Core Engineering Group • Fire • Risk • Emergency Management

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12 October 2015 | Updated Draft Issue | Report No. s131441_FSS_02

Fire Engineering Report

Crown Tower

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Report Details

Project: Crown Tower, Lime Street, Barangaroo, NSW

Document: Fire Safety Strategy

Report No.: s131441_FSS_03

Report Revision History

REV	DATE ISSUED	COMMENT	PREPARED BY	REVIEWED AND VERIFIED BY
01	19/03/14	Draft Issue for comment	**Kailas Prasannan** B.Eng (Architectural) Grad. Cert. (Performance based Building and Fire Codes)	**Sandro Razzi** B.Eng (Building) Grad. Dip. (Performance Based Building & Fire Codes) Accredited Fire Engineer BPB 0501 MIEAust CPEng 2180287
02	15/08/14	Updated Draft Issue		
03	12/10/2015	Updated Draft Issue	**Sandro Razzi** B.Eng (Building) Grad. Dip. (Performance Based Building & Fire Codes) Accredited Fire Engineer BPB 0501 MIEAust CPEng 2180287	

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1 INTRODUCTION

1.1 OVERVIEW

This Fire Safety Strategy has been undertaken to nominate proposed Alternative Solutions for assessing compliance with the nominated performance requirements of the BCA [1] in accordance with the methodologies defined in the IFEG [3].

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

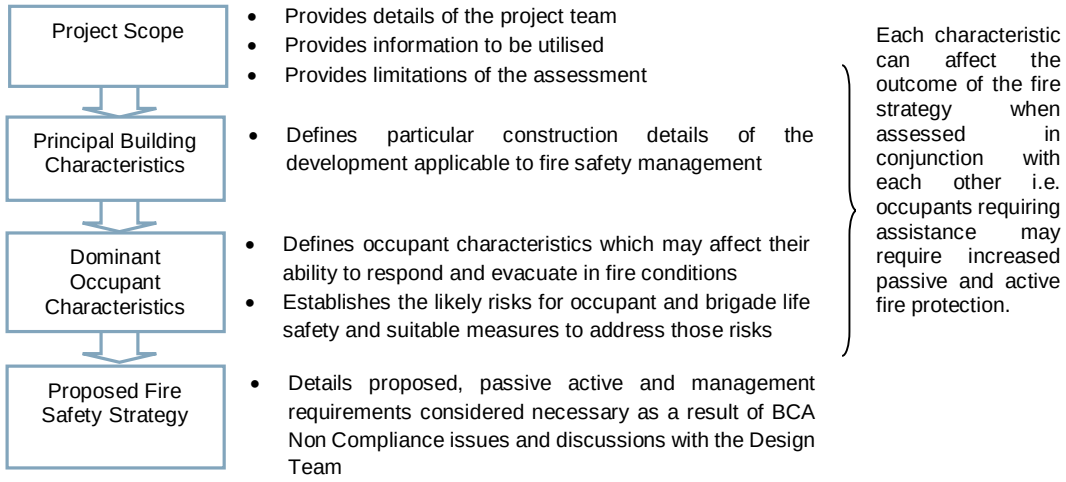


Figure 1-1: Fire Safety Strategy Process

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

1.2 FIRE SAFETY OBJECTIVES

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

1.2.1 Building regulatory objectives

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

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

the proposed building design and fire safety systems would minimise the risk of fire spreading from one building to another.

1.2.2 Fire Brigade objectives

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

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

1.2.3 Non-prescribed objectives

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

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

1.3 REGULATORY FRAMEWORK OF THE FIRE ENGINEERING ASSESSMENT

1.3.1 Building Code of Australia

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

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

(a) complying with the Deemed-to-Satisfy Provisions; or

(b) formulating an Alternative Solution which –

  (i) complies with the Performance Requirements; or

  (ii) is shown to be at least equivalent to the Deemed-to-Satisfy Provisions or

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

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

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

(e) Verification Methods such as:

  (i) the Verifications Methods in the BCA; or

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

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

(g) Expert Judgment.

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

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

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

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

1.3.2 International Fire Engineering Guidelines

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

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

2 PROJECT SCOPE

2.1 PROJECT SCOPE

The Crown Hotel Tower in Sydney is one the most prestigious construction projects in recent years and will add a new landmark to Sydney's growing skyline. The tower itself with a height of more than 250m has its own unique engineering design challenges across various disciplines.

This document has been prepared by CORE Engineering Group (formerly known as RAWFiRE Safety Engineering) to provide advice and propose solutions to the client, design team, project managers and all other interested parties in regards to the proposed fire safety strategy for the building as a whole.

2.2 RELEVANT STAKEHOLDERS

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

Table 2-1: Relevant Stakeholders

ROLE	NAME	ORGANISATION
Client Representative	Daniel Prince Jason Redgrave	Crown Melbourne
Architects	Alex Kyriakides Thomas Ibbitson Etain Fitzpatrick David Campos	Wilkinson Eyre Architects (London)
	Julian Anderson Robert Moore Mark Pellen	Bates Smart (Sydney)
Principal Certifying Authority	Stephen Natilli Brigitte Thearle	McKenzie Group Consulting
Fire Safety Engineer	Sandro Razzi	CORE Engineering Group

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, 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 clients decision to involve such parties, especially local fire brigade, to ensure a transparent and adequate fire safety solution for all. Where we are not notified of the inclusion of such parties it is assumed the client / representative has given due consideration to the above.

2.3 SOURCES OF INFORMATION

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

- BCA Assessment Report - Crown Hotel, prepared by Brigitte Thearle of McKenzie Group Consulting, dated 28 February 2014, ref: 064811-03BCA
- Updated schedule of Alternative Solutions, prepared by Brigitte Thearle of McKenzie Group Consulting, dated 26 February 2014, ref: 064811-08EM
- CAN: Emergency Egress Strategy (concept), Revision 01, prepared by RAWFiRE Safety Engineering, dated 13 December 2013
- Architectural Plans provided by Wilkinson Eyre, dated 02 July 2014.

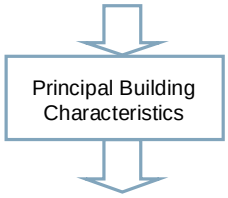
2.4 LIMITATIONS AND ASSUMPTIONS

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

- The report is specifically limited to the project described in Section 2.1.
- The report is based on the information provided by the team as listed above in Section 2.3.
- Building and occupant characteristics are as per Section 3 and 4 respectively of this report. Variations to these assumptions may affect the Fire Engineering Strategy and therefore they should be reviewed by a suitably qualified Fire Engineer should they differ.
- As per any building design, DtS or otherwise, the report is limited to the fire hazards and fuel loads as prescribed. The report does not provide guidance in respect of areas, which are used for bulk storage, processing of flammable liquids, explosive materials, multiple fire ignitions or sabotage of fire safety systems.
- The development complies with the DtS provisions of the BCA [1] with all aspects unless otherwise specifically stated in this report. Where not specifically mentioned, the design is expected to meet the BCA DtS requirements of all relevant codes and legislation at the time of construction and / or at the time of issue of this report.
- The assessment is limited to the objectives of the BCA and does not consider property damage such as building and contents damage caused by fire, potential increased insurance liability and loss of business continuity.
- Malicious acts or arson with respect to fire ignition and safety systems are limited in nature and are outside the objectives of the BCA. Such acts can potentially overwhelm fire safety systems and therefore further strategies such as security, housekeeping and management procedures may better mitigate such risks.
- This report is prepared in good faith and with due care for information purposes only, and should not be relied upon as providing any warranty or guarantee that ignition or a fire will not occur.
- The Fire Engineering Strategy is only applicable to the completed building. This report is not suitable, unless approved otherwise, to the building in a staged handover.
- Where parties nominated in Section 2.2 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.

3 PRINCIPAL BUILDING CHARACTERISTICS

3.1 OVERVIEW



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

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

3.2 BUILDING DESCRIPTION

The design of the building takes inspiration from flower petals, thus giving it a non-cubic plan/form. This unique plan gives rise to an iconic building that offers views of Sydney's harbour, the Harbour Bridge and the Opera House.

3.2.1 Site Location and Context

Barangaroo is located on the north western edge of the Sydney Central Business District (CBD), bounded by Sydney Harbour to the west and north; the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east; and a range of new development dominated by large CBD commercial tenants and the King Street Wharf/Cockle Bay precinct to the south.

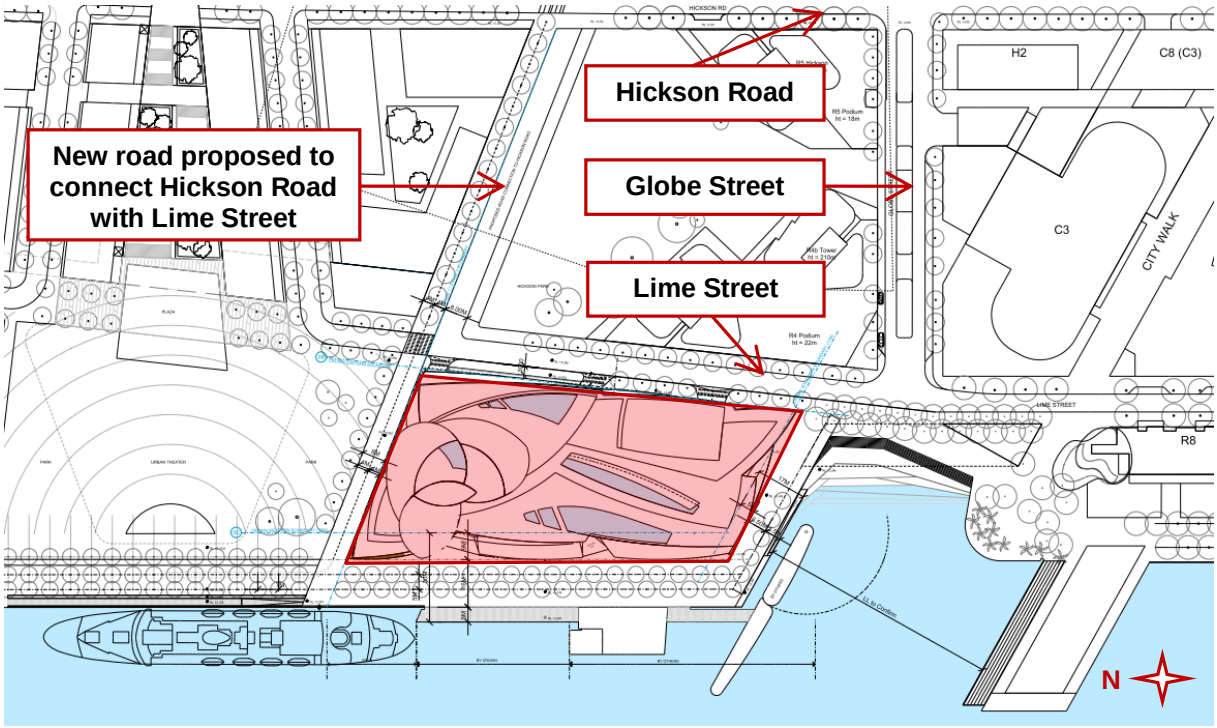


Figure 3-1: Context plan showing extent of Crown boundaries

The 22ha Barangaroo site is generally rectangular in shape and has a 1.4 kilometre harbour foreshore frontage, with an eastern street frontage to Hickson Road. The site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Barangaroo Central and Barangaroo South. Figure 3-1 indicates the proposed site of the building in the north-western corner of Barangaroo South.

The detailed design, construction and use of an hotel, casino and residential apartment building with associated retail, restaurant and commercial uses and a basement car park to accommodate parking and servicing allocated to the proposed uses within the development, comprising a total Gross Floor Area of approximately 77,500m^2 and a maximum building height of approximately 271 metres (RL 275).

3.2.2 Floor-by-floor breakdown

The building shall be Type A construction. The following table details the various functions of different spaces in the building:

Table 3-1: Type of occupancies

LEVELS		MAIN FUNCTION OF SPACE	BCA CLASSIFICATION	MAIN ACTIVITIES
B1,B2,B3	Basement	Car park, loading docks and associated areas	7a	Car parking, loading and unloading of goods, maintenance of equipment
B1m	Basement 1 Mezzanine	Kitchen	6	Cooking, food storage
0	Ground floor	Hotel lobby, restaurants, retail and associated areas	3,5,6	General administration, dining, sale of goods
	Mezzanine	Restaurant, kitchen, offices, plant, staff areas	3,5,6,9b	Cooking, staff dining, linen storage
1	Mahogany room	Mahogany room, bar, restaurants, kitchen and associated areas	6,9b	Cooking, dining, gaming, food storage
	Mezzanine	Plant rooms	3,5,6,9b	Maintenance of equipment
2	Chairman's Club	Gaming room, bars, restaurant, kitchen and associated areas	6, 9b	Cooking, dining, gaming, food storage
	Mezzanine	Plant rooms	3,5,6,9b	Maintenance of equipment
3	Pool	Function rooms, pool, restaurant, kitchen and associated areas	3,5,6,9b	Cooking, dining, indoor functions/events, swimming
	Mezzanine	Plant rooms	3,5,6,9b	Maintenance of equipment
4	Spa	Spa, gym, pools, associated plant and open tennis court	3, 9b	Hydrotherapy, swimming, maintenance of equipment
5	Plant and offices	Mechanical plant rooms, executive offices and associated areas	3,5,6,9b	Administration/offices, surveillance, maintenance of equipment
6-22	Hotel	Hotel rooms and associated areas	3	Sleeping

LEVELS		MAIN FUNCTION OF SPACE	BCA CLASSIFICATION	MAIN ACTIVITIES
23	Plant	Mechanical plant rooms, stair transfer corridor and refuge space	3	Maintenance of equipment
24	Crystal Club	Reception, restaurant, meeting room, lounge, pool	5,6,9b	Dining, gaming
26-26		Gaming and associated spaces	9b	
27,28	Plant	Mechanical plant rooms	3	Maintenance of equipment
29-33	Residential	Villas	3	Cooking, sleeping
34		Apartment, Plant rooms	3	Cooking, sleeping, maintenance of equipment
35-45		Apartments	2	Cooking, sleeping
46		Apartment, Plant rooms	2	Cooking, sleeping, maintenance of equipment
47-55		Apartments	2	Cooking, sleeping
56		Apartment, Plant rooms	2	Cooking, sleeping, maintenance of equipment
57-64		Apartments	2	Cooking, sleeping
65		Plant rooms	2	Cooking, sleeping , maintenance of equipment
66-69		Apartment	2	Cooking, sleeping
70	Roof	Plant	2	Cooking, sleeping , maintenance of equipment

3.2.3 Basement

The building has three basement levels which provide car parking spaces. The basement floorplate is larger than the footprint of the levels above ground. These basement levels extend east beyond Lime Street as indicated in the figure below.

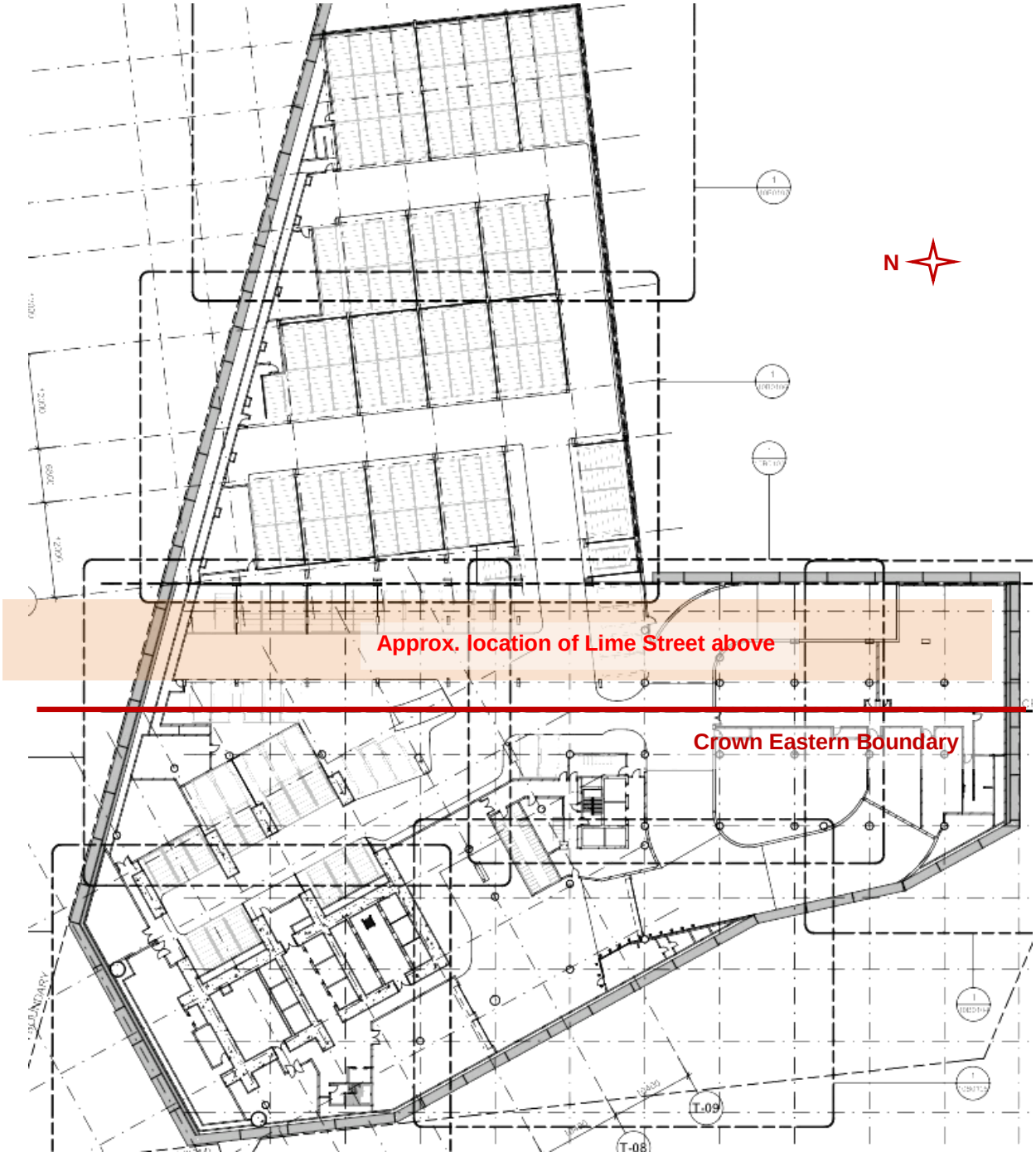


Figure 3-2: Plan of Basement Level 1 (B1) with approximate location of Lime Street superimposed to indicate the extent of the floor plate relative to the ground floor plate shown in Figure 3-3

3.2.4 Podium

The ground floor (Figure 3-3) and Levels 1-4 are collectively referred to as the 'podium' levels. Together, these levels provide spaces for restaurants, gaming and function rooms which are expected to accommodate large numbers of visitors/patrons. As shown in Figure 3-4, parts of these floors are double-height.

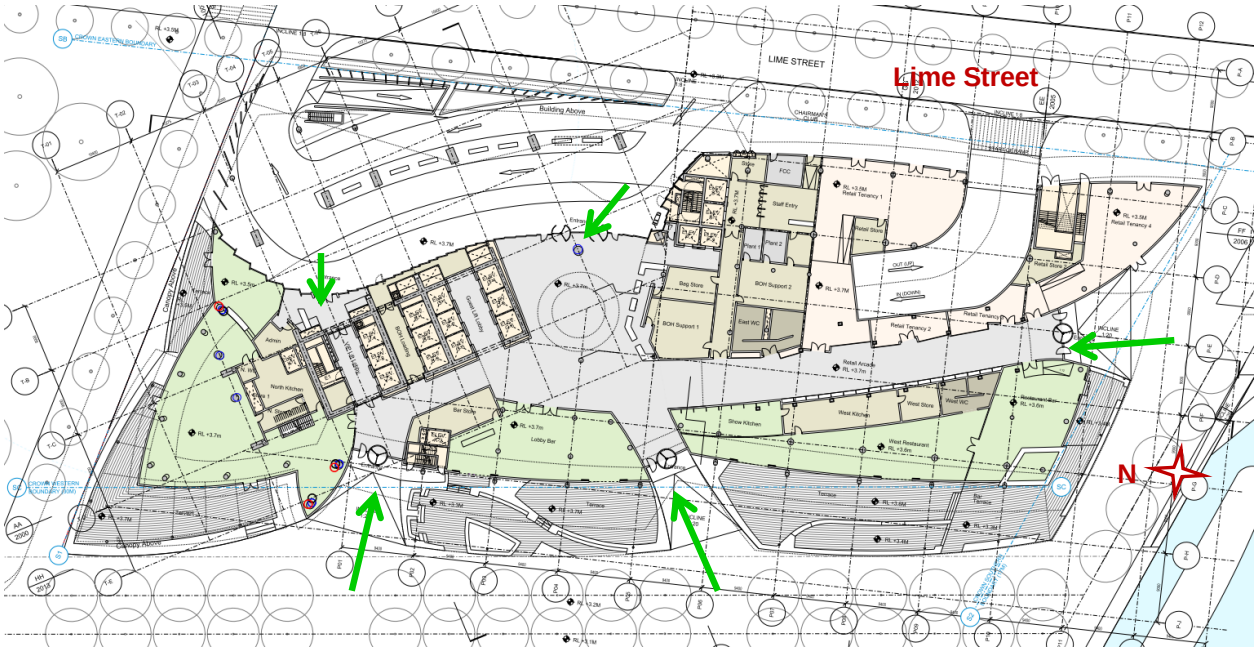


Figure 3-3: Ground floor plan

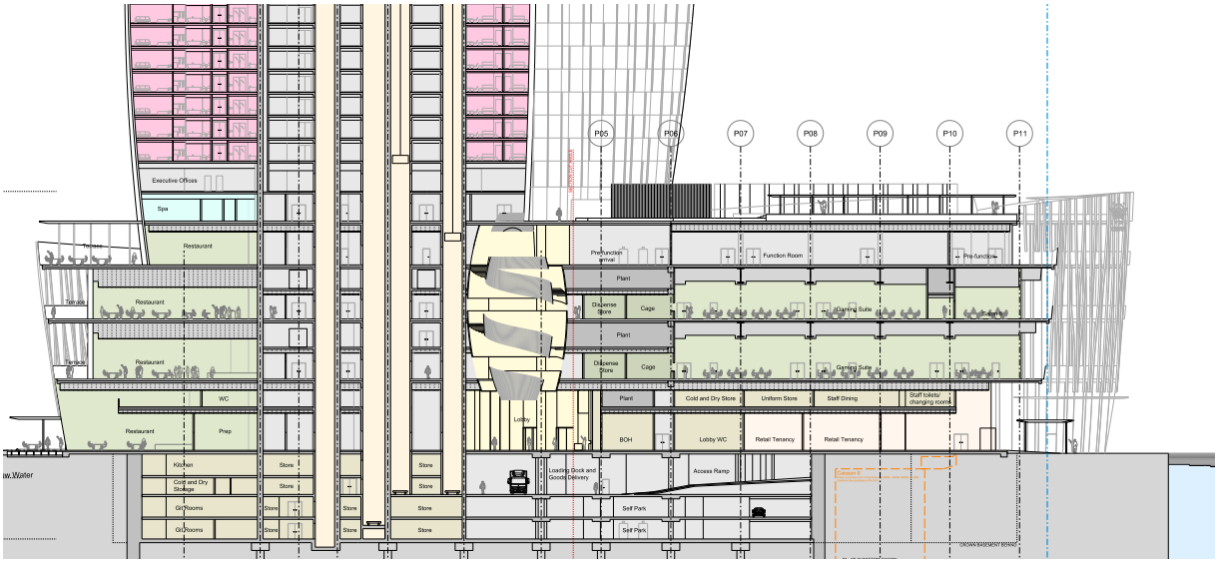


Figure 3-4: Section through the podium levels

There exists an atrium through the podium level as seen in the figure above. This atrium is connected to the ground floor, Level 1, 2 and 3 via an internal stair. All other levels such as the mezzanine floors and Level 4 are fire separated from the atrium.

3.2.5 Tower

The tower comprises of 65 storeys above the podium levels. The floor plate reduces at specific floors vertically up the building. The different functions within the building are indicated in the figure below (plant floors are not labelled):

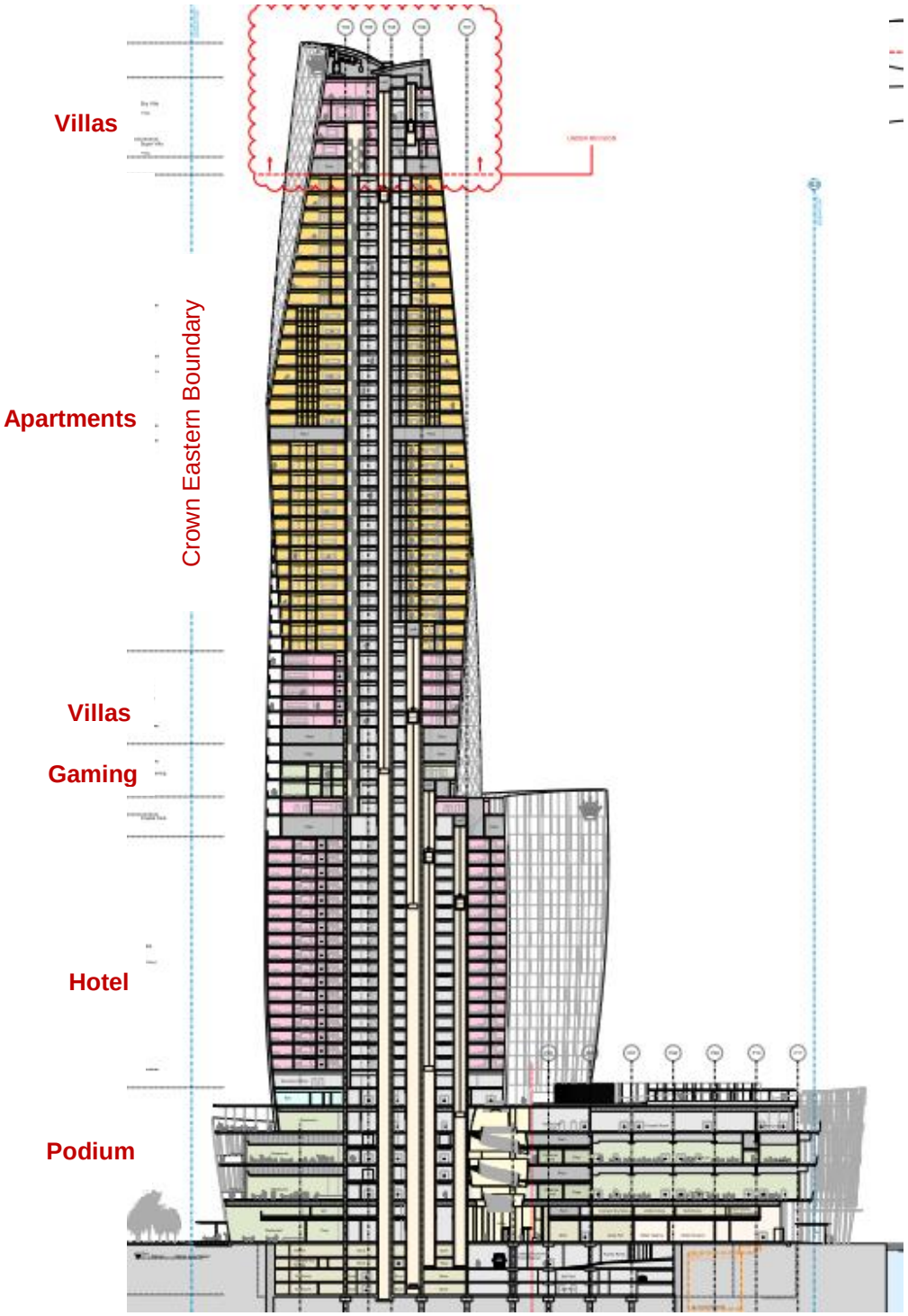
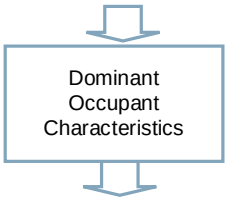


Figure 3-5: Section through the tower (including the podium levels)

4 DOMINANT OCCUPANT CHARACTERISTICS

4.1 DOMINANT OCCUPANT CHARACTERISTIC ASSESSMENT



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

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

Table 4-1: Occupant groups and characteristics

CHARACTERISTIC	DESCRIPTION
Occupant groups	▪ Visitors / Patrons to Gaming suites and restaurants ▪ Hotel customers ▪ Apartment residents ▪ Staff ▪ Fire brigade
Population numbers	Approximate numbers based on floor area (as per BCA Table D1.13 are noted in the BCA report. Expected numbers based on similar well-managed occupancies have been advised by the client and shall be documented in detail within the FEB.
Population location	The population is expected to be generally well distributed across the floor plate except for podium levels where high population density may be expected within the function rooms and the Gaming suties (Mahogany rooms and Chairman's Club).
Physical and mental attributes	Occupants of all ages can be expected. The majority of occupants are expected to be mobile with staff available and expected to inform others of danger and assist in evacuation. ***Visitors*** – Visitors may or may not be familiar with the layout of the building and may require assistance in locating the exits. The occupants of the bars and restaurants are expected to be similar to the residential levels however expected to always be awake and alert. Some patrons may be intoxicated and would require staff assistance. ***Hotel + apartments*** – Occupants throughout the building will vary from alert and able bodied, to occupants who are asleep, affected by drugs and or alcohol and people with significant disabilities. Specifically to residential and hotel parts, the occupant group will generally represent the broader population. There will be no factors that draw occupants with dominant features, or influence the physical and mental attributes of the general occupant group. Disabled occupants of any degree can not be discounted from being present in the building. It should be noted however that for the period when occupants are present, much of the time will be spent asleep and therefore recognition and reaction to emergency situations can be assumed to be affected and delayed. Also the influence of medication, alcohol and other drugs must be considered as a factor in individual occupants.

CHARACTERISTIC	DESCRIPTION
	Staff – can be expected to have a good familiarity with the administration areas and the means of exits from these parts. General familiarity of the building as a whole and the location of main exits. These occupants are expected to assist clients and visitors in locating an exit during an evacuation. ***External Maintenance Contractors*** – this occupant group is expected to have a reasonable familiarity with the building as they would have to undergo site specific induction prior to commencement of work on site. ***Fire & Rescue NSW*** – are not expected to have any familiarity of the building layout, however are assumed to obtain the required information from the site block plans and tactical fire plans available prior to entering the building. Notwithstanding this, they will be equipped with breathing apparatus and specialist equipment to prevent them from being adversely affected by fire hazards.

5 PROPOSED FIRE SAFETY STRATEGY

5.1 EGRESS STRATEGY – BASEMENT

The building consists of three basement car park levels. These basement levels are one of the largest floor plates in the building and extend beyond the footprint of the building to underneath the park to the east of the site. This design results in extended travel distances to a point-of-choice, an exit and between alternative exits due to the number of exits available.

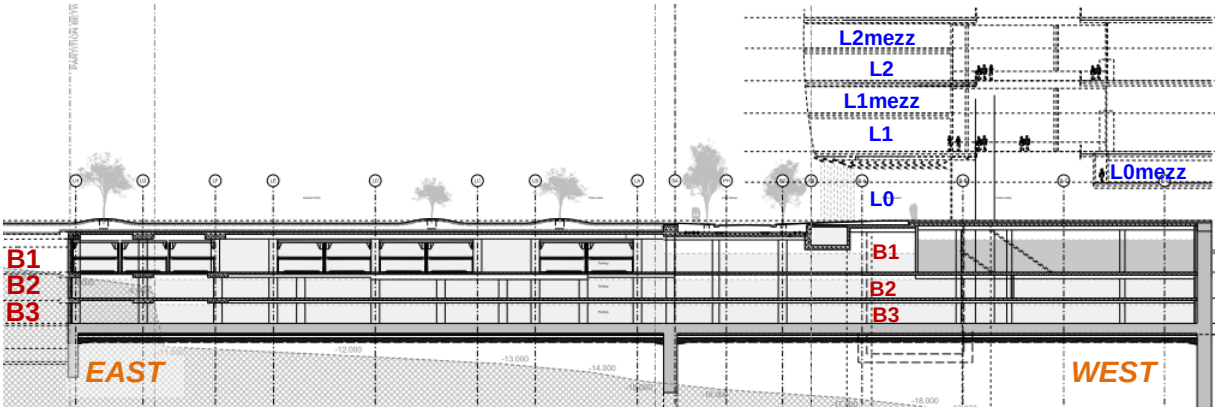


Figure 5-1: Approximate East-West section through basement levels indicating extent of basement under the podium/tower

As an exit from the east part of the floor plate directly on ground level (as it is outside the title boundary), a unique solution has been detailed utilising a fire-isolated passageway / corridor. A fire-isolated exit has been located in the east of the floor plate on Basement Levels 3 and 2. However, on Basement Level 1, these connect to a fire-isolated passageway along the northern edge of the floor until it discharges directly on ground floor in the porte-cochere.

Figure 5-2, Figure 5-3 and Figure 5-4 illustrates the egress strategy for the basement levels. These figures indicate locations of the exits, access to these exits and worst-case travel distances. The exits are numbered and referenced in the overall vertical egress chart attached in APPENDIX A. The travel distances that exceed the BCA requirements in the basement levels are noted in the table below:

Table 5-1: Summary of worst-case basement travel distances

LEVEL	AREA	REF.	TRAVEL DISTANCE	BCA LIMITS
B1	B01.025	1.1	22m to POC*	20m to a POC* 40m to an exit 60m between exits
	Telecom room B01.016	1.2	63m to an exit	
	Stair 08 and Stair 10	1.3	109m between exits	
B2	Plant B02.008	2.1	60m to an exit	
	South-western corner of floor	2.2	24m to POC*	
			59m to an exit	
	Stair 08 and Stair 10	2.3	94m between exits	
B3	Store room B03.008	3.1	58m to an exit	
	Corner of ramp from B2	3.2	25m to POC*	
			62m to an exit	
	Stair 08 and Stair 10	3.3	90m between exits	

*POC: Point of choice

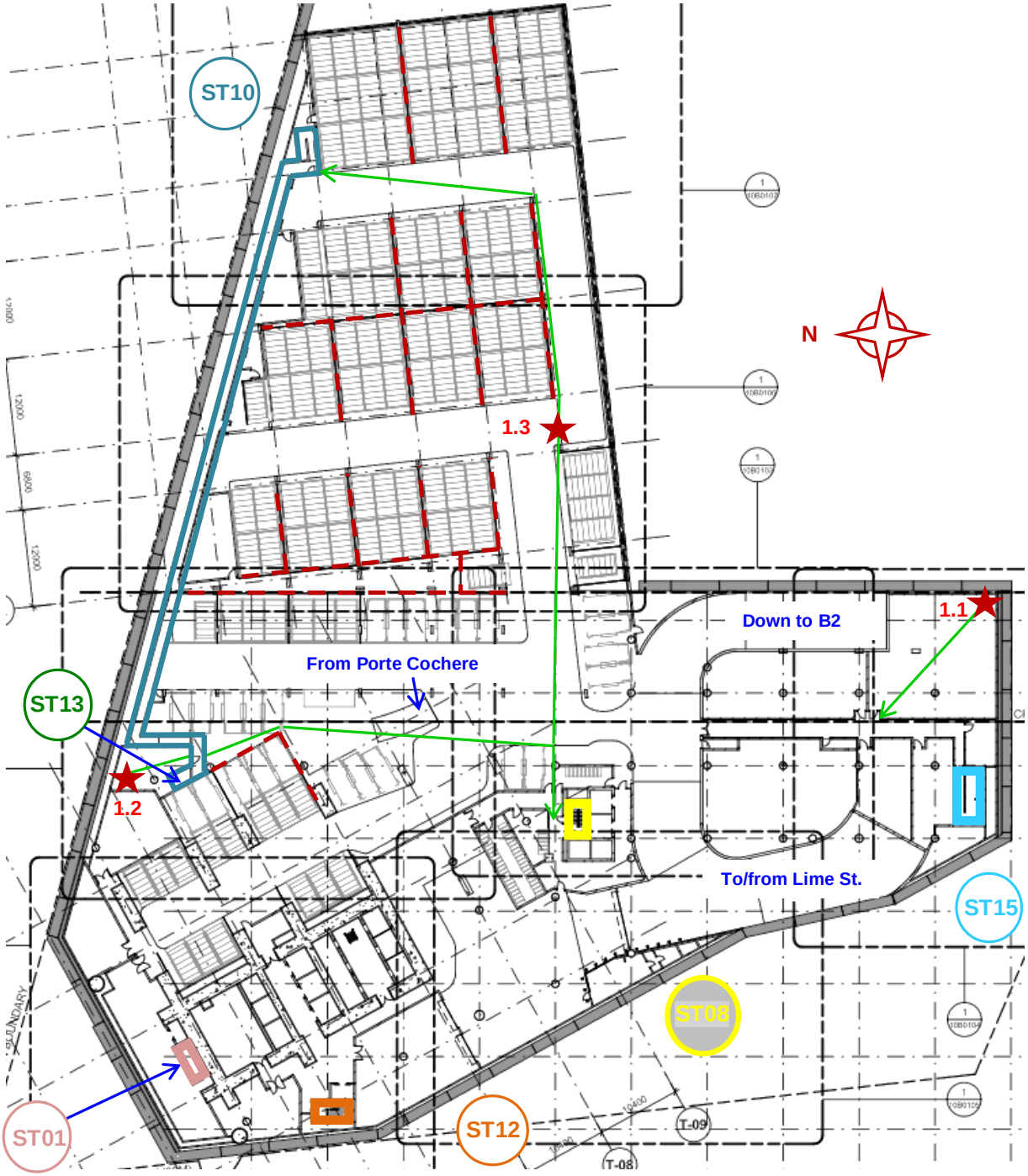


Figure 5-2: Basement Level 1 (B1) indicating the three fire-isolated exits that are available for egress and worst-case travel distances

In the figure above:

- Green lines and arrows indicate different routes of travel for occupants to reach an exit;
- Red dashed lines indicate chain wire fencing.
- Red stars indicate location of worst-case travel distances as listed in Table 5-1

Basement Level 1 (B1) consists of several spaces for car stackers which are part of the valet parking facilities provided by Crown. As such, only staff members are expected to be on this floor.

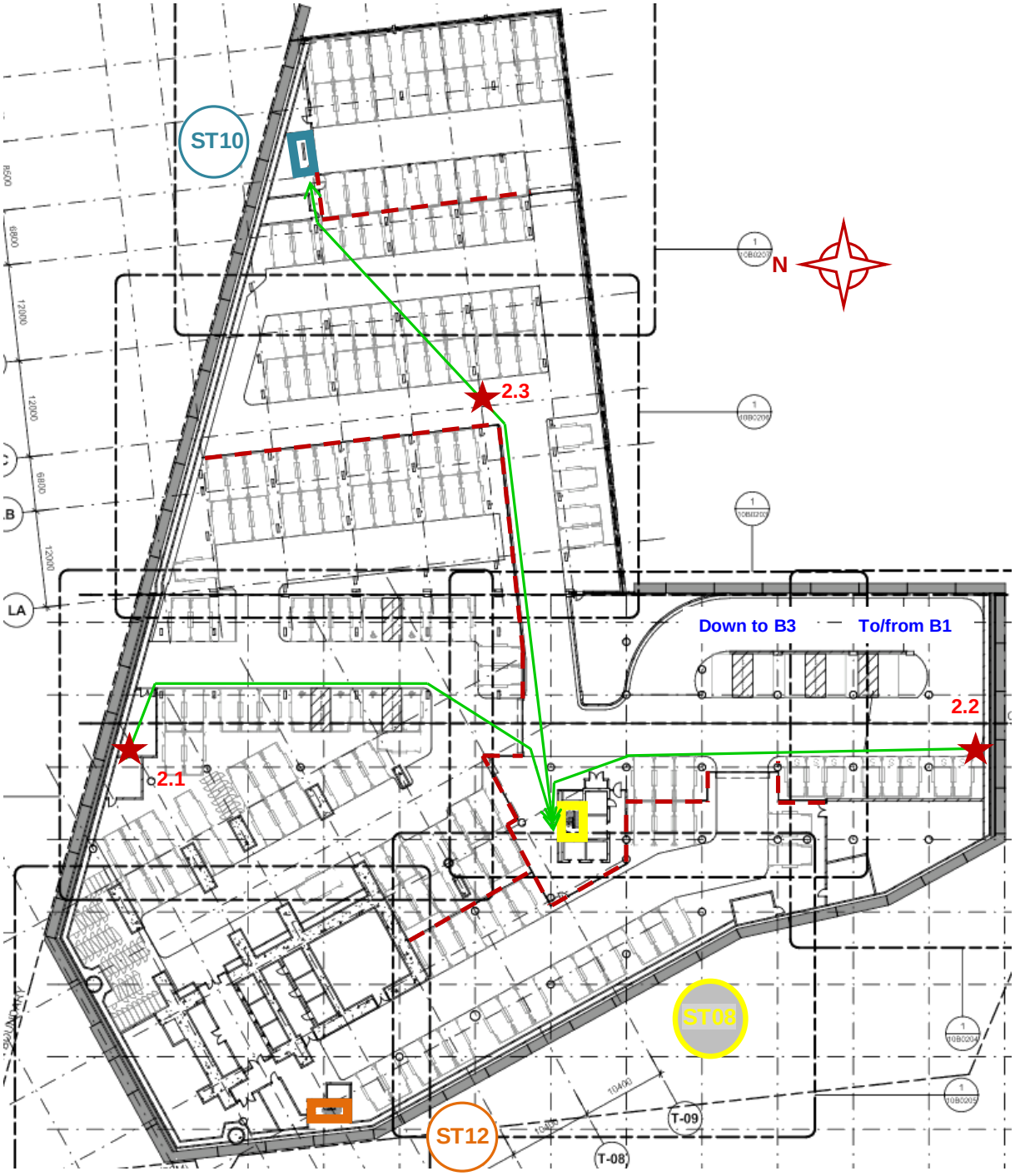


Figure 5-3: Basement Level 2 (B2) indicating the three fire-isolated exits that are available for egress

In the figure above:

- Green lines and arrows indicate routes of travel for occupants to reach an exit;
- Red dashed lines indicate chain wire fencing.
- Red stars indicate location of worst-case travel distances as listed in Table 5-1

Basement Level 2 (B2) consists of residential car parking and self-park facilities.

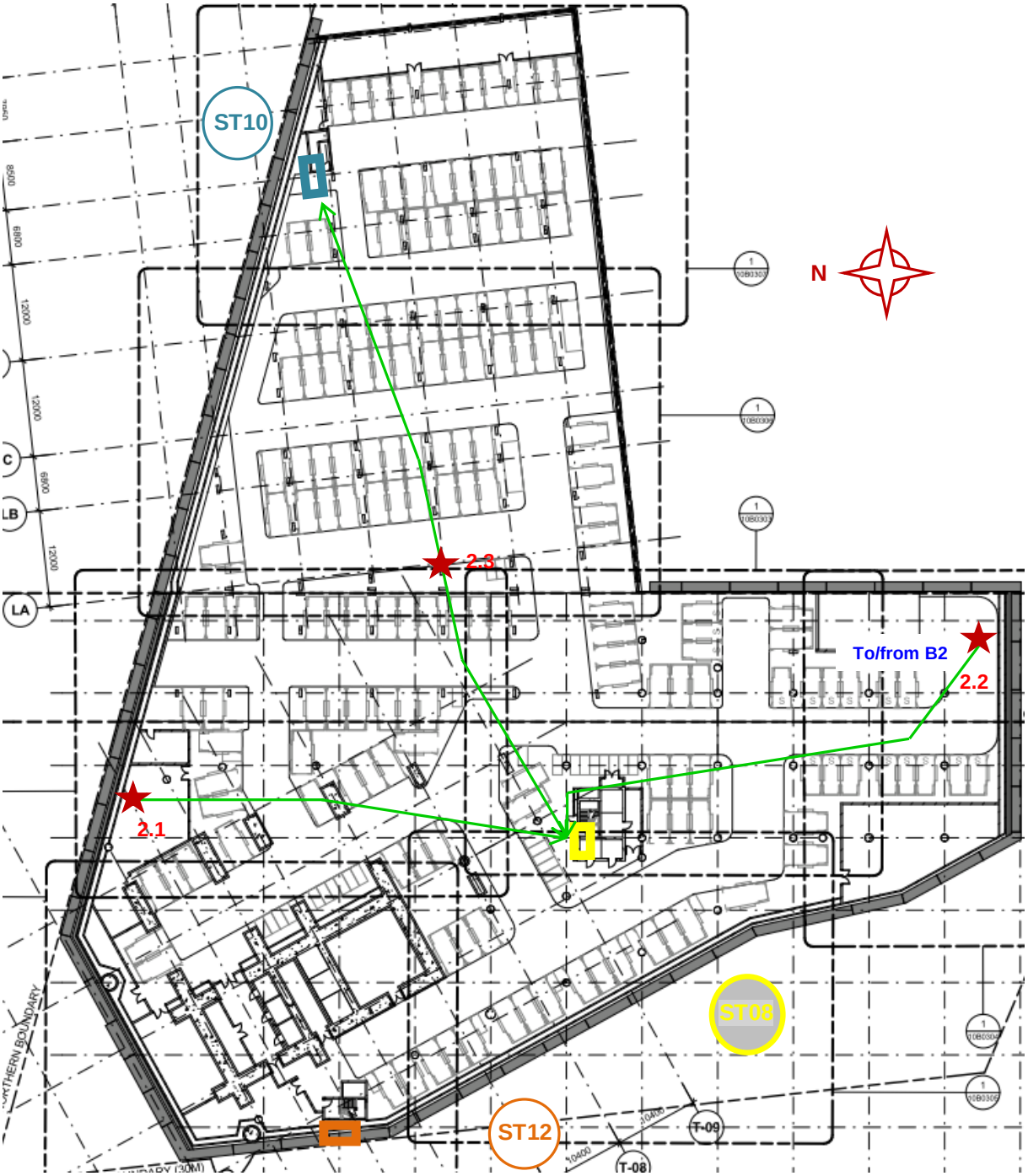


Figure 5-4: Basement Level 3 (B3) indicating the three fire-isolated exits that are available for egress

In the figure above:

- Green lines and arrows indicate routes of travel for occupants to reach an exit;
- Red stars indicate location of worst-case travel distances as listed in Table 5-1

Basement Level 3 (B3) consists of mainly self-park facilities.

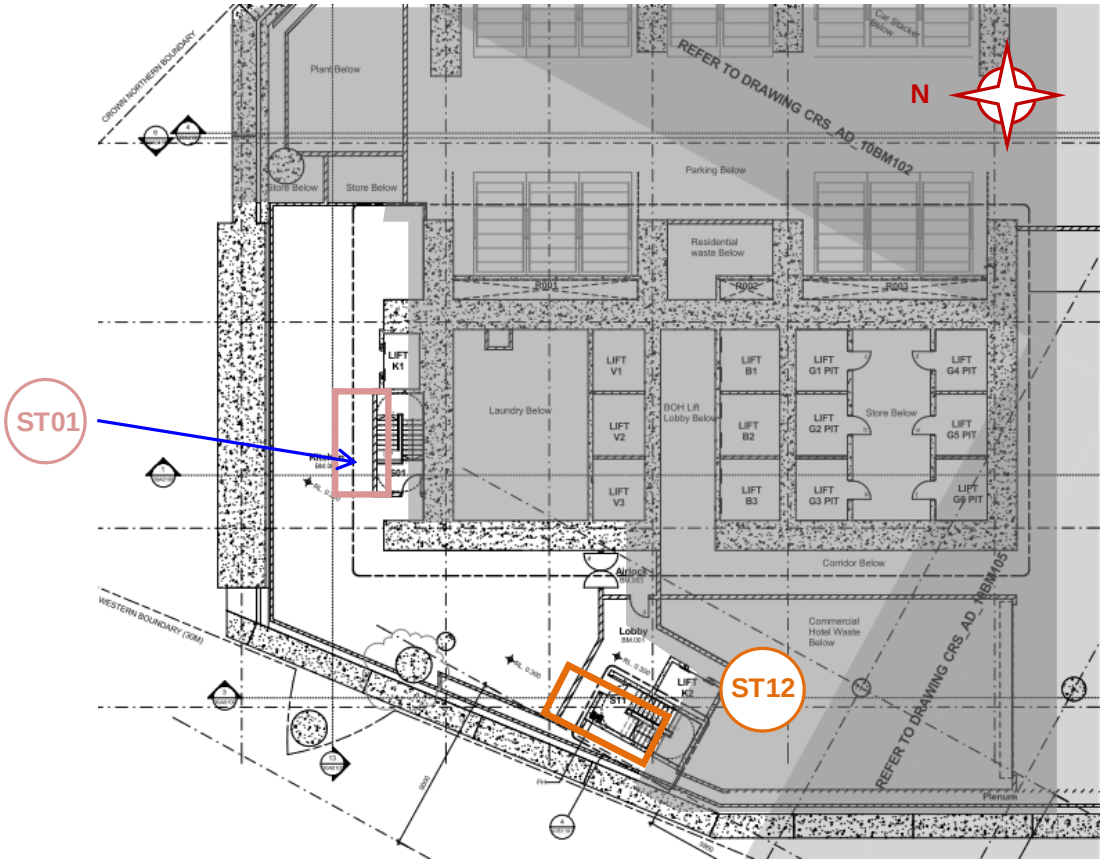


Figure 5-5: B1 Mezzanine plan

In the figure above, Stair ST01 is a fire-isolated stair that connects B1 Mezz down to Basement Level 1 (B1). Therefore, occupants on B1 mezz have the option of using the fire-isolated exit ST12 or egress down to B1 from where they have multiple options of egress. The following image indicates the discharge points on ground floor of the fire stairs serving the basement levels:

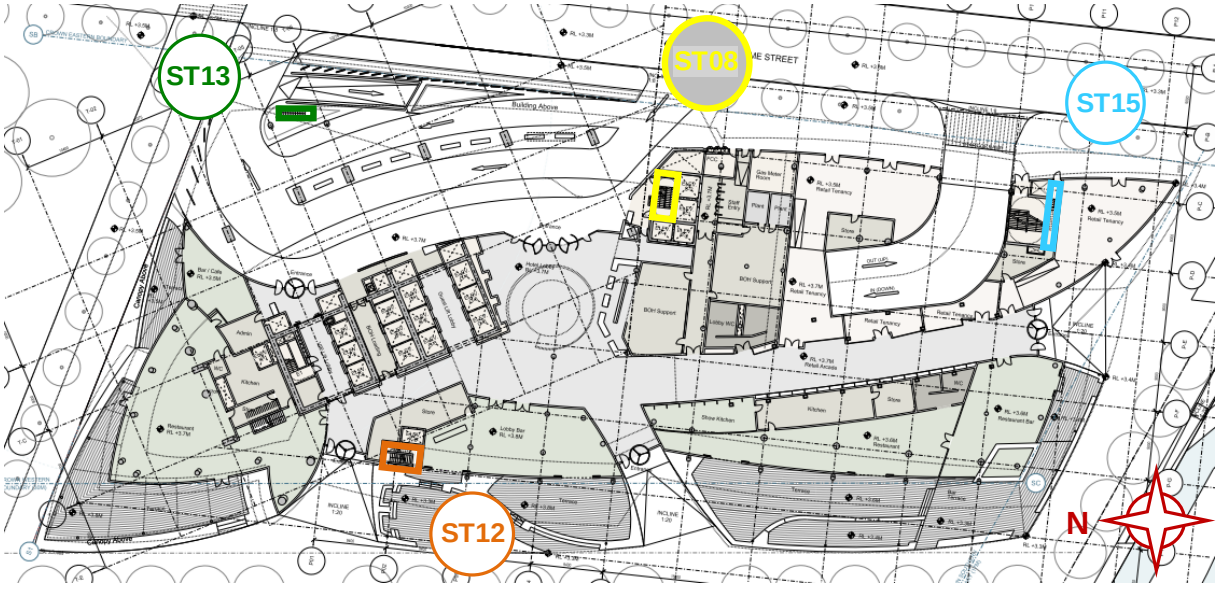


Figure 5-6: Ground floor (L0) plan indicating discharge of exits from the basement.

A vertical egress chart has been created to visually represent all the major lifts and fire stairs in the building. Figure 5-7 has been extracted from the vertical egress chart (full chart attached in **Error! Reference source not found.**) to show only the lifts and stairs that serve the basement levels.

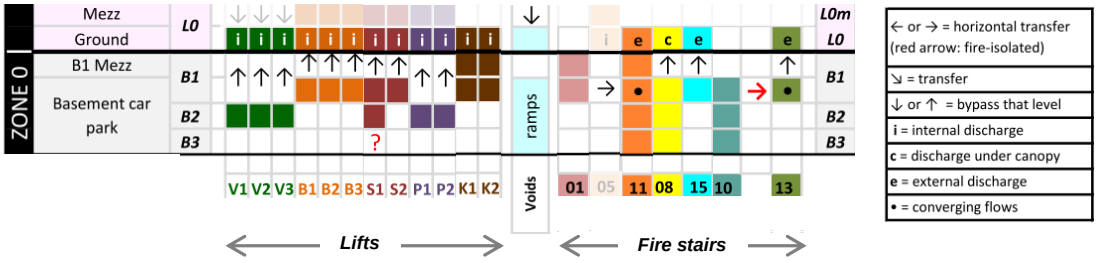


Figure 5-7: Vertical egress chart for basement levels indicating lifts and fire stairs

5.1.1 Fire rated corridor on Basement 1

The fire rated corridor that runs along the northern edge of the basement 1 floor plate shall meet the following requirements:

- Be pressurised in accordance with AS1668.1-1998
- Be provided with full sprinkler protection, directional signage, and emergency lighting as per the requirements of the BCA.
- Additional signage to guide occupants shall be provided within the corridor upon entry. An example is provided below:

Figure 5-8: Example of additional signage to be provided within the fire rated corridor on B1

5.1.2 General Fire Alarm

All levels of the basement including B1 mezzanine shall be one fire and evacuation zone. Activation of a single smoke detector in any areas of the basement shall initiate a 180 second investigation time. The Building Occupant Warning System (BOWS) shall sound an alert tone throughout the basement levels. If no intervention occurs in the investigation time period, the BOWS shall sound an evacuation tone throughout the basement levels.

If a sprinkler head is activated, then all basement levels shall be evacuated immediately. The VIP lift lobby security locks shall be released on the basement levels upon commencement of evacuation to enable easier access for occupants to all fire-isolated exits in the event of an emergency.

5.1.3 Signage and Lighting

Adequate exit signage and emergency lighting is to be provided in accordance with the BCA 2014 and AS 2293.1-2005.

5.2 EGRESS STRATEGY – TOWER

The available egress provisions (fire-isolated stairs and lifts) on each floor are presented in the form of a simple bar chart attached in APPENDIX A. The chart also indicates the proposed division of the building vertically into zones, horizontal transfers required by users of the stairs, type of discharge of stairs, critical nodes (converging flows), expected population on each level and floors bypassed by lifts.

Please note that egress for the BOH areas on Levels 66-70 are still under development.

5.2.1 Horizontal transfer corridors

The building is vertically divided to provide several different functions such as hotel, gaming and apartments. Due to its changing form and floor layouts, some fire-isolated stair arrangements are not the typical single shaft stairs that continue through the entire height of the building. Users of such stairs in this building are required to horizontally transfer to a different stair at certain levels. Such horizontal transfers are fire-isolated and pressurised as they are an extension of the fire-isolated exit.

For example, (with reference to the chart attached in APPENDIX A) users of one of the stairs within the northern scissors stair shaft (i.e., Stair 03 which serves the residential and gaming floors: Levels 24 and above) and users of the terrace exit (Stair 18: serving Level 24) are required to:

- On Level 23: make way to a second fire-isolated stair (Stair 07) via a horizontal fire-isolated transfer corridor from Stairs 03 and 18,
- On Level 02 Mezzanine: make way to fire-isolated stair (Stair 06) via a horizontal fire-isolated transfer corridor from Stair 07,
- On Level 0 Mezzanine: make way to fire-isolated stair (Stair 12) via a horizontal fire-isolated transfer corridor from Stair 06, then
- discharge directly to the outside on ground floor (L0).

5.2.2 Lifts as a secondary means of evacuation

Preamble

It is proposed to use lifts only as a secondary means of egress. The fire-isolated exits provided in the building are the primary egress option for all occupants and lifts are not relied upon to evacuate the building. The option to use lifts (when possible) provides additional benefits during an evacuation process in the following ways:

(i) reduces total evacuation time for occupants on floors higher up in the building,
(ii) provides an easier egress option for disabled occupants,
(iii) reduces fatigue in older, weaker (chronic illness, injuries), pregnant and disabled occupants, and
(iv) less counter-flow traffic within stairs that enables fire fighters to set up a forward control point for fire attack.

Vertical evacuation zones

For the purposes of staging a partial evacuation and designing for variance in characteristics of various user groups, the building has been divided into the following zones:

1. Zone 0: Basement Levels 1, 2 and 3
2. Zone 1: Podium levels from Level 0 to Level 5
3. Zone 2: Hotel levels from Level 6 to Level 22
4. Zone 3: Gaming levels from Level 23 to Level 27
5. Zone 4: Residential levels from Level 28 to Level 70

As shown in the 'Vertical Egress Chart' attached in APPENDIX A, 3x VIP lifts are available to the residential and gaming levels in addition to at least one BOH lift (B-series). Hotel floors are served by 6 Guest lifts (G-series) in addition to the B-series lifts. The podium is served by several lift banks depending on its use. Mezzanine plant floors are not served by VIP or G-series lifts.

Phased / staged evacuation

As the building provides world-class facilities and services for high-profile customers, it is in the best interest of Crown to minimise disruption to the majority of its customers in the event of an emergency in any one part of the building. The presence of trained staff within the building with good security/surveillance managed by

on-site building management personnel, modern fire detection and communication systems, evacuation can be controlled and staged to minimise impact on floors distant to the Floor-of-Fire-Origin (FFO).

Phased evacuation begins evacuation on the FFO only and after a set amount of time, if the fire alarm has not been manually deactivated by either the fire warden or fire brigade personnel (either due to a progressing emergency event or delay in assessing the cause of alarm), floors closest to FFO also begin evacuation. This vertically cascading evacuation alarm continues vertically in both directions until the cause has been verified or the situation is under control by staff and emergency crews / fire brigade personnel.

Partial + Phased Evacuation Strategy for Crown Tower

During the event of a fire alarm, it is critical that the situation is investigated as soon as possible and appropriate actions prior to total evacuation. Therefore, the progressive occurrence of events are to be categorised in stages with consideration given to type/source of alarm, function/use of the floor of fire origin (FFO), fire compartmentation and number of occupants on that floor to determine the next course of action.

Such a concept is best explained visually, through an example. For the purpose of demonstrating the concept of staging alarm and evacuation, multiple fire scenarios (for Zones 2, 3 and 4) are considered. The alarm staging sequences are presented in the form of a matrix and attached in APPENDIX B.

In a scenario where a fire event is progressing and floors other than the FFO are likely to come under direct threat (as determined by the chief fire warden / fire brigade personnel), the alarm and evacuation process applied to the FFO shall progressively cascade vertically through the affected zone.

It is to be noted that the staging sequence presented in APPENDIX B are specific to Zones 2, 3 and 4. Staging sequences are based on the following factors:

- Type of alarm (first and second)
- Time duration for alarm investigation (if applicable)
- Height of FFO above ground floor
- Occupant population on FFO and floors adjacent
- Available aggregate egress width
- Occupant characteristics (age group, physical attributes/ability, behaviour/decision-making, alertness)
- Number of storeys in the zone and expected load on stairs
- Fire stair characteristics: horizontal transfers, internal discharge, converging flows

Alert and Evacuation tones shall be accompanied by voice messages. Additional languages shall be nominated for voice messages if a large proportion of non-English speaking patrons are expected. These may be specific to certain zones in the building or throughout.

5.2.3 Cascading Fire Alarm

The fire alarm shall cascade vertically as detailed in APPENDIX B and shall cross over zones if not addressed, eventually resulting in total building evacuation. The Chief Fire Warden and fire brigade personnel shall have the capability of manually overriding the cascading alarm to suit situational strategies. In a typical scenario, a cascade would involve alarm and evacuation progressing to two storeys above and one storey below. Similarly, the second cascade would involve an additional two storeys above and another storey below, and so on. Each cascade has a default time period of 90 seconds. If no intervention occurs in the 90 seconds or a second alarm is detected, a cascade in alarm shall occur automatically.

5.2.4 Operation of lifts for evacuation

Lift shafts are not proposed to be pressurised. Therefore, lifts shall not be used for evacuation if any of the following occurs:

- Smoke detector or sprinkler head activation in lift lobby (or a space connected to the lift lobby),
- Decision by chief fire warden or fire brigade personnel due to perceived risk specific to a particular event

Note: For the above to be achievable, sprinklers located in the lift lobbies and connected spaces must be fed from a separate pipe branch with its own flow switch.

The lift evacuation sequence being developed for the various zones follows a similar process to the ‘Operational approach B’ nominated within ABCB Information Handbook: Lifts used during evacuation [9]. Key features of the sequence developed (APPENDIX B) are:

- Lift B2 goes into fire service recall operation on fire alarm,
- Selected lifts go into 'evacuation mode' (also called lifeboat operation) shuttling between fire affected floor and ground floor,
- Additional lifts go into 'evacuation mode' as the fire alarm cascades.
- Lifts that are in 'evacuation mode' must first discharge its original occupants on ground floor, prior to serving the fire affected floor. Also, lifts in 'evacuation mode', shall not attend to calls from any floors other than the nominated priority floors as per the alarm sequence.

Additional features that require further considerations and design are:

- Lift to have in built voice message when discharging occupants on L0 prior to lifeboat shuttling to notify them of the emergency.
- Lift LCD panels located within the lobbies shall be programmed to indicate availability of lift for evacuation and be provided with emergency/backup power supply. When a lift is in 'evacuation mode', panels for that lift on all other floors (not in alert mode) shall indicate: 'Lifts temporarily unavailable.'
- Lifts in 'evacuation mode' do not serve plant floors other than L23.
- At maximum capacity, lifts shall proceed straight to L0 to discharge occupants, prior to more shuttling.
- CCTV in B-series, VIP and G-series lift lobbies

5.2.5 Pressurisation of fire exits

Automatic pressurisation shall be provided to all fire stairs shafts and associated fire-isolated passageways / horizontal transfer corridors that form part of the exits.

5.2.6 Temporary refuges or safe havens

The back-of-house (BOH) loading areas serving the B-series lifts (B1, B2 and B3) on every floor shall be fire separated from the remainder of the respective floor. As Lift B2 is the nominated fireman's lift, this space shall provide an additional forward control point during fire brigade intervention. Also, if lifts are not operating either due to maintenance or for reasons discussed in Section 5.2.4, occupants who are not physically capable of using the fire stairs can use the BOH space as temporary refuge and assistance from emergency personnel.

If BOH doors are locked in normal operation, these shall automatically unlock on fire alarm.

5.2.7 Signage and Lighting

Adequate exit signage and emergency lighting is to be provided in accordance with the BCA 2014 and AS 2293.1-2005.

Additional directional signage (such as photoluminscent floor markings) shall be provided in the horizontal transfer corridors in the building.

5.3 PASSIVE FIRE AND SMOKE PROTECTION

5.3.1 General

The building is constructed to Type A throughout. The following are the nominated Fire Resistance Levels (FRLs) for the various parts of the building:

- Basement: 60 minutes (based on concession due to sprinkler protection provided)
- Podium: 120 minutes
- Tower: 90 minutes

Stairs, lifts, linen, garbage and other services required to be in fire protected shafts shall achieve the required FRLs as per above.

Additionally, the BOH loading areas (B-series lift lobbies) are fire separated from the remainder of the floors. Fire doors to these areas shall be provided with vision panels.

5.3.2 Atrium and Podium Fire Compartmentation

Atrium

The atrium shall be fire separated via use of fixed glazed drencher protected parts (bounding the walkway around the atrium on each floor). The fire separation shall achieve 60/60/60 FRL for bounding construction and -/60/30 for doors. This atrium fire compartment is connected to the ground floor. As such, the entire ground floor (L0) along with the atrium is one fire and smoke zone.

General podium

Levels 1, 2 and 3 shall be fire separated into two fire compartments each (north and south). Fire compartmentation for the podium is as indicated in Figure 5-9 to Figure 5-16 in the following pages.

This is to enable a staged evacuation implementing both horizontal and vertical egress for the high population identified on these floors.

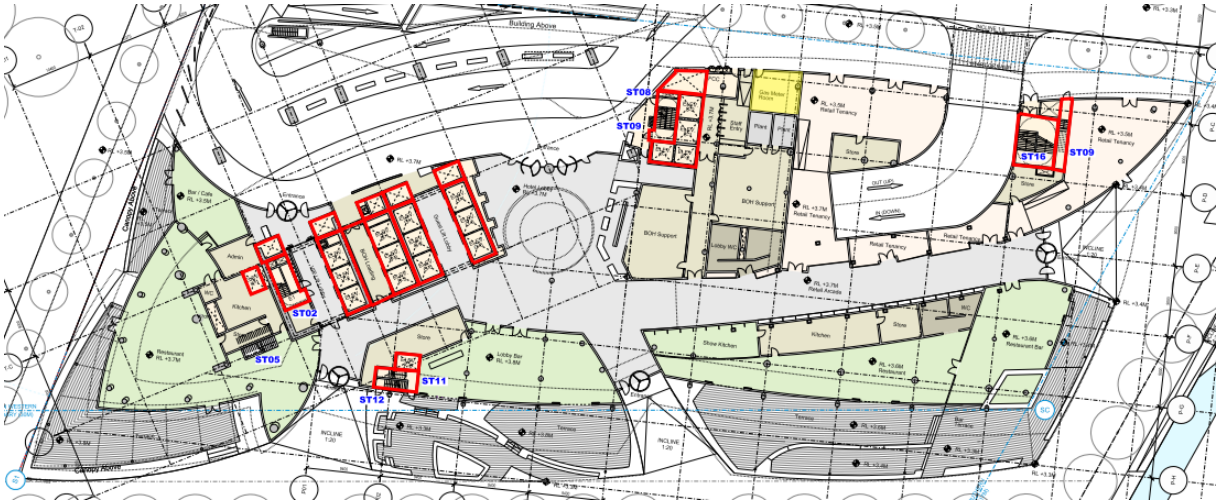


Figure 5-9: Level 0 / Ground floor fire compartmentation lines

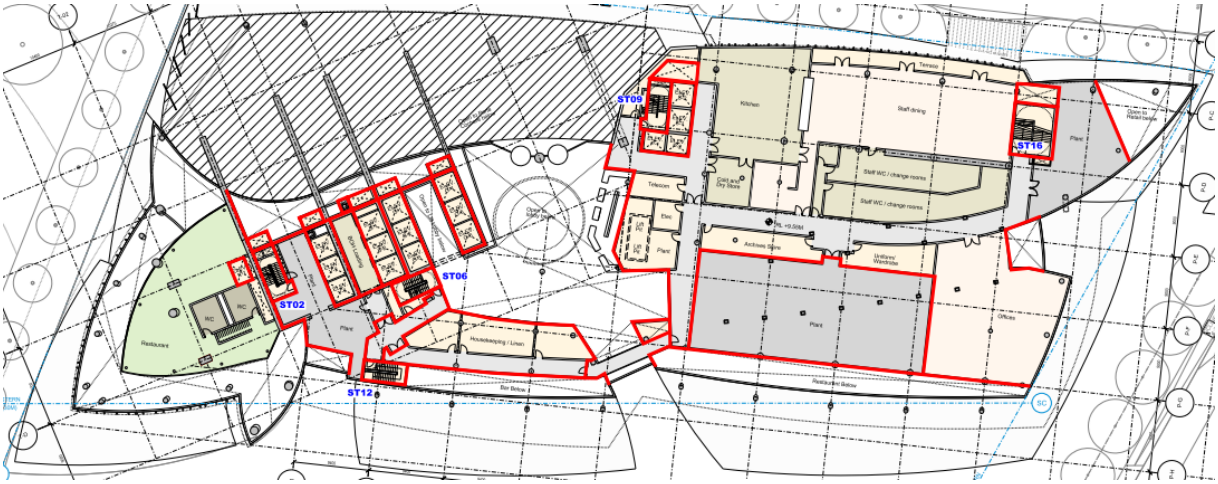


Figure 5-10: Level 0 mezzanine fire compartmentation lines

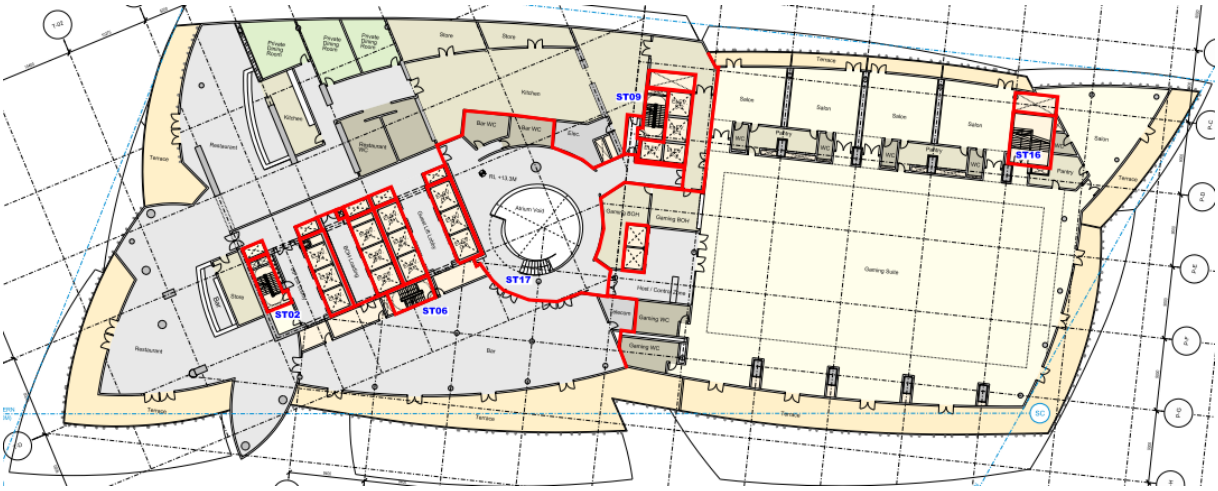


Figure 5-11: Level 1 fire compartmentation lines

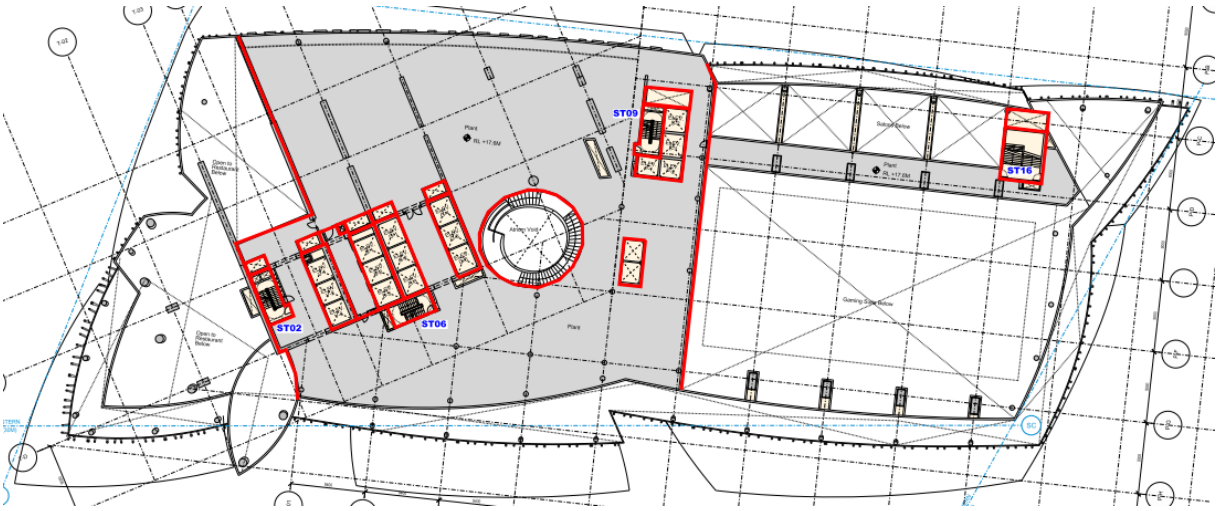


Figure 5-12: Level 1 mezzanine fire compartmentation lines

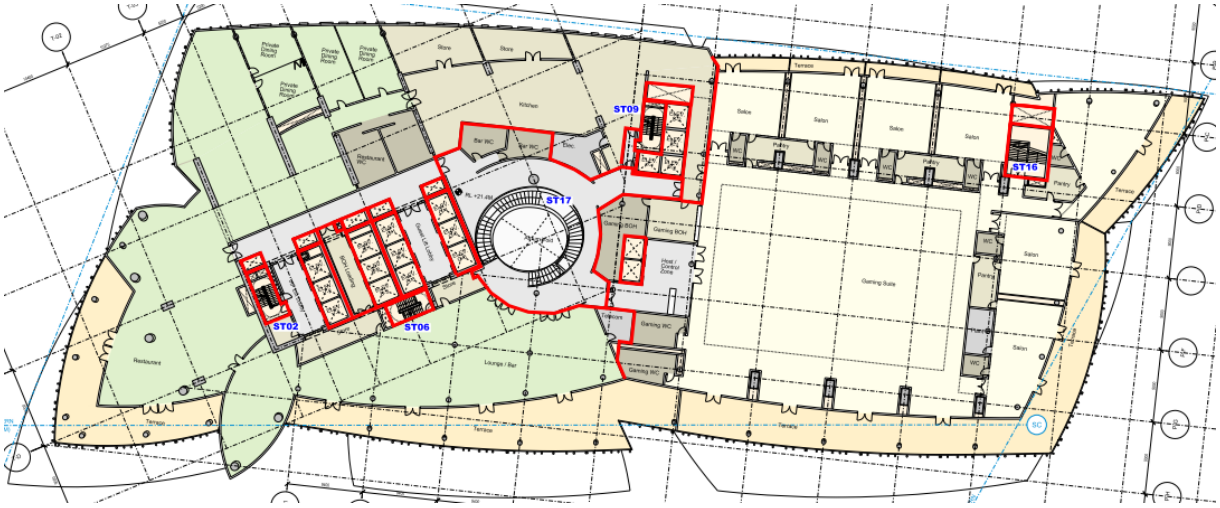


Figure 5-13: Level 2 fire compartmentation lines

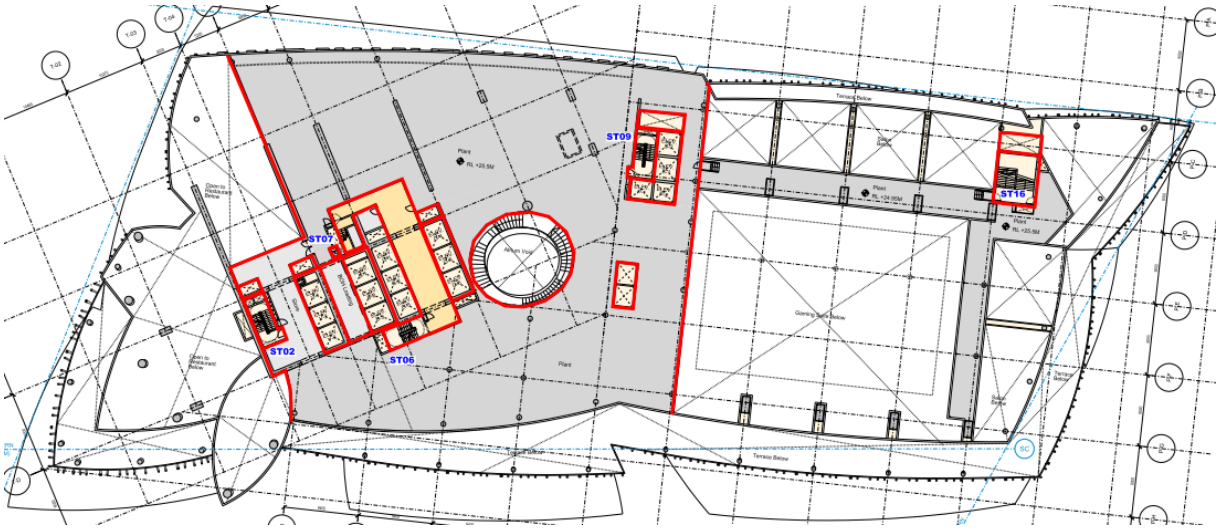


Figure 5-14: Level 2 mezzanine fire compartmentation lines

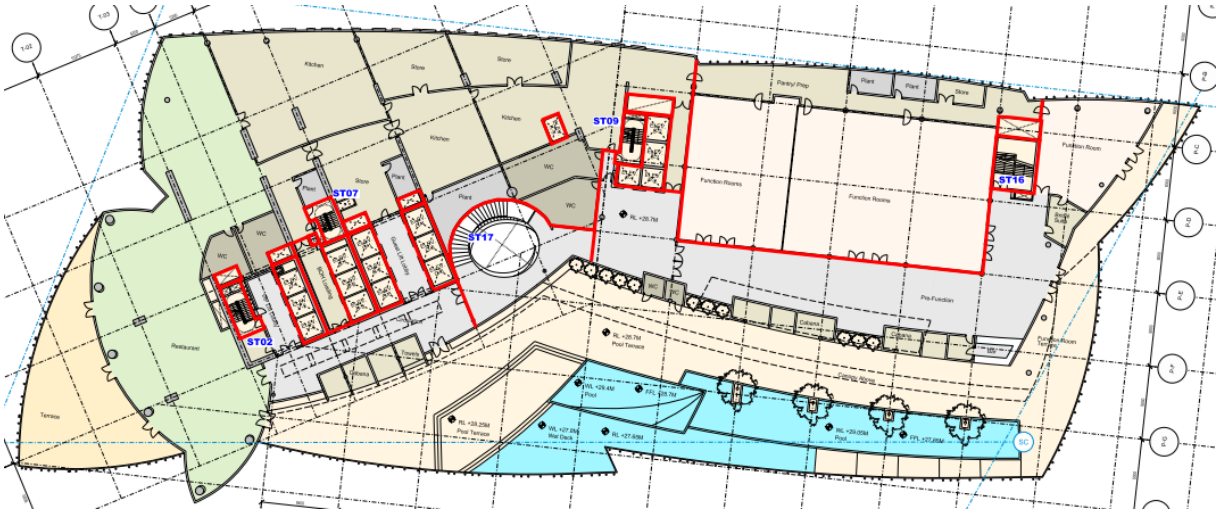


Figure 5-15: Level 3 fire compartmentation lines

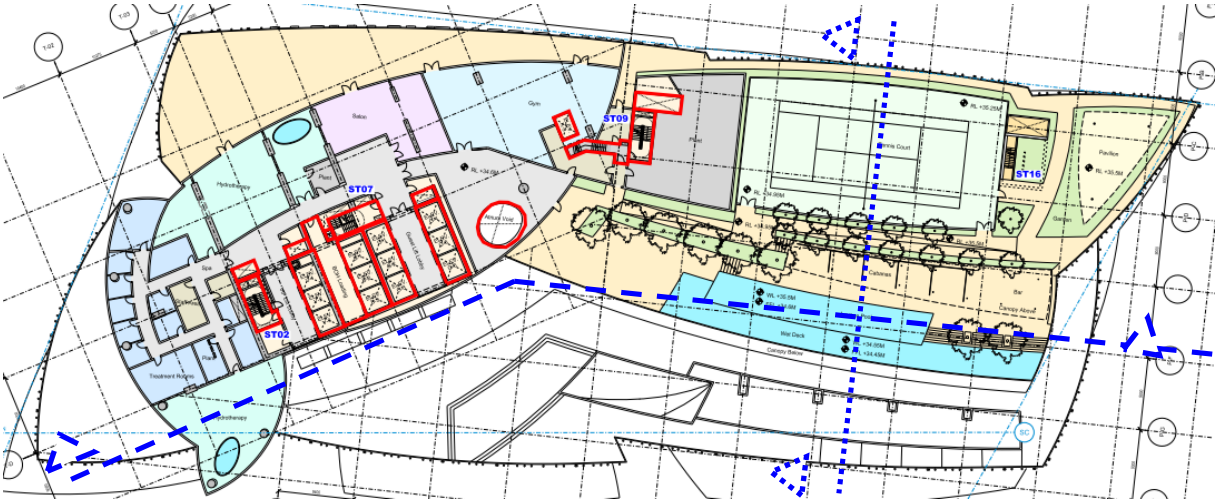


Figure 5-16: Level 4 fire compartmentation lines

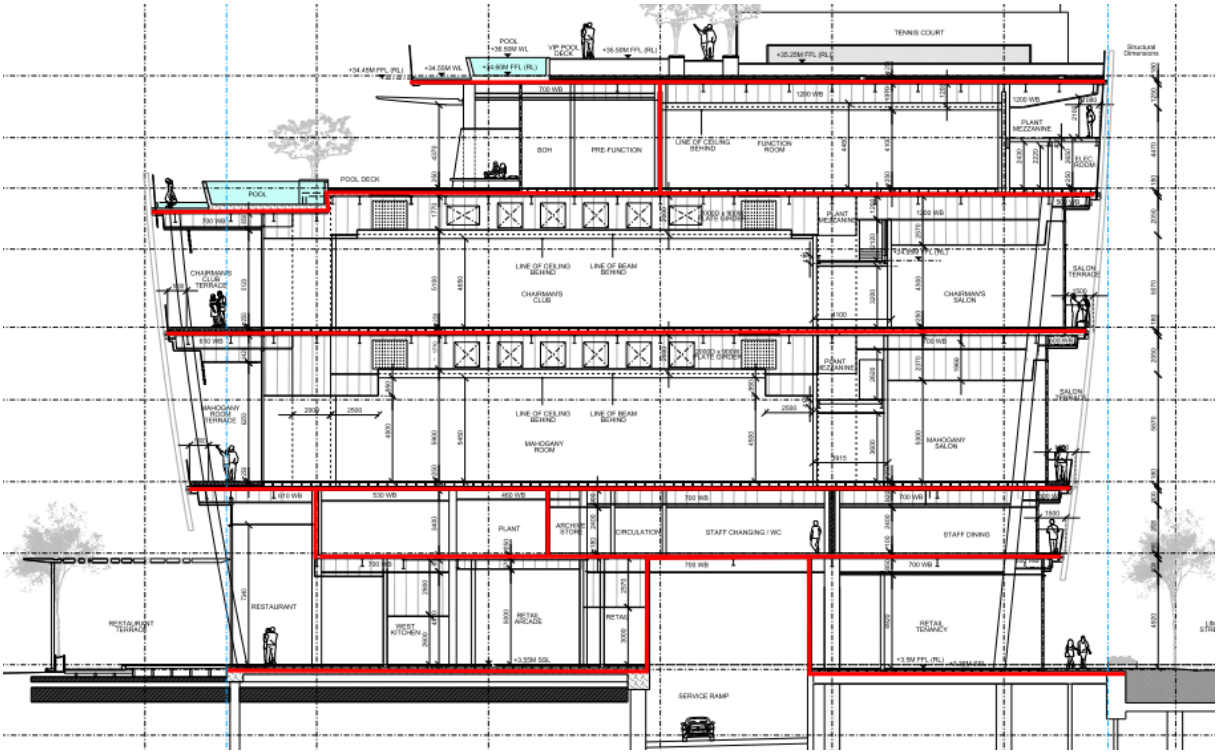


Figure 5-17: Section through podium as indicated by the dotted blue lines in Figure 6-16

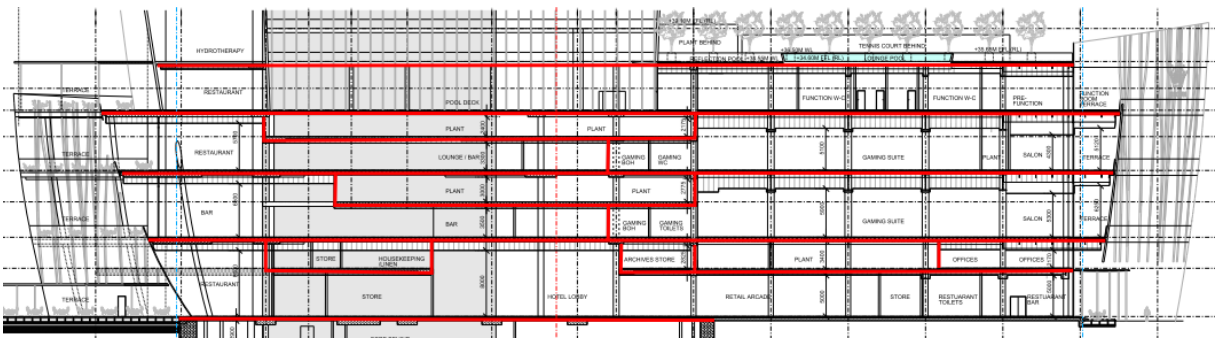


Figure 5-18: Section through podium as indicated by the dashed blue lines in Figure 6-16.

Sky Gaming

The Crystal Club (L24), the Sky gaming levels (L25-26) and possibly L27 (Sky Gaming / plant) are interconnected by a void/internal stair. It is proposed to achieve fire separation via the use of a horizontal fire curtain.

Figure 5-19: Section through the Crystal club and the sky gaming levels with orange dashed line indicating location of proposed horizontal fire curtain.

5.4 FIRE PROTECTION SYSTEMS

5.4.1 Fire Sprinkler System

The building is sprinkler protected throughout in accordance with AS2118.1-1999. Activation of a sprinkler head should:

- Automatically sound the BOWS in that zone as per the (cascading) alarm sequence.
- Automatically notify the fire brigade.

5.4.2 Automatic Detection

Automatic detection system shall be provided throughout the building in accordance with BCA Specification E2.2a Clause 5. Activation of the detection system shall activate the following:

- Building Occupant Warning System
- Automatic notification to the Fire Brigade (after a 180 seconds investigation time)
- Smoke extraction system / Zone smoke pressurisation system.

It is to be noted that fire alarms are localised the Mahogany Room (Level 1) and Chairman's Club (Level 2) before cascading horizontally and then vertically. A similar strategy applies to Level 3 function rooms. The staging sequence for two example scenarios (Zones 2 and 4) are detailed in APPENDIX B.

Additionally, thermal detectors shall be provided within each SOU (residential levels) adjacent to the entry door.

5.4.3 Smoke Hazard Management

Throughout the podium, where smoke extraction has not been nominated, the capacity for a standard zone pressurisation system to contain smoke to (fire) compartment of fire origin is assumed. The smoke exhaust rates for the atrium and podium levels are proposed to be as per the following table:

Table 5-2: Minimum smoke exhaust quantities proposed for various spaces in the podium

FLOOR	SPACE	PROPOSED SMOKE EXHAUST QUANTITY
L0	Restaurant	15,000 L/s
	Atrium	80,000 L/s (TBC)
L1	Restaurant	20,000 L/s
	Bar	15,000 L/s
	Gaming Suite*	46,000 L/s
L2	Restaurant	20,000 L/s
	Bar	15,000 L/s
	Gaming Suite*	35,000 L/s
L3	Restaurant	20,000 L/s
	Function rooms	20,000 L/s

*No smoke exhaust to private salons.

The Crystal Club and the Sky Gaming levels shall be provided with their own smoke exhaust systems. Smoke exhaust rates are to be confirmed.

5.4.4 Building Occupant Warning System

A building occupant warning system shall be installed throughout the development and is to be interfaced with the detection and sprinkler system. The general concept for alarm sequencing for various parts of the building shall be as per the 'Alarm + Lift sequence / matrix' attached in APPENDIX B. Additional speakers should be provided, where necessary, to ensure adequate coverage in all areas.

5.5 FIRST AID FIRE FIGHTING

5.5.1 Fire Hose Reels

Fire Hose Reels to be installed in accordance with the provisions within the BCA 2014 and AS 2441. If full coverage to satisfy BCA 2014 is not achieved then additional fire hose reels should be provided.

Note: BCA 2014 does not require fire hose reels to be provided to Class 2, 3 and 4 parts of a building. It is yet to be determined if fire hose reels are provided to the Class 2 and 3 parts to achieve coverage as per BCA 2013 (via an Alternative Solution) or compliant coverage by fire extinguishers as per BCA 2014.

5.5.2 Fire Hydrants

Fire hydrants must be installed as required by Clause E1.3 of the BCA in accordance with AS 2419 or as per dispensations provided by the fire authority.

5.5.3 Portable Fire Fighting Equipment

Portable fire extinguishers are to be provided in accordance with BCA 2014 Table E1.6 and selected, located and distributed in accordance with AS 2444.

5.6 COMMISSIONING AND MAINTENANCE REQUIREMENTS

All fire safety systems, including passive system components such as self-closing doors, must be maintained as per the applicable Australian Standards. Up to date logbooks must be kept on site.

Periodic inspection, testing and maintenance of all fire safety systems including fire hydrants, emergency lighting and exit signage, emergency warning, fire/smoke/exit doors, fire resistance, portable fire extinguishers, etc. shall be implemented in accordance with AS 1851.

Under all circumstances, it is important to keep as much of the systems fully operational as is practical. Should any building works extend over a number of days, the system should be re-instated as far as practical at the end of each day.

Maintenance contracts shall be in place and supplemented by building management on a regular basis.

5.7 BUILDING MANAGEMENT REQUIREMENTS

An Emergency Management Plan (EMP) should be developed and should incorporate training schedules for use of fire fighting equipment and other protective fire control systems and resident evacuation procedures.

The recommended fire safety systems must be extended or replaced with equivalent systems in all future works, and the recommended fire safety systems must be applied to any renovations or new works.

It is imperative that if the building is modified, refurbished or extended that those plans be continually updated to reflect any changes in the fire safety measures in the building.

To reduce the probability of failure in management procedures and fire protection systems it is desirable that a regular audit (i.e., annually) be carried out to ensure that effective fire safety management procedures are implemented on a continuing basis.

The management must document and inspect the following fire prevention activities:

- Provide fire safety information for all employees and contractors including as a minimum familiarisation with facility fire prevention procedures, fire reporting and facility emergency alarms including evacuation;
- Control of general housekeeping practices and transient combustibles particularly in escape paths;
- All plant and equipment that could constitute a fire origin hazard should be subject to regular, maintenance according to a designated schedule;
- A fire reporting procedure, including investigation requirements and corrective action requirements;
- All electrical equipment, systems and circuits should be tested in accordance with AS3000 and relevant electrical standards – periodic scheduled inspection and certification from a qualified electrician for all electrical equipment should be sought and filed;
- Earth leakage current protection should be tested regularly;
- A work permit system, including hot work permits, should be in place for use by all staff and contractors undertaking maintenance or refurbishment;
- Full emergency procedures and training schedule to AS3745 should be documented and implemented. Full records of all training should be maintained up to date.

- Staff members shall also be given annual training and practice in the use of portable fire extinguishers to fight small fires (if safe to do so). This includes necessary considerations to ensure that each staff member is thoroughly familiar with the steps to be taken in the event of fire.
- Copies of policies, procedures, and records appropriate to fire safety should be kept in a central location. Records of all fire incidents and false alarms should be made, reviewed and appropriate action taken.
- Regular testing, inspection and maintenance of all fire safety systems in the building should be undertaken and log books completed by competent local staff or registered and licensed fire protection maintenance contractors.
- Planned maintenance procedures shall be established and used to ensure that all fire protection systems can operate effectively when required. Maintenance shall be carried out in accordance with relevant standards or codes of practice and inspection and testing of these systems shall be carried out.

5.8 FIRE BRIGADE INTERVENTION

5.8.1 Fire Brigade Rendezvous

The fire brigade rendezvous point shall be located at the fire control room access from Lime Street. The Main Fire Indicator Panel shall be located here along with a tactical fire plan.

5.8.2 Tactical Fire Plans

Tactical fire plans are to be provided for use by the fire brigade. These shall be floor plans with the location of the following clearly identified:

- Fire hydrants
- Fire hose reels and fire extinguishers
- Fire indicator and any other repeater panels
- Egress paths
- Control equipment
- Any significant hazards on site
- Identification of rendezvous point
- Sprinkler valve and fire pump rooms
- Isolation valves
- Booster and suction pumps
- Any other relevant information

5.8.3 Fire Hydrants

A fire hydrant system and booster assembly is installed in accordance with AS 2419.1-2005.

5.9 BUILDING MANAGEMENT PROCEDURES

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

5.9.1 Maintenance of Fire Safety Equipment

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

5.9.2 No Smoking Policy

A no-smoking policy shall be implemented through all internal areas of the building with the exception of the Gaming Lounges designated for smoking.

5.9.3 Housekeeping

A Fire Risk Assessment (FRA) or similar method should be adopted upon occupation to determine high risk areas, processes and fuel loads and instigate appropriate control measures. The FRA should be undertaken periodically or upon major alterations to the building layout or to the occupancy demographic or distribution.

5.9.4 Fire Drills and General Fire Safety Training

All fire wardens are to be trained in first-aid fire fighting and emergency response. All staff are to 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.

5.9.5 Evacuation Plan

An evacuation plan shall be developed by CORE in accordance with AS 3745-2002.

5.9.6 Assembly Area

An assembly area is to be designated in a suitably safe and open location.

5.9.7 Fire Safety Manual

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

5.9.8 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 REFERENCES

1. ABCB, “Building Code of Australia, Volume One”, CanPrint Communications, Canberra 2008.
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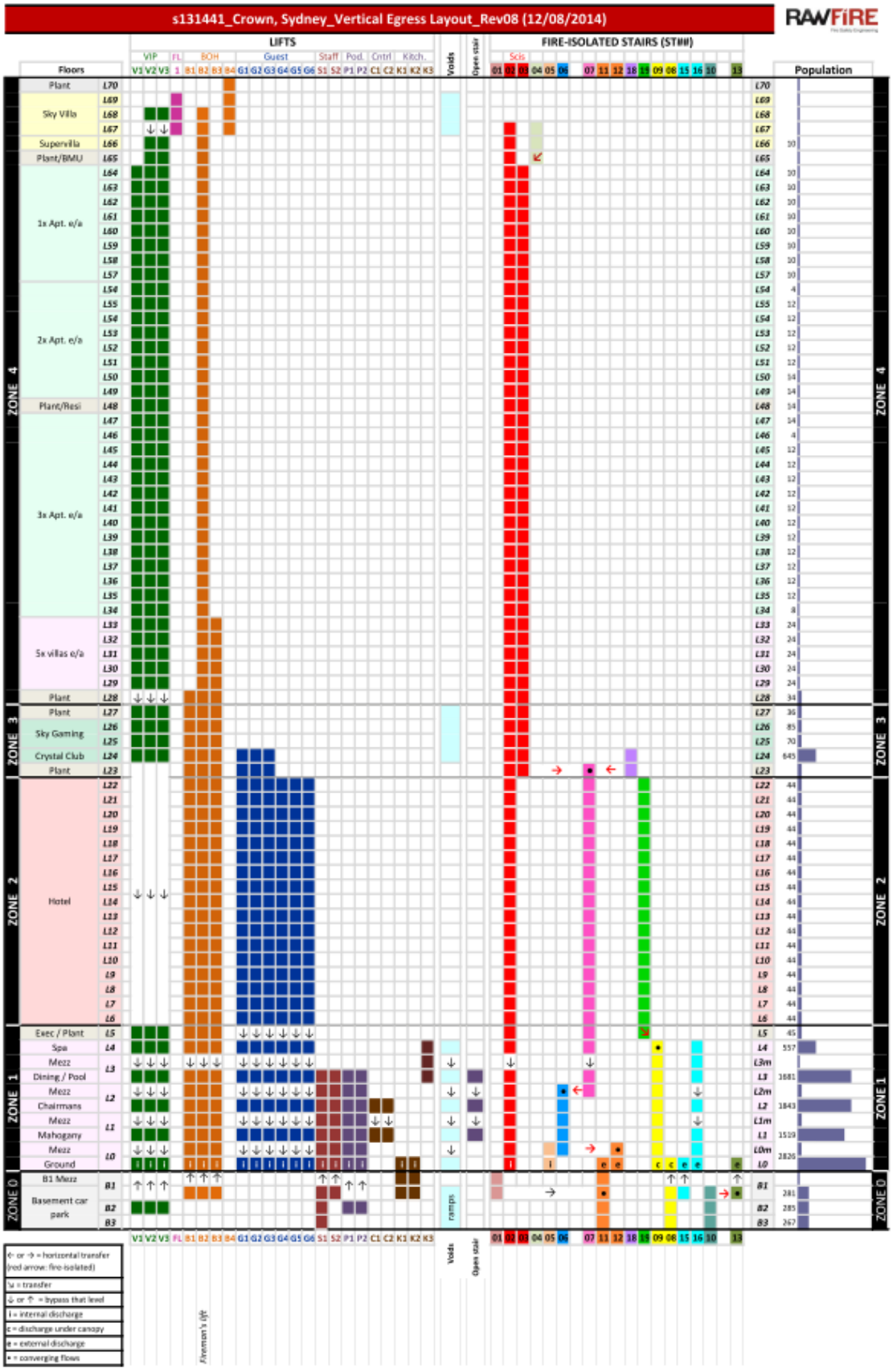
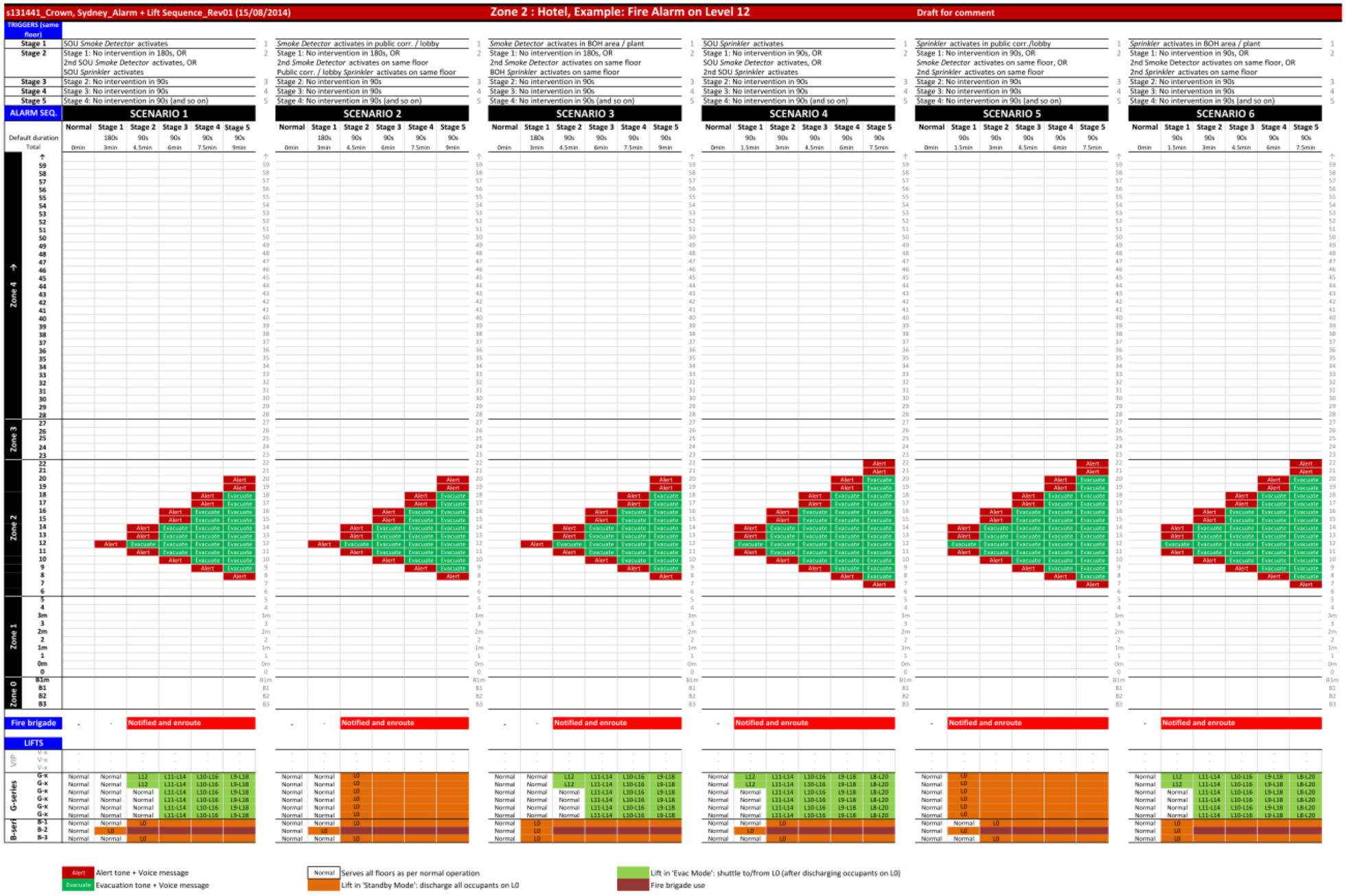
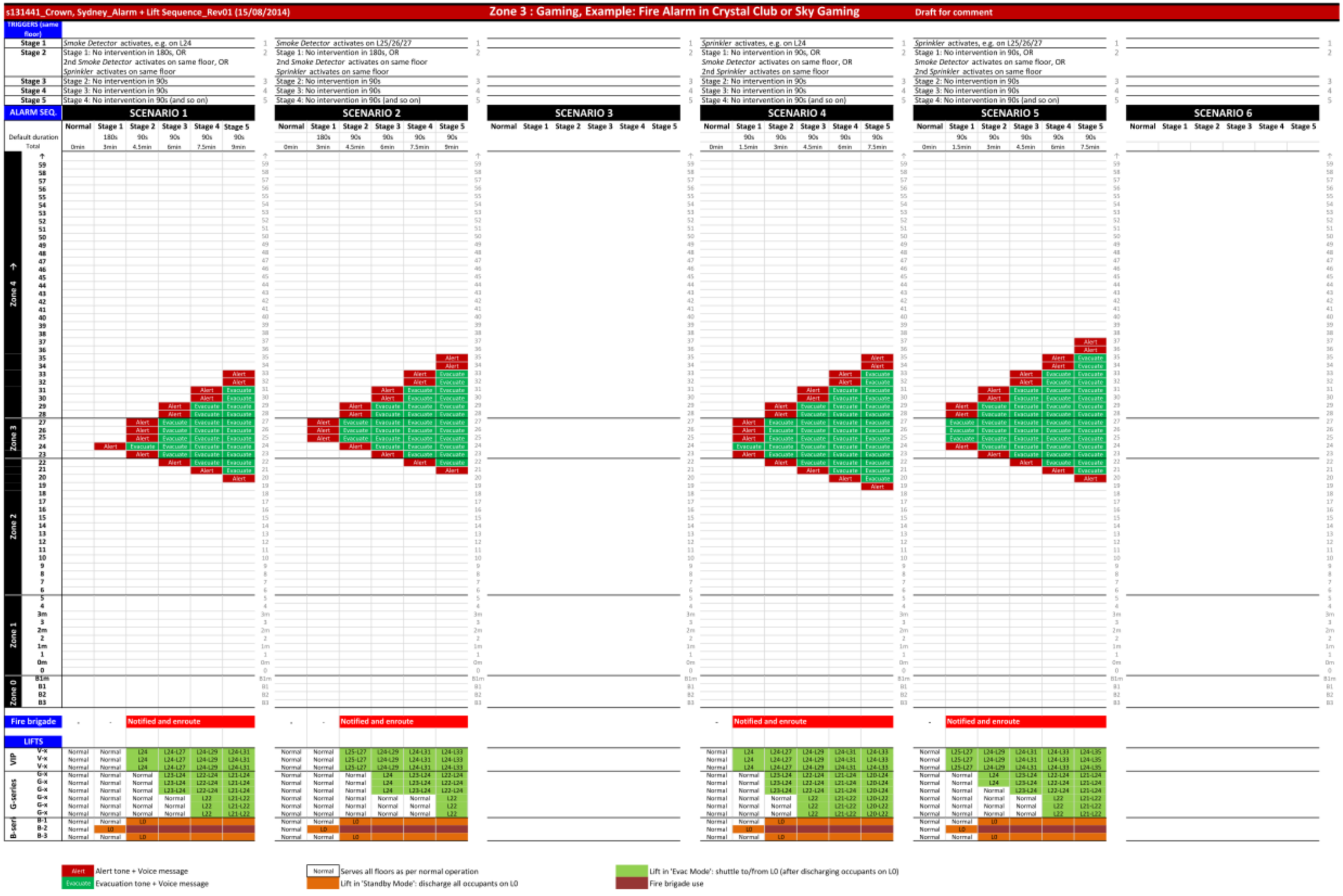
4. Australasian Fire Authorities Council, ‘Fire Brigade Intervention Model V2.1’, November 1997.
5. BS 9999: Code of practice for fire safety in the design, management and use of buildings, October 2008
6. PD 7974-6:2004, “The application of fire safety engineering principles to fire safety design of buildings – Part 6: Human factors: Life safety strategies – Occupant evacuation, behaviour and condition (Sub-system 6)”, BSI British Standards.
7. Society of Fire Protection Engineers, ‘Handbook of Fire Protection Engineers’, 3rd Edition, 2002.
8. The Chartered Institute of Building Services Engineers, ‘CIBSE Guide E, “Fire engineering’, 2nd Edition, September 2003.
9. Australian Building Codes Board, ‘Information Handbook: Lifts Used During Evacuation’, 2013.

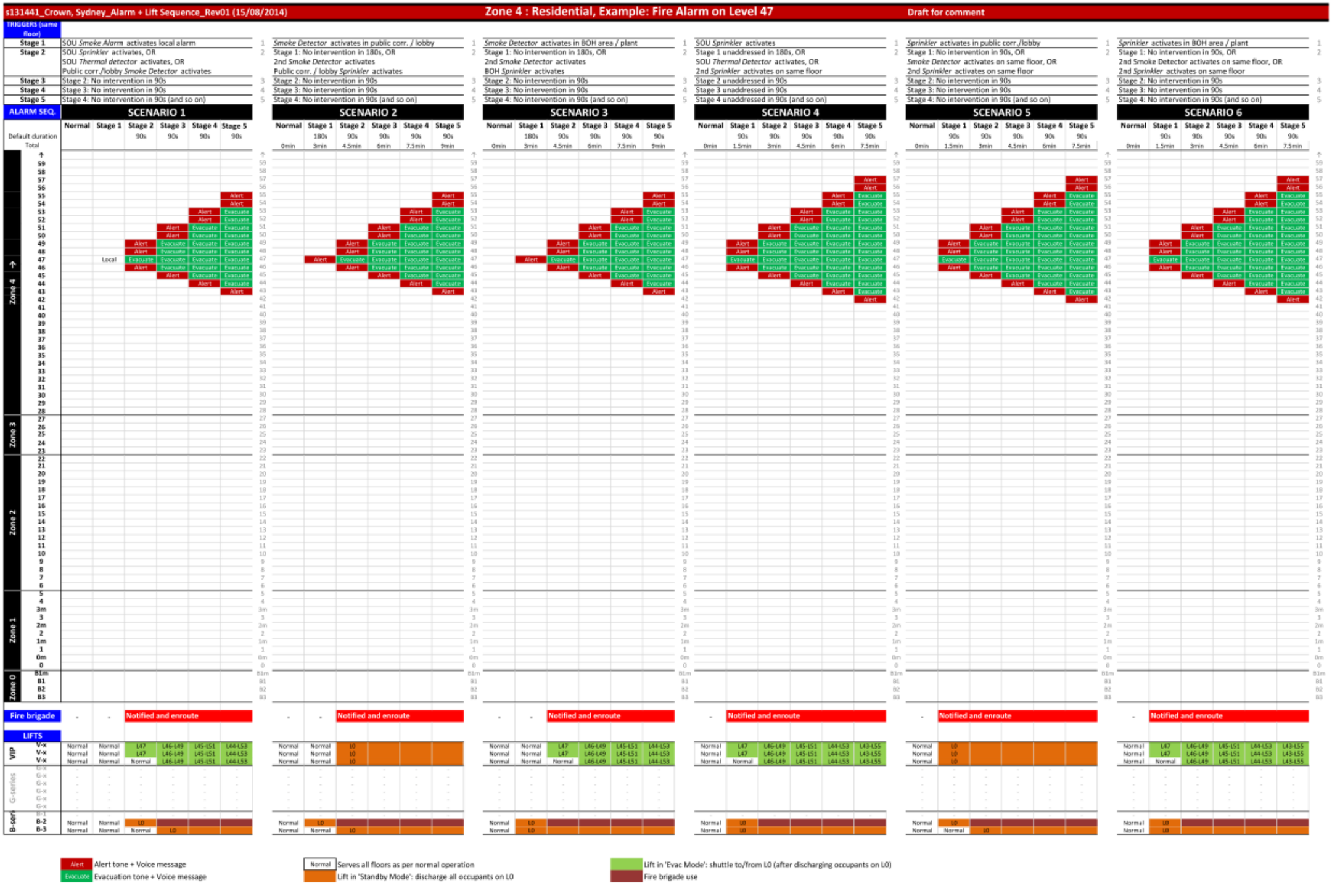
APPENDIX A VERTICAL EGRESS CHART



APPENDIX B ALARM STAGING SEQUENCE EXAMPLES FOR ZONES 2, 3 AND 4




s131441_Crown, Sydney_Alarm + Lift Sequence_Rev01 (15/08/2014)
Zone 3 : Gaming, Example: Fire Alarm in Crystal Club or Sky Gaming
Draft for comment
TRIGGERS (same floor)
Stage 1 Smoke Detector activates, e.g. on L24
Stage 2 Stage 1: No intervention in 180s, OR 2nd Smoke Detector activates on same floor, OR Sprinkler activates on same floor
Stage 3 Stage 2: No intervention in 90s
Stage 4 Stage 3: No intervention in 90s
Stage 5 Stage 4: No intervention in 90s (and so on)
ALARM SEQ.
SCENARIO 1
Smoke Detector activates on L25/26/27
Stage 1: No intervention in 180s, OR 2nd Smoke Detector activates on same floor, OR Sprinkler activates on same floor
SCENARIO 2
SCENARIO 3
Sprinkler activates, e.g. on L24
Stage 1: No intervention in 90s, OR Smoke Detector activates on same floor, OR 2nd Sprinkler activates on same floor
SCENARIO 4
Sprinkler activates, e.g. on L25/26/27
Stage 1: No intervention in 90s, OR Smoke Detector activates on same floor, OR 2nd Sprinkler activates on same floor
SCENARIO 5
SCENARIO 6
Normal Stage 1 Stage 2 Stage 3 Stage 4 Stage 5
Default duration
Total
Zone 4
Zone 3
Zone 2
Zone 1
Zone 0
Fire brigade
Notified and enroute
LIFTS
VIP
G-series
B-series
Alert Alert tone + Voice message
Evacuate Evacuation tone + Voice message
Normal Serves all floors as per normal operation
Lift in 'Standby Mode': discharge all occupants on L0
Lift in 'Evac Mode': shuttle to/from L0 (after discharging occupants on L0)
Fire brigade use


s131441_Crown, Sydney_Alarm + Lift Sequence_Rev01 (15/08/2014)
Zone 4 : Residential, Example: Fire Alarm on Level 47
Draft for comment
TRIGGERS (same floor)
Stage 1 SOU Smoke Alarm activates local alarm
Stage 2 SOU Sprinkler activates, OR SOU Thermal detector activates, OR Public corr./lobby Smoke Detector activates
Stage 3 Stage 2: No intervention in 90s
Stage 4 Stage 3: No intervention in 90s
Stage 5 Stage 4: No intervention in 90s (and so on)
Smoke Detector activates in public corr. / lobby
Stage 1: No intervention in 180s, OR 2nd Smoke Detector activates Public corr. / lobby Sprinkler activates
Stage 2: No intervention in 90s
Stage 3: No intervention in 90s
Stage 4: No intervention in 90s (and so on)
Smoke Detector activates in BOH area / plant
Stage 1: No intervention in 180s, OR 2nd Smoke Detector activates BOH Sprinkler activates
Stage 2: No intervention in 90s
Stage 3: No intervention in 90s
Stage 4: No intervention in 90s (and so on)
SOU Sprinkler activates
Stage 1 unaddressed in 180s, OR SOU Thermal Detector activates, OR 2nd Sprinkler activates on same floor
Stage 2 unaddressed in 90s
Stage 3 unaddressed in 90s
Stage 4 unaddressed in 90s (and so on)
Sprinkler activates in public corr./lobby
Stage 1: No intervention in 90s, OR Smoke Detector activates on same floor, OR 2nd Sprinkler activates on same floor
Stage 2: No intervention in 90s
Stage 3: No intervention in 90s
Stage 4: No intervention in 90s (and so on)
Sprinkler activates in BOH area / plant
Stage 1: No intervention in 90s, OR 2nd Smoke Detector activates on same floor, OR 2nd Sprinkler activates on same floor
Stage 2: No intervention in 90s
Stage 3: No intervention in 90s
Stage 4: No intervention in 90s (and so on)
ALARM SEQ.
SCENARIO 1
SCENARIO 2
SCENARIO 3
SCENARIO 4
SCENARIO 5
SCENARIO 6
Normal Stage 1 Stage 2 Stage 3 Stage 4 Stage 5
Default duration
Total
Zone 4
Zone 3
Zone 2
Zone 1
Zone 0
Fire brigade
Notified and enroute
LIFTS
VIP
G-series
B-series
Alert
Evacuate
Local
Alert tone + Voice message
Evacuation tone + Voice message
Normal
Serves all floors as per normal operation
Lift in 'Standby Mode': discharge all occupants on L0
Lift in 'Evac Mode': shuttle to/from L0 (after discharging occupants on L0)
Fire brigade use