FIRE ENGINEERING BRIEF

Illoura Place - 28 Elizabeth St, Liverpool

Project:	Illoura Place - 28 Elizabeth St, Liverpool
Reference No:	113165-FEB-r2
Date:	29 October 2021
Client:	Altis Bulky Retail Pty Ltd as trustee for Altis ARET Sub Trust 20 “Altis”
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DOCUMENT CONTROLS

Reference	Date	Description	
113165-FEB-r1	22 July 2021	Original Fire Engineering Report	
113165-FEB-r2	29 October 2021	Updates to FEB based on revised drawings.	
		Prepared by:	Checked by:
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EXECUTIVE SUMMARY

SGA Fire has been appointed by Altis Bulky Retail Pty Ltd to develop a fire engineered Performance Solutions to address departures from the Building Code of Australia (BCA) Deemed-to-Satisfy (DTS) provisions for Illoura Place - 28 Elizabeth St, Liverpool.

This Fire Engineering Brief (FEB) presents proposed Performance Solution(s) and proposed Fire Engineering Requirements additional and/or alternate to BCA DTS provisions to permit the BCA 2019 Amendment 1 Deemed to Satisfy (DTS) non-conformance(s) tabled below. This FEB has been undertaken in line with the Performance-Based Design Brief (PBDB) requirements of Clause A2.2(4) of the BCA. This FEB assumes all other new works comply with the applicable BCA DTS Provisions expect where described otherwise.

This document pertains to compliance for the specific Performance Solutions only. The project Certifying Authority remains responsible for assessing overall BCA compliance of the project, of which this document is only one component. This document assumes all other new works comply with the applicable BCA DTS Provisions expect where described otherwise.

This report is not a Design Compliance Declaration under the Design and Building Practitioners Act 2020 and is not to be used or construed as such.

#	BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
1.	Specification C1.1	Rationalise FRLs throughout different classifications on the Ground Floor	CP1, CP2
2.	Clause C1.9	Allow for combustible plywood noggins in internal SOU walls	CP2
3.	Clause C2.14	Allow for residential corridors to be longer than 40m without smoke separation	EP2.2
4.	Clause D1.2	Allow for only a single exit being provided to several locations throughout the building.	DP4
5.	Clause D1.4	Allow for extended travel distances throughout the ground floor areas of the building: > The residential lobby on the Ground Floor, a distance of up to 26m to a single exit in lieu of the required 20m. > Travel distance within the loading dock of up to 26.4m to a point of choice in lieu of the required 20m.	DP4, EP2.2
6.	Clause D1.4	Allow for extended travel distances throughout the residential areas of the building: > Throughout the residential levels, the SOU doorways are located up to 9.5m to a single exit or point of choice in lieu of the required 6m.	DP4, EP2.2

#	BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
7.	Clause D1.4	Allow for extended travel distances throughout the Common open areas of the building: > On the Level 5 open lawn area up to 54m to a single exit or point of choice in lieu of the required 20m. > The common areas of the residential floors include distances from the AC condenser room on each level which require travel of 20.5 m to an exit or point of choice in lieu of 20 m.	DP4, EP2.2
8.	Clause D1.4, D1.5	Allow for extended travel distances throughout the carparks: > Travel distance throughout the carpark up to 51m to an exit in lieu of the required 40m. > Allow for extended travel distance between two alternative exits in the basement of up to 78.3m in lieu of the required 60m	DP4, EP2.2
9.	Clause D1.5	To allow for exit to be located within 9m of each other.	DP4, EP2.2
10	Clause D1.10	Allow for the alternative exits to discharge within proximity to each other on the Ground Floor	DP4
11.	Clause E1.3	Allow for the fire hydrant booster to be located on the side street in lieu of within site of the main building entrance as required by AS2419.1-2005.	DP5

Table 1 - Performance Solution summary

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1 INTRODUCTION

1.1 The Project

This project is for the new development located at Illoura Place - 28 Elizabeth St, Liverpool.

1.2 Building Code of Australia

The Building Code of Australia currently applicable to this project is the National Construction Code Series Volume 1 - Building Code of Australia 2019 Amendment 1, herein referred to as the BCA.

1.3 Engagement

BCA Logic Pty Ltd has been engaged by Altis Bulky Retail Pty Ltd as trustee for Altis ARET Sub Trust 20 to develop fire engineered Performance Solutions to address departures from the Building Code of Australia (BCA) Deemed-to-Satisfy (DTS) provisions, in accordance with the International Fire Engineering Guidelines (IFEG)[1].

1.4 Fire and life safety objectives

The following items are a summary of the Fire and Life Safety objectives of the BCA for which this document considers compliance:

- Life safety of occupants – the occupants must be able to leave the building (or remain in a safe refuge) without being subjected to hazardous or untenable conditions.
- Life safety of the fire fighters – fire fighters must be given a reasonable time to rescue any remaining occupants before hazardous conditions or building collapse occurs.
- Protection of adjoining buildings – structures must not collapse onto adjacent property, and fire spread by radiation should not occur.

BCA Logic has not been advised there are other regulatory objectives that are applicable to this project, such as:

- Property protection.
- Business continuity.
- Insurer's requirements.
- Corporate image issues.
- Community issues.
- Environmental issues.

1.5 Report objectives, scope and extent

This report is a Fire Engineering Brief (FEB) produced in accordance with IFEG. The FEB purpose is to present for stakeholder involvement the proposed Performance Solutions, design fires, occupant traits, and required preventative and protective measures.

The FEB is undertaken in line with the Performance-Based Design Brief (PBDB) requirements of Clause A2.2(4) of the BCA.

This document pertains only to compliance for the specific Performance Solutions described herein. The project Certifying Authority remains responsible for assessing overall BCA compliance of the

[1] Australian Building Code Board; International Fire Engineering Guidelines; 2005.

project, of which this document is only one component. This document assumes all other new works comply with the applicable BCA DTS Provisions expect where described otherwise.

Where fire safety Performance Requirements are to be met by Performance Solutions by other entities, all such FERs must be provided to BCA Logic for consideration in developing and assessing the Performance Solutions in this report.

Performance Solutions presented herein are undertaken in accordance with the key principals of the BCA 2019 Fire Safety Verification Methods (FSVM) Schedule 10. ANNEXURE A presents our understanding of these key principals and our methodology of application.

1.6 Stakeholder consultation

The key stakeholders in the fire engineering process for this project are identified below. The attending fire service is included as a stakeholder where this is required by Environmental Planning and Assessment Regulations (EP&A Regs) or specifically requested by an Authority.

Stakeholder consultation has included:

- Identification of non-compliances by the BCA Consultant
- Discussion of the identified issues between the client and SGA Fire staff
- Internal discussion between SGA Fire staff as to the potential performance solutions

FEB feedback from stakeholders will be incorporated into the future FER development.

	Company	Contact
Client	Altis Bulky Retail Pty Ltd as trustee for Altis ARET Sub Trust 20 “Altis”	Fiona Beaverson
Fire engineer	SGA Fire	James Murch
Architect	Turner Studio	TBA
Builder	TBA	TBA
Fire protection designer / Competent Fire Safety Practitioner (CFSP)	TBA	TBA
Certifier	TBA	TBA
BCA consultant	BCA Logic	Benjamin Long
Attending Fire Service	FRNSW	TBA

Table 2 - Key stakeholders

1.7 Interaction with other Performance Solutions

BCA Logic has not been advised of other fire engineering Performance Solutions applicable to the development.

2 PRINCIPAL BUILDING CHARACTERISTICS

2.1 Building description

The subject site is located at Illoura Place - 28 Elizabeth St, Liverpool. Below Figure 1 shows the site location/configuration. Key building BCA parameters are nominated in the table that follows. The proposed development consists of:

- 6 basement carparking levels
- Ground floor retail stores
- End of trip facilities
- 4 levels of commercial offices
- 29 levels of residential apartments
- Communal open spaces on Level 5

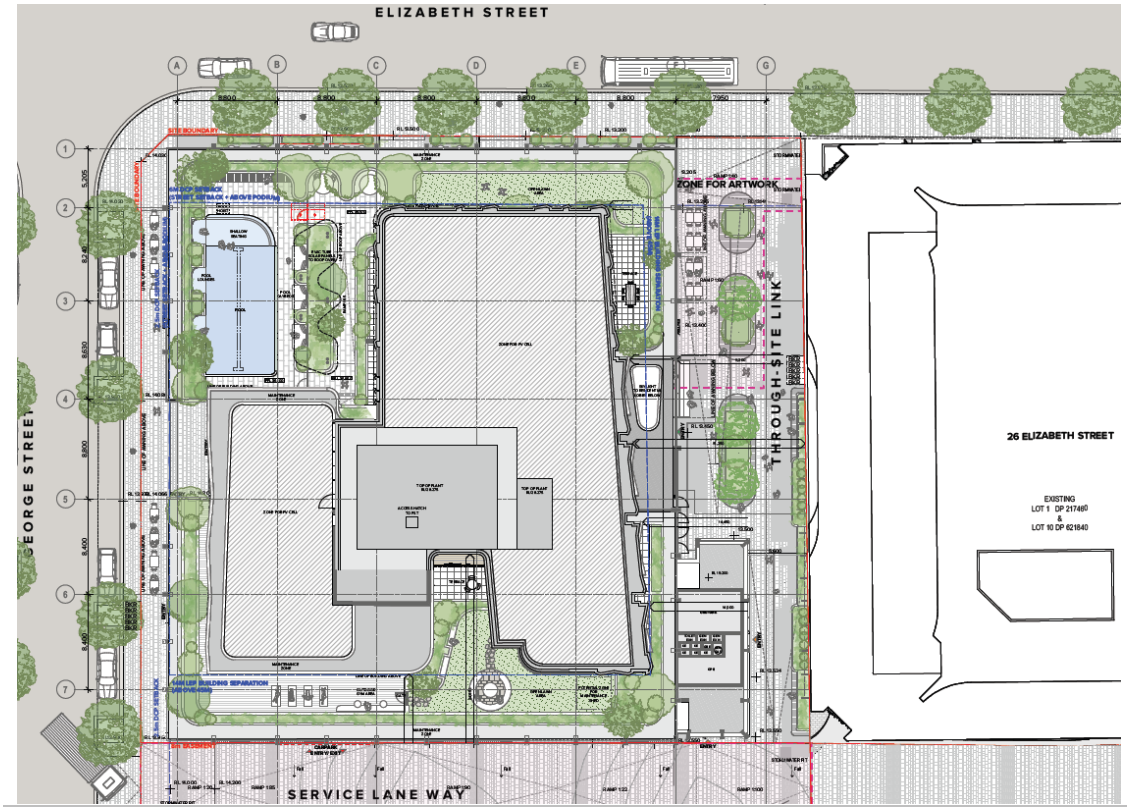

Figure 1 - Site Plan

Table 3- Building Classifications

BCA parameter	Description
Base building BCA classification(s)	2, 5, 6, 7b, 7a & 8
Effective height of the building	109.2 m
Rise in stories	35
Stories contained	40
Type of construction	A

2.2 General arrangement and exits

The building general arrangement exit locations are identified in the below figures.

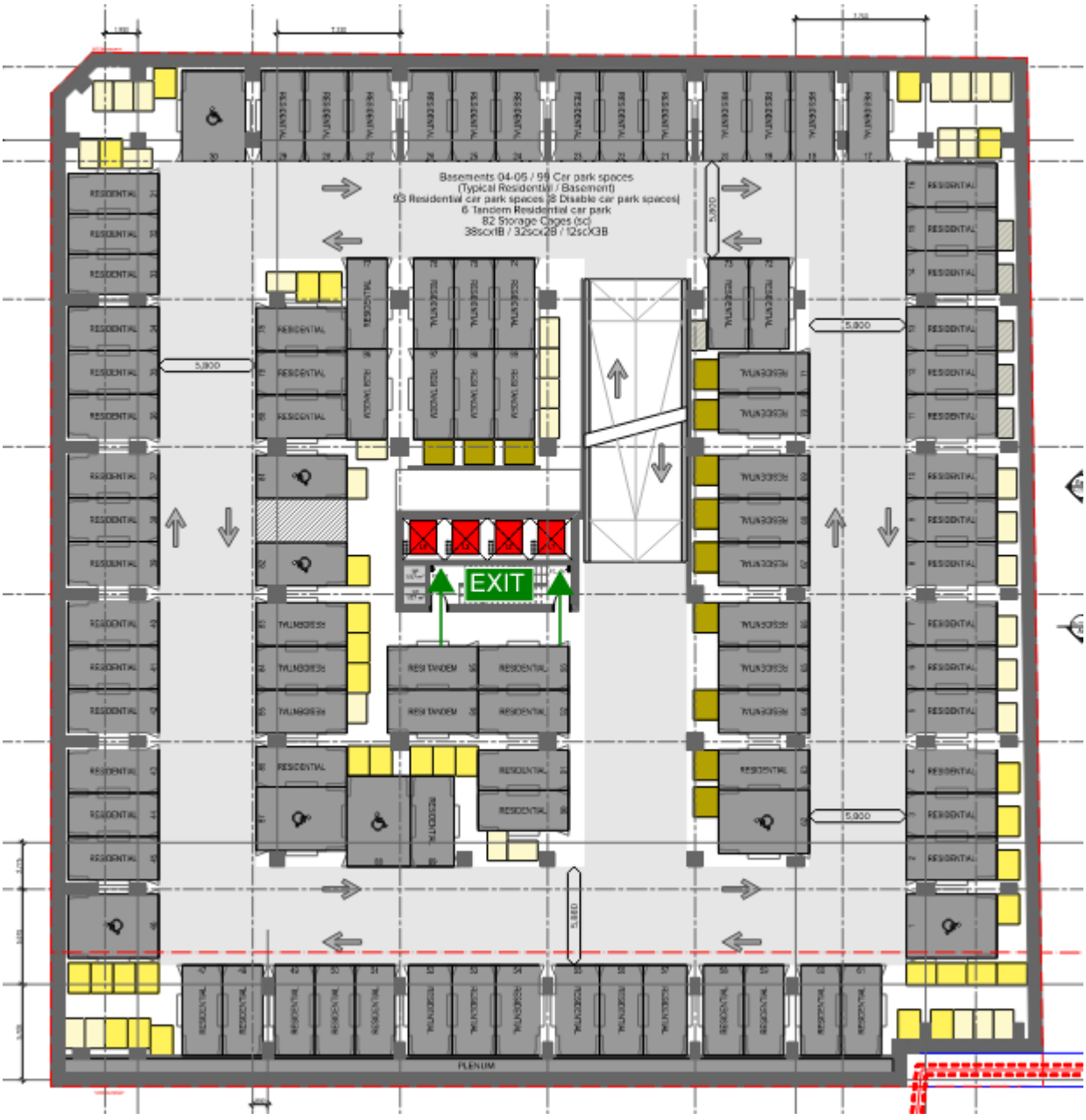

Figure 2 - Typical Basement

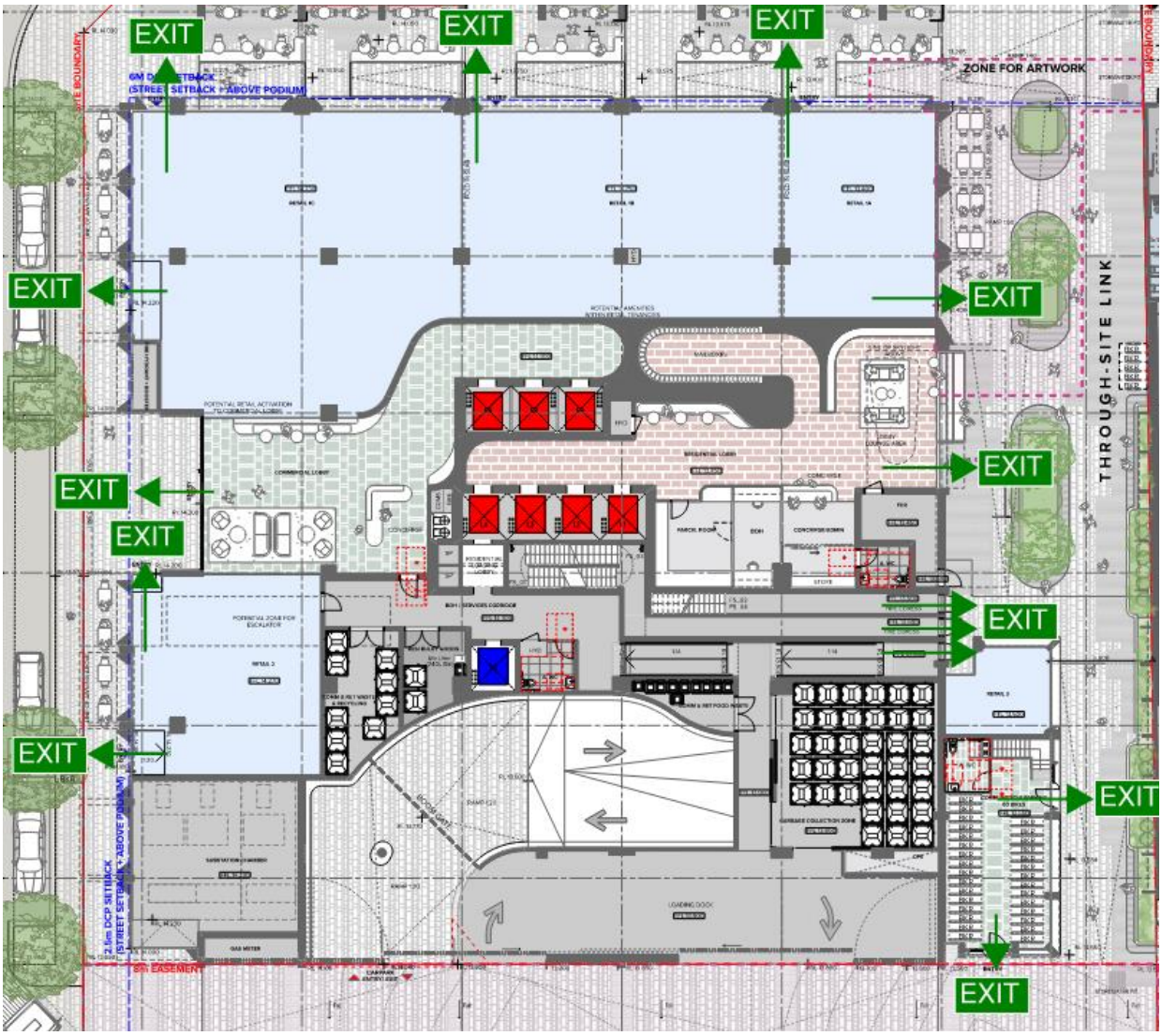

Figure 3 - Ground

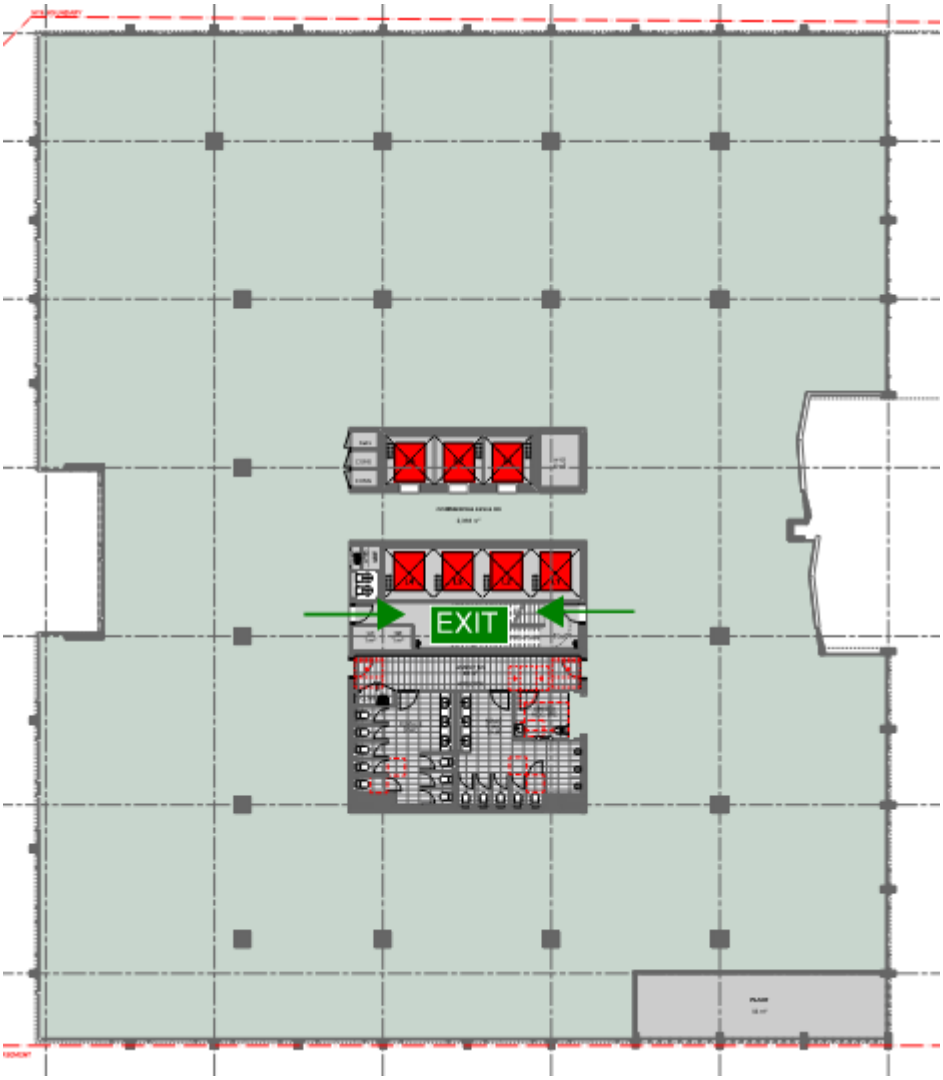

Figure 4 – Typical Office

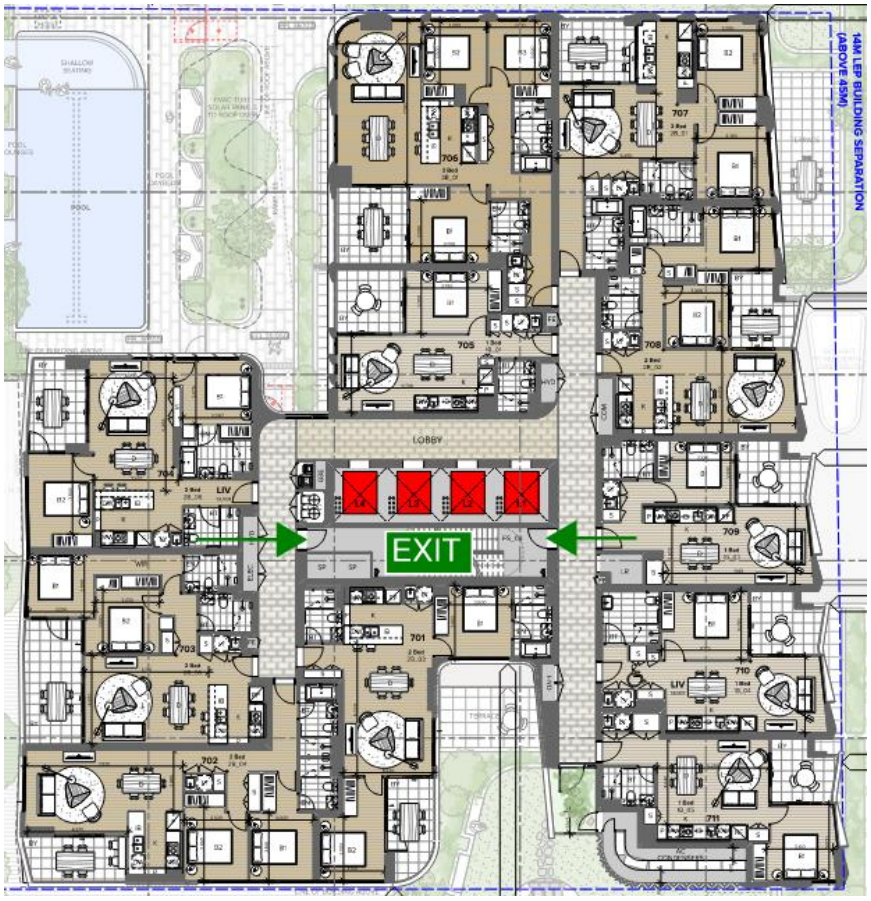

Figure 5 – Typical Residential

2.3 Potential fire hazards

The potential fire hazards in the subject building are tabled below. These hazards have been considered in the development of the design fire scenarios.

Factor	Example
Ignition Sources	> Office equipment. > Electrical appliances. > Personal technology, ie phones and tablets etc. > Heating and air-conditioning equipment. > Electrical power supply and lighting system. > Smoking, whether prohibited or not. > Vehicles.
Fuel Sources	> Office equipment. > Office documentation. > Carpets and wall hangings. > Furnishings. > Furniture.

	> Electrical appliances. > Personal belongings. > Electrical power supply and lighting system components. > Stored items. > Vehicles.
Activities	> Improper use of electrical equipment. > Smoking whether prohibited or not. > Minor arson.

Table 4 - Potential fire hazards

Major arson fires with multiple ignition sources and/or multiple ignition locations are discounted in this instance (relative to the Performance Solutions reviewed) and are outside the scope of this report. No amount of professional advice (in both DTS and performance-based designs) can obviate major arson fires with multiple ignition sources and areas of fire origin. Security and fire management procedures and measures would be required to address major arson fires (as for any building).

In any case, it is assumed within this report that a fire will start. The worst credible design fires selected to evaluate the proposed Performance Solutions are considered to have included minor arson fires as minor arsonists are typically opportunistic and use the combustibles readily available on site rather than employ introduced fuel load.

3 DOMINANT OCCUPANT CHARACTERISTICS

3.1 Commercial floors

3.1.1 Occupants

The occupants are to consist of staff, maintenance contractors and visitors. Medium to long term staff members and maintenance contractors are expected to be familiar with the layout of the subject building and location of exits. Visitors may not be familiar with the building layout but are expected to be aware of the main entrance by which they access the subject building.

3.1.2 State and physical attributes

Occupants are expected to be awake and alert. The majority of building occupants are expected to be able-bodied. Any occupants requiring mobility assistance are likely to be accompanied by a caregiver or under the assistance of the staff members in the event of an emergency.

3.1.3 Mental attributes

It is expected that the staff would have the ability to interpret fire cues, understand fire alarm messages, and make and implement decisions.

Most of the other occupants are expected to have the ability to interpret fire cues, understand fire alarm messages, and follow the instructions given to them by the staff and emergency services personnel.

Most occupants are expected to evacuate the building following the warning signals and guidance provided by the staff or fire brigade.

3.1.4 Emergency training

Occupants are not expected to have been trained in first attack firefighting using hose reels or extinguishers.

Staff are expected to have been provided with training with respect to emergency procedures to AS3745-2010.

3.2 Residential floors

3.2.1 Occupants

The occupants are to consist of residents and visitors, and contractors on occasion. Residents are expected to be familiar with the layout of the subject building and location of exits. Contractors and visitors may not be familiar with the building layout but are expected to be aware of the main entrance by which they access the subject building.

3.2.2 State and physical attributes

Occupants may be awake and alert, or could be asleep or drug or alcohol impaired. Any such potential impairment of occupants is considered to be equally applicable to DTS to Performance Solutions and therefore is not a differentiating factor in Performance Solution assessment. The majority of building occupants are expected to be able-bodied and are expected to be able to evacuate the building by themselves.

As with the general population, a portion of the occupants in the subject buildings is expected to have some mobility and hearing impairment and may require assistance for evacuation.

3.2.3 Mental attributes

It is expected that occupants would have the ability to interpret fire cues, understand fire alarm messages, and make and implement decisions.

Most occupants are expected to evacuate the building following the warning signals and guidance provided by attending fire brigade.

3.2.4 Emergency training

Occupants are not expected to have been provided with training with respect to emergency procedures to AS3745-2010 and/or first-aid firefighting.

3.3 Retail occupancy

3.3.1 Occupants

The occupants are to consist of customers, staff and maintenance contractors. Medium to long term staff members and maintenance contractors are expected to be familiar with the layout of the subject building and location of exits. Visitors may not be familiar with the building layout but are expected to be aware of the main entrance by which they access the subject building.

3.3.2 State and physical attributes

Occupants in the building are expected to be awake and alert. The majority of building occupants are expected to be able-bodied. Any occupants requiring mobility assistance are likely to be accompanied by a caregiver or under the assistance of the staff members in the event of an emergency.

3.3.3 Mental attributes

It is expected that the staff in the subject building would have the ability to interpret fire cues, understand fire alarm messages, and make and implement decisions.

Most of the other occupants are expected to have the ability to interpret fire cues, understand fire alarm messages, and follow the instructions given to them by the staff and emergency services personnel.

Most occupants are expected to evacuate the building following the warning signals and guidance provided by the staff or fire brigade.

3.3.4 Emergency training

Occupants are not expected to have been trained in first attack firefighting using hose reels or extinguishers.

Staff are expected not to have been provided with training with respect to emergency procedures to AS3745-2010.

3.4 Number of occupants

Based on application of BCA table D1.13 the maximum number of occupants anticipated are as follows:

Location	Area	Density (BCA D1.13)	Occupants
Basement Carparks (per floor)	3387 m^2	0.033 persons/m^2	113 persons
Ground Floor Retail	754 m^2	1 persons/m^2	754 persons
Office Floors (per floor)	2066 m^2	0.1 persons/m^2	207 persons

Table 5 - Number of occupants

4 FIRE ENGINEERING REQUIREMENTS

4.1 Overview

Assessment of the Performance Solutions described within this report relies on the preventative and protective fire safety measures and building design features nominated in this section. This section constitutes the "trial design" per IFEG nomenclature.

The successful outcome of Performance Solutions is subject to the following:

- The provisions listed in this section are to be strictly adhered to.
- Should a change in use or building alterations or additions occur in the future, a re-assessment will be needed to verify consistency with the analysis contained within this report.

Where this report is silent regarding a fire safety measure it is assumed that it is DTS compliant or has otherwise been deemed acceptable by the Certifying Authority. Refer also to section 1.7 regarding other Performance Solutions that have been considered in the development of this report.

The responsibility for confirming the full fire safety schedule of required systems remains with the Certifying Authority (Certifier). The Fire Safety Measures and Standards of Performance summarised below in Table 6 are required to be added to the building's schedule of essential fire safety measures/AFSS.

Fire Safety Measure	Standard of Performance
Automatic fire detection & alarm:	AS1670.1-2018 Specification E2.2a Clause 5 BCA Logic FER 113165-FEB-r2
Automatic fire suppression system (sprinklers)	AS2118.1-2017 BCA Logic FER 113165-FEB-r2
Exit, Emergency and Wayfinding signage and lighting	AS2293.1-2018 BCA Logic FER 113165-FEB-r2
Fire and smoke resisting construction	BCA Logic FER 113165-FEB-r2
Smoke seals	AS 1530.7-2007 BCA Logic FER 113165-FEB-r2

Table 6 - Fire Safety Measures and Standard of Performance to be added to the Fire Safety Schedule

4.2 Fire and smoke resisting construction

- The lining materials of the fire compartments proposed to have reduced FRL to be confirmed in the FER.
- Unprotected openings in compartments proposed to have reduced FRLs are to have sufficient area such that breakage of 50% of the glazed area would result in burnout of the fuel load in less time than the proposed FRL. The extent of the required unprotected openings will be confirmed in the FER.
- The residential common corridors are not required to be provided with smoke compartmentation.

- The ground floor residential garbage room is to be fire separated from the loading dock and associated corridors.

4.3 Egress

- The following areas on the ground floor may be provided with a single exit in lieu of the required 2.
  - Residential Lobby.
  - Retail tenancies.
  - Commercial bike parking and End-of-Trip facilities.
- The following areas on the ground floor may have extended travel distances.
  - Residential Lobby up to 26 m to a single exit.
  - Loading Dock up to 26.4 m to a point of choice.
- The following areas on the residential floors may have extended travel distances.
  - Residential Lobby up to 9.5 m to an exit or point of choice.
  - Communal open areas up to 54 m to a point of choice.
  - AC condenser rooms up to 20.5 m to an exit or a point of choice.
- The basement carparks may be provided with the following extended travel distances.
  - Up to 51 m to an exit.
  - Up to 78.3 m between exits through a point of choice.

4.4 Automatic fire sprinkler System

- The carpark is to be provided with a DTS compliant sprinkler system throughout. The sprinkler system is to incorporate fast response sprinkler head with an RTI of no more than 50 $m^{0.5}s^{0,5}$.

4.5 Fire detection and alarm System

- Additional heat detectors are to be provided to the residential SOUs with 1.5m of the SOU entry door. These detectors are to provide an early alarm cue and activate the occupant warning system. These heat detectors will be interconnected with the common building alarm system.
- The occupant warning system within the residential areas is to achieve an A-weighted sound pressure level of 75dB at the bedhead (as stipulated in AS1670.1-2018 Clause 3.22.3) in lieu of the requirements of Spec E2.2a Clause 6 of the BCA.

4.6 Smoke seals

- Medium temperature smoke seals (tested to AS 1530.7 for temperatures up to 200°C for 30 minutes) are to be applied to the following doors on the Residential Floors.
  - SOU entry doors.
  - Doors to hydraulic and elec/comms service cupboards.
  - Any other doors required to be fire resisting.

4.7 Exit signage

- Illuminated Exit signs are to be provided in the residential common corridors.

4.8 Signage and equipment identification

- A full site plan showing the hydrant booster location, FIP, surrounding streets and access points for FRNSW personnel is to be provided at the following locations:
  - The Hydrant Booster Assembly.
  - FIP.

- Fire Control Room.
- At street level in front of the main entrance to the building.

> The signage should be constructed of all-weather fade resistant material with red lettering not less than 25mm high with a contrasting-coloured background.

> A strobe light is to be located above the hydrant booster assembly to aid in location by FRNSW.

4.9 Management in use

The fire safety systems must be maintained in accordance with applicable legislation, codes and standards and manufacturers' directions, in accordance with NSW and Federal legislations. Appropriate information to enable use, testing and maintenance of fire safety systems, including applicable Fire Engineering Report(s), shall be included in the Building Manual.

4.10 Fire brigade intervention

The overall philosophical Fire Brigade objectives throughout Australia are to protect life, property and the environment from fire[2]. Fire Brigade intervention is anticipated for the fire scenarios considered, whether via automatic Fire Brigade monitoring or by occupants or passers by phoning.

Where the positive impact of Fire Brigade intervention is not included in the Performance Solution, ie a conservative assumption, a Fire Brigade Intervention Model (FBIM) is not considered necessary and is therefore not included.

Where fire brigade intervention is relied upon for a Performance Solution and a Fire Brigade Intervention Model (FBIM) is undertaken this will be included as an Annexure to the FER.

4.11 Implementation and commissioning

Prior to the Certification of Practical Completion (Occupation Certificate) appropriate undertakings of acceptance of the works and commissioning of systems should be sought from the consultants and contractors that are adequate to satisfy all approval conditions and contractual requirements.

Commissioning of the fire systems should be carried out in accordance with the relevant standards listed in the following sections. Commissioning and integrated function testing of all fire safety systems including interfaces should be carried out to ensure proper function.

[2] Fire Brigade Intervention Model (FBIM), Australasian Fire Authorities Council, Fire Brigade Intervention Model, Ver 2.2; Australasian Fire Authorities Council, Melbourne, 2004

5 PERFORMANCE SOLUTION 1 – RATIONALISATION OF FRLS

5.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The proposed FRLs are still to be determined but are likely to be reducing the retail tenancies FRLs from 3 hours down to 2 hours. The ground floor retail tenancies are shown in Figure 6

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Specification C1.1	Rationalise FRLs throughout different classifications on the Ground Floor	CP1, CP2

Table 7 - Performance Solution Overview

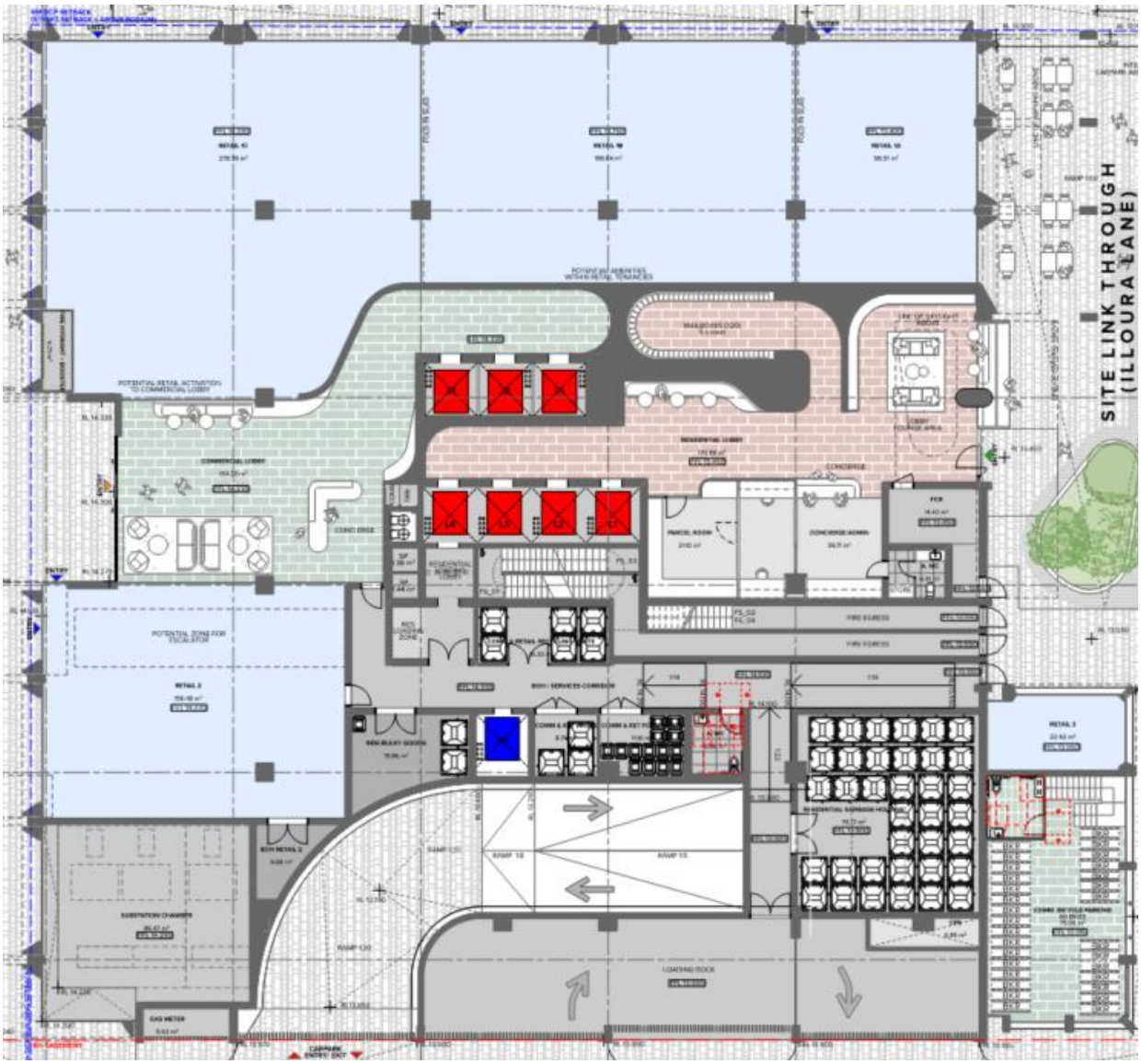

Figure 6 – Ground Floor Layout

5.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Quantitative
IFEG sub-system(s) considered	C – Fire Spread and Impact and Control

5.3 Acceptance criteria

The proposed design is considered acceptable if it is demonstrated that the fire resistance of the building elements is greater than the established fire exposure equivalent to burnout of the fire compartment.

A dedicated safety factor has not been established, since the critical input data into the burnout analysis, such as fire load density and area of ventilation openings (50% ventilation ratio) is considered to contain an adequate level of conservatism.

5.4 Design fire scenario

The assessment considers total burnout of the fire compartment based on the expected fire load, compartment dimensions, openings and properties of compartment lining materials.

The fuel load densities will be based on the 95% percentile of fuel loads as identified in the IFEG

5.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- The lining of the affected compartments is assumed to be plasterboard.
- No fire separation is provided between retail tenancies.
- 50% of the available openings will break during a fire vent.
- Fuel load in the compartment is the 95% percentile of expected fuel loads.
- Positive impact of fire sprinklers has been conservatively ignored.

5.6 Fire engineering assessment

In order to determine the Fire Resistance Level (FRL) required for building elements in the subject compartment, the expected fire severity is to be determined. Fire severity is defined as the time of exposure to the standard fire test which results in the same thermal impact on the building elements as a complete burnout of the compartment in a real fire.

The time equivalence approach using the Eurocode formula [3] with adjustment of the k_b parameter as recommended by Kirby et al. [4] has been adopted. The approach is in line with the International Fire Engineering Guidelines [5].

The fire severity is expressed in minutes and estimated based on the following equation:

$$t_e = e\ k_b\ w_f$$

where t_e fire severity [min]

e fire load density [MJ/m^2]

k_b conversion factor based on thermal properties of boundary material

w_f ventilation factor based on available ventilation openings

It will then be determined whether the building elements proposed to have a reduced FRL are capable of withstanding the established fire exposure and maintaining structural adequacy and their separating function as required.

The full assessment will be undertaken within the Fire Engineering Report.

5.7 Conclusion

To be completed in the FER.

[3] EN 1991-1-2, 2002, *Eurocode 1: Actions of structures – Part 1-2: General actions – Actions on structures exposed to fire*, Annex F.

[4] Kirby B.R. et al., 1999, Natural fires in large scale compartments, *International Journal on Engineering Performance-Based Fire Codes*, Volume 1, Number 2, p.43-58.

[5] *International Fire Engineering Guidelines,* Edition 2005, Australian Building Codes Board, p. 2.6-3 – 2.6-5

6 PERFORMANCE SOLUTION 2 – COMBUSTIBLE ELEMENTS IN INTERNAL WALLS

6.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The internal SOU walls are required to achieve and FRL of at least -/60/60 and as such, they are required to be constructed of non-combustible materials. It is proposed to include combustible plywood noggins in order to support heavy furnishings fixed to the wall.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause C1.9	Allow for combustible plywood noggins in internal SOU walls	CP2

Table 8 - Performance Solution Overview

6.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Click here and choose an item.
IFEG sub-system(s) considered	C – Fire Spread and Impact and Control

6.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that the combustible elements of the walls do not significantly increase the fire risk within the building.

6.4 Design fire scenario

A fire occurs within in a residential SOU. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

6.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

6.6 Fire engineering assessment

It is understood that the requirement for the use of non-combustible materials in fire-resisting internal walls is to limit the overall fire load within the building. As such, the performance solution will aim at demonstrating that the inclusion of the plywood noggins does not constitute a significant fire risk within the building and does not have a significant adverse impact on the fire resistance of the wall system. Account will be taken of the following:

- The fuel load contributed by the noggins in comparison to overall fire load
- The required FRL of the walls and comparable construction methods.

The full assessment be undertaken within the Fire Engineering Report.

6.7 Conclusion

To be completed in the FER.

7 PERFORMANCE SOLUTION 3 – SMOKE COMPARTMENTATION ON RESIDENTIAL LEVELS.

7.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The aggregate length of the residential corridors exceeds 40 m as shown in Figure 7. It is proposed to omit the required smoke separation.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause C2.14	Allow for residential corridors to be longer than 40m (up to 49 m) without smoke separation	EP2.2

Table 9 - Performance Solution Overview

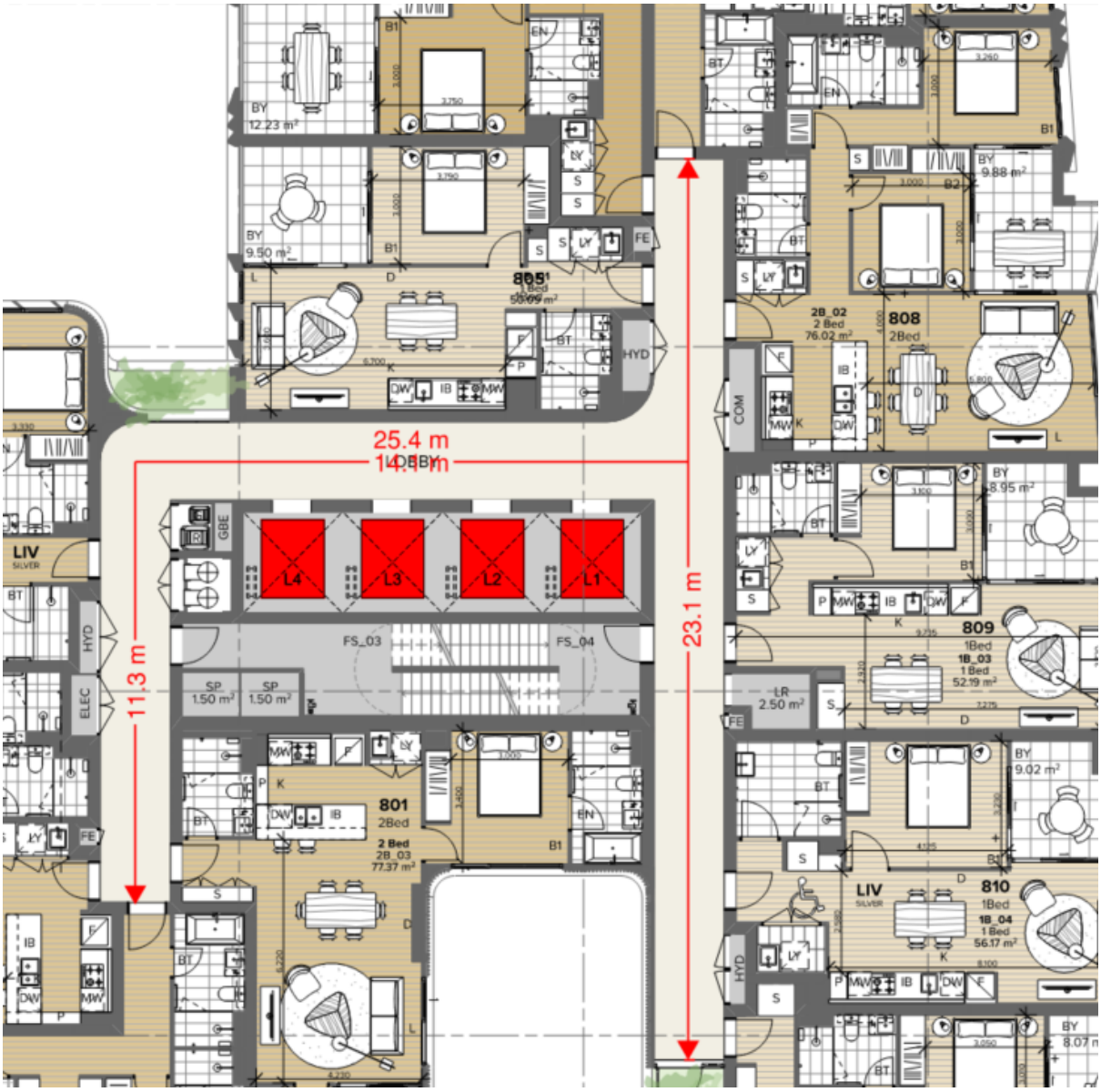

Figure 7 – Aggregate length of residential corridors

7.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(b) and A2.2 (2)(d) – Comparison with the Deemed-to-Satisfy Provisions.
Type of analysis	Qualitative
IFEG sub-system(s) considered	B – Smoke Development and Spread and Control E – Occupant Evacuation and Control F – Fire brigade intervention

7.3 Acceptance criteria

The design is considered acceptable if the potential distances to which occupants would travel through smoke is no greater than in a DTS complaint building.

7.4 Design fire scenario

A fire occurs within in a residential SOU. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment.

7.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

The following proposed and reference designs are proposed to be used in the assessment.

Proposed Design

- Travel distances to the nearest exit on the residential levels is up to 12 m.
- Travel distances between exits is up to 19 m.
- Smoke compartmentation to 40 m segments is not provided within the corridors

Reference Design

- Travel distances to the nearest exit on the residential levels is up to 28.5 m.
- Travel distances between exits is up to 45 m.
- Smoke compartmentation to 40 m segments is not provided within the corridors

7.6 Fire engineering assessment

The performance solution will aim at demonstrating that potential distances through which occupants will travel through smoke in the proposed design is no greater than what could occur in a DTS compliant reference design.

Account will also be taken of additional fire safety measures within the building and how they affect occupant egress from the building.

The full assessment will be undertaken within the Fire Engineering Report.

7.7 Conclusion

To be completed in the FER.

8 PERFORMANCE SOLUTION 4 – NUMBER OF EXITS PROVIDED ON THE GROUND FLOOR.

8.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The building has an effective height of more than 25 m, and therefore each floor is generally required to be provided with 2 exits. However, the ground floor lobby and retail tenancies are generally only provided with a single exit as shown in Figure 8.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.2	Allow for only a single exit being provided to several locations throughout the building.	DP4

Table 10 - Performance Solution Overview

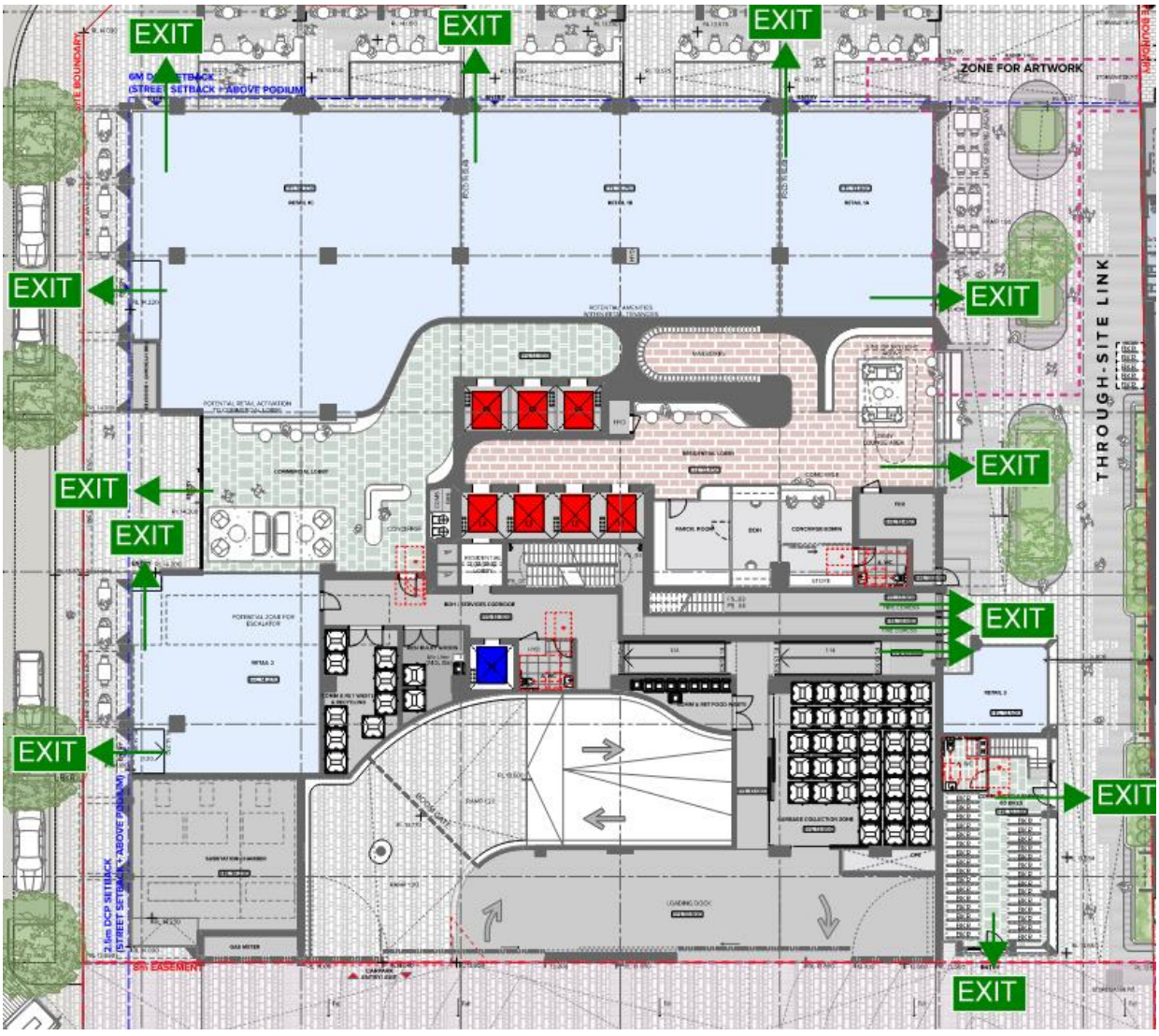

Figure 8 – Ground floor exit provisions

8.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative
IFEG sub-system(s) considered	E – Occupant Evacuation and Control F – Fire brigade intervention

8.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that egress is provided to the degree necessary from the areas with only a single exit.

8.4 Design fire scenario

A fire occurs in an area of the building with access to only a single exit. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

8.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

8.6 Fire engineering assessment

The proposed design will aim at demonstrating that the areas provided with a single exit are provided with sufficient egress provisions to facilitate safe egress from the building. Account will be taken of the following:

- Risk of fire blocking the single exit
- Interaction with the egress provisions in other areas of the building.
- Egress provisions in comparable DTS compliant designs

The full assessment will be undertaken within the Fire Engineering Report.

8.7 Conclusion

To be completed in the FER.

9 PERFORMANCE SOLUTION 5 – EXTENDED TRAVEL DISTANCES ON THE GROUND FLOOR LEVEL.

9.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. Select areas of the ground floor have travel distances to the single exit that exceed the DTS allowable maximum as shown in Figure 9.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.4	Allow for extended travel distances throughout the ground floor areas of the building: > The residential lobby on the Ground Floor, a distance of up to 26m to a single exit in lieu of the required 20m. > Travel distance within the loading dock of up to 26.4m to a point of choice in lieu of the required 20m.	DP4, EP2.2

Table 11 - Performance Solution Overview

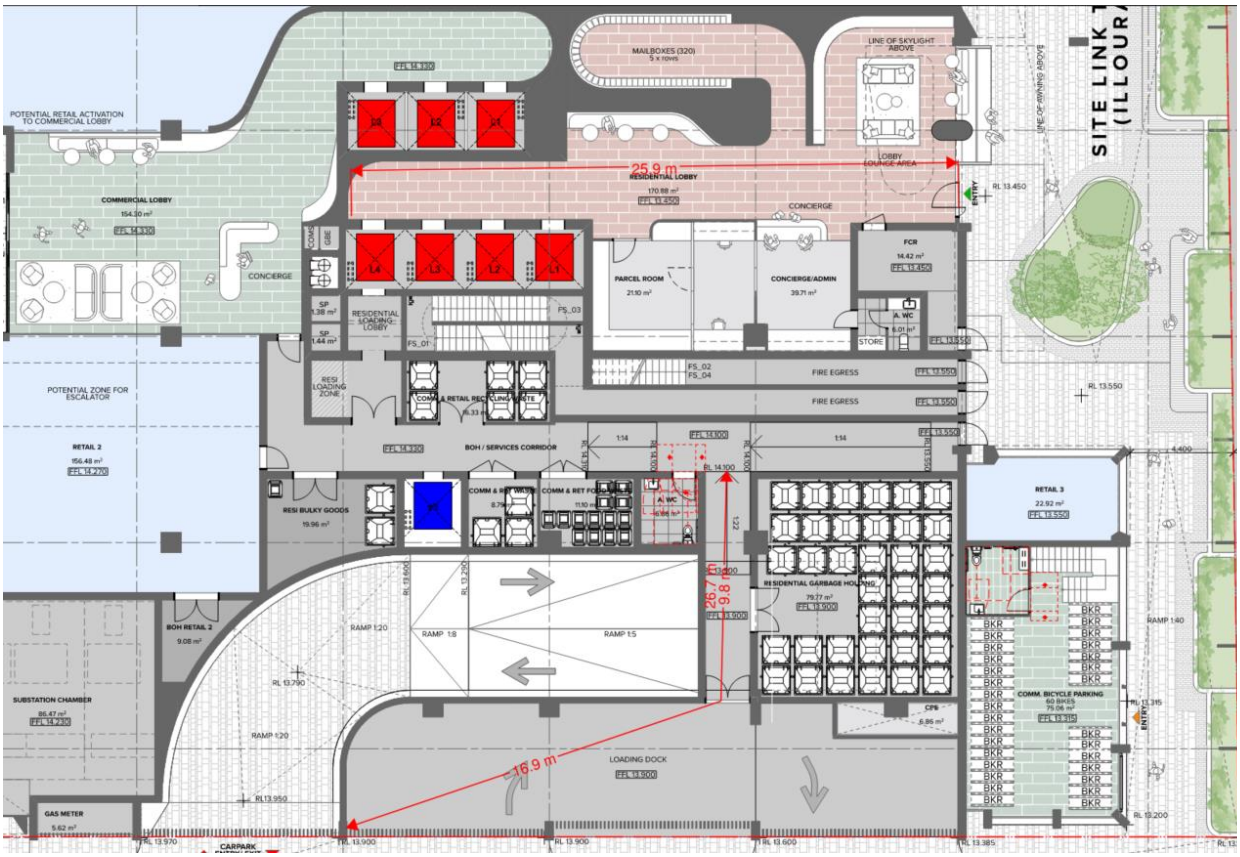

Figure 9 – Ground floor extended travel distances.

9.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative
IFEG sub-system(s) considered	E – Occupant Evacuation and Control

9.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that the increased travel distances does not result in a significantly increased risk of fire blocking occupant egress.

9.4 Design fire scenario

9.4.1 Fire Scenario 1

A fire occurs in the residential lobby. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

9.4.2 Fire Scenario 2

A fire occurs in the loading dock. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

9.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

9.6 Fire engineering assessment

The proposed Performance Solution will aim at demonstrating that the extended travel distances do no pose a significant increase in the risk of fire blocking occupant egress. Account will be taken of the following.

- Fuel loads within the areas of extended travel
- Fire safety provisions within the building
- Likely occupant numbers in the affected areas

The full assessment will be undertaken within the Fire Engineering Report.

9.7 Conclusion

To be completed in the FER.

10 PERFORMANCE SOLUTION 6 – TRAVEL DISTANCES OF RESIDENTIAL LEVEL

10.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The travel distances from the residential SOUs to the nearest exit or point of choice exceeds the DTS allowable maximum distances as shown in Figure 10.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.4	Allow for extended travel distances throughout the residential areas of the building: > Throughout the residential levels, the SOU doorways are located up to 9.5m to a single exit or point of choice in lieu of the required 6m.	DP4, EP2.2

Table 12 - Performance Solution Overview

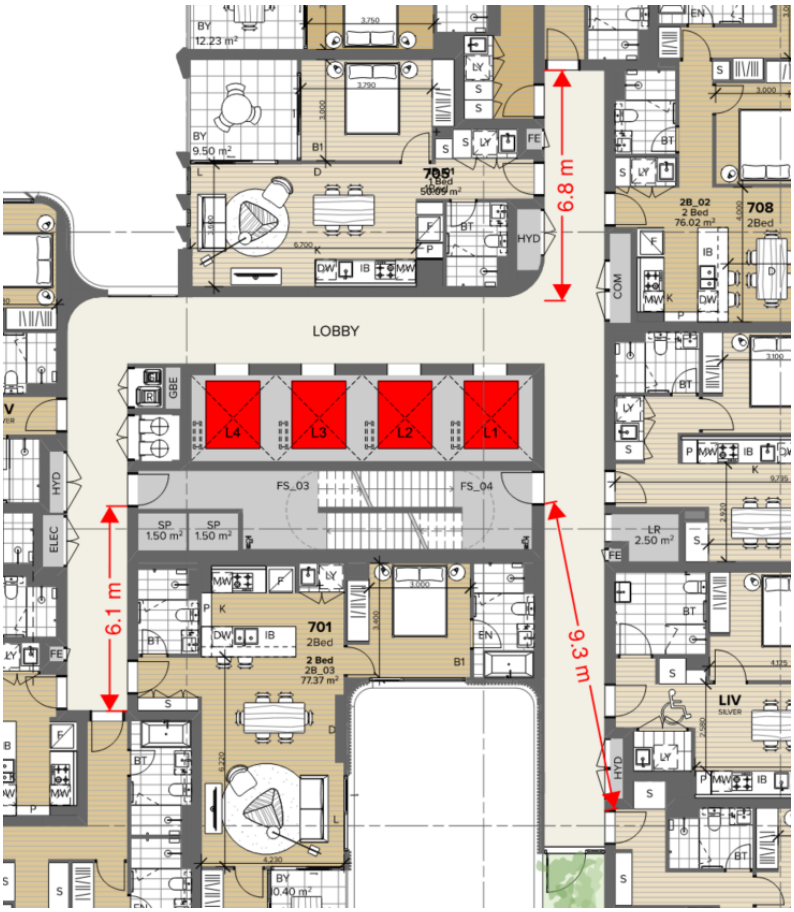

Figure 10 – Extended travel distances on residential levels

10.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(b) and A2.2 (2)(d) – Comparison with the Deemed-to-Satisfy Provisions.
Type of analysis	Qualitative
IFEG sub-system(s) considered	E – Occupant Evacuation and Control

10.3 Acceptance criteria

The proposed design will be considered acceptable if it can be demonstrated that the risk posed to egressing occupants is at least equivalent to a DtS compliant design.

10.4 Design fire scenario

A fire occurs within in a residential SOU. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

10.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

10.6 Fire engineering assessment

The intent of Clause D1.4 of the BCA is *"to maximise the safety of occupants by enabling them to be close enough to an exit to safely evacuate"* [6]. The travel distances are based on an assumption of what is considered "reasonable" distances to be travelled by occupants in reaching an exit. Travel distances within Apartments are not part of the distance specified in BCA Clause D1.4; the distance specified relates to travel from the entrance doorway of the Apartment to the exit or point of choice. The Guide to the BCA states that as a result, "the permitted distance of travel from the point at which the occupant leaves the unit must take account of the time needed for the occupant to reach that point from within the unit. Distance of travel must factor in the time occupants need to wake up, become alert to their predicament, and exit in a state of confusion." [7]

The performance solution will aim at demonstrating that the risk posed to egressing occupants is no greater than the risk in a DTS compliant building. Account will be taken of the following:

- Number of potential sources of fire blocking the path of travel and how they compare to what could be expected in a DTS compliant building;
- Likely occupant response to alarm cues and behaviour during a fire.
- The effect of extra detection on occupant behaviour;
- The possible occupant exposure to hazardous conditions in the subject building while compared to a DTS compliant building;

6 *Guide to the BCA 2019* – Australian Building Codes Board – p 126

7 *Guide to the BCA 2019* – Australian Building Codes Board – p 126

- Additional measures such as smoke seals and illuminated exits signs and their impact on occupant behaviour, risk and potential exposure;
- How the travel distances in the different parts of the building compare to other DTS buildings of similar height.

The full assessment will be undertaken within the Fire Engineering Report.

10.7 Conclusion

To be completed in the FER.

11 PERFORMANCE SOLUTION 7 – TRAVEL DISTANCES IN OPEN AREAS

11.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The travel distances to the nearest exit or point of choice in the common outdoor areas exceeds the DTS allowable

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.4	Allow for extended travel distances throughout the Common open areas of the building: > On the Level 5 open lawn area up to 54m to a single exit or point of choice in lieu of the required 20m. > The common areas of the residential floors include distances from the AC condenser room on each level which require travel of 20.5 m to an exit or point of choice in lieu of 20 m.	DP4, EP2.2

Table 13 - Performance Solution Overview

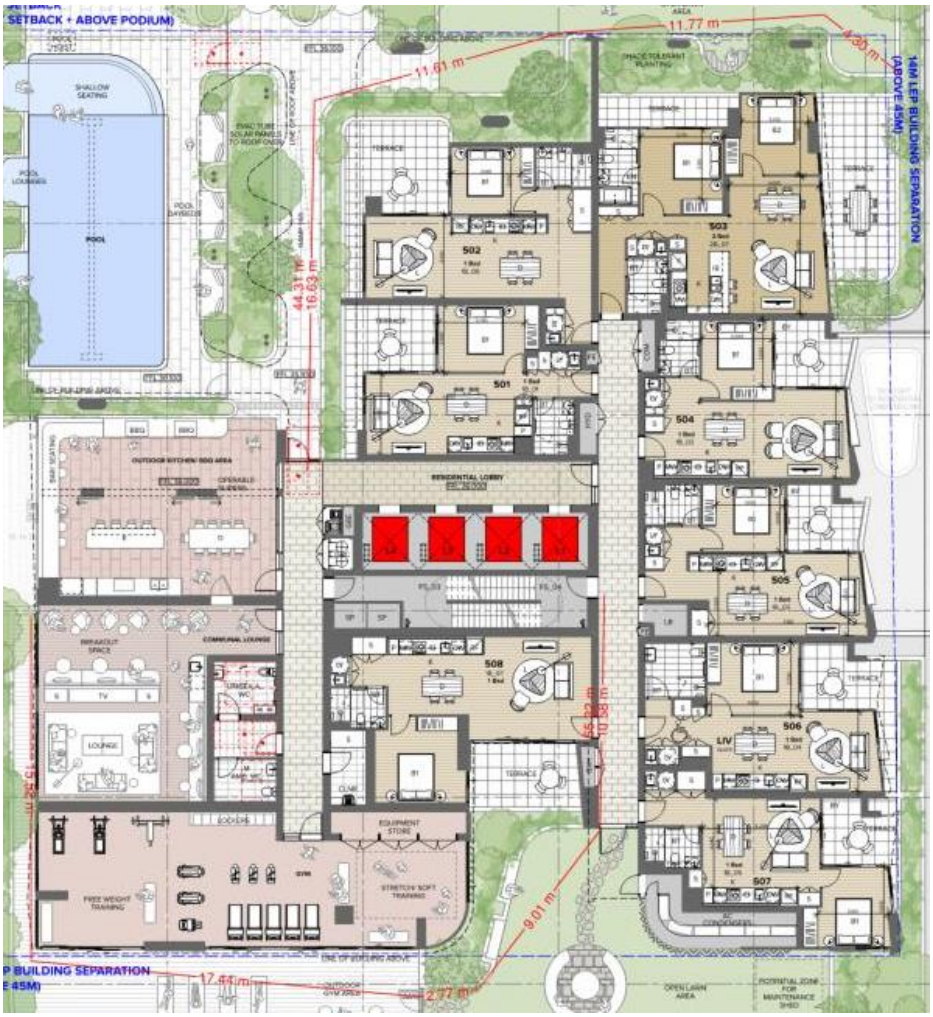

Figure 11 – Extended travel distances in open areas

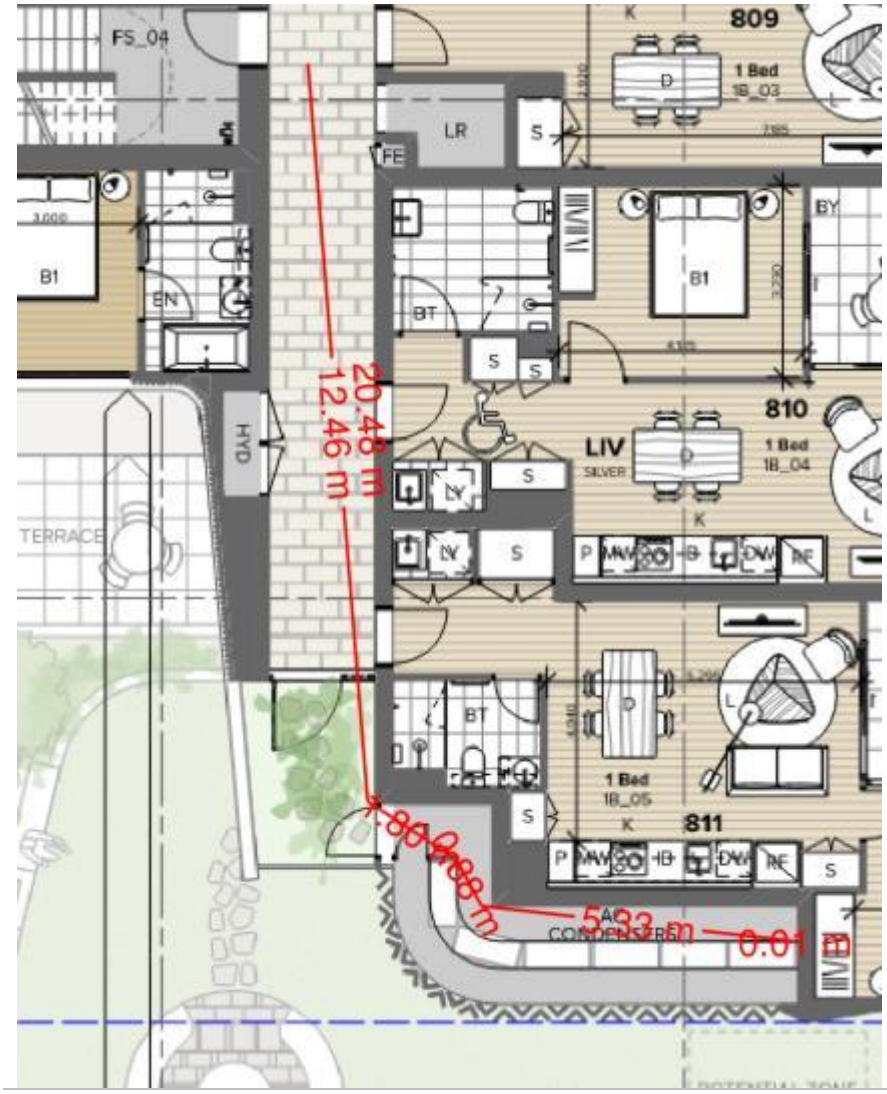

Figure 12 – Extended travel distances from AC Condenser rooms on residential floors

11.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative
IFEG sub-system(s) considered	B – Smoke Development and Spread and Control C – Fire Spread and Impact and Control E – Occupant Evacuation and Control

11.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that occupants would not be prevented from reaching an exit.

11.4 Design fire scenario

11.4.1 Fire Scenario 1

A fire occurs in the open areas. Quantitative fire characteristics have not been established since a qualitative approach is to be adopted for the analysis.

11.4.2 Fire Scenario 2

A fire occurs in a residential SOU. Quantitative fire characteristics have not been established since a qualitative approach is to be adopted for the analysis.

11.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended
- Occupants in the communal areas are awake and alert

11.6 Fire engineering assessment

The Performance Solution will aim at demonstrating that occupants in the communal open area are unlikely to be prevented from reaching the exits, taking account of the following.

- Potential sources of fire in the communal open areas or along the path of travel.
- The likelihood of possible fires impacting on occupant egress.
- The effect of smoke on occupant egress.
- The likelihood of occupants being located in areas most remote from an exit.

The full assessment will be undertaken within the Fire Engineering Report.

11.7 Conclusion

To be completed in the FER.

12 PERFORMANCE SOLUTION 8 – TRAVEL DISTANCES ON BASEMENT CARPARK LEVELS

12.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. Travel distances to and between exits within the basement carpark levels exceed the DTS maximum as shown in Figure 13

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.4, D1.5	Allow for extended travel distances throughout the carparks: > Travel distance throughout the carpark up to 51m to an exit in lieu of the required 40m. > Allow for extended travel distance between two alternative exits in the basement of up to 78.3m in lieu of the required 60m	DP4, EP2.2

Table 14 - Performance Solution Overview

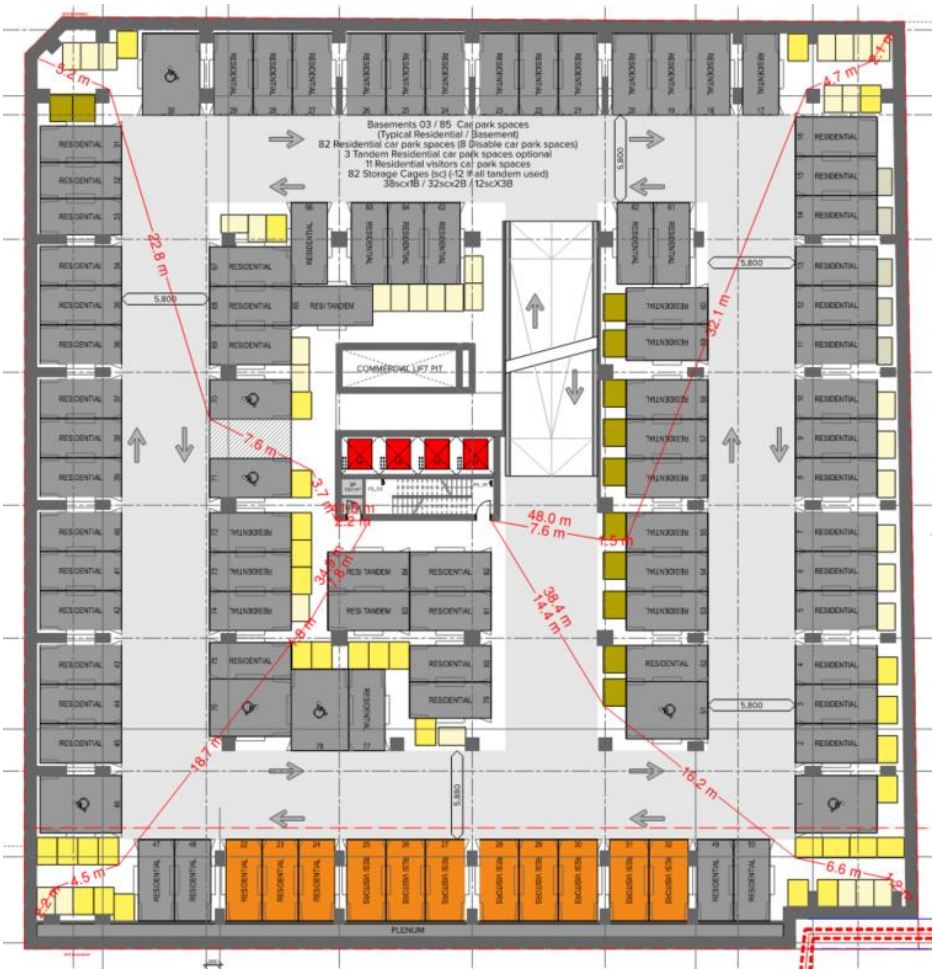

Figure 13 – Typical extended travel distances in basement carpark levels.

12.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(b) and A2.2 (2)(d) – Comparison with the Deemed-to-Satisfy Provisions.
Type of analysis	Quantitative
IFEG sub-system(s) considered	D – Fire Detection Warning and Suppression E – Occupant Evacuation and Control

12.3 Acceptance criteria

The acceptability of the level of fire safety represented by a given building design may be determined by comparison between the margin arising from that design, and the margin arising from a similar, BCA complying design. The margin attendant to the BCA complying design may be either positive or negative, and may be used as a relative measure of the level of safety.

Since the Proposed Design and the Reference Design have similar geometries and fire loads, the ASETs would be equivalent. The improvement in the ASET for the Proposed Design as result of the fast-response sprinkler heads has been ignored on a conservative basis. Therefore, the acceptance criterion for the proposed building design becomes a comparison of RSET as follows:

$$RSET_{\text{Proposed Design}} \leq RSET_{\text{Reference Design}}$$

12.4 Design fire scenario

12.4.1 Fire Scenario 1

Car park fires have been the subject of extensive research throughout the world. The heat release rate generated by cars is well established. An investigation carried out by Mangs and Keski-Rahkonen resulted in a set of equations being developed to characterise the heat release rate produced by a passenger vehicle fire [8]. The equation set provides a resultant heat release rate for a burning car that is graphically represented in Figure 14.

[8] Mangs, J. and Keski-Rahkonen, O., *Characterisation of fire behaviour of a burning passenger car, Part II Parametrization of Measured Rate of Heat Release Curves*, Fire Safety Journal, No. 23, 1994.

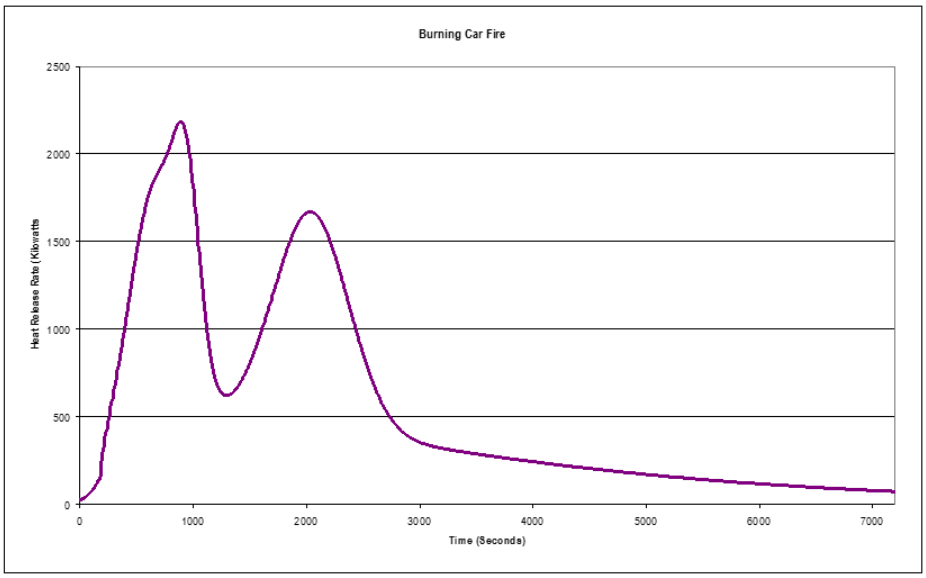

Figure 14 - Burning Car Fire

Using the design fire established by Mangs & Keski-Rahkonen and the passage of fire spread versus time recorded for the experiment they conducted, given in Figure 14 a total heat release rate versus time can be plotted to represent a 'worst credible' car park design fire. This fire is taken as the design for the assessment of the car park and is illustrated in Figure 15. As a point of reference, the 'slow' and 'medium' t^2 fire growth curves are included to provide a comparison. As it represents the worst-case scenario, a 'medium' t^2 growth rate will be used in the assessment.

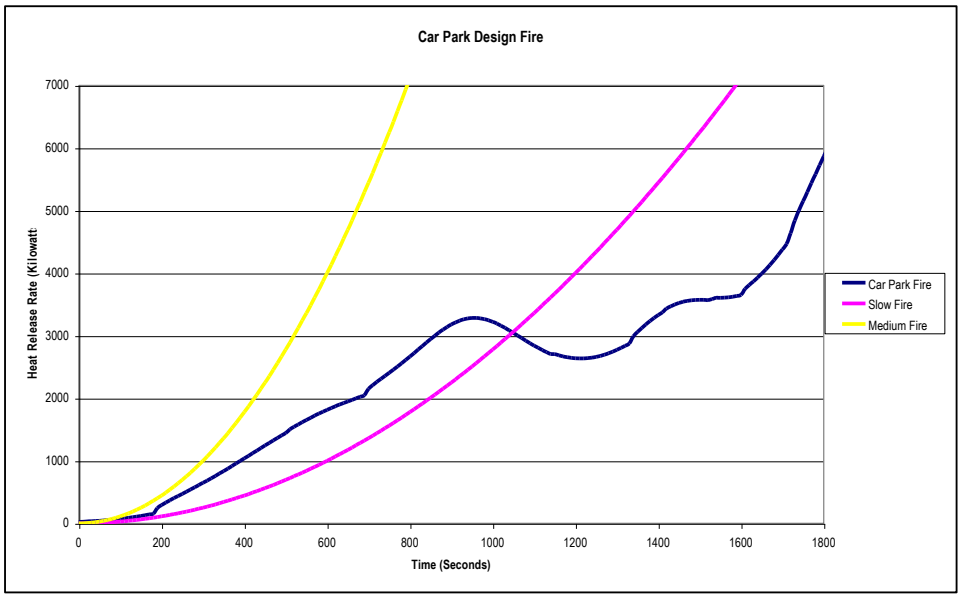

Figure 15 - Carpark Design Fire

12.4.2 Fire Scenario 2

A 'fast' t^2 car fire is to be used as a sensitivity study.

12.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

The following proposed and reference designs are proposed to be used in the assessment.

Proposed Design

- The maximum travel distance to an exit is up to 51 m.
- The maximum travel distance between exist through the point of choice is up to 78.3 m.
- A fast response sprinkler system is provided with a maximum RTI of 50.

Reference Design

- The maximum travel distance to an exit is up to 40 m.
- The maximum travel distance between exist through the point of choice is up to 60 m.
- A standard sprinkler system is provided with sprinkler heads that have an RTI of 150.

12.6 Fire engineering assessment

The Performance Solution is proposed to demonstrate that occupant evacuation is facilitated by offsetting the additional time taken to travel the extended distance with the earlier warning received by the fast response sprinkler system. The assessment intends to show that the RSET for the proposed design would be better than or at least equivalent to that of the BCA DTS compliant design.

Account will also be taken of occupant ability to move freely throughout the carpark.

The full assessment will be undertaken within the Fire Engineering Report.

12.7 Conclusion

To be completed in the FER.

13 PERFORMANCE SOLUTION 9 – REDUCED SEPARATION BETWEEN EXITS

13.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The distance between exits in the basement carpark is less than the DTS required 9 m, down to 6.4 m as shown in Figure 16.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.5	To allow for exit to be located within 9m of each other.	DP4, EP2.2

Table 15 - Performance Solution Overview

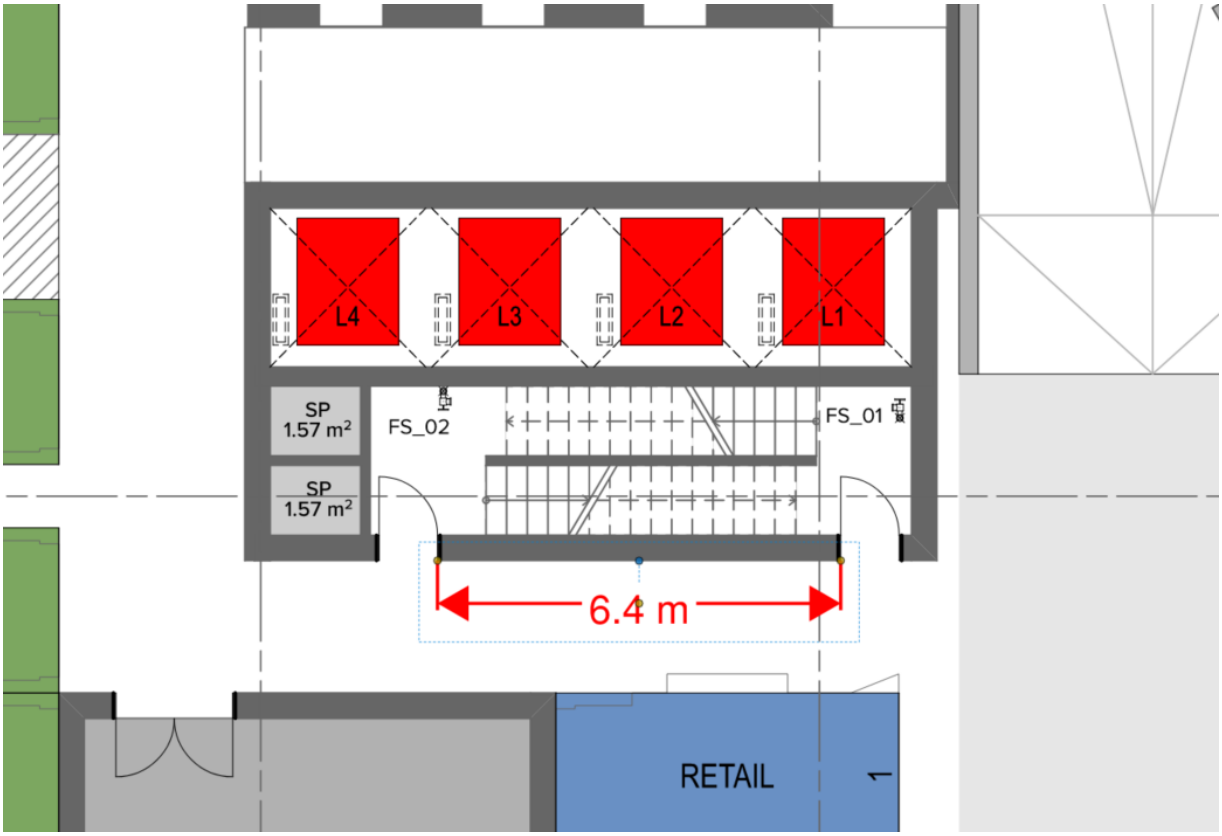

Figure 16 – Separation distance of basement exits

13.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative

IFEG sub-system(s) considered	C – Fire Spread and Impact and Control E – Occupant Evacuation and Control

13.3 Acceptance criteria

The Performance Solution is considered acceptable if can be demonstrated that a fire in the building is not expected to block both exits despite the reduced separation.

13.4 Design fire scenario

A fire occurs within the basement carpark. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

13.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

13.6 Fire engineering assessment

Clause D1.5 specifies the minimum distances that exits must be separated by a minimum distance of 9 m. The intent of this is to minimise the risk that a single fire event block both exits. The performance solution will aim at demonstrating that fire is unlikely to block both exits, taking into account the following.

- The location of the exits and the proximity of fire hazards to the exits,
- The potential for fire to spread from other portions of the building.
- The effect of fire safety systems provided within the building.
- The potential effect of smoke spread on occupant egress and use of the exits.

The full assessment will be undertaken within the Fire Engineering Report.

13.7 Conclusion

To be completed in the FER.

14 PERFORMANCE SOLUTION 10 – LOCATION OF EXIT DISCHARGE POINTS

14.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The alternate exits from the residential levels and basement carpark discharge adjacent to each other on the ground floor as shown in Figure 17 which is not considered to be 'as far apart as practical'.

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause D1.10	Allow for the alternative exits to discharge within proximity to each other on the Ground Floor	DP4

Table 16 - Performance Solution Overview

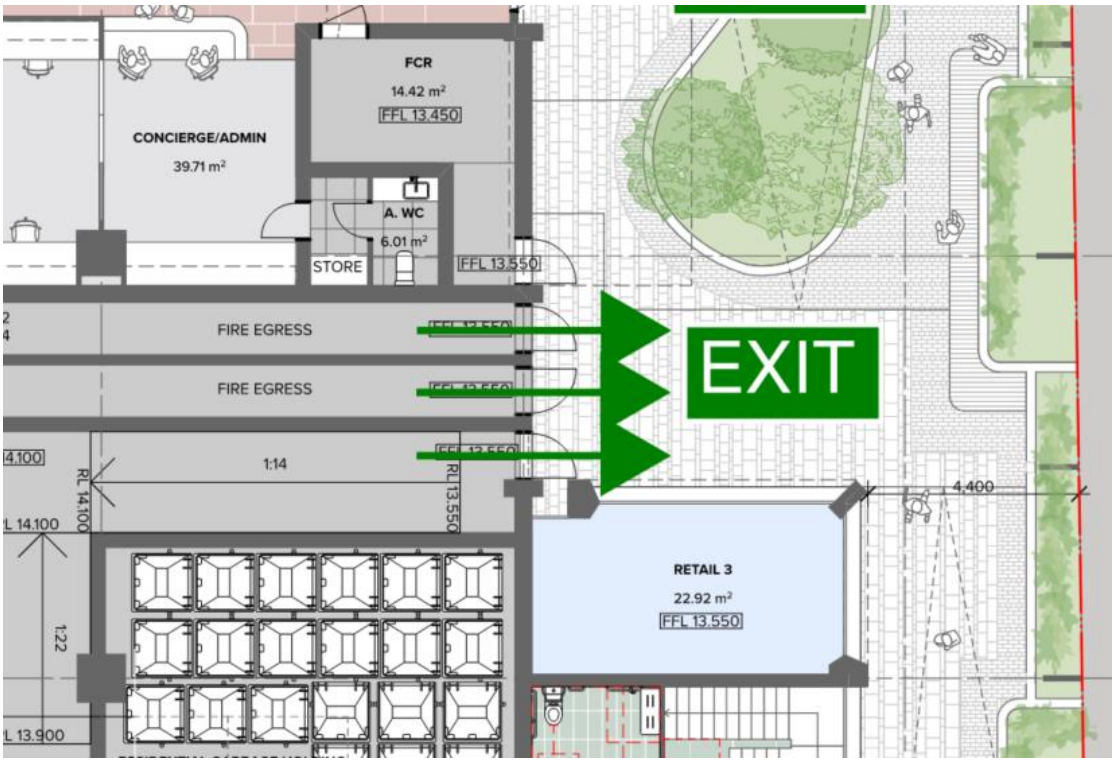

Figure 17 – Ground floor discharge points in close proximity to each other

14.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative and Quantitative

IFEG sub-system(s) considered	C – Fire Spread and Impact and Control E – Occupant Evacuation and Control

14.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that occupants are expected to be able to egress from the building despite the exits being in close proximity to each other

14.4 Design fire scenario

A fire occurs in the retail tenancy adjacent to the discharge point. Quantitative fire characteristics are not currently proposed to be determined due to the qualitative nature of the assessment:

14.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

14.6 Fire engineering assessment

The intent of Clause D1.10 of the BCA in regards to proximity of the discharge point is *"so that if the discharge point from one of them is blocked, the other will still operate satisfactorily"* [9]. While there is no specific distance that exits must be separated by, the performance solution will aim at demonstrating that the exits are unlikely to be affected by fire to the point where egress is prevented. Account will be taken of the following:

- Potential for fire to block the exits.
- Potential for other external factors to block the exit, eg parked vehicles.
- Expected behaviour of occupants during egress
- Fire safety provisions provided in the building.

The full assessment be undertaken within the Fire Engineering Report.

14.7 Conclusion

To be completed in the FER.

9 *Guide to the BCA 2019* – Australian Building Codes Board – p 148

15 PERFORMANCE SOLUTION 11 – HYDRANT BOOSTER LOCATION

15.1 Departure(s) from DTS provisions

The below table presents the Performance Solution key information. The hydrant booster is proposed to be located on the side street (George st) as shown in Figure 18 rather than on the street address or within sight of the main entrance (considered to be the residential entrance)

BCA DTS clause(s)	DTS Non-conformance / Performance Solution	BCA PR(s)
Clause E1.3	Allow for the fire hydrant booster to be located on the side street in lieu of within site of the main building entrance as required by AS2419.1-2005.	DP5

Table 17 - Performance Solution Overview

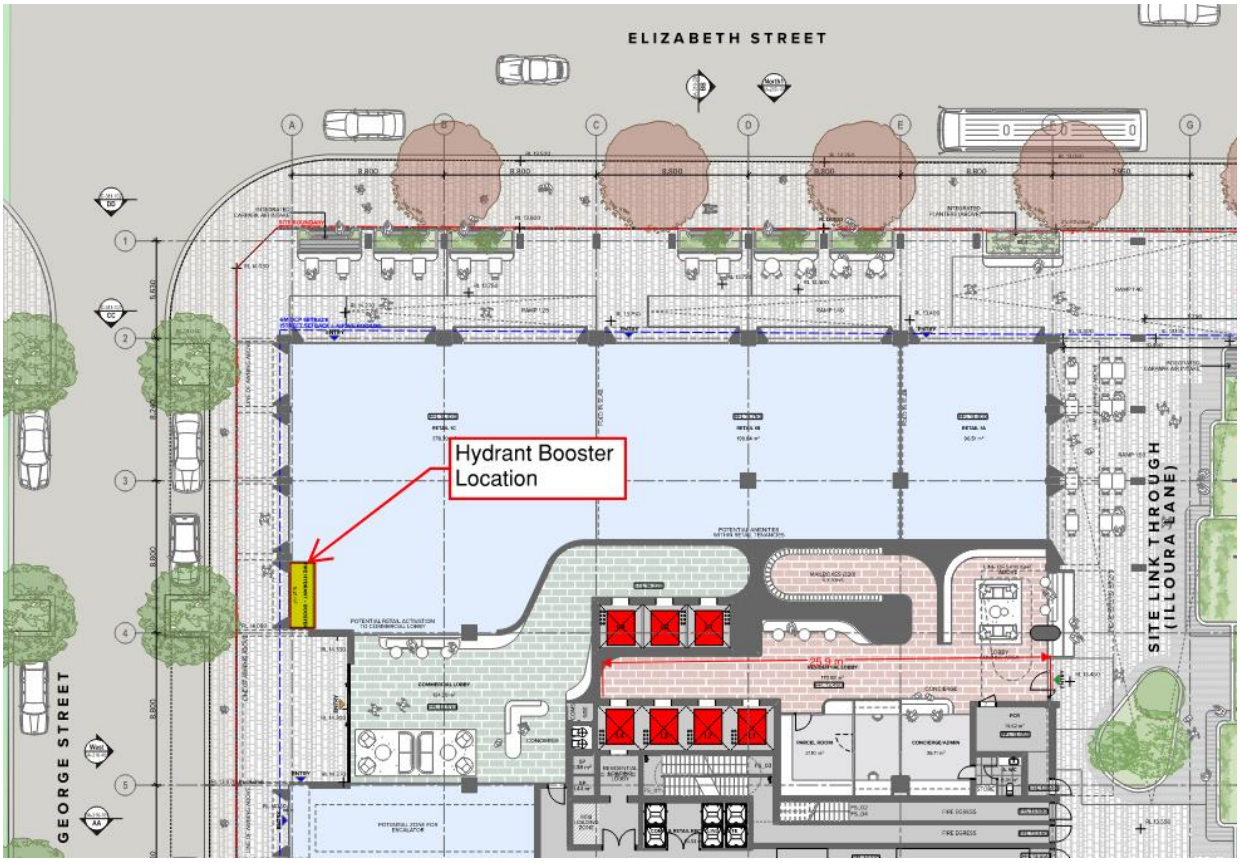

Figure 18 – Hydrant Booster Location

15.2 Methodology

The approach used to formulate this Performance Solution is as follows:

BCA compliance method	A2.2(1)(a) and A2.2 (2)(b) (ii) – Other Verification Methods accepted by the appropriate authority.
Type of analysis	Qualitative
IFEG sub-system(s) considered	F – Fire brigade intervention

15.3 Acceptance criteria

The proposed design is considered acceptable if it can be demonstrated that sufficient provisions are provided such the Fire Brigade can quickly locate the booster and Fire Brigade intervention is appropriately facilitated.

15.4 Design fire scenario

A fire occurs within the building requiring Fire Brigade intervention. Quantitative fire characteristics have not been determined due to the qualitative nature of the assessment:

15.5 Key assumptions and inputs

The following assumptions and inputs will be used in the assessment.

- Only a single fire occurs at a time.
- All fire safety systems operate as intended

15.6 Fire engineering assessment

The booster assembly is located on a side street rather than at the main entrance. Thus, FRNSW personnel arriving on site would likely turn up to the main entrance before proceeding to the side street to access the booster. To ensure FRNSW personnel can easily locate the booster, the following provisions are provided.

- Site plans are to be provided in the four locations. The FIP, Hydrant Booster, in the Fire control Room, and at Street Level of the Main Entrance. These site plans are to include the following.
  - Hydrant booster assembly location so FRNSW personnel can reach the booster once arriving on site.
  - Surrounding streets so FRNSW can plan the locations and approaches of appliances
  - Entry points into the tower and the basement carpark.
- A strobe is also provided at the booster assembly for ease of location from the street.

The full assessment will be undertaken within the Fire Engineering Report.

15.7 Conclusion

To be completed in the FER.

16 INFORMATION SOURCES, ASSUMPTIONS AND LIMITATIONS

16.1 Assumptions

Assumptions are based on the practice nominated in the International Fire Engineering Guidelines and practical simplifications have been utilised to maintain a simple analysis that is representative of a real fire and life safety situation. For the purpose of this report, the following are assumed:

- All other components of the building not addressed within this document are compliant to the codes and standards nominated on the building's AFSS or as nominated by the Certifying Authority.
- Only one (1) fire will occur at a time.
- Occupants will become aware of the fire through fire cues, respond to the cue, cope with the cue and attempt to avoid the fire, as intended by the BCA for safe evacuation.
- Occupants do not engage in major firefighting activities. However, occupants may engage in minor firefighting. Any positive outcome from this `will not be included in the analysis.
- No excessive quantity of hazardous, flammable, explosive or highly combustible materials will be stored on site.

16.2 Limitations

This report does not include nor imply any design or assessment of compliance or upgrading for:

- The structural adequacy or design of the building,
- The inherent derived fire-resistance ratings of any proposed structural elements of the building,
- The design basis and/or operating capabilities of any proposed electrical, mechanical or hydraulic fire protection services (other than any specifically referred to within the FER),
- Business protection or business continuity,
- Insurer's requirements, and
- Property protection, other than adjacent properties.

This report also does not include, or imply compliance with:

- The Disability Discrimination Act (DDA) including the Disability (Access to Premises - Building) Standards 2012,
- Demolition Standards not referred to by the BCA 2019,
- Occupational Health and Safety Act (Work practices under general Work Cover issues),
- Construction Safety Act (During building alterations and additions process only),
- Requirements of other Regulatory Authorities including, but not limited to, Telstra, Telecommunications Supply Authority, Water Supply Authority, Electricity Supply Authority, Work Cover, Roads and Maritime Services (RMS), Local Council, ARTC, Department of Planning and the like, and
- Conditions of Development Consent issued by the Local Consent Authority.

16.3 Report purpose

The purpose of this report is to review the current design and assist in the design process for the preparation of the solutions contained within this report. This report does not represent and should not be construed to be a Compliance Certificate as defined by Division 6.5 of the Environmental Planning and Assessment Act 1979.

This report is not a Design Compliance Declaration under the Design and Building Practitioners Act 2020 and is not to be used or construed as such.

This report is not certification work to which the provisions of Building and Development Certifiers Act 2018 with respect to conflicts of interest apply as outlined in Section 28 of that Act.

16.4 Design and safety in design

With respect to design, the extent of this report is to nominate fire safety measures that are relied on for Performance Solutions to comply with BCA Performance Requirements. Design of fire safety elements of any kind is beyond the scope of this report including but not limited to detailed design, concept design, specifications, product selections, material selections or any other guidance as to selection or design of building elements or systems.

Design of the fire engineering requirements and the development as a whole remains the full responsibility of others, who in turn assign where and how systems and structures are installed and therefore are responsible for safety in design.

No unique or unusual hazards that would not otherwise be present in the construction, installation, maintenance and decommissioning of a typical building and its elements are nominated by the fire engineering requirements of this FER.

System and building designers are responsible for the identification and mitigation of any risks associated with the construction, installation, maintenance and decommissioning of systems described within this report.

16.5 Information sources

This report has been based on the following information tabled below.

Reference	Title	Produced by	Rev	Date
113165-BCA-r3	BCA Assessment Report	BCA Logic	3	27.10.2021

Table 18 - Information sources

ANNEXURE A BCA FIRE SAFETY VERIFICATION METHODS

There are challenges associated with application of the BCA Fire Safety Verification Methods (FSVM), to the extent that rigid adherence to every clause of the FSVM cannot practically be implemented. Johnson [10] tested the VSFM methods by designing eight hypothetical DTS buildings and found that none of the eight buildings could deemed as fulfilling BCA Performance Requirements through application of the FSVM. The outcome of the paper was that "more fire science and engineering research is required before the FSVM are universally adopted". However, at the time of writing this FER FSVM remain unaltered in the BCA.

Engineers Australia Society of Fire Safety (SFS) established a task force to assess the FSVM. They considered 6 case studies of common and typical Performance Solutions and attempted to apply the FSVM and the companion Handbook. SFS found that none of the case studies were able to be completed in accordance with the handbook and therefore recommended against their application [11] in their current form.

BCA Logic does recognise however that there are core principals within the FSVM that are beneficial and can be applied to the fire engineering process.

Therefore the fire engineering assessment presented in this FER has been undertaken in accordance with the key principals of the BCA 2019 Fire Safety Verification Methods Schedule 10. The following points present our understanding of these key principals and our methodology of application.

FSVM Inferred Principal	BCA Logic interpretation and application
Adherence to the purpose of the Fire Safety Verification Methods	All Performance Solutions in this FER have been shown to be at least equivalent to the level of safety achieved by the DTS provisions by virtue of being demonstrated as fulfilling the applicable Performance Requirements, ie fulfil the purpose declared by schedule 7 section 1.1.
Performance Based Design Brief	A Fire Engineering Brief Process has been followed. The methodology is in accordance with the International Fire Engineering Guidelines (IFEG)[12] and has included relevant stakeholders.
Fire Service as a stakeholder	The attending fire service has been included as a stakeholder where this is required by Environmental Planning and Assessment Regulations (EP&A Regs) or specifically requested by an Authority.
Design Scenarios	Multiple design scenarios have been considered in accordance with BCA schedule 7 tables 1.1 and 1.2. It is noted that not all scenarios and Performance Requirements are necessarily applicable. The Performance Solutions will include assessment only of the scenarios deemed applicable.
Provisions over and above equivalence to DTS provisions	FSVM design scenarios CS, IS, FI, UF, RC, SS and VS include "required outcomes" that are in excess of the DTS provisions, ie over and above the declared purpose of the FSVM.

[10] Peter Johnson and Nate Lobel 2018; J Phys; Conf:. Ser. 1107 042033

[11] SFS presentations 2019; electronic material distributed.

[12] Australian Building Code Board; International Fire Engineering Guidelines; 2005.

	In many cases these additional outcomes are not feasible for inclusion in Performance Solutions and therefore these have not been incorporated into our fire engineering assessments. However, the Performance Solutions presented in this FER do generally achieve a level of fire safety over and above DTS provisions, consistent with recommendations of the IFEG.
Consideration of the whole building vs part thereof	The language of the FSVM refers to "the building" throughout, in particular the "fire strategy for the building". We understand this to encourage that Performance Solutions be developed holistically, giving due regard to the context of any specific Performance Solution as a part of a whole building, the impact of new Performance Solutions on existing, and vice versa.
Particular attention to occupants with a disability and the vulnerable	The BCA DTS provisions do not include any consideration whatsoever for safe and dignified egress of occupants with a disability. BCA Logic approach to assessment of Performance Solutions includes consideration of the slower range of movement times in order to represent those with disabilities and the vulnerable where applicable.
Deliberately lit fires	Schedule 7 clause 2.1.1 identifies that "Fire in evacuation routes can be the result of accidental or deliberately lit fire." Our FER limits consideration of a deliberately lit fire to minor arson using only the materials at hand – ie no accelerants or harmful intent. We understand this to align with the objectives of BCA DTS provisions.
Vertical Fire Spread	Design Scenario VS includes a "Method" that states compliance with CV3. All other design scenarios include "Typical Methods". This difference in wording infers CV3 is the only method of demonstrating compliance whereas all other scenarios leave the fire engineer free to select any methodology they deem appropriate. CV3 is an absolute methodology and not a suitable means of determining equivalence with DTS provisions. Particularly considering that many DTS compliant façade systems do not achieve an EW rating from an AS5113 test and CV3 includes prescriptive requirements over and above DTS requirements. Our FER therefore does not necessarily use CV3 as a means of determining equivalence with DTS provisions with respect to vertical fire spread. We note however that in the context of a Performance Solution for external wall construction not complying with C1.9 CV3 would then be an appropriate method.

Annexure Table A-1 -

ANNEXURE B REFERENCE DRAWINGS

Architectural Plans Prepared by Turner Studio			
Drawing Number	**Revision**	**Date Title**	**Title**
DA-110-001	S1	20.10.21	Basement 06
DA-110-002	S1	20.10.21	Basement 04-05
DA-110-003	S1	20.10.21	Basement 03
DA-110-004	S1	20.10.21	Basement 02
DA-110-005	S1	20.10.21	Basement 01
DA-110-009	S1	20.10.21	Ground Level
DA-110-010	S1	20.10.21	Mezzanine
DA-110-011	S1	20.10.21	Level 01
DA-110-012	S1	20.10.21	Level 02
DA-110-013	S1	20.10.21	Level 03
DA-110-014	S1	20.10.21	Level 04
DA-110-015	S1	20.10.21	Level 05
DA-110-016	S1	20.10.21	Typical Level A Lowrise (Level 6/10)
DA-110-017	S1	20.10.21	Typical Level B Lowrise (Level 7/11)
DA-110-018	S1	20.10.21	Typical Level C Lowrise (Level 8/12)
DA-110-019	S1	20.10.21	Typical Level D Lowrise (Level 9/13)
DA-110-116	S1	20.10.21	Typical Level A Highrise (Level 14/18/22/26/30)
DA-110-117	S1	20.10.21	Typical Level B Highrise (Level 15/19/23/27/31)
DA-110-118	S1	20.10.21	Typical Level C Highrise (Level 16/20/24/28/32)
DA-110-119	S1	20.10.21	Typical Level D Highrise (Level 17/21/25/29)
DA-110-330	S1	20.10.21	Level 33
DA-110-340	S1	20.10.21	Roof Level

Architectural Plans Prepared by Turner Studio			
Drawing Number	**Revision**	**Date Title**	**Title**
DA-210-101	S1	20.10.21	North Elevation - Elizabeth Street
DA-210-201	S1	20.10.21	East Elevation - Through Site Link
DA-210-301	S1	20.10.21	South Elevation - Rear laneway
DA-210-401	S1	20.10.21	West Elevation - George Street
DA-310-101	S1	20.10.21	Section AA
DA-890-001	S1	20.10.21	External Material Finishes

Annexure Table B-1 – Architectural Drawings