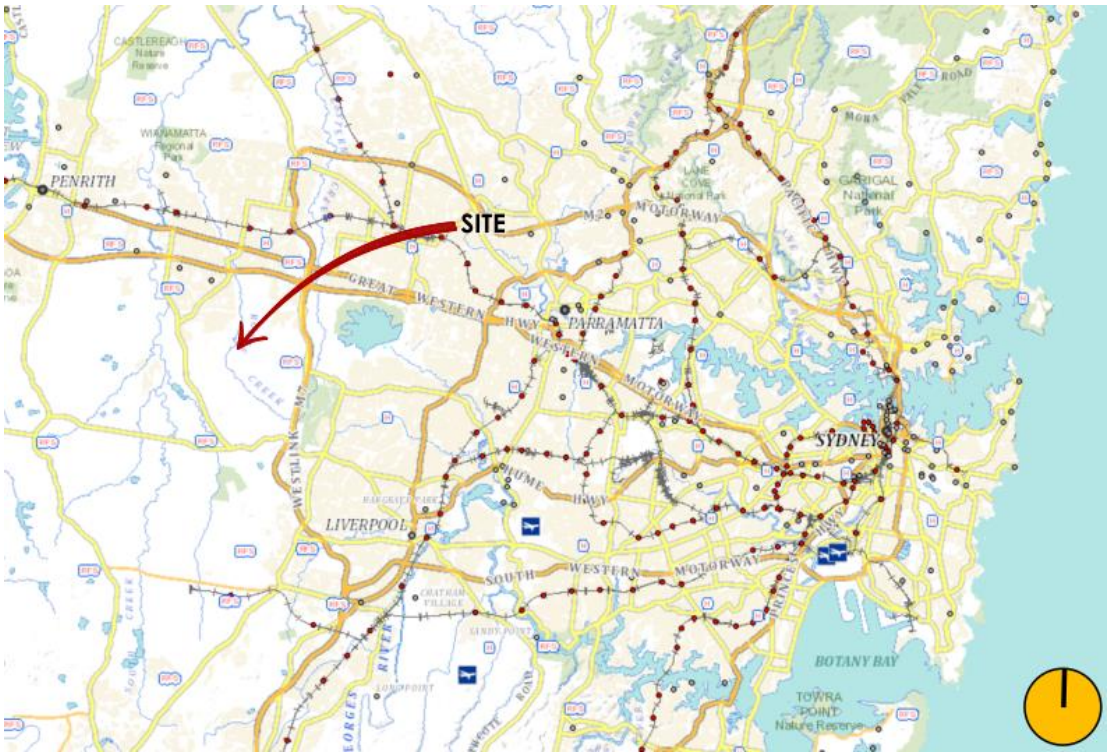


Figure 1: Regional Location

The site is an irregular rectangular shape with a primary street frontage to new future link roads to the east, south eastern corner and western boundary of the allotment (refer to Figure 2).

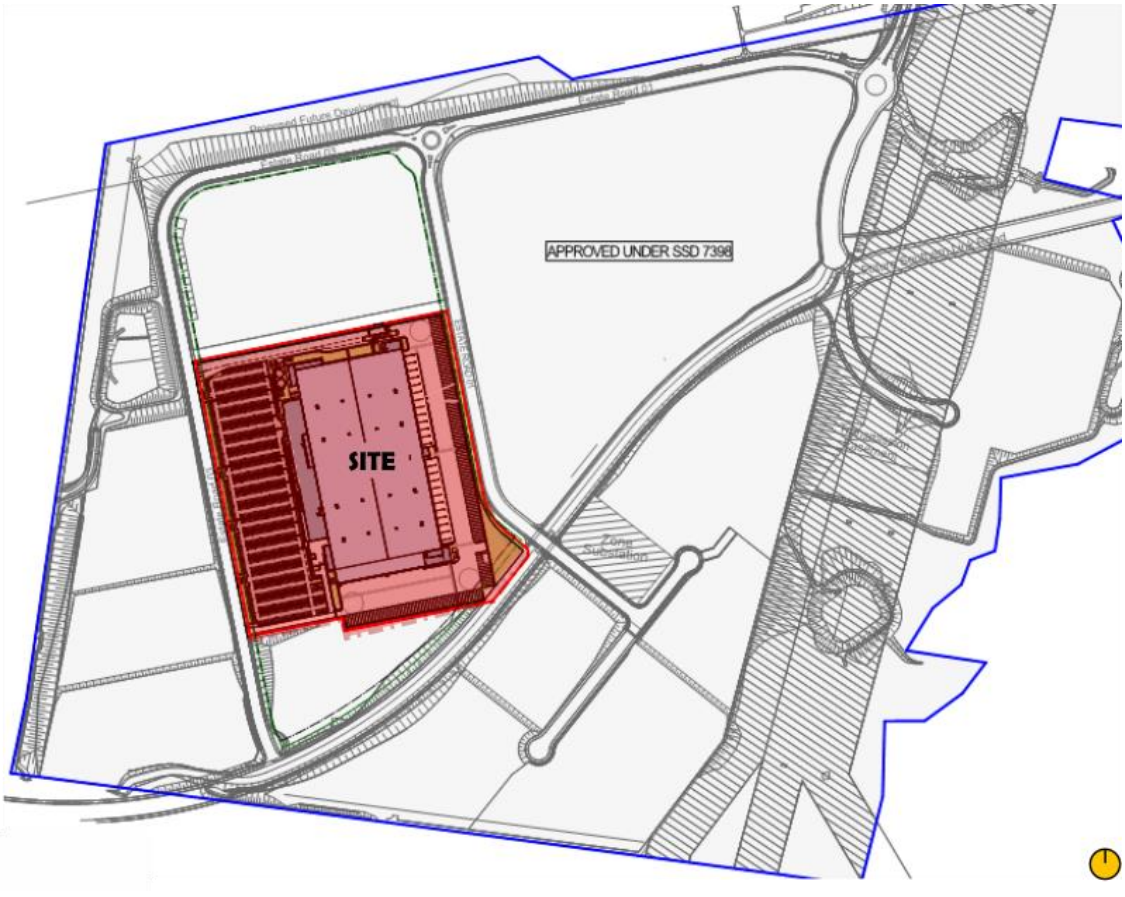


Figure 2: Estate Location Plan

The building works involve construction of a four (4) storey composite concrete and steel portal frame industrial warehousing and distribution facility. The office associated with the warehouse ins located on the western side of the floorplate (adjacent to the public roads), breakout and rest areas for staff are positioned within the main office on the western side of the building and in the southern and northern corners of the building.

Loading and unloading facilities undertaken on the southern and eastern side of the building under super awnings.

The building is serviced by a hardstand area for loading and manoeuvring on the eastern and southern sides of the building, a separate 1,127 space carpark on the western side of the site and perimeter landscaping.

Vehicle access is provided from the western allotment boundary, with heavy vehicle access to the north and south and four (4) entry points to the staff carpark.

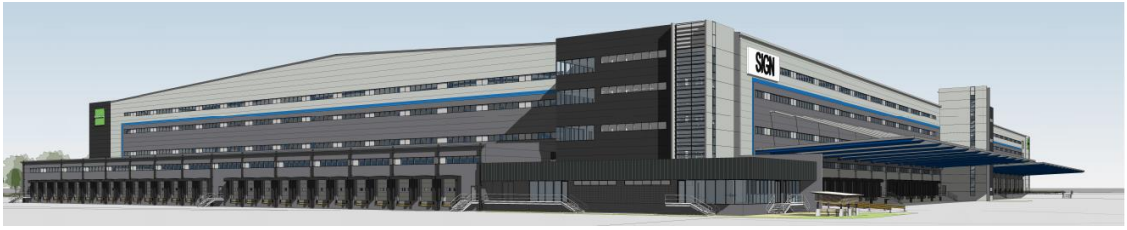


Figure 3: Architectural Perspective (south-east view)

Building Use

The building is a single fire compartment with an associated single storey office.

The building is designed to store goods in automated low level racks having a height of not more than 3m. The building has floor areas in the order of:

- Ground Floor Office -5,492 m^2
- Warehouse – 50,873 m^2 (Ground Level)
- Mezzanine – 6,300 m^2 (Ground Level)
- Warehouse – 48,101 m^2 (Level 1 to Level 3)

Total floor area is therefore in the order of 206,968 m^2.

An architectural perspective, section and site plan are provided in Figure 5 and Figure 6.

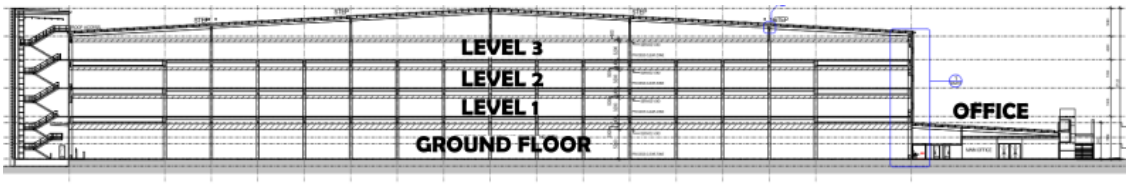


Figure 4: East West Section

Due to the need to respond to the warehousing operational needs of the tenant, the building height provides a maximum clearance height of:

- Offices – generally 2,700 mm
- Ground Floor Warehouse – <7,600mm with a process clear zone of 5,260 mm
- Ground Floor Mezzanine - ~3,800 mm
- Level 1 and Level 2 – 4,530 mm with a process clear zone of 2,780 mm
- Level 3 – 4,000 mm to the underside of the haunch, with a process clear zone of 2,780 mm

The warehouse will act as a storage and distribution centre for a range of non-putrescible merchandise. The warehouse includes an automated picking field that is a restricted area. Within the field robots deliver large stacks of products to workers located around the perimeter of the processing zone (Figure 8), by following set paths around the warehouse.

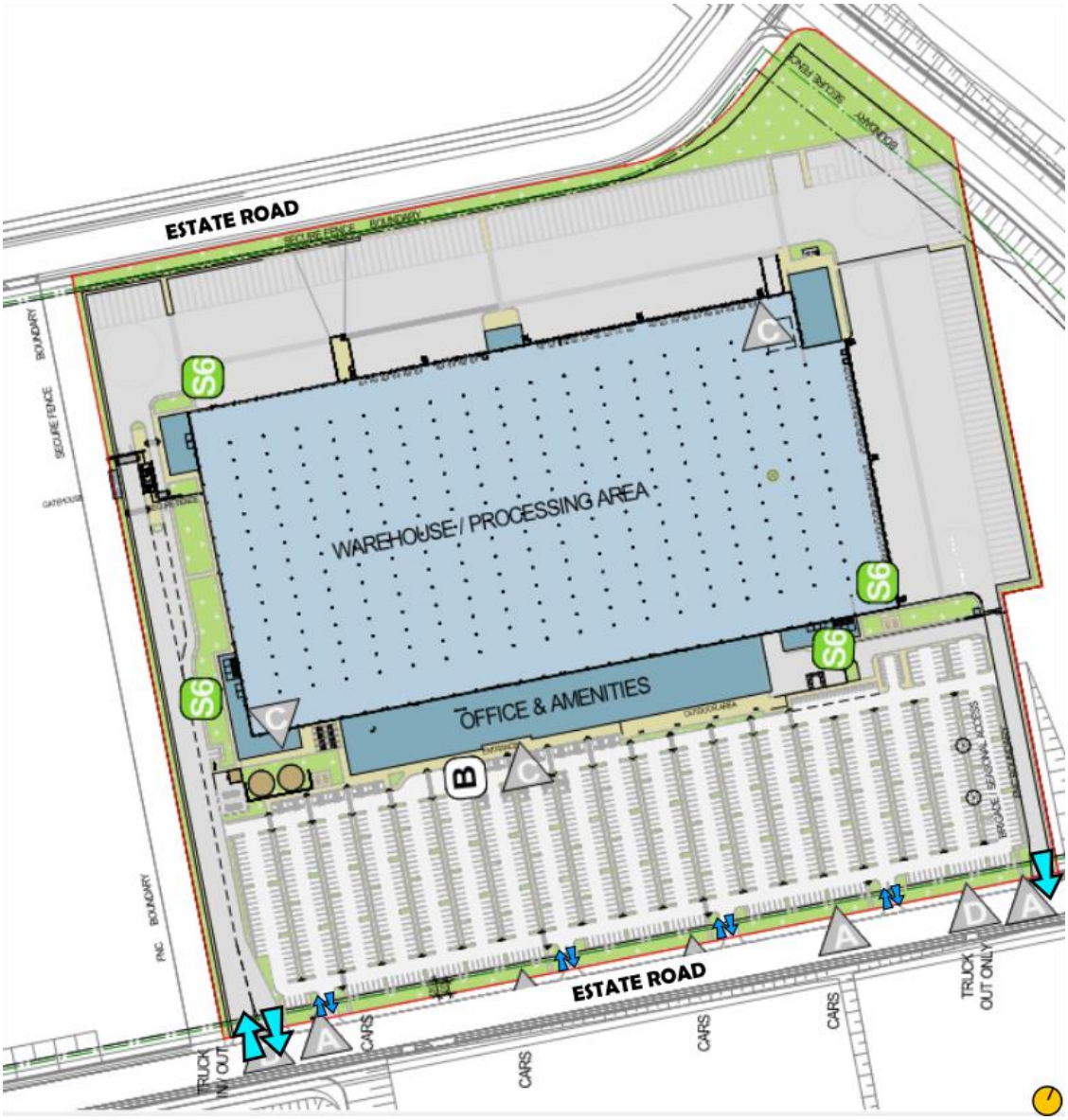


Figure 5: Estate Site Plan

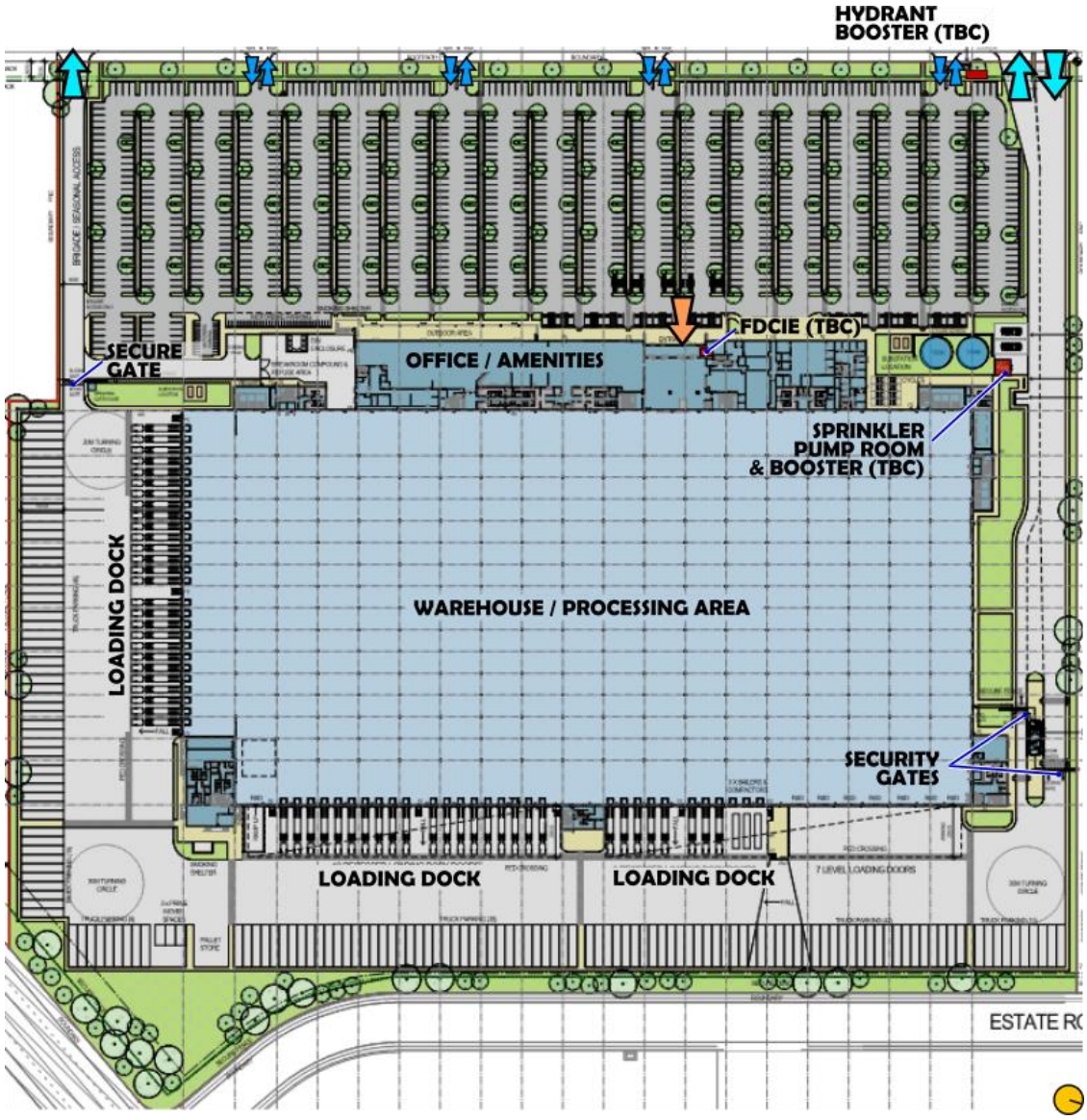


Figure 6: Warehouse Site Plan

Whilst there are multiple egress points around the perimeter of the building, due to the expansive nature of the floor plate it is necessary for a Performance Solution to address travel distances throughout the building.

At Ground Level, egress is direct to open space at grade. Egress from the Ground Floor Mezzanine is via stairways and walkways complying with AS 1657 and therefore is subject to a performance solution in relation to both the total travel distance that needs to be traversed and the nature of the egress system.

On Level 1 to Level 3 egress is via fire isolated stairs (refer to Figure 8). The discharge of the fire isolated stairs into office lobby and around the perimeter of the building are likely to be subject to a Performance Solution.

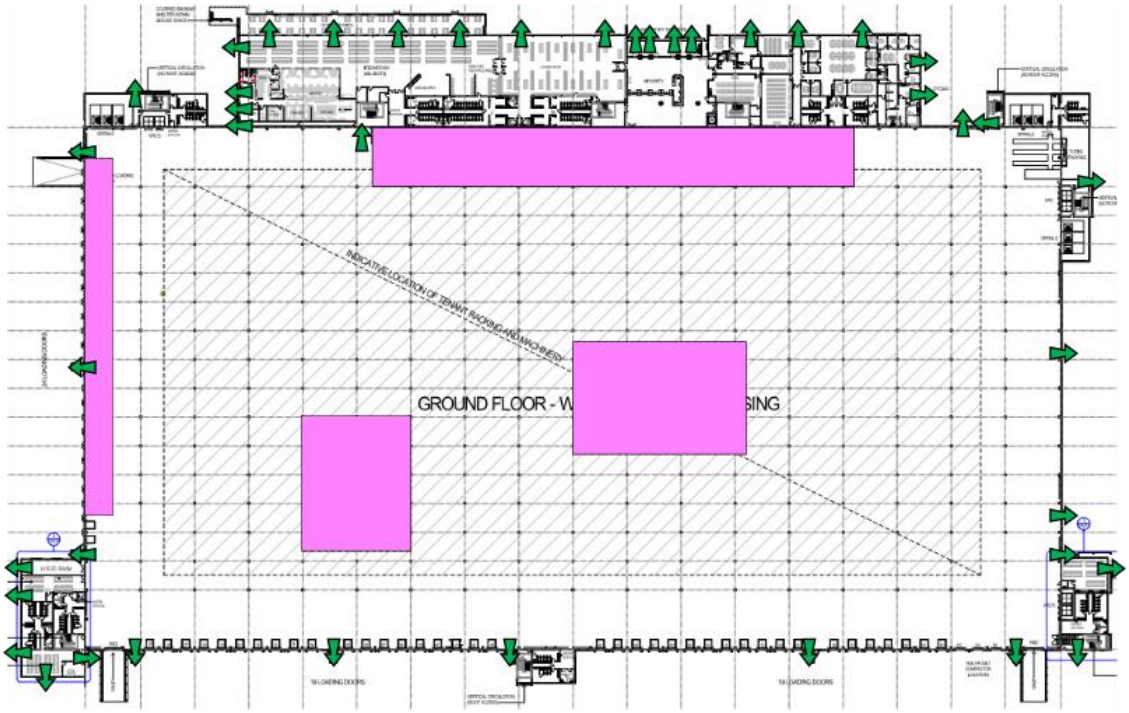


Figure 7: Ground Floor egress points and mezzanine (highlighted pink)

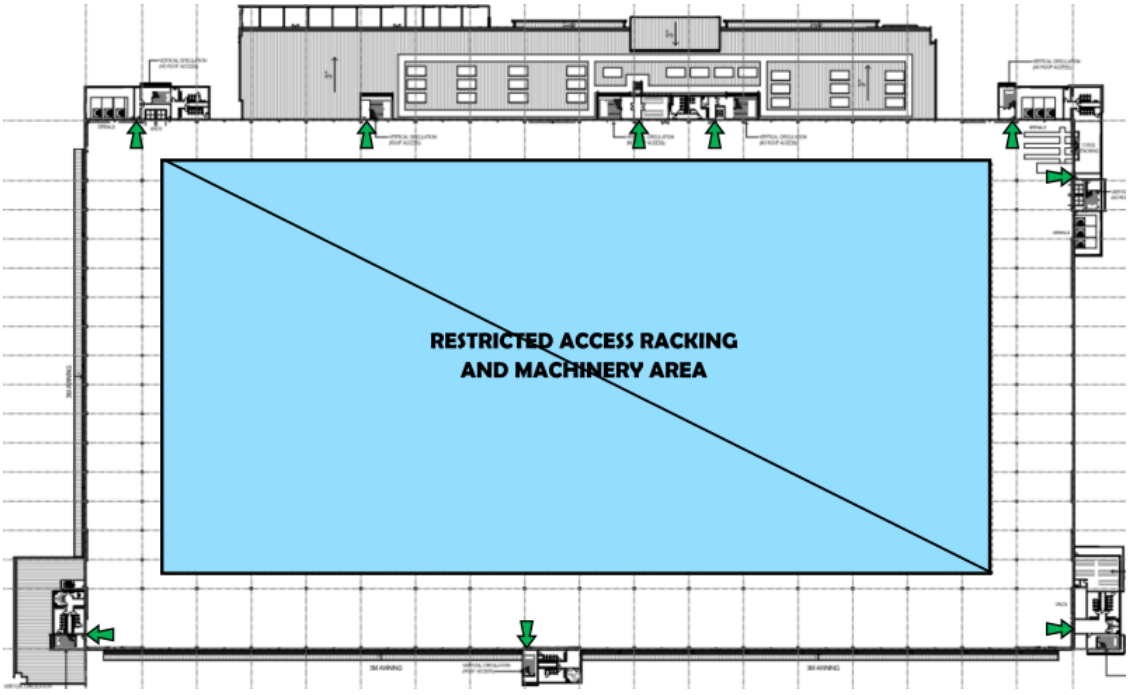


Figure 8: Level 1, Level 2 and Level 3 typical egress arrangement

Fire Brigade Intervention

The building is provided with access for emergency appliances and vehicles around its perimeter.

That access will be subject to a Performance Solution as a result of the proximity of the vehicular pathway being greater than 18 metres from the external wall of the building, the “pinch points” at the entry gates and security access control points as well as the discontinuity of the pathway as a result of the staff carpark (refer to Figure 9).

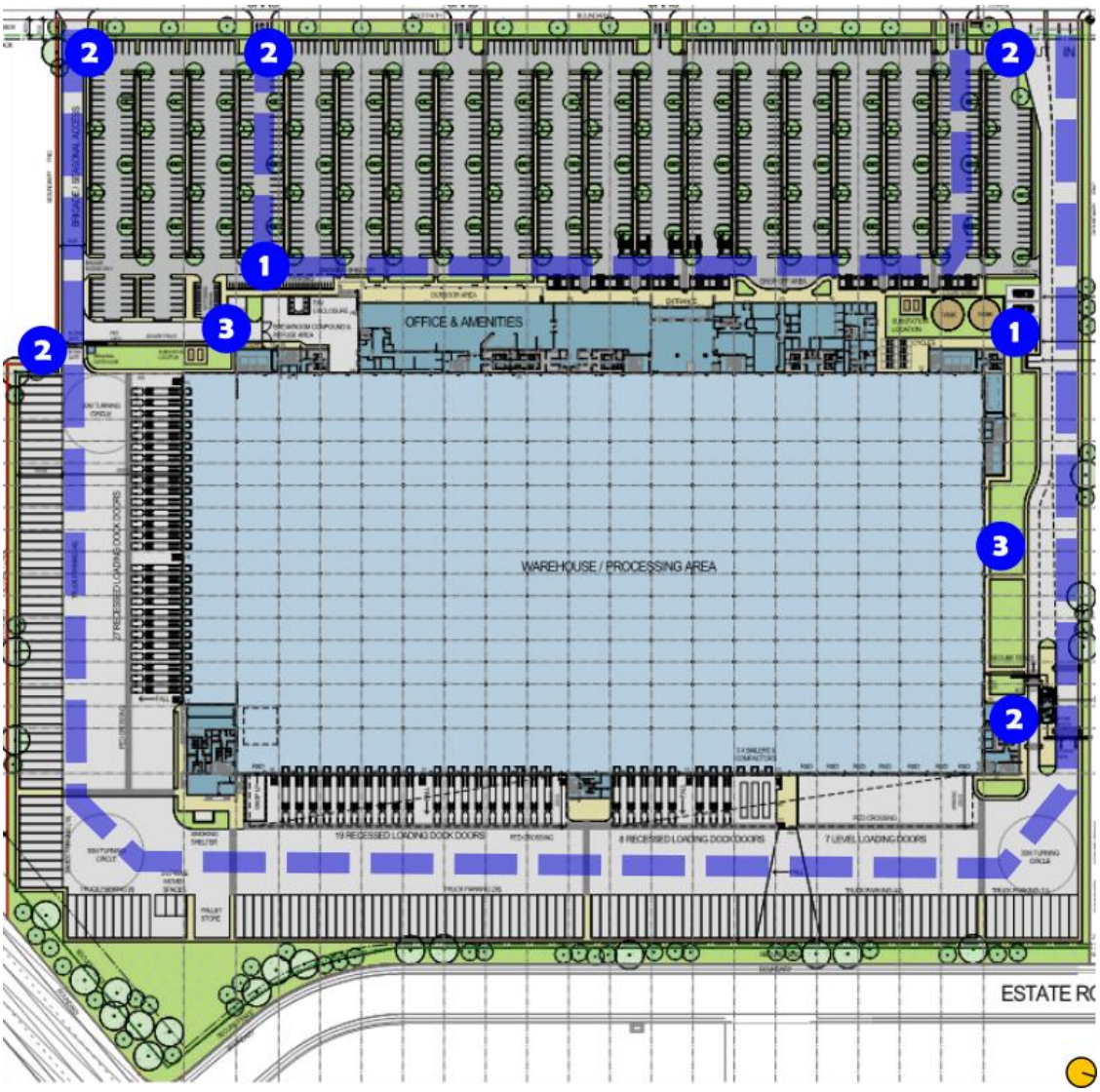


Figure 9: Perimeter Access and points of non-conformity (Point ‘1’ discontinuous travel path, Point ‘2’ restricted width at gates and security control points, Point ‘3’ pathway >18 m from the building)

The fire hydrant booster assembly is located at the western street frontage, and the sprinkler booster and suction point is adjacent to the sprinkler tanks and pump room (refer to Figure 10). Connection to the sprinkler booster hard suction is facilitated by appliance parking space adjacent to the sprinkler pump room on the road. The location of the sprinkler booster is subject to a Performance Solution.

A main fire indicator panel and a fire fan control panel will be located in a fire control centre in the office (refer to Figure 10). This is within sight of the booster assembly which is situated on the western street frontage. The controls together with operating instructions for use by emergency personnel are to be provided adjacent to the FDCIE in accordance with the requirements of clauses 4.11 and 4.13 of AS/NZS 1668.1.

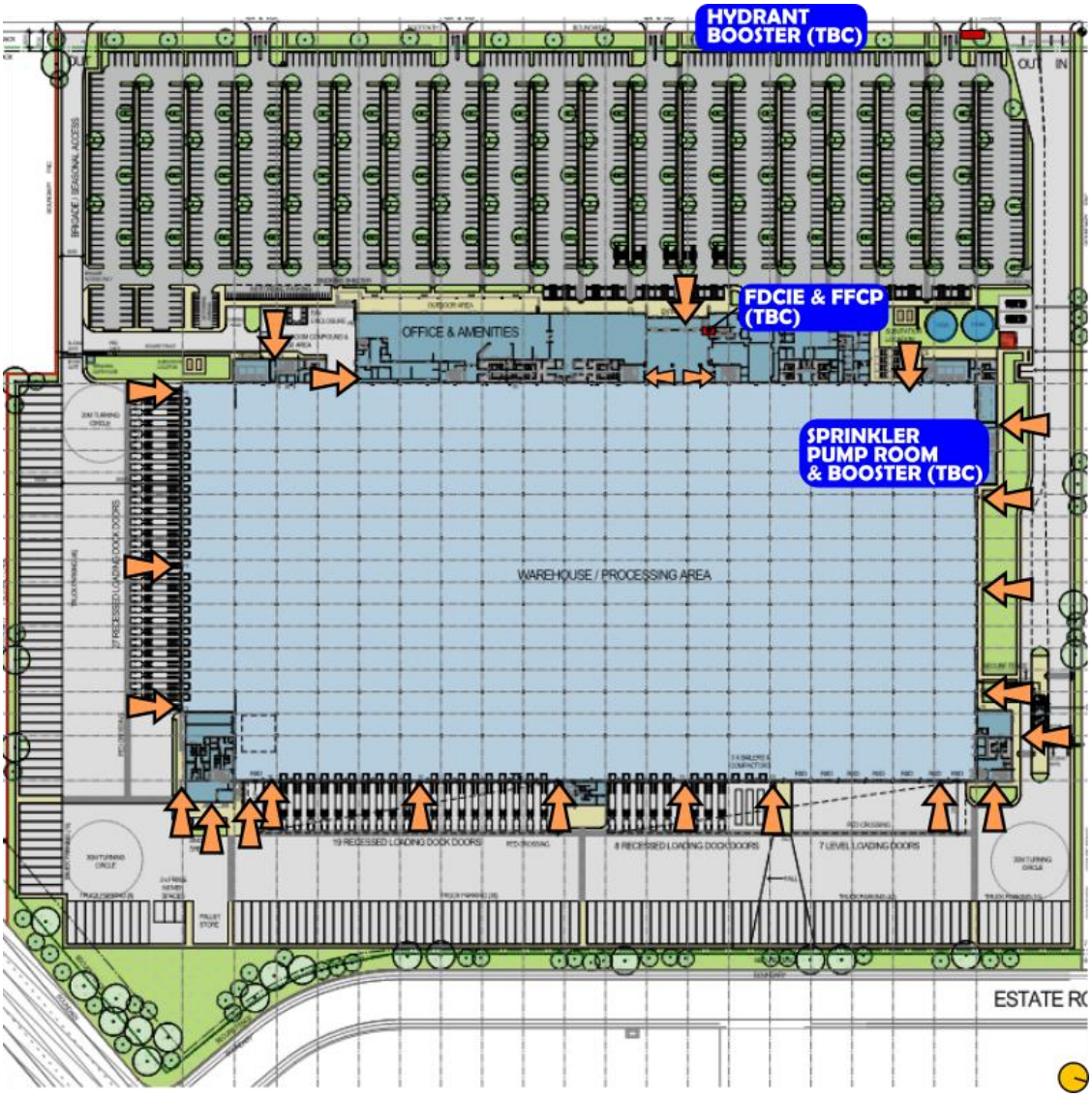


Figure 10: Location of Fire Brigade Infrastructure and Fire Fighter Entry Points

It is expected that the fire brigade will react to a call in a timely manner with notification occurring via direct monitored alarm. Based on the response time data from the fire brigade and the Fire Brigade Intervention Model, it is suggested that the following activities generally outline the likely timing of the Fire Brigade's response.

1. *Time for notification and travel to site*

   The closest fire stations (© 2019 Google) are as considered to be:

   - Mount Druitt Fire Station (81 Railway Street, Mount Druitt NSW 2770) ~14 km by road from the site
   - Huntingwood Fire Station (42 Huntingwood Drive, Huntingwood NSW 2148) ~11 km by road from the site

   Whilst the response time obviously depends on the distance to the building from the fire station and the density of traffic. It can be seen from the FRNSW Annual Report (Fire & Rescue New South Wales, 2016) that the 50th percentile response time is around 7 minutes and the 90th percentile is less than 12 minutes. As the building is expected to contain both smoke detectors and sprinklers the 90th percentile response time is adopted.

2. *Locate an appliance adjacent to booster connections*

   The boosting of the fire-fighting water supply is important to ensure that there is adequate flow and pressure and is normally undertaken by one of the responding appliances. This activity is related to Point 5 and 6 and can be considered to occur independently of the other activities.

3. *Dismount vehicle and put on breathing apparatus and prepare for activities*

   This is estimated as being typically between 2—3 minutes.

4. *Enter building to FIP*

   This time can be short (eg. 60 secs) as the location of the FDCIE in relation to the vehicular entrance to the site is considered to be readily apparent. There will also be interaction between security staff and the fire brigade and it is likely that the staff will initially have a better understanding of the location of the fire.

5. *Remove, connect and charge 65 mm hose from hydrant to appliance*

   See comment under Point 6 below.

6. *Remove, connect and charge 65mm hose from appliance to boosters*

   Estimated elapsed time for Tasks 2 and 5 is between 3—4 minutes.

7. *Gather information from FIP and tactical fire plans*

   This is when the Officer-in-Charge (OIC) considers the available information and directs crews as to operational procedures.

   As the building incorporates automated processing so the transfer of information is expected to be ongoing.

   Note: The emergency procedures for the building include the automatic call out of staff in the pre-alarm fire condition should detection by the Smoke Detection System occur after hours.

   For the purposes of the intervention assessment it is estimated as taking up to 2 minutes before initial operating decisions are made and is improved by the presence of staff.

8. *Travel to set-up area with equipment (hose lines etc)*

   This is a function of the distance to the fire area and whether it is on ground level or the levels above. Assuming a fire in the centre of the warehouse the estimated travel time is ~307 seconds (200 metres at 0.65 m/s)

9. *Connect and charge hose lines*

   Connection, layout and charging of hose lines is estimated to take about two minutes.

10. *Gather additional information and provide feedback*

This action (by the OIC) is aimed at providing additional information in relation to the best strategy for fighting the fire and takes place concurrently with the first application of water.

Table 1: Time to supply water to the fire

Activity	Activity time (secs)	Elapsed time (secs)
1. Time for notification and travel to site	720	720
2. Locate an appliance adjacent to booster connections	Included in activity 6.	-
3. Dismount vehicle and put on breathing apparatus and prepare	120	840
4. Enter building to FIP.	60	900
5. Remove, connect and charge 65 mm hose from hydrant to appliance (included in 6. Below)	Included in activity 6.	-
6. Remove, connect and charge 65mm hose from appliance to boosters	240	1,140
7. Gather information from FIP and tactical fire plans	120	1,260
8. Travel to set-up area with equipment (hose lines etc)	307	1,567
9. Connect and charge hose lines	120	1,687
10. Gather further information and feedback	Ongoing	-
Total	-	28 minutes 7 seconds

In summary, from the time of alarm approximately 28 minutes will elapse before fire fighters are in a position where they may direct water onto the fire. If staff offer support in terms of direction, it is possible that the above times could be reduced.

3.2 BCA Assessment Data

The relevant BCA classifying information for the subject development is summarised in Table 2.

Table 2: Relevant BCA Assessment Data

BCA Reference	BCA Assessment
Classification	Class 5 (office) and Class 7b (warehouse)
Rise in Storeys	Five (5)* *The rise in storeys is five (5) as a result of the application of Clause C1.2(c) of the BCA.
No. of Levels Contained	Four (4)
Minimum Type of Construction Required	Type A
Effective Height	16.72 m
Maximum Fire Compartment Size	The building is a single fire compartment of ~18,000m^2 and volume > 108,000 m^3. As such, for the purposes of classification under the BCA the building is treated as 'large isolated'. Nominal sizing is as follows: ▪ Office -5,280 m^2 ▪ Warehouse – 46,030 m^2 (Ground Level) ▪ Mezzanine – 6,000 m^2 (Ground Level) ▪ Warehouse – 45,940 m^2 (Level 1 to Level 3) Total floor area is therefore in the order of 195,130 m^2.

4.0 DOMINANT OCCUPANT CHARACTERISTICS

4.1 POPULATION AND DISTRIBUTION

The occupants within subject development will predominantly comprise of staff and visitors. It is not likely for visitors to be unescorted when within the warehouse.

Visitors will be made up of a combination of customers and technicians and/or maintenance personnel.

The population level can be calculated by using the population densities in Table D1.13 of the Building Code of Australia (NCC Vol. 1), or via any other suitable means of assessing its capacity (Clause D1.13(c)).

Population numbers are estimated at 750 full time equivalent positions during a single shift.

This figure is proposed to be utilized for the purpose of the assessment.

4.2 STATE, PHYSICAL AND MENTAL ATTRIBUTES

The staff profile will be that of working age adults with no expected skew in relation to gender, age or physical attributes. Staff are likely to be awake and generally unaffected by drugs and/or alcohol during occupied hours. Staff members are also expected to require minimal response time in the event of an emergency.

Similarly, visitors to the warehouse and/or office and areas are expected to be awake and have a range of physical attributes as would be displayed by the general public.

External contractors are expected to be mobile with normal hearing and visual abilities and occupants in this group are considered to take and implement decisions independently and require minimal assistance during evacuation in a fire emergency. The contractors are always expected to be awake and generally aware of their surroundings when inside the building.

Fire fighters are expected to be equipped with safety equipment and will be educated in firefighting activities and the dangers associated with fire incidents. This occupant group would be expected to be able to assist other occupants requiring assistance to evacuate. It is not expected that fire fighters would be present in the building at the time of fire ignition; however, they are expected to enter the building at a later stage to assist with the evacuation of occupants, if required, and to undertake fire suppression activities.

4.3 FAMILIARITY WITH THE BUILDING

Staff are expected to be familiar with the building layout and the location of exits. Whilst other occupants are expected to be generally familiar with the building layout and the location of exits that they utilized on entry to the building.

Visitors to the development are not considered to be familiar with the overall site and building layout, however, site visitors are generally expected to be accompanied by staff, and wayfinding within the building is straightforward.

Despite this, due to there being clear sightlines between exits, the relatively straight line of sight between exits with minimal directional changes, wayfinding is not considered to be complex.

The provision of exit signage is expected to assist occupants identify the location of the exits, and the path of travel to the exits.

4.4 Level of Assistance and Emergency Training

Fire wardens are expected to be present, as required by the Workplace Health and Safety legislation enforced by the State, i.e. emergency management planning in accordance with AS 3745.

Wardens are expected to have received at least some level of fire safety training which may include the use of first aid firefighting equipment.

Most of the occupants are not assumed to have received fire safety training or training to use first aid fire-fighting equipment such as fire hose reels and portable fire extinguishers.

4.5 Disabled Occupants

Occupants with disabilities who are unable to evacuate of their own volition are expected to be assisted by able-bodied carers or staff.

Managing the evacuation of people with disabilities relies on the individual building management systems, procedures and training, which are outside the scope of the BCA, but can substantially contribute to the overall evacuation efficiency of the building.

Therefore, disabled access and egress should be addressed in an emergency evacuation plan and management procedures developed for people with disabilities.

5.0 HAZARD IDENTIFICATION

5.1 GENERAL

In identifying potential fire hazards within the development, and those that are typical and/or unique to the development the following factors are considered:

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

5.2 GENERAL BUILDING LAYOUT AND CONSTRUCTION

Refer to Section 3 of this Report for a description of the subject development and an overview of the layout.

In summary, the building is segregated into two main areas; warehousing and ancillary uses, and offices; the design of the building is such that there are good sightlines between exits and clear wayfinding paths.

Non-conformant travel egress provisions are proposed in a fire engineering assessment.

Specifically, extended travel distances to an exit and between exits are evident due to the scale of the warehouse.

In general warehouses pose substantial challenges for fire protection due to their large floor plate, storage configurations and picking and packing technologies, ceiling heights, and types of commodities stored.

The sprinkler system is an essential element of the warehouse fire protection system.

In the NFPA report on the U.S. experience with sprinklers ((Hall, 2010)) it was calculated that sprinklers operated at least 86% of the time when properties were protected by wet pipe sprinklers and fires were large enough to activate the equipment. Wet pipe sprinklers were effective in 84% of the fires in which they were present and contributed to a 61% reduction in dollar loss in those fires. The design of the warehouse in this instance is one which minimises the risk of occupants having to pass by high ignition hazards (e.g. kitchenettes and switch rooms) in reaching a point of choice between exits.

Services equipment and installations are to be correctly designed, specified, constructed in accordance with the Australian Standards and BCA and checked when commissioned. In the long term planned maintenance in accordance with the statutory legislation will be provided so that safety standards can be maintained.

The subject development is assumed to comply with the relevant provisions for Type A construction, with the materials of construction typically steel, concrete or masonry.

External walling is non-combustible (i.e. insulated rockwool panels) and roofing is metal deck.

5.3 BUILDING ACTIVITIES

The building will be used as a storage and distribution centre.

Hazards are generally expected to be typical to that exhibited in incident data for warehouse buildings with the exception of the automated processing area that dominates the floor area on Level 1 to Level 3.

The warehouse will be stocked with a range of goods and commodities that do not exceed the thresholds for Dangerous Goods and Hazardous Substances in the legislation. The products are to be redistributed to customers.

Loading, unloading and storage of products and materials will be primary activities within the building.

Whilst maintenance and repair work will be undertaken it is not expected that the activities undertaken represent a greater hazard than any other warehouse development.

NFPA (Campbell, 2016) reported the leading causes of fires in warehouses as:

- 18% of fires were intentionally lit.
- Electrical distribution or lighting equipment was also the cause of 18% of fires.
- Heating equipment accounted for 8% of fires
- Smoking accounted for 5% of all fires
- Arcing was the most common heat source (13% of fires).

Due to the nature of the use, the general members of the public are unlikely to be within the building without direct supervision. This supervision will assist in ensuring that appropriate decision-making choices are made in a fire emergency. Hazards from operational activities are most likely to include moving parts, human error and carelessness, forklift impact and mechanical failure of any associated equipment.

As the warehouse is a restricted space the danger posed is related to the fact that this area is not designed to be an area where unauthorised people will gain access.

The risks of working in the space includes:

- fire or explosion from the ignition of flammable contaminants
- difficulty rescuing and treating an injured or unconscious person

The provision of access control, infrequent access and job specific risk management controls e.g. SWMS shall be used to minimise the risk to occupants.

These risks will be managed to the degree expected in any other development with scheduled and unscheduled maintenance of equipment and machinery, maintenance of workplace health and safety requirements and compliance with relevant statues for health, safety and fire compliance.

These risks will be managed to the degree expected in any other development with scheduled and unscheduled maintenance of equipment and machinery, maintenance of workplace health and safety requirements and compliance with relevant statues for health, safety and fire compliance.

5.4 POTENTIAL IGNITION SOURCES AND AREAS OF FIRE ORIGIN

Within the building the items first ignited are expected to be:

- Rubbish, trash or waste (~12%)
- Electrical wire or cable insulation (~8%)
- Unclassified items (~7%)
- Flammable and combustible liquids or gases, piping and filters (6%)

5.5 COMBUSTIBLE CONTENTS

The structural elements of the building (walls, floors, roofs, ceilings, beams, etc.) are non-combustible or deemed to be non-combustible and therefore will not serve as a significant fuel sources in the event of a fire.

The interior finishes on the walls and any ceilings will act as a fuel sources, however they are to comply with the prescriptive provisions of Building Code of Australia (NCC Vol. 1) Clause C1.10 and its Specification to reduce the hazard to an acceptable level.

The greatest hazard will therefore be associated with the contents of the building, which will comprise of:

- Palletised goods, carboard boxes and other cellulosic fuels
- Storage of boxed goods and equipment
- Computer equipment, monitors, printers and copiers
- Plastic packers and fillers, and plastic componentry
- Fixed furnishing and equipment
- Robots, including batteries

The risk associated with the storage of the abovementioned fuel sources is mitigated by a suppression system that is designed in accordance with the necessary requirements for the commodity being stored. This will include:

- High hazard ESFR sprinklers in the warehouse.
- Ordinary hazard sprinklers to the awnings.
- Light hazard sprinklers to the offices.

6.0 DESIGN OBJECTIVES

6.1 REGULATORY OBJECTIVES

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

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

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

6.2 RELEVANT PERFORMANCE REQUIREMENTS

The relevant Performance Requirements of the BCA (being CP1, CP2, CP8, CP9, DP2, DP4, DP5, DP6, EP1.1, EP1.3, EP1.4 and EP2.2) associated with the proposed Performance Solutions are presented below. The Performance Solutions must comply with these Performance Requirements.

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

(a) the function or use of the building; and

(b) the fire load; and

(c) the potential fire intensity; and

(d) the fire hazard; and

(e) the height of the building; and

(f) its proximity to other property; and

(g) any active fire safety systems installed in the building; and

(h) the size of any fire compartment; and

(i) fire brigade intervention; and

(j) other elements they support; and

(k) the evacuation time.

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

(i) to exits; and

(ii) to sole-occupancy units and public corridors; and

(iii) between buildings; and

(iv) in a building.

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

(i) the function or use of the building; and

(ii) the fire load; and

(iii) the potential fire intensity; and

(iv) the fire hazard; and

(v) the number of storeys in the building; and

(vi) its proximity to other property; and

(vii) any active fire safety systems installed in the building; and

(viii) the size of any fire compartment; and

(ix) fire brigade intervention; and

(x) other elements they support; and

(xi) the evacuation time.

***CP8** Any building element provided to resist the spread of fire must be protected, to the degree necessary, so that an adequate level of performance is maintained -*

(a) where openings, construction joints and the like occur; and

(b) where penetrations occur for building services.

***CP9** Access must be provided to and around a building, to the degree necessary, for fire brigade vehicles and personnel to facilitate fire brigade intervention appropriate to -*

(a) the function or use of the building; and

(b) the fire load; and

(c) the potential fire intensity; and

(d) the fire hazard; and

(e) any active fire safety systems installed in the building; and

(f) the size of any fire compartment.

***DP2** So that people can move safely to and within a building, it must have -*

(a) walking surfaces with safe gradients; and

(b) any doors installed to avoid the risk of occupants -

(i) having their egress impeded; or

(ii) being trapped in the building; and

(c) any stairways and ramps with -

(i) slip-resistant walking surfaces on -

(A) ramps; and

(B) stairway treads or near the edge of the nosing; and

(ii) suitable handrails where necessary to assist and provide stability to people using the stairway or ramp; and

(iii) suitable landings to avoid undue fatigue; and

(iv) landings where a door opens from or onto the stairway or ramp so that the door does not create an obstruction; and

(v) in the case of a stairway, suitable safe passage in relation to the nature, volume and frequency of likely usage.

***DP4** Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to -*

(a) the travel distance; and

(b) the number, mobility and other characteristics of occupants; and

(c) the function or use of the building; and

(d) the height of the building; and

(e) whether the exit is from above or below ground level.

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

(a) the number of storeys connected by the exits; and

(b) the fire safety system installed in the building; and

(c) the function or use of the building; and

(d) the number of storeys passed through by the exits; and

(e) fire brigade intervention

DP6 *So that occupants can safely evacuate the building, paths of travel to exits must have dimensions appropriate to—*

(a) the number, mobility and other characteristics of occupants; and

(b) the function or use of the building.

EP1.1 *A fire hose reel system must be installed to the degree necessary to allow occupants to safely undertake initial attack on a fire appropriate to -*

(a) the size of the fire compartment; and

(b) the function or use of the building; and

(c) any other fire safety systems installed in the building; and

(d) the fire hazard.

EP1.3 *A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to -*

(a) fire-fighting operations; and

(b) the floor area of the building; and

(c) the fire hazard.

EP1.4 *An automatic fire suppression system must be installed to the degree necessary to control the development and spread of fire appropriate to –*

(a) The size of the fire compartment; and

(b) The function or use of the building; and

(c) The fire hazard; and

(d) The height of the building.

EP2.2 *(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that -*

(i) the temperature will not endanger human life; and

(ii) the level of visibility will enable the evacuation route to be determined; and

(iii) the level of toxicity will not endanger human life.

(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to -

(i) the number, mobility and other characteristics of the occupants; and

(ii) the function or use of the building; and

(iii) the travel distance and other characteristics of the building; and

(iv) the fire load; and

(v) the potential fire intensity; and

(vi) the fire hazard; and

(vii) any active fire safety systems installed in the building; and

(viii) fire brigade intervention.

EP4.2 *Identification of exits*

To facilitate evacuation, suitable signs or other means of identification must, to the degree necessary—

(a) be provided to identify the location of exits; and

(b) guide occupants to exits; and

(c) be clearly visible to occupants; and

(d) operate in the event of a power failure of the main lighting system for sufficient time for occupants to safely evacuate.

6.3 FIRE BRIGADE OBJECTIVES

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

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

To satisfy the performance requirements of the BCA, fire fighters must have reasonable time to enter and exit a building to undertake fire brigade intervention activities before untenable conditions occur and prior to building collapse. The Performance Solutions will be assessed against the objectives of the fire brigades during fire brigade intervention activities. Where the relevant Performance Requirements of the BCA refer to Fire Brigade Intervention, the objectives of the fire brigades will be considered.

7.0 BCA DTS NON-CONFORMANCE ASSESSMENT

Table 3 summarises the Variations to the BCA DtS Provisions, the relevant BCA Performance Requirements, the Compliance and Assessment Methods, and the International Fire Engineering Guidelines (IFEG) Subsystems that have been considered in the Fire Engineering Analysis.

Table 3: Summary of Proposed Performance Solutions

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
1.	Clause C1.1 **Fire resistance levels**	Clause C1.1 requires a building of Type A construction to have a Fire Resistance Level (FRL) commensurate with the requirements of Table 3 of Specification C1.1. The single storey office at Ground Floor is proposed to be constructed of lightweight steel framework.	CP1 and CP2	A2.2(1)(a) and A2.2(1)(b)(ii) and A2.2(b)(d)	C and F
2.	Clause C1.1 **Fire resistance levels**	Clause C1.1 requires a building of Type A construction to have a Fire Resistance Level (FRL) commensurate with the requirements of Table 3 of Specification C1.1. The Ground Floor Mezzanine structure is proposed to retain the inherent fire resistance of the structure only in lieu of having fire protection applied.	CP1 and CP2	A2.2(1)(a) and A2.2(1)(b)(ii)	C and F
3.	Clause C1.1 **Composite construction**	Clause C1.1 requires a building of Type A construction to have a Fire Resistance Level (FRL) commensurate with the requirements of Table 3 of Specification C1.1. The warehouse is to be constructed in accordance with AS 2327:2017 i.e. the fire design adopts the slab panel methodology (which permits some beams within a floor to be left unprotected). The design is based on the standard fire curve.	CP1	A2.2(1)(a) and A2.2(1)(b)(ii)	C and F

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
4.	Clause C2.3 & C2.4 **Perimeter access**	Clause C2.3(b) requires a large isolated building with a floor area and volume of more than 18,000 m2 or 108,000 m3 to be provided with perimeter access complying with C2.4(b), being a roadway not less than 6 m wide not more than 18 m from the building. The following non-conformance have been identified: ▪ Vehicular access is not continuous around the perimeter of the building; and ▪ At the access control points (gates and security points) the width of the vehicular pathway is less than 6 m; and The pathway is not provided within 18m of a proportion of the external wall of the building on the northern side and south western corner side of the building.	CP9	A2.2(1)(a) and A2.2(1)(b)(ii)	F
5.	Clause C3.15 **Protection of service penetrations**	Clause C3.15 states that where an electrical, electronic, plumbing, mechanical ventilation, air-conditioning or other service penetrates a building element (other than an external wall or roof) that it is required to have an FRL with respect to integrity or insulation or a resistance to the incipient spread of fire. The automated processes building results in vertical penetration of services throughout the building. It is not proposed to fire separate the penetrations in accordance with Clause C3.15 nor Specification C3.15.	CP2 and CP8	A2.2(1)(a) and A2.2(1)(b)(ii)	B, C, E and F
6.	Clause D1.2 **Number of exits**	Clause D1.2 states that every building must have at least one exit from each storey. A preliminary review of the design has identified that there are a number of automated equipment zones on both the Ground Level and Level 1 to Level 3 that are enclosed or inaccessible and do not have clearly defined dedicated access to exits through the equipment.	DP2	A2.2(1)(a) and A2.2(1)(b)(ii)	E and F

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
7.	Clause D1.4 **Travel distances**	Clause D1.4(c)(i) states that no point on a floor must be more than 20 m from an exit, or a point from which travel in different directions to 2 exits is available, in which case the maximum distance to one of those exits must not exceed 40 m; and Clause D1.4(c)(ii) states in a Class 5 or 6 building, the distance to a single exit serving a storey at the level of access to a road or open space may be increased to 30 m. Travel distances in the building will exceed 20 m and 40 m to a point of choice and to the nearest exit respectively. Preliminary assessment indicates distances in the order of: ▪ 125 m to the nearest exit at Ground Level ▪ 40 m to point of choice at Ground ▪ 45 m to nearest exit on Central Mezzanine ▪ 100 m to the nearest exit on Level 1 to Level 3	DP4 and EP2.2	A2.2(1)(a) and A2.2(1)(b)(ii)	E and F
8.	Clause D1.5 **Travel between alternative exits**	Clause D1.5 states that exits that are required as alternative means of egress must be not more than 60 m apart. Travel distances between alternative exits will exceed 60 m. Preliminary assessment indicates distances in the order of: ▪ 225m between alternative exits at Ground Level ▪ 180m between alternative exits Level 1 to Level 3	DP4 and EP2.2	A2.2(1)(a) and A2.2(1)(b)(ii)	E and F
9.	Clause D1.6 **Width of travel paths**	Clause D1.6 states that in a required exit or path of travel to an exit the unobstructed width of each exit or path of travel to an exit, except for doorways, must be not less than 1 m. Throughout the building the path of travel is reduced to less than 1 m where access platforms and stairways complying with AS 1657 are utilised.	DP4 and DP6	A2.2(1)(a), A2.2(1)(b)(ii) and A2.2(2)(d)	E and F

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
10.	Clause D1.7 **Fire isolated stair discharge**	Clause D1.7(b) states that each fire-isolated stairway or fire-isolated ramp must provide independent egress from each storey served and discharge directly, or by way of its own fire-isolated passageway to: ▪ a road or open space; or ▪ to a point in a storey or space, within the confines of the building, that is used only for pedestrian movement, car parking or the like and is open for at least 2/3 of its perimeter; and from which an unimpeded path of travel, not further than 20 m, is available to a road or open space; or ▪ into a covered area that ○ adjoins a road or open space; and ○ is open for at least 1/3 of its perimeter; and ○ has an unobstructed clear height throughout, including the perimeter openings, of not less than 3 m; and ○ provides an unimpeded path of travel from the point of discharge to the road or open space of not more than 6 m. Clause D1.7(c)Where a path of travel from the point of discharge of a fire-isolated exit necessitates passing within 6 m of any part of an external wall of the same building, measured horizontally at right angles to the path of travel, that part of the wall must have— ▪ an FRL of not less than 60/60/60; and ▪ any openings protected internally in accordance with C3.4, for a distance of 3 m above or below, as appropriate, the level of the path of travel, or for the height of the wall, whichever is the lesser. Two of the fire isolated stairs discharge into the office lobby / reception area on the western side of the building. In addition, around the perimeter of the building fire isolated stairs discharge within 6 m of openings in the external wall.	DP4, DP5, EP2.2	A2.2(1)(a) and A2.2(1)(b)(ii)	B, C, D, E and F

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
11.	Clause D1.9 **Travel via non-fire isolated stairs**	Clause D1.9 states that a non-fire-isolated stairway or non-fire-isolated ramp serving as a required exit must provide a continuous means of travel by its own flights and landings from every storey served to the level at which egress to a road or open space is provided. In a Class 5, 6, 7, 8 or 9 building, the distance from any point on a floor to a point of egress to a road or open space by way of a required non-fire-isolated stairway or non-fire-isolated ramp must not exceed 80 m. Preliminary assessment indicates that the distances in the order of 140 m are evident and that the total distance from the discharge location is greater than 40 m.	DP4, DP5 and EP2.2	A2.2(1)(a) and A2.2(1)(b)(ii)	E and F
12.	Clause E1.3 **Fire hydrant**	Clause E1.3 states that a fire hydrant system must be provided in accordance with AS 2419.1. Clause 7.3(d) of AS 2419.1 states that the fire hydrant booster must be located more than 10m from the external wall of the building and within sight of the main entrance to the building. Clause 3.2.2.2 (e) of AS 2419.1 states that external hydrants must not be located within 10 m of the buildings unless they are safeguarded by construction having a FRL of not less than 90/90/90 extending 2 m each side of the hydrant outlet and 3 m above ground level. In the subject warehouse: ▪ The hydrant booster may not within sight of the main entry; and ▪ At Ground Floor a number of hydrants are located outside the building but are positioned beneath an awning and are proposed to considered as “external hydrants” for the purposes of coverage.	EP1.3	A2.2(1)(a) and A2.2(1)(b)(ii)	F
13.	Clause E1.4 **Fire hose reels**	Clause E1.4 requires a fire hose reel system must have fire hose reels installed in accordance with AS 2441:2005. It is not proposed to provide coverage to the automated zones on Ground Level, Level 1, Level 2 and Level 3.	EP1.1	A2.2(1)(a), A2.2(1)(b)(ii) and A2.2(2)(d)	A, C and D

No.	DtS Provisions	Variations to DtS Provisions	Performance Requirements	Compliance & Assessment Methods	IFEG Subsystems
14.	Clause E1.5 **Sprinkler system**	Clause E1.5 states that a sprinkler system must be provided in accordance with AS 2118.1:2017 Clause of 4.14.1 of AS 2118.1 requires a sprinkler booster assembly to be located in accordance with AS 2419.1. This requires the booster to be within sight of the main entrance to the building (refer to Clause 3.2.2.2 (e) of AS 2419.1). The sprinkler booster is not within sight of the main entry to the building.	EP1.4	A2.2(1)(a) and A2.2(1)(b)(ii)	F
15.	Clause E2.2 **Smoke hazard management**	In a Class 5, 6, 7, 8 or 9 building, which exceeds 18 000 m^2 in floor area or 108 000 m^3 in volume, the building must be provided with an automatic smoke exhaust system in accordance with Specification E2.2b. The smoke hazard management system in the building shall be rationalised in relation to: ▪ Smoke exhaust quantities which vary from that of Figure 2 of Specification E2.2b; and ▪ Smoke reservoir size in accordance with Clause 4 of Specification E2.2b.	EP2.2	A2.2(1)(a) and A2.2(1)(b)(ii)	B, E and F
16.	Clause E4.6 **Emergency exit signage**	Clause E4.6 states that if an exit is not readily apparent to persons occupying or visiting the building then exit signs must be installed in appropriate positions in corridors, hallways, lobbies, and the like, indicating the direction to a required exit. On Level 1 to Level 3 the central area of the floor plate is inaccessible to occupants during normal operating conditions. It is proposed to rationalise the directional exit signage arrangement throughout the area.	EP4.2	A2.2(1)(a) and A2.2(1)(b)(ii)	E

8.0 DESIGN FIRE SAFETY STRATEGY

The design strategy is based on early detection and warning of fire in order to preserve life by facilitating speedy evacuation from the premises.

When considering the factors that will influence escape related to the risk profile and occupancy levels of the building the stages in the process of escape and the maximum distances people can be expected to travel. Escape is generally considered in four distinct stages as follows:

- Stage 1 – escape from the room or area of fire origin
- Stage 2 – escape from the compartment of origin via the circulation route to a protected stairway or an adjoining compartment offering refuge
- Stage 3 – escape from the floor of origin to the ground level
- Stage 4 – escape at ground level away from the building.

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 development, and as such have been generally derived from the preventative and protective measures outlined within the BCA, and fire engineering literature and research.

Where items of non-compliance have not been identified by the design team in the concept design it is considered that those items are to be deemed-to-satisfy solutions.

The specified Fire Safety Strategy will undergo analysis as part of the Fire Engineering Report to ascertain whether the relevant Performance Requirements of the BCA are satisfied.

The Fire Safety Strategy will incorporate the following elements:

8.1 FIRE RESISTANCE

In addition to life safety, the potential impact of a fire on the client and end users ability to provide business activities, as a result of loss of facility, working capability or denial of access is considered. Beyond the passive and active fire safety measures introduced for life safety, there is scope to make provision to limit the extent of fire and smoke spread, reducing the time and cost associated with reinstatement, and minimising business interruption.

Wherever practicable, to secure property protection, the guiding strategy for compartmentation is to restrict the spread of fire to the room of origin.

The subject development shall fully comply with the DTS provisions of Section C of the BCA (Parts C1, C2 & C3) with the exception of the following.

Fire rating to the Ground Floor Office

1. The internal and external columns supporting the non-fire rated roof of the single storey office at Ground Floor are not required to be fire rated.

Working Platforms / Mezzanine

1. The Ground Floor Warehouse Mezzanine structures shall be constructed of structural steel having an exposed surface area to mass ration (ESA/M) of not greater than 26 m^2/tonne for columns and 30 m^2/tonne for beams provided that the mezzanine are independent of the main warehouse structure.

Stairs above Ground Floor Office Roofing

1. Where the roof of the office is lower than the fire isolated stairs that pass through the office, the fire rating bounding the fire isolated stair is to extend not less than 1.5 m above the covering of the lower roof.
2. Any equipment located on the roof top deck is to be located not less than 6 m from the face of the glazing to the fire isolated stairs.
3. The lower roof is to be constructed of steel construction and be screw fixed.

Discharge of stairs into the Ground Floor lobby

4. The Ground Floor office lobby is to be separated from the adjoining rooms by construction having an FRL for structural adequacy, integrity and insulation (as the case requires) of 60 minutes (refer to Figure 11). The construction shall meet the following level of performance.

    i. Walls having an FRL of (120/120/120) in accordance with Clause C2.7a of the Building Code of Australia (NCC Vol. 1)

    ii. Self-closing (or automatic closing) doors having an FRL of -/120/30 in accordance with Clause C3.5(b) of the Building Code of Australia (NCC Vol. 1)

    Note: Doors to the FDCIE and Fire Hose Reel cabinets do not need to be fire rated.

    iii. Signage on doors shall be applied in accordance with Clause D2.23 of the Building Code of Australia (NCC Vol. 1)

    iv. Openings for service installations in accordance with Clause C3.15 of the Building Code of Australia (NCC Vol. 1)

    v. Construction joints in accordance with Clause C3.16 of the Building Code of Australia (NCC Vol. 1)

    a. The door which opens into the lobby from the fire stairs is to be provided with a vision panel complying with the provisions of Clause 2.5 of AS 1905.1:2015.

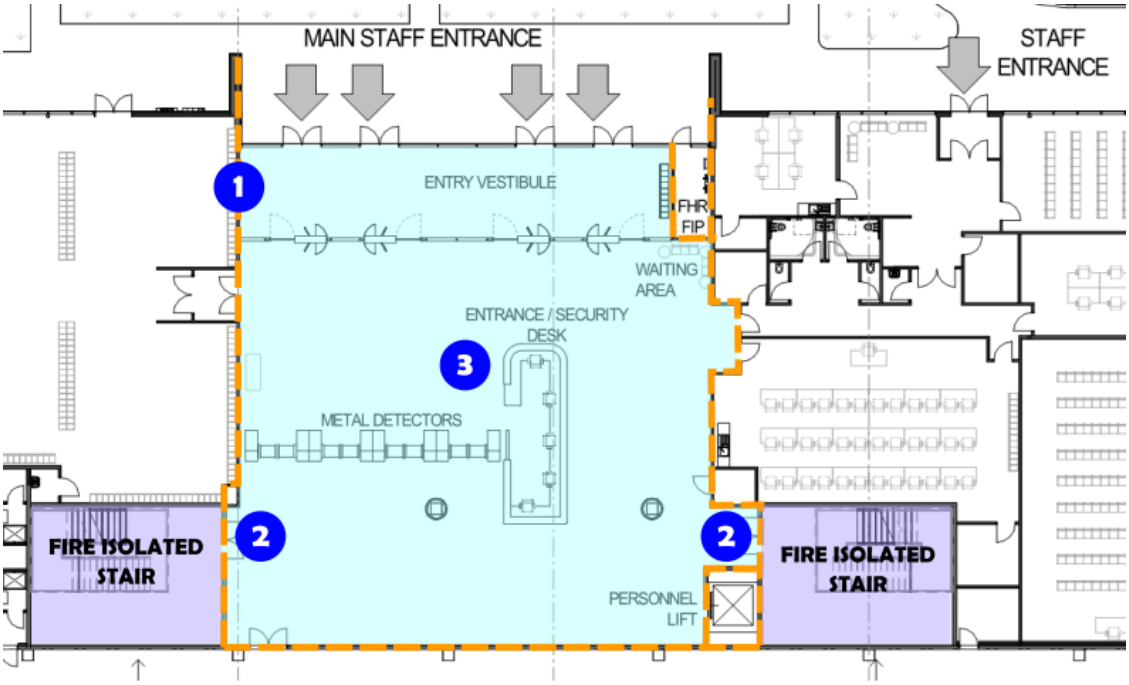
    b. At Ground Level, on the internal (stair side) face of the door a sign in 25 mm high lettering of a contrasting colour is to be erected. The signage shall state the following, or similar

    CAUTION - IF LOBBY IS OBSTRUCTED EXIT VIA LEVEL 1

    At level 1, on the internal (stair side) face of the door a sign in 25 mm high lettering of a contrasting colour that identifies the floor level is to be erected. All signage shall be fixed between 1,500-1,800mm above floor level, and shall comprise of permanent durable construction, such as anodized metal.

    c. The door(s) that provide access to the Ground Floor office lobby are to be self-closing or automatic closing **hinged doors**. Where automatic closing, the operation must be initiated by the activation of a smoke detector installed in accordance with the relevant provisions of AS 1670.1:2018 and located on each side of the door not more than 1.5 m horizontal distance from the opening.

    d. Where parts of the wall utilise glazed panes the glazing shall protected with wall wetting sprinklers. The glazing shall comprise of at least 6mm thick heat strengthened toughened safety glass in accordance with AS 1288:2006.



LEGEND

1. **120/120/120 (load-bearing) or -/120/120 fire rating to the underside of the roof above. Self-closing (or automatic closing) doors having an FRL of -/120/30 in accordance with Clause C3.5(b) of the Building Code of Australia (NCC Vol. 1)**
   Where parts of the wall utilise glazed panes, the glazing shall be protected with wall wetting sprinklers on the opposite side of the lobby. The glazing shall comprise of at least 6mm thick toughened safety glass in accordance with AS 1288.
2. **Vision Panel to fire stair discharge door in accordance with Clause 2.5 of AS 1905.1**
   At Ground Floor on the internal (stair side) face of the door a sign in 25 mm high lettering of a contrasting colour is to be erected. The signage shall state the following or similiar:
   CAUTION - IF LOBBY IS OBSTRUCTED EXIT VIA LEVEL 1
3. **Lobby to be a separate fire detection zone to the remainder of the Ground Floor.**

Figure 11: Proposed Lobby Protection Measures

Protection of Vertical Transport Chutes and Spirals

1. Vertical Transport Chutes and Spiral are to be contained in enclosing construction having an FRL of 240/120/120 (load bearing) or -120/120 (non-loadbearing) refer to Figure 12 and Figure 13.

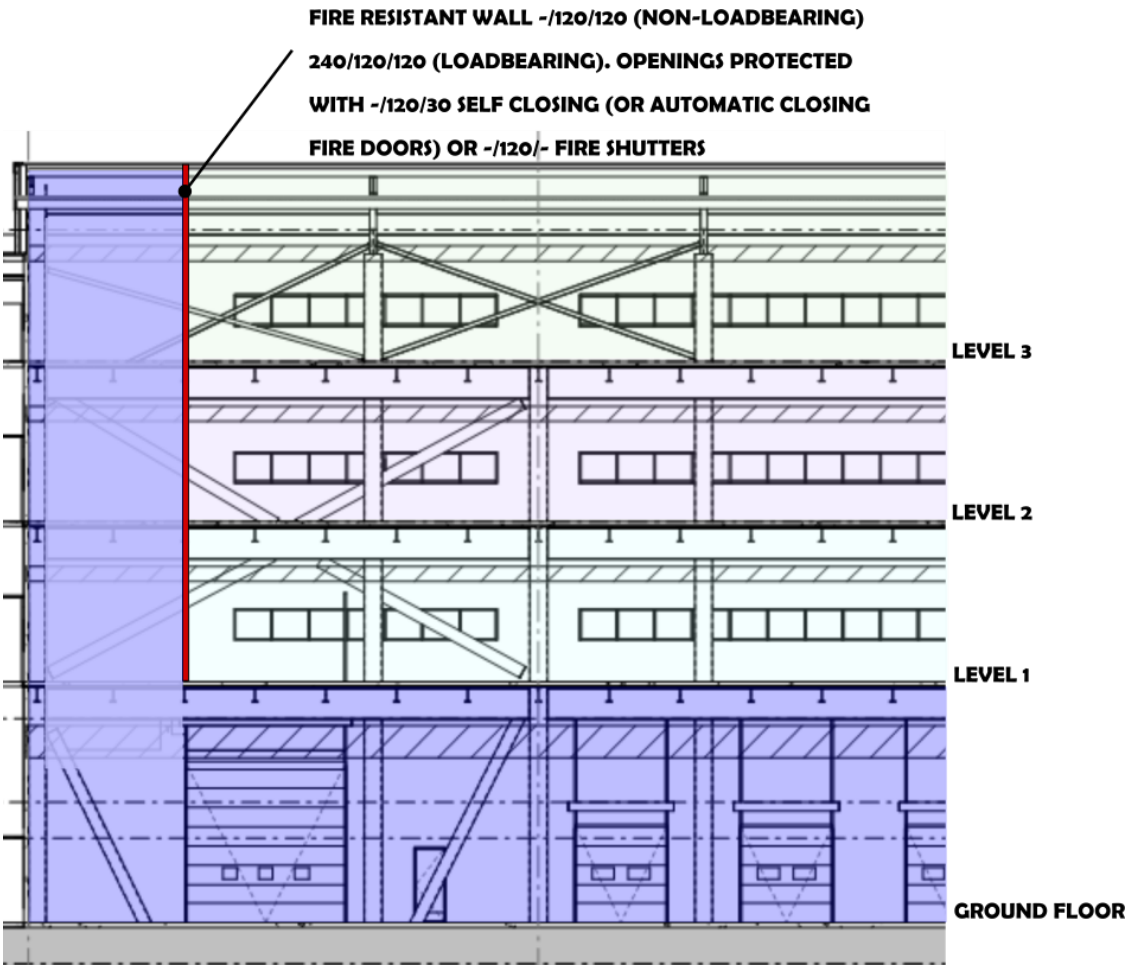
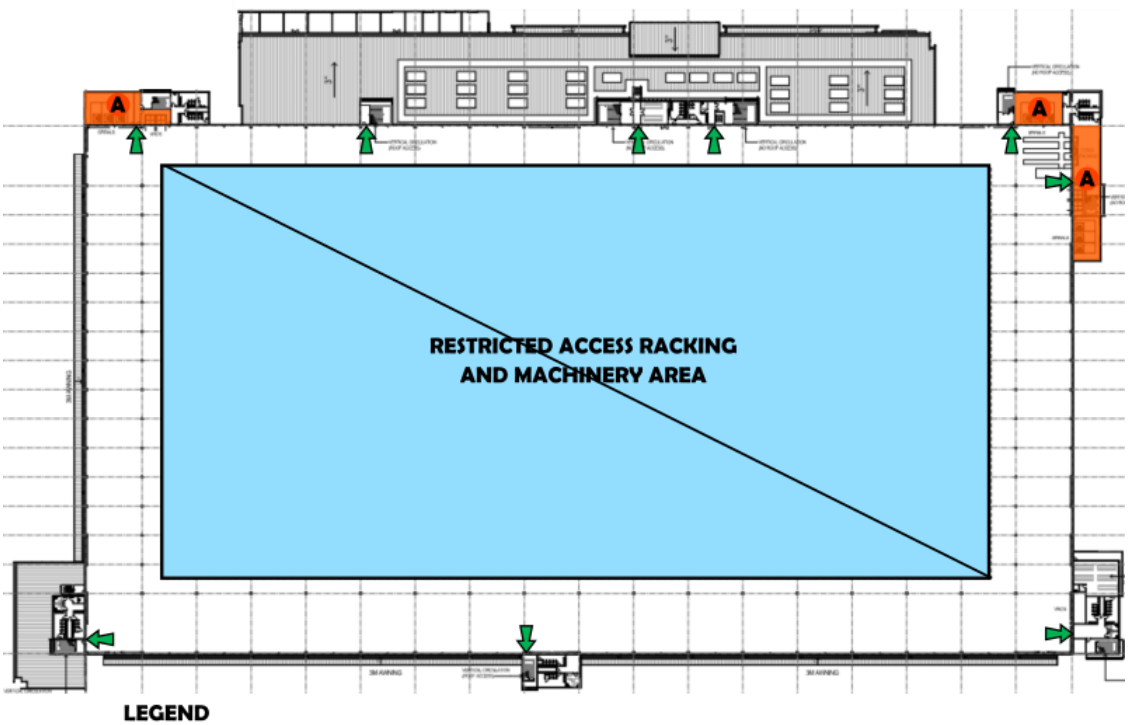


Figure 12: Indicative section through goods transport shaft

Fire shutters that achieves an FRL of -/120/30 shall be provided to protect the opening into the vertical chute and spiral locations shown in Figure 13



2. **Figure 13**. The fire shutter shall comply with the relevant provisions of AS 1905.2 and shall incorporate the following specific features:

   - The fire rated shutter shall automatically close upon activation of a fire alarm within the building and / or fusible link and / or fire detector (deemed suitable in accordance with AS 1670.1) located centrally not more than 1.5m horizontal distance from the opening formed by the fire shutter.
   - A red strobe light shall be provided above the fire shutter and shall automatically activate upon fire alarm.
   - Permanent line markings (e.g. yellow strips or tiger tails), at least 1m in width, shall be provided on the floor on both sides of the fire shutter to minimise obstructions being placed within the immediate area of the fire shutter.
   - Signage shall be provided on the fire shutter stating:

     WARNING — FIRE SHUTTER

     The sign shall be in capital letters at least 50 mm high in a colour contrasting to the background and shall be of fade resistant and weatherproof construction (e.g. anodized metal).
   - The fire shutter shall be protected with sprinklers located not more than 500 mm horizontal distance from the opening formed by the fire shutter.

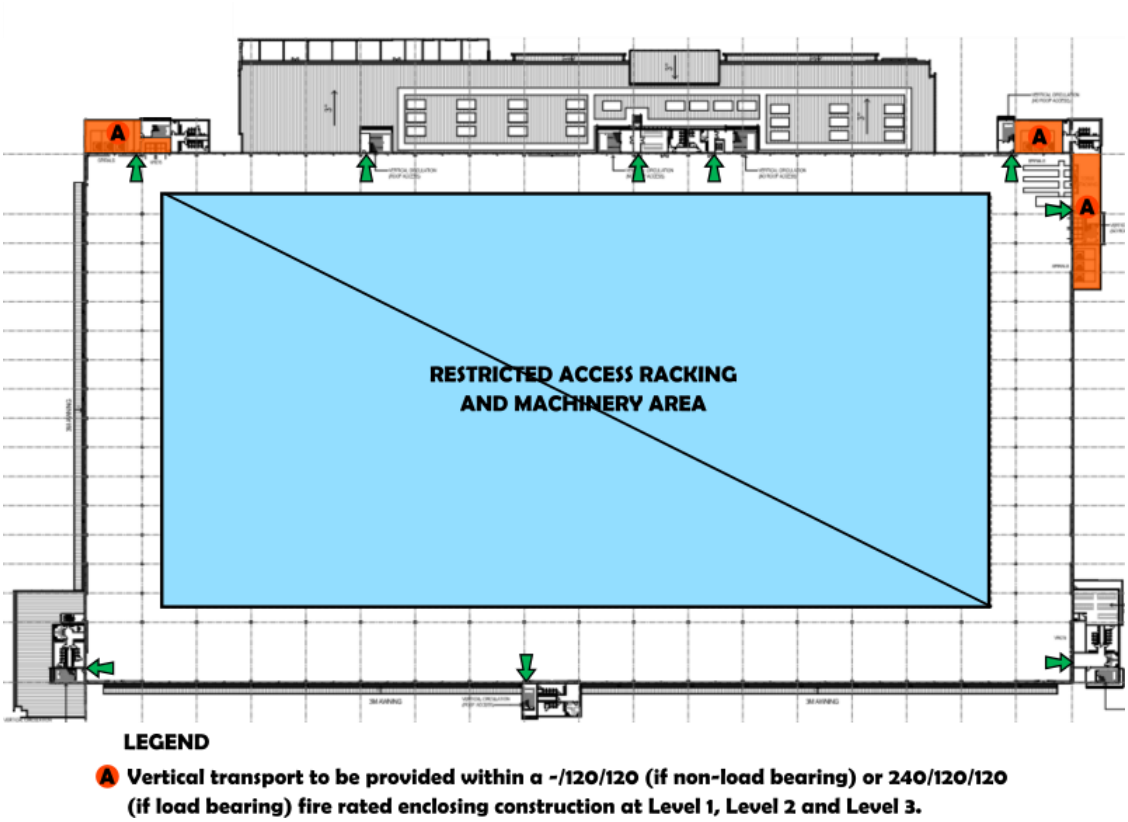


Figure 13: Vertical Material Transport lifts and spiral separation

Note: The composite warehouse structure shall comply with AS/NZS 2327:2017 using the standard fire curve for four (4) hours.

This permits the omission of protection of secondary beams.

8.2 ACCESS AND EGRESS

Means of escape travel distances will be in accordance with the relevant distances identified in the BCA Assessment Report and the Fire Engineering assessment provided that through the application of fire engineering principles, distances can be increased in response to identified need or design requirements.

During the design phase, every effort will be made to avoid dead-end conditions and inner room situations where an extended travel path exists. Where dead-end corridors exist distances will be limited to the degree necessary having regard to the nature of access to the area and the geometry of the enclosure.

Therefore the subject development shall fully comply with the DTS provisions of Section D of the BCA (Parts D1, D2 & D3), except for the design variations addressed in any Performance Solution.

Working Platforms / Mezzanine

Access to, on and from the Ground Floor Warehouse Mezzanine structures shall be provided by stairs, walkways and platforms that comply with AS 1657:2018.

8.3 SERVICES AND EQUIPMENT

The subject development shall fully comply with the DTS provisions of Section E of the BCA (Parts E1, E2, E3 & E4), except for the design variations summarised in the Performance Solution, and the following specific requirements.

NOTE: Reference shall be made to the Fire Safety Schedule for the subject development for the list of required fire safety systems and measures, and the relevant Standards of Performance.

Fire Hydrants

Note: The fire hydrant system needs to be designed in consultation with FRNSW.

3. A fire hydrant system shall be installed in accordance with Clause E1.3 of the BCA and the relevant provisions of AS 2419.1:2005, except:
    a. External hydrant valves are permitted to apply the concession for the radiant heat shields in sprinkler protected buildings as detailed in the Performance Solution and AS 2419.1:2017.
    b. Dual hydrant valves external to the building envelope but positioned under the awning shall be treated as external hydrants for the purpose of coverage. They are to be provided with permanent all-weather fade resistant signs which state in text not less than 25 mm in height:

       "External Hydrant – 2 Hose Lengths Required"

    c. Hydrant valves are to be located around the perimeter of the restricted access / processing zone on Level 1, Level 2 and Level 3 and within the restricted access / robotic zone as decided with the local fire brigade.
    d. When internal hydrants are provided a localised block plan should be provided at every hydrant pictorially and numerically illustrating the location of the next available additional hydrant.

       These localised block plans should be at least A4 size and be of all-weather fade resistant construction.
4. All fire hydrant valves shall be fitted with Storz aluminium alloy delivery couplings manufactured and installed in accordance with Clauses 7.1 and 8.5.11.1 of AS 2419.1:2005. All hydrant valves shall possess a forging symbol and manufacturers mark and shall comply with Fire & Rescue NSW Fire Safety Guideline Technical Information (D15/45534).

Fire Hose Reels

1. A fire hose reel system shall be installed in accordance with Clause E1.4 of the BCA, and the relevant provisions of AS 2441:2005 except that 50 m hose lengths (54 m coverage) may be utilized in the warehouse.

   Coverage shall be achieved by providing not more than 2 changes in direction on any hose run.

   Fire hose reel coverage is not proposed to be provided throughout the restricted access / robotic field.

Portable Fire Extinguishers

1. Portable fire extinguishers shall be installed in accordance with Clause E1.6 of the BCA, and the relevant provisions of AS 2444:2001.
2. Subject to resolution of the hydrant coverage design additional portable fire extinguishers may be provided at strategic locations around the perimeter of the robotics zone.

Fire Sprinkler System

1. A sprinkler system in accordance with Building Code of Australia (NCC Vol. 1) Clause E1.5 and the relevant provisions of AS 2118.1:2017 and relevant FM Global data sheets. The sprinkler system shall meet the following performance criteria:
    a. The sprinkler design shall be undertaken on the basis that a high hazard system shall be installed throughout the warehouse.
    b. Early suppression fast response (ESFR) sprinklers in the warehouse.
    c. The sprinkler response time index (RTI) is to be no greater than 50 $m^{0.5}s^{0.5}$.
    d. Sprinkler activation temperature no greater than 68°C (below the ceiling) in the office and the warehouse where appropriate.
    e. Higher temperature sprinkler heads are permitted directly below the roof covering in these areas as stipulated within the relevant provisions of AS 2118.1:2017.
    f. Sprinklers under awnings are to be in accordance with the relevant requirements of AS 2118.1:2017.
2. Where glazing is utilised in the wall separating the ground floor reception lobby from the remainder of the building it shall be protected internally (i.e. tenancy side) with wall wetting sprinklers.
    a. The wall wetting sprinklers shall be fit for purpose and installed in accordance with AS 2118.2:2010 and the manufacturer's specification.
    b. Coverage shall not be impeded by any mullions and transoms.
    c. The hydrant, sprinkler and wall wetting sprinkler demand shall be calculated based on simultaneous operation.
    d. The wall wetting sprinklers supply must have a capacity of not less than 60 minutes.
    e. The wall wetting system shall incorporate a labelled system isolating valve, secured in the open position by a padlocked chain.

Detection System

1. Smoke detection and alarm system is to be installed throughout the building in accordance with Clause E2.2 of the BCA and the relevant provisions of Section 7 of AS 1670.1:2018 for a smoke control system.
2. The ground floor reception lobby is to form **a separate fire detection zone** (refer to Figure 11). In the event of general fire alarm **in this zone** (the **"lobby" zone**) the following shall occur:
    a. The doors of the two stairs that discharge into the lobby shall not be locked from the inside (Level 1) and outside (Ground Floor) so as to permit re-entry into the stair.
    b. The dynamic exit signage located on Level 1 to Level 3 shall display an illuminated "Red X" (refer to Emergency lighting and Exit Signs below).

Building Occupant Warning System

1. A building occupant warning system in accordance with Building Code of Australia (NCC Vol. 1) Clause E2.2 and AS1670.1:2018.

    The evacuation signal 1 shall include the words such as "Fire" and "Evacuate" inserted in the time period provided in ISO 8201, or a site-specific voice message as provided for in AS 4428.16.

Smoke Hazard Management

1. A smoke exhaust is to be provided in the warehouse. The system is to be designed so that each level operates in isolation. The smoke hazard management system shall:
    a. Incorporate fans designed to operate at 200°C for a period no less than 60-minutes and fire rated cabling; and
    b. Have a capacity at least equal to one enclosure air change per hour (TBC) so that the smoke layer height is maintained to the degree necessary to facilitate fire brigade intervention; and
    c. Shall be initiated automatically by the smoke detection system. The controls together with operating instructions for use by emergency personnel must be provided adjacent to the fire indicator panel in accordance with the requirements of clauses 4.11 and 4.13 of AS/NZS 1668.1.
    d. Make up air is to be provided by permanently open or louvre/dampers that automatically open on fire detection at low level.

Manual Call Points

1. Manual call points connected to the FDCIE are to be provided at each fire isolated stair entry point and at the FDCIE.

Emergency Lighting and Exit Signs

1. Emergency lighting and exit signs shall be installed in accordance with Clauses E4.2, E4.4, E4.5, E4.6 and E4.8 of the BCA, and the relevant provisions of AS 2293.1:2018 except as permitted herein.

    The exit signage installed on, above or adjacent to the two stairs that discharge into the Ground Floor reception lobby on Level 1 to Level 3 to nominate the required exit shall be dynamic and activate in fire mode.

    The dynamic exit sign shall incorporate a “Red X” (e.g. Clevertronics Pty Ltd or Hochiki Pty Ltd RED-X sign) over the face of the signage plate when the zone is activated.

    Adjoining signs are to incorporate a “Dynamic Green” sign that provides positive reinforcement to occupants.

    Refer to Figure 14 and Figure 15 for graphic illustration of the operational intent.

    The sign shall be installed in accordance with AS 2293.1:2018 and the manufacturer’s specification.

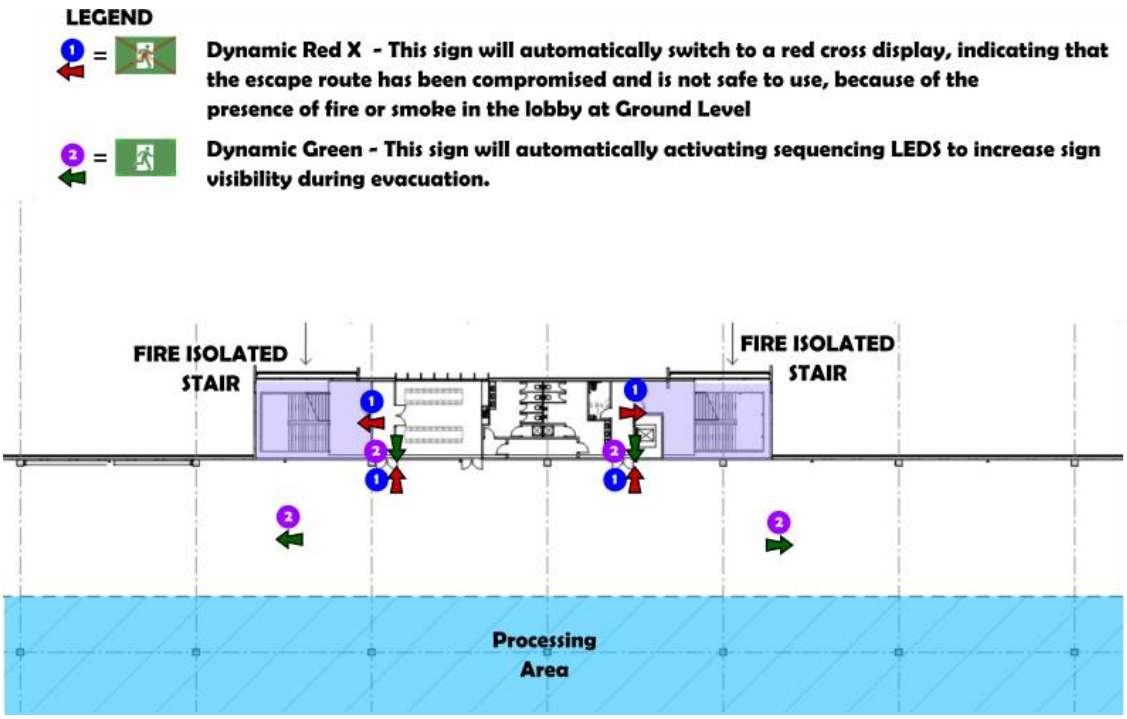


Figure 14: Fire Detected in " Ground Floor Lobby Zone" – Dynamic Exit Sign to Stair operates with negative reinforcement and alternate signs operate with positive dynamic green reinforcement (Typical Level 1 to 3)

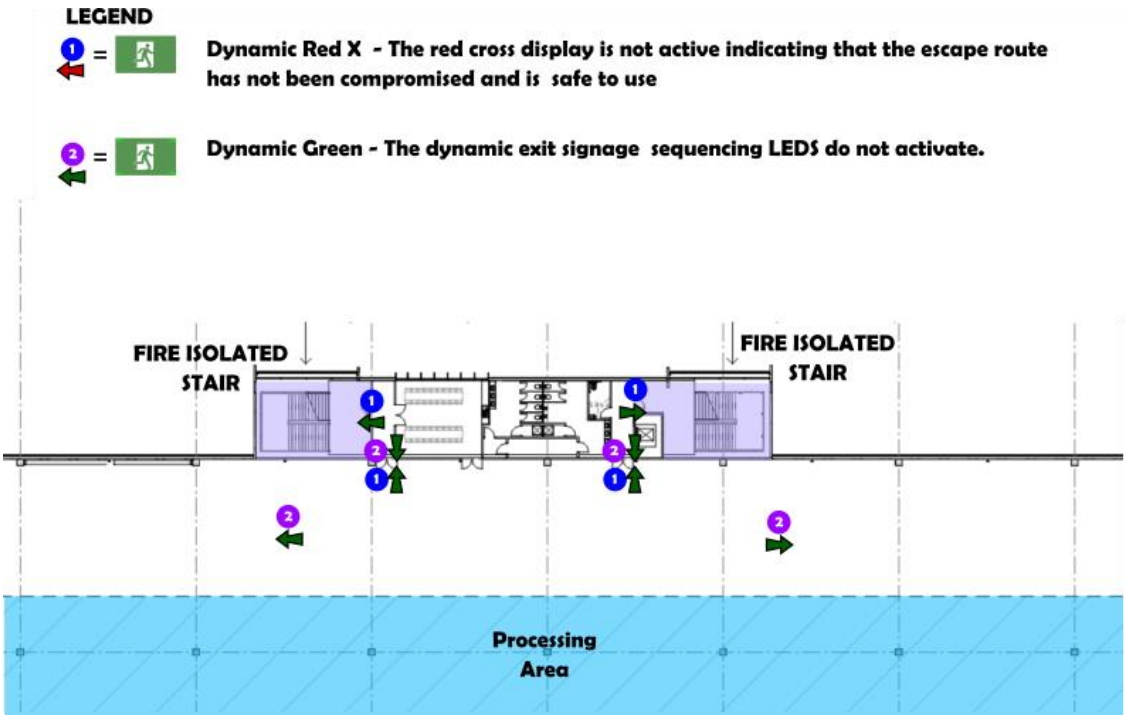


Figure 15: Fire Detected in any zone other than Ground Floor Lobby Reception Zone – Dynamic Exit Sign to Stairs maintains standard operation (Typical Level 1 to 3)

Perimeter Access

1. Access around or passing by an immovable object (e.g. building, structure, bollard, pylon, gate or vehicular barrier) shall have a clear width of not less than 3.2 m as per the FRNSW Fire Safety Guideline "Access for fire brigade vehicles and firefighters".
2. Gates and security checkpoints in the emergency vehicle travel path are to be secured with a loose chain and 003 type padlock or be provided with locking devices that can be unlocked by key (i.e. provided to the two nearest local fire stations) and be manually released or operated onsite (i.e. manual override).
3. A designated hardstand area shall be provided adjacent to the fire sprinkler tank suction connections in accordance with FRNSW Policy Guide Sheet No. 5.

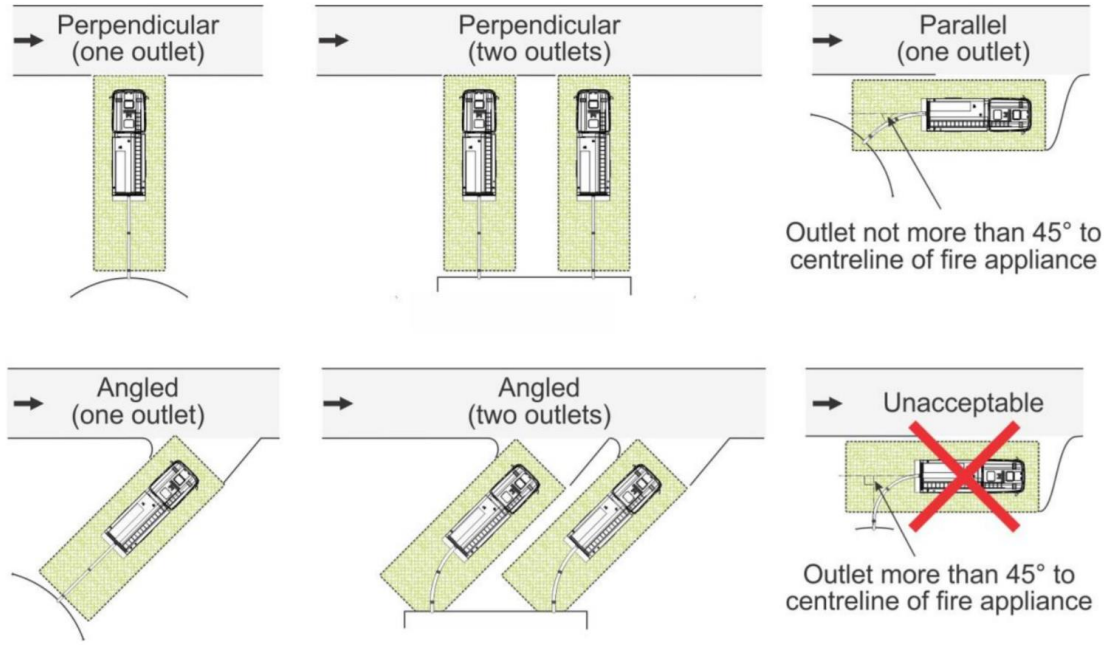


Figure 16: Excerpt of FRNSW hardstand orientation (Source: FRNSW Fire Safety Guideline "Access for fire brigade vehicles and firefighters").

8.4 MANAGEMENT AND USE

1. The following specific management procedures are recommended
   a. The restricted access / robotics zone is to be secured so that free and ready access is not available to general members of staff. Access is to be undertaken in accordance with procedures and protocols prepared and documented by the end user.
   b. An emergency management plan (EMP) shall be prepared in accordance with AS 3745:2010. The EMP shall incorporating first attack firefighting training for the Emergency Planning Committee and Emergency Control Organisation members and emergency procedures which reinforce containment of fires only where safe to do so.

      In the design the evacuation strategy will aim to apply a simultaneous single stage evacuation throughout the building. As a consequence, fire detection and alarm system design and performance, as well as building evacuation plans will be tailored to support this strategy.
   c. An emergency services information package (ESIP) is to be prepared for the building in accordance with FRNSW Community Safety Directorate's Fire Safety Guideline on Emergency Services Information Package and Tactical Fire Plans. A copy of the ESIP is to be provided to FRNSW.

d. In addition to the general provisions documented in the building's emergency management plan specific procedures relating to fire events in the processing area are to be provided.

   The plan shall account for emergency events during business hours and include an after hours call out procedures.

   The plan is designed to ensure that appropriate resources are dedicated to help brief emergency service personnel on the hazard within the building and help to facilitate access.

   Thereafter the emergency management plan shall ensure that nominated staff have sufficient authority to be able to act on the instructions of the emergency service's senior officer and assist in the provision of equipment and or necessary resources to facilitate emergency service operational procedures.

e. Warning signage is to be provided adjacent to the FDCIE (i.e Fire Indicator Panel). The signage shall pictorially show the location of the automated equipment and be permanent and fade resistant which states in text not less than 25 mm in height:

   CAUTION

   Automated Equipment may be operating within this building.

   FRNSW are not to access the processing area without staff instruction.

f. Emergency stop controls are to be provided to the automatic equipment. Safe Work Method Statements (SWMS) or similar procedures shall be developed and maintained that nominate:

   i. Positioning of stop controls in prominent, clearly and durably marked and immediately accessible to each operator of the plant;

   ii. handles, bars or push buttons associated with the stop control are coloured red

   iii. the stop control cannot be adversely affected by electrical or electronic circuit malfunction

   iv. Where the equipment is designed to be operated or attended by more than one person and more than one control is fitted, the multiple controls must be of the "stop and lock-off" type so that the plant cannot be restarted after a stop control has been used unless each activated stop control is reset.

2. A Management in Use system where all required fire safety systems / measures are subjected to the relevant maintenance regimes nominated in AS 1851:2012. The Management in Use system shall also incorporate the following measures as a minimum:

   a. A no smoking policy within internal public areas.

   b. Routine maintenance of all plant and equipment.

   c. Routine maintenance of all fire safety systems and equipment.

   d. Regular emptying of rubbish bins.

   e. Ensuring paths of travel to exits are kept free of anything that may obstruct or impede the free passage of persons.

   f. Ensuring all exit doors are functional, and all statuary signage is in place.

9.0 REFERENCES

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