BCA LOGIC

Building Regulation, BCA, Fire, Access and Energy Consultants

To:	C&C Project Management Pty Ltd
Project:	48a Queenscliff Road, Queenscliff NSW
Report:	FIRE ENGINEERING REPORT (107347-FER-r4)
Date:	23 September 2019
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107347-FER-r2	5 July 2018	Updated Fire Engineering Report to address the peer reviewer's FEBQ comments. Issued for Peer reviewer's comment only.		
107347-FER-r3	31 July 2018	Updated Fire Engineering Report to address the comments in the peer review report by PGA Pty Ltd dated 10 July 2018.		
107347-FER-r4	23 September 2019	Modified fire engineering requirements. Modified performance solutions 2, 3, 5, 6, 7, 8 and 9.		
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EXECUTIVE SUMMARY

This document is the Fire Engineering Report (FER) prepared for **C&C Project Management Pty Ltd** for a development related to an existing residential building located at 48a Queenscliff Road, Queenscliff NSW 2096.

The existing residential building is a concrete / masonry structure and has a rise in storey of eleven. Part of the ground level (lobby area) and the whole of levels 1 to 9 are being used as residential accommodation (apartments), the lower ground level and the rest of the ground level are being used for carparking.

The proposed development consists of the following internal modifications to both the undercroft and the ground level of the existing residential building:

- to convert the undercroft area to become a new residential unit;
- to convert a portion of the carpark area to a new residential unit on the ground level;
- to convert a small portion of the carpark area to a storage area on the ground level; and
- to add a small portion of new carparking area on level 1.

It is understood that Warringah Council issued an Order No. 6 (Fire Safety Upgrade) to the subject residential building in 2009, which was referred to FRNSW (NSWFB at the time). According to the documents provided (detailed in Annexure F to this report), FRNSW agreed the building to be described as having an effective height of less than 25 metres during the Fire Order process. The proposed development is to occur at the undercroft, the ground level and the proposed carparking portion on level 1 only, and does not increase the existing height of the subject building.

In order to demonstrate compliance with the Performance Requirements of the BCA 2016, Performance Solutions have been formulated to address the deviations from the Building Code of Australia (BCA) 2016 Deemed-to-Satisfy (DTS) Provisions for the internal modification of the existing residential building as outlined below:

(1) To allow the provision of spandrel that is 400 mm above the floor slab on the ground level in lieu of 600 mm.

(2) To allow the existing carpark portion on the lower ground level and the proposed carparking portion on the ground level to have a minimum FRL of 90/90/90 in lieu of 120/120/120.

(3) To allow the storage area on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.

(4) to permit the following egress DTS non-conformances for the non-fire isolated exits serving the new undercroft and ground floor residential units:

- One exit is provided in lieu of two.
- The pathway from exit discharge to a road involves travel via an incline greater than 1:8.

(5) To allow the following variations in egress provisions related to the carparking and storage areas:

- a single exit to serve the carparking areas on levels lower ground, ground and level 1; and
- a minimum egress width of 810mm in lieu of 1,000mm from Level 1; and
- a minimum egress width of 800mm in lieu of 1m from the lower ground floor storage are, including storage cupboard door of 550mm and egress door width 630mm; and
- a single exit to serve the carparking area on level 1; and
- extended travel distances of up to approximately 22 m from the carparking areas to a single exit on the ground level; and
- a minimum egress width of 900mm at base of stairs serving level 1.

(6) To allow the existing central fire-isolated stairway to discharge into a covered area on the ground level.

(7) To allow the lift serving the new unit at the undercroft not to be an emergency lift.

(8) To allow the proposed external attack fire hydrant to be located approximately 4.5 m from the nearest unprotected opening in lieu of 10 m from the building.

In order to support the above performance solutions the following fire safety measures presented in chapter 5 of this FER are required to be provided, which in summary include:

- The proposed spandrel on the ground level is to be 400 mm above the slab in lieu of 600 mm, has a FRL of at least 60/60/60, and has a total height of at least 900 mm; whilst the proposed slab of the ground level is to extend approximately 1.3 m beyond the external walls of the lower ground level and form a patio for the undercroft
- The louvres that are to be provided to the openings within the southern external walls on the lower ground level are to have at least 50% free area; and
- The existing western and eastern ends of the driveway on the lower ground level are to directly open to the outside without any doorway or roller shutter.
- The stairway (including the pathway from the entry door of the proposed undercroft unit to the stairway) connecting the undercroft level and the lower ground level is to be constructed of non-combustible construction.
- The entry doors of the proposed new residential units on the ground level and at the undercroft are to be fitted with medium and hot temperature smoke seals protecting all sides of the door/doorway.
- The undercroft, the lower ground level, the ground level and the carparking portion on level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015.
- A heat detector is to be provided in each of the proposed new apartments on the ground level and at the undercroft, and be located not more than 1.5 m horizontal distance from the doorway within the SOU.
- A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout the areas under the proposed development, being the undercroft, the lower ground level, the ground level and the carparking portion on level 1.
- The undercroft, the lower ground level, the ground level and the carparking portion on level 1 are to be provided with an automatic fire sprinkler system.
- A permanent, fade-resistant and water-resistant sign stating the following in capital letters, not less than 50 mm high and in a colour contrasting with the background “NO STORAGE OF COMBUSTIBLE MATERIALS & FUNITURE WITHIN THIS AREA” is to be provided to the following locations:
  (a) within the covered building main entrance area on the ground level,
  (b) within the lift lobby/foyer area on the ground level,
  (c) within the car entrance area on the lower ground floor.
- A building management-in-use policy is to be implemented, which is to be included in the building annual fire safety statement, and checked and certified annually, and include the following:
  (a) inhibiting any combustible materials and furniture to be stored within all common property areas at all times.
  (b) maintaining all egress pathways within the building free of obstructions.

This report is to be part of the assessment of a Construction Certificate application in relation to the specific deviations from the DTS Provisions documented in this report only. All other aspects of the building not specifically discussed as the part of the proposed Performance Solutions in this report are to comply with the DTS Provisions of the BCA 2016 or the fire safety upgrade requirements specified in the fire order. This applies to the proposed new building works as well as the remainder of the existing building. This includes the essential fire safety systems listed in Section 15.2 of this report.

Commissioning and maintenance of the fire safety systems for the building must be carried out in accordance with Section 15 of this report.

It is understood that a range of fire safety upgrade works have been undertaken as part of the on-going fire order process, which has not been fully completed. As such, the proposed trial fire safety design of

this report is subject to both the determination by the Consent Authority during the fire order process and the assessment by the Certifying Authority for a Construction Certificate application.

The scope of work of this report is strictly limited to the specific deviations from the DTS Provisions which have been identified by the Certifying Authority and are required to be addressed in this report by the proposed Performance Solutions. The assessment and conclusions of this report do not apply to any matter that is outside the scope of work of this report.

This fire engineering report should be reviewed whenever a change in use or future alterations and additions are proposed to either the existing building or the proposed building as the objectives may require revision, the assumptions may become invalid, or the fire engineering analysis may not be applicable to the proposed change in use, alterations and additions. For a development application, this report is subject to the acceptance of the relevant Certifying Authority.

1 INTRODUCTION

1.1 Location and Description

The proposed development, the subject of this report, is located at 48a Queenscliff Road, Queenscliff NSW.

The existing residential building has a rise in storey of eleven (11) that includes a basement level for carparking, and an undercroft area. The building is a concrete / masonry structure and has Type A construction. Part of the ground level (lobby) and the whole of levels 1 to 9 are being used as residential accommodation (apartments), the ground level and the basement levels are being used for carparking.

As shown in Figure 1, the subject building is bounded by other similar multi-dwelling residential properties to the immediate east (42 Queenscliff Road), the north (44 Queenscliff road) and the west (1 & 1A Greycliffe Street & 50A Queenscliff Road), and abuts and overlooks Queenscliff Beach to the south. An existing driveway between the adjoining properties to the east (44 Queenscliff Road) and the west (50 & 50A Queenscliff Road) provides pedestrian and vehicular access to the subject building from Queenscliff Road.

Figure 1: Site overview (Courtesy of Google Map)

It is understood that the subject building was the subject of a Council Fire Order No. 6 issued by Warringah Council in 2009. The proposed fire safety upgrade strategy has been agreed and partially implemented with the Council and Fire and Rescue NSW. In particular, FRNSW (NSWFB at the time) did not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report (Comment item 1 in NSWFB letter File Ref. NFB/01239 dated 19 October 2010, included in Annexure E to this report) which means that the subject building was not required to be provided with the fire safety measures such as an automatic sprinkler system, a stair pressurisation system and a Sound Systems and Intercom Systems for Emergency Purposes (SSISEP), which are required to be provided to a building having an effective height exceeding 25 m in accordance with the BCA DTS Provisions.

As shown in Figure 2, it is currently proposed to modify the undercroft area to become a residential unit (new Unit A) and to introduce a new residential unit (new Unit 18) on the ground level and a small portion of the ground level to become a storage area. All levels above the ground level and the existing ramp to Queenscliff Road are to remain unchanged (except the proposed carparking portion on level 1). As a result, this report for the subject development relates to the specific deviations from the Deemed-to-Satisfy (DTS) Solutions that have been identified by the Certifying Authority and are required to be assessed in accordance with Section A0.5 of the BCA 2016 to demonstrate that said deviations comply with the relevant Performance Requirements.

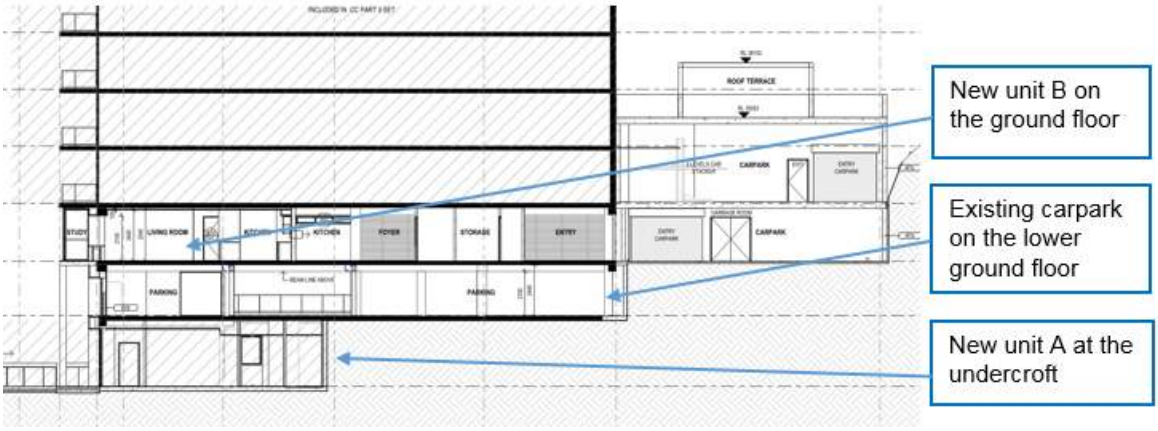


Figure 2: Location of the proposed alteration to the existing building (section view shown)

According to FRNSW website, the two nearest fire stations to the subject building are shown in Table 1:

Table 1: Two nearest fire stations

Fire Stations	Approximate Distance from the Subject Site	Staff Type
Manly Fire Station 128 Sydney Road, Fairlight NSW 2094	3 km	Permanent
Dee Why Fire Station 38 Fisher Road, Dee Why NSW 2099	4.5 km	Permanent

BCA Logic Pty Ltd has been engaged by **C&C Project Management Pty Ltd** to carry out Fire Safety Engineering Assessments of the Performance Solutions identified.

1.2 Purpose of Report

The purpose of this report is to define the scope of the Performance Solutions applicable to this project; identify the trial design, design fire scenarios and design fires for evaluation; describe the approaches and methods of fire engineering analysis, and propose the acceptance criteria and factors of safety for the fire engineering analysis as part of the fire engineering brief process; as well as to document the results of an evaluation of the Performance Solutions formulated to address the nominated deviations from the BCA DTS Provisions, which are identified and confirmed by the Certifying Authority, as part of the fire engineering report (FER) process.

A fire engineering brief questionnaire (FEBQ) has also been submitted to FRNSW for stakeholder consultation. Input and comments from FRNSW on the FEBQ are included in Annexure H to this report.

In addition, this fire engineering report and its associated FEBQ process are subject to a fire engineering peer review process. Previous peer review report by PGA Pty Ltd, Report No.17084-R1-V1 dated 10 July 2018 and BCA Logic Pty Ltd response are included in Annexure G to this report. It is anticipated that a new peer review report will be undertaken in response to this updated FER.

1.3 Stakeholders

The relevant Stakeholders for the purposes of this report include the following members:

Table 2: Stakeholders for fire engineering report

Name	Role	Company / Agency
Kate Gassmann	Project Management	C&C Project Management Pty Ltd
Vic Lilli, BPB 0229 Gary Rafferty, BPB 2681	Principal Certifying Authority	Vic Lilli & Partners Pty Ltd
SO Darren Bofinger	Referral Agency	Fire & Rescue NSW

Jason Wang		
Prem Anandh	Architect	Custance Associate Australia Pty Ltd
TBA	Structural Engineer	NB Consulting Engineers
Peter Gardner, BPB 0131	Third party fire engineering peer reviewer of FEBQ and FER	PGA Pty Ltd
Stuart Boyce, BPB 0044	BCA Consultant	BCA Logic Pty Ltd
Michael Mason, BPB 3308	Accredited Fire Safety Engineer (C10)	BCA Logic Pty Ltd

1.4 Building Code of Australia

The legislative requirements applicable to this project are the NSW Environmental Planning and Assessment Act 1979 and the NSW Environmental Planning and Assessment Regulation 2000 which make reference to the Building Code of Australia on technical matters.

The Building Code of Australia (BCA) applicable to this project is the National Construction Code Series Volume 1 – Building Code of Australia, 2016 Edition (BCA 2016) incorporating the NSW variations where applicable (in force as of 12 March 2018) herein referred to as the BCA.

Please note that the version of the BCA applicable to new building works is the version applicable at the time of the lodgement of the Construction Certificate Application to the Accredited Certifying Authority. The BCA is updated generally on a three-yearly cycle, starting from 1st May 2016.

1.5 Source of Project Information

This report has been based on the following information:

- the architectural drawings listed in Annexure A of this report;
- BCA Assessment & Fire Safety Upgrade Report, by BCA Logic Pty Ltd, dated 1 September 2009;
- the email correspondence between stakeholders dated from 05/08/2016 to 31/07/2018, with some of them included in Annexure E to this report;
- the letter from Warringah Council dated 26 October 2010, containing the recommendations by NSW Fire Brigade, File No. NFB/0139, dated 19 October 2010, included in Annexure F to this report;
- the FRNSW comments on the FEBQ version 1 prepared by BCA Logic Pty Ltd and submitted on 03/05/2018, with FRNSW reference number BFS18/1161, dated 30 May 30/05/2018, included in Annexure H to this report; and
- Fire engineering peer review report by PGA Pty Ltd, Report No.17084-R1-V1, dated 10 July 2018, included in Annexure G to this report.

1.6 Limitations

This report has been prepared in accordance with the client's instructions and based on the stakeholders' inputs. This report focuses on the building parts of the subject building which relate to the proposed development only, including the undercroft, the lower ground level, the ground level and the carparking portion on level 1 of the base building.

It is understood that a range of fire safety upgrade works have been undertaken as part of the ongoing fire order process, which has not been fully completed. As such, the proposed trial fire safety design of this report is subject to both the determination by the Consent Authority during the fire order process and the assessment by the Certifying Authority for a Construction Certificate application.

The scope of work of this report is strictly limited to the specific deviations from the DTS Provisions which have been identified by the Certifying Authority and required to be addressed in this report by the proposed Performance Solutions. The assessment and conclusions of this report does not apply to any matter that is out of the scope of the work of this report.

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

(1) the structural adequacy or design of the building, including the assessment of the structural robustness to satisfy the BCA performance requirement BP1.1, BP1.3 and BP1.4 when considering the proposed reduction of FRL on the lower ground level and the ground level;

(2) the inherent derived fire-resistance ratings of any proposed structural elements of the building (unless specifically referred to);

(3) the design basis and/or operating capabilities of any proposed electrical, mechanical or hydraulic fire protection services (other than those specifically referred to in relation to the smoke / heat detection and alarm system);

(4) business protection or business continuity;

(5) existing building parts and building conditions that are not affected by the proposed development;

(6) overall building fire safety that is subject to the determination of the Consent Authority;

(7) insurer's requirements; and

(8) property protection, other than adjacent properties.

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

(1) Disability Discrimination Act (DDA) including the Disability (Access to Premises – Building) Standards 2012;

(2) demolition standards not referred to by the BCA 2016;

(3) Occupational Health and Safety Act (Work practices under general Work Cover issues);

(4) Construction Safety Act (During building alterations and additions process only);

(5) any matter to be determination by consent and planning authorities;

(6) requirements of other Regulatory Authorities including, but not limited to, Telstra, Sydney Water, Electricity Supply Authority, Roads and Maritime Services (RMS), Work Cover, the local Council and the like; and

(7) conditions of Development Consent issued by the Local Consent Authority.

2 DESIGN OBJECTIVES

2.1 Regulatory Objectives

The following items are a summary of the Fire and Life Safety objectives of the BCA 2016:

- 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.

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).

Over and above the requirements of the BCA 2016, the Fire Brigade has functions with regard to property protection and considerations regarding occupational health and safety for its employees which as far as reasonable commensurate with costs are to be incorporated.

2.3 Other Regulatory Objectives

BCA Logic has not been advised there are other regulatory objectives that are applicable to this project.

2.4 Other Non-regulatory Objectives

BCA Logic has not been advised there are specific non-regulatory objectives that need to be addressed for this project, such as:

(i) property protection; or

(ii) business continuity; or

(iii) insurer's requirements; or

(iv) corporate image issues; or

(v) community issues; or

(vi) environmental issues.

3 PRINCIPAL BUILDING CHARACTERISTICS

For the purposes of the BCA, the proposed development is described as follows:

3.1 Rise in Storeys (Clause C1.2)

The building has a rise in storey of eleven (11).

3.2 Classification (Clause A3.2)

The building has been classified as follows:

Class	Level	Description
2	Undercroft	Proposed residential apartment
7a	Lower ground level	Car park
7a	Part ground level	Car park
7a	Part Level 1	Car park
7b	Part ground level	Proposed storage
2	Part ground level	Proposed residential apartment
2	Part Levels 1, level 2 – 8	Existing residential apartments

3.3 Effective Height (Clause A1.1)

The proposed building has an effective height of more than 25 metres, being approximately 30.2 m based on the letter by BCA Logic Pty Ltd dated 24.03.2018 which is detailed in Annexure E to this report.

Note: The definition of the effective height of a building changed on 1 May 2016. Any Construction Certificate submitted after this date will need to comply with the new definition.

The BCA 2016 definition is as follows:

> *"Effective height means the vertical distance between the floor of the lowest storey included in a determination of rise in storeys and the floor of the topmost storey (excluding the topmost storey if it contains only heating, ventilating, lift or other equipment, water tanks or similar service units)."*

It is understood that the subject building was the subject of a Council Fire Order No. 6 issued by Warringah Council in 2009. The proposed fire safety upgrade strategy has been agreed with the Council and Fire and Rescue NSW and partially implemented. In particular, FRNSW (NSWFB at the time) did not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report (Comment item 1 in NSWFB letter File Ref. NFB/01239 dated 19 October 2010).

In relation to the effective height of the subject building, FRNSW has provided the following comments in the FEBQ:

FRNSW: Noted that the building could be interpreted having an effective height of less than 25 m. However, given the fact that the definition of effective height has been changed since 2016, the determination of effective height should be in accordance with the latest version of BCA and the provision of fire safety measures should therefore be based on the newly determined effective height which is greater than 25 m.

BCA Logic Pty Ltd: It is understood that the existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portion being repurposed is to occur at the undercroft, the lower ground level, the ground level and the proposed carpark portion on level 1 only, and does not increase the existing height of the subject building.

During the recent Fire Order process, the current level of fire safety of the subject building was accepted by the Consent Authority and FRNSW. The existing fire and life safety risk level of the occupants on the existing upper levels are not expected to be affected by the mere change of the definition of effective height in the building code.

3.4 Type of Construction Required (Table C1.1)

The building is required to be of Type A fire-resisting construction.

3.5 Floor Area and Volume Limitations (Table C2.2)

The building is subject to maximum floor area and volume limits of:

Class 7	Maximum Floor Area Maximum Volume	5,000m² 30,000m³
Class 2	The Class 2 portions of the building are not subject to floor area and volume limitations of C2.2 as Table 3 of Specifications C1.1 and Clause C3.11 of the BCA regulates the compartmentation and separation provisions applicable to buildings, or building portions, of Class 2 classifications.	

3.6 Fire Compartments

The following fire compartments (to the BCA DTS Provisions in accordance with clause A1.1 of BCA 2016) have been assumed:

(1) The storage area on the ground level forms its own fire compartment.

(2) The carpark area on the ground level forms its own fire compartment.

(3) As the existing residential building is Type A construction, it is assumed each storey is a separate fire compartment. It is assumed that the building is only connected by fire-isolated stairs and lift shafts to allow each storey to be a separate fire compartment.

3.7 Potential Fire Hazards

The potential fire hazards in the building are identified as follows:

Factors	**Examples**
Ignition sources	Cooking appliances Household appliances Heating and air-conditioning system Electrical power supply and lighting system Motor vehicles
Fuel sources	Furniture Furnishing Electrical appliances Personal belongings Motor vehicles
Activities	Occupants sleeping Improper use of appliances Motor vehicle incidents Minor arson

Major arson fires with multiple ignition sources and/or multiple ignition locations are discounted in this instance (relative to the proposed Performance Building 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.

3.8 Fire Preventative and Protective Measures

The following fire preventative and protective measures are proposed for the building in accordance with the BCA DTS Provisions:

- Access panels, doors and hoppers to fire-resisting shafts
- Automatic fail safe devices
- Automatic fire detection and alarm system
- Automatic fire sprinklers in ground, lower ground and undercroft levels
- Fire hydrant
- Building occupant warning system
- Emergency lighting
- Exit signs
- Fire control centre
- Fire dampers
- Fire doors
- Fire hose reel system (to basement car park levels)
- Fire seals protecting openings in fire resisting components of the building
- Lightweight (fire rated) construction
- Mechanical air handling system
- Paths of travel, stairways, passageways or ramps
- Portable fire extinguishers and fire blankets
- Smoke alarms and heat alarms (within SOUs)
- Smoke seals and intumescent fire seals
- Warning and operational signs

The measures above are assumed to have been designed, installed and/or constructed in full accordance with the relevant Australian Standards, or international engineering standards where appropriate, applicable at the time of installation, unless otherwise specifically identified in this report.

According to the information provided by the client, the fire control centre incorporating the Fire Indicator Panel is to be located within the covered area adjacent to the building main entry area on the ground level.

The fire hydrant system drawing, Ref. No. H-04, by ITM Design Pty Ltd, Rev. C dated 01.08.17 is included in Annexure A to this report. Based on the abovementioned fire hydrant system plans,

- the proposed fire hydrant booster assembly is to be located near Queenscliff road and facing the driveway; and
- the proposed fire hydrant pump assembly is to be located along the side of the driveway next to the stairway serving the carparking portion on level 1.

It is understood that the proposed fire hydrant system design is to be finalised by a competent fire safety practitioner and is subject to the acceptance of FRNSW, the Consent Authority and the Certifying Authority.

3.9 Summary of Performance Solution for the Building and BCA Assessment Methods

Table 3 below details the proposed design deviation from the DTS Provisions and the Performance Requirements relevant to the Performance Solution as determined in accordance with BCA Clause A0.7, and the BCA Assessment Methods.

Table 3: Deviations from the BCA DTS Provisions

Performance Solutions	Part(s) of the Building Affected by the Performance Solution	Relevant Deemed-to-Satisfy Provisions	Description of Departures from the DTS Provisions	Performance Requirements Achieved by the Performance Solution	Impact on Other Building Design Solutions	Method of assessment
1	The ground level	C2.6	To allow the provision of spandrel that is 400 mm above the floor slab on the ground level in lieu of 600 mm.	CP2	Nil, refer Section 7 of this report	A0.3 (a) (ii) & A0.5 (d)
2	The lower ground level and the ground level	C1.1, C2.8, C2.9, & Table 3 of Specification C1.1	To allow the existing carpark portion on the lower ground level and the proposed carparking portion on the ground level to have a minimum FRL of 90/90/90 in lieu of 120/120/120.	CP1 & CP2	Nil, refer Section 8 of this report	A0.3 (a) (i) & A0.5 (b) (ii)
3	The ground level	C1.1, C2.8, C2.9, & Table 3 of Specification C1.1	To allow the storage area on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.	CP1 & CP2	Nil, refer Section 8 of this report	A0.3 (a) (i) & A0.5 (b) (ii)
4	The proposed new SOUs on the ground level and at the undercroft	D1.2 & D1.10	To allow the following variations in egress provisions related to the carparking and storage areas: • One exit is provided in lieu of two; and • The pathway from exit discharge to a road involves travel via an incline greater than 1:8.	DP4 & EP2.2	Nil, refer Section 9 of this report	A0.3 (a) (i) & A0.5 (b) (ii)
5	Carparking and storage areas on the lower ground, ground level and level 1	D1.2, D1.4 & D1.6	To allow the following variations in egress provisions related to the carparking and storage areas: • a single exit to serve the carparking areas on levels lower ground, ground and level 1; and • a single exit to serve the carparking area on level 1; and • a minimum egress width of 810mm in lieu of 1,000mm from level 1 car park; and • a minimum egress width of 800mm in lieu of 1m from the lower ground floor storage are, including storage cupboard door of 550mm and egress door width 630mm; and • extended travel distances of up to approximately 22 m from the carparking areas to a single exit on the ground level.	DP4, DP6 & EP2.2	Nil, refer Section 0 of this report	A0.3 (a) (i) & A0.5 (b) (ii)

Performance Solutions	Part(s) of the Building Affected by the Performance Solution	Relevant Deemed-to-Satisfy Provisions	Description of Departures from the DTS Provisions	Performance Requirements Achieved by the Performance Solution	Impact on Other Building Design Solutions	Method of assessment
6	The ground level	D1.7	To allow the existing central fire-isolated stairway to discharge into a covered area on the ground level.	DP5 & EP2.2	Nil, refer Section 11 of this report	A0.3 (a) (i) & A0.5 (b) (ii)
7	The undercroft & the lower ground level	E3.4	To allow the lift serving the new unit at the undercroft not to be an emergency lift.	EP3.2	Nil, refer Section 12 of this report	A0.3 (a) (ii) & A0.5 (d)
8	The whole building	E4.9	To allow the proposed building portions being repurposed to not be provided with a Sound Systems and Intercom System for Emergency Purposes (SSISEP).	EP4.3	Nil, refer Section 13 of this report	A0.3 (a) (ii) & A0.5 (d)
9	The lower ground level	E1.3	To allow the proposed external attack fire hydrant to be located approximately 4.5 m from the nearest unprotected opening in lieu of 10 m.	EP1.3	Nil, refer Section 14 of this report	A0.3 (a) (i) & A0.5 (b) (ii)

3.10 Environmental Planning and Assessment Regulation 2000

In accordance with the provisions of Section 144 of the Environmental Planning and Assessment Regulation 2000, this report is required to be referred to the Fire & Rescue NSW because the largest fire compartment in the subject building is more than 2,000 m², the total floor area of the subject building exceeds 6,000 m², and the Performance Requirements EP1.3, EP2.2 and EP3.2 are a referral trigger.

3.11 On-going Fire Order process

It is understood that Warringah Council issued a Fire Order, Order 6 (Fire Safety Upgrade) to the subject residential flat building in 2009, which was referred to FRNSW (NSWFB at the time). The fire safety upgrade works have been partially implemented, and therefore, the fire order process has not been fully completed.

As such, the proposed trial fire safety design of this report is subject to the determination by the Consent Authority during the fire order process and the assessment by the Certifying Authority for a Construction Certificate application.

4 DOMINANT OCCUPANT CHARACTERISTICS

4.1 Nature of Occupancy

The occupants in the subject building are to consist of residents and their visitors, and maintenance contractors. The age of the occupants in the subject building may range from very young to the aged.

The medium to long term residents in the apartments are expected to be familiar with the layout of the subject building and location of emergency exits. Short term residents, visitors and maintenance contractors 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.

4.2 State of Occupants

Most occupants in the car park are expected to be awake and alert.

Maintenance contractors are expected to be awake and alert.

Occupants in the residential apartments may be asleep or under the influence of medication and/or alcohol at the time of fire emergency.

4.3 Physical Attributes

Most occupants are expected to be able to evacuate the building by themselves, whereas a small portion of occupants may need assistance from other occupants to evacuate.

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

4.4 Mental Attributes

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

The majority of the residents in the subject building is expected to have the ability to interpret fire cues, understand fire alarm messages, and follow the instructions given to them by the fire brigades, except for the very young and occupants with disorder such as dementia etc.

4.5 Level of Assistance Required

The occupants with mobility, hearing and visual impairment present at the site may require assistance during an emergency. Assistance is likely to be provided by care-givers, friends or relatives.

4.6 Emergency Training

Residents and their visitors are not expected to have received trainings in accordance with AS 3745. Most occupants are expected to evacuate the building following the warning signals and guidance provided by the fire brigade.

4.7 Activity at the Outbreak of Fire

At the outbreak of fire in the subject building, occupants in the residential apartments may be asleep or under the influence of medication and/or alcohol at the time of fire emergency.

5 TRIAL FIRE SAFETY DESIGN

5.1 General

This section outlines the main assumptions used to simplify the building system and design fire scenarios to enable suitable fire engineering analysis to be undertaken on a practical level for the subject building. All assumptions are based on the practice nominated in the International Fire Engineering Guidelines (IFEG) 2005 and practical simplifications have been utilised to maintain a simple analysis that is representative of a real fire and life safety situation.

5.2 Assumptions

(1) Only one (1) fire will occur at a time.

(2) 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 BCA 2016 for safe evacuation.

(3) Occupants do not engage in major firefighting activities.

(4) All corridors, exit paths and egress points are maintained clear of obstructions that may prevent safe evacuation.

(5) All essential services, equipment, services and strategies will be maintained to the operational capacity to which they were designed and correctly functioning during a fire situation.

(6) All other components of the building not addressed within this document will be installed to the requirements of the DTS Provisions of the BCA 2016 and/or remain as required within the subject building approval conditions / design.

5.3 Trial Concept Design

It is understood that a range of fire safety upgrade works have been undertaken as part of the fire order process. However, the fire order process has not been fully completed. As such, the proposed trial fire safety design of this report is subject to both the determination by the Consent Authority during the fire order process and the assessment by the Certifying Authority for a Construction Certificate application.

The trial fire safety design is to be based on the following requirements as described below. Note that all other items of fire and life safety where not specifically addressed or reviewed as part of the Fire Engineering Scope, refer Section 1.2, are to be in accordance with the DTS Provisions of the BCA 2016 and the fire safety order as applicable.

5.3.1 Fire and smoke resisting construction

5.3.2 Spandrels

Spandrel construction on the existing lower ground level is to adopt the BCA 2016 DTS Provisions.

As part of the proposed Performance Solution in this report, the proposed spandrel on the ground level is to be 400 mm above the slab in lieu of 600 mm, has a FRL of at least 60/60/60, and has a total height of at least 900 mm; whilst the proposed slab of the ground level is to extend approximately 1.3 m beyond the external walls of the lower ground level and form a patio for the undercroft.

5.3.3 Lift doors

The lift landing doors of the central lift on the lower ground level and the ground level are to have an FRL of −/60/− in accordance with the BCA 2016 DTS Provisions;

5.3.4 Lower ground openings

The louvres that are to be provided to the openings within the southern external walls on the lower ground level are to have at least 50% free area; and

The existing western and eastern ends of the driveway on the low ground level are to directly open to the outside without any doorway or roller shutter.

5.3.5 External stairway from undercroft to lower ground

The stairway (including the pathway from the entry door of the proposed undercroft unit to the stairway) connecting the undercroft level and the lower ground level is to be constructed of non-combustible construction.

5.3.6 Fire and smoke compartmentation

The entry doors of the proposed new residential units on the ground level and at the undercroft are to be fitted with medium and hot temperature smoke seals protecting all sides of the door/doorway.

As highlighted in orange in Figure 3 to Figure 5 in this report, the following areas are to have a minimum FRL that is not in accordance with the BCA DTS Provisions:

- the existing carparking portion on the lower ground level to have an FRL of at least 90/90/90 in lieu of 120/120/120;
- the proposed tandem carparking portion on the ground level to have an FRL of at least 90/90/90 in lieu of 120/120/120; and
- the proposed storage portion on the ground level to have an FRL of at least 120/120/120 in lieu of 240/240/240.

As illustrated in Figure 6 the following fire compartmentation shall be provided on ground floor:

- Proposed storage area on the ground level is to be fire separated from the adjoining carparking and lobby areas by fire resisting construction having an FRL of at least 120/120/120 (shown in purple).
- The fire wall separating the new tandem garages from the SOU is to have an FRL of at least 90/90/90 (shown in green).
- Fire doors having minimum FRL of -/120/30 and fitted with medium and hot temperature smoke seals protecting all sides of the door/doorway (shown in red).

Building elements or parts of the building elements outside the abovementioned are to have a minimum FRL in accordance with the BCA 2016 DTS provisions.

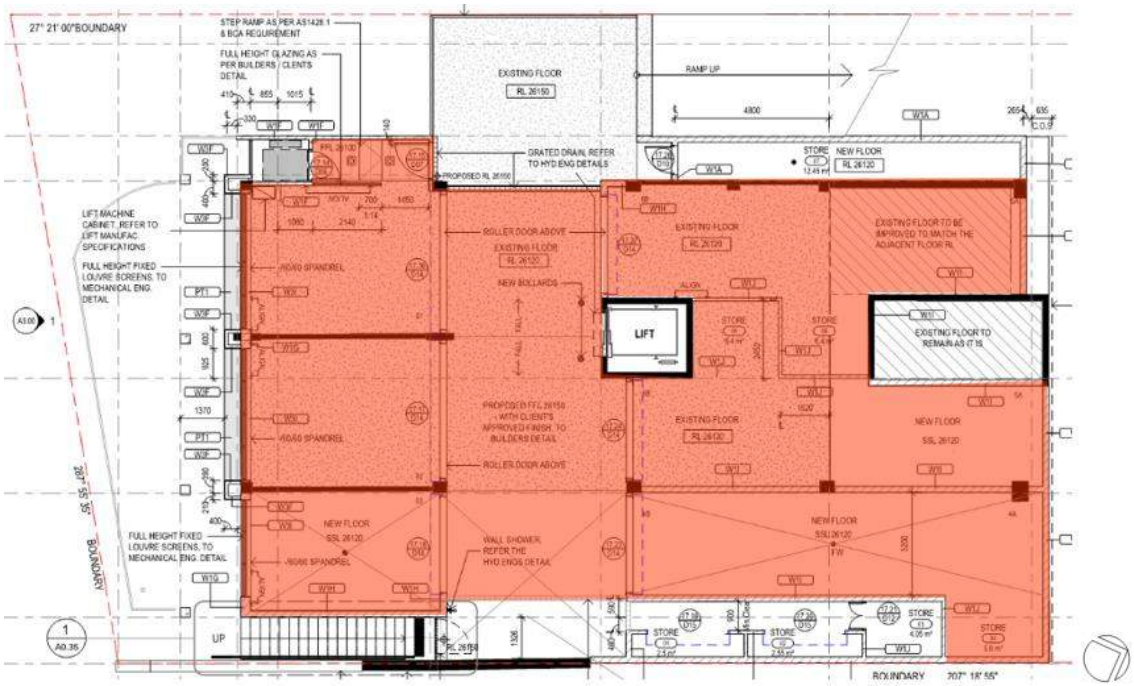


Figure 3: Existing carparking areas on the lower ground level

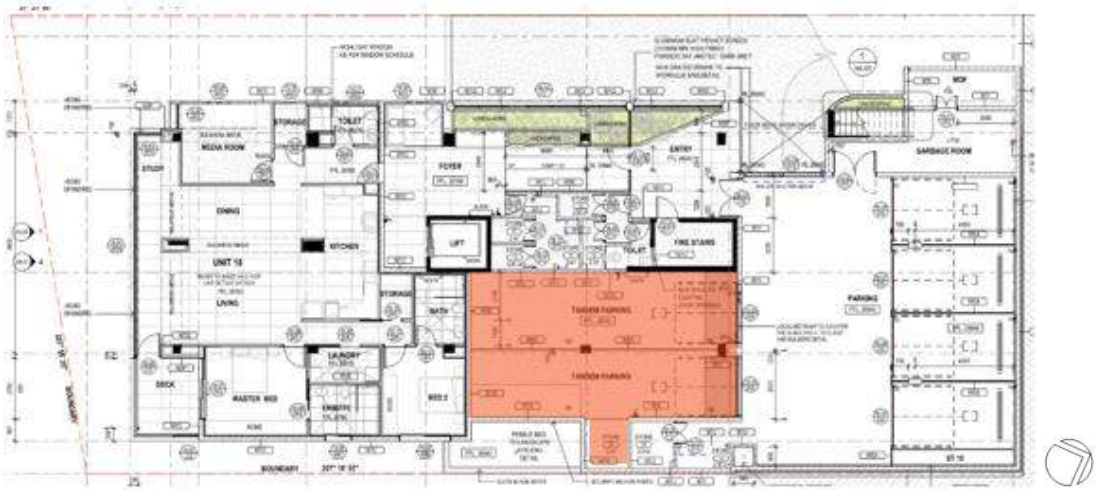


Figure 4: Proposed new tandem carparking portion on the ground level

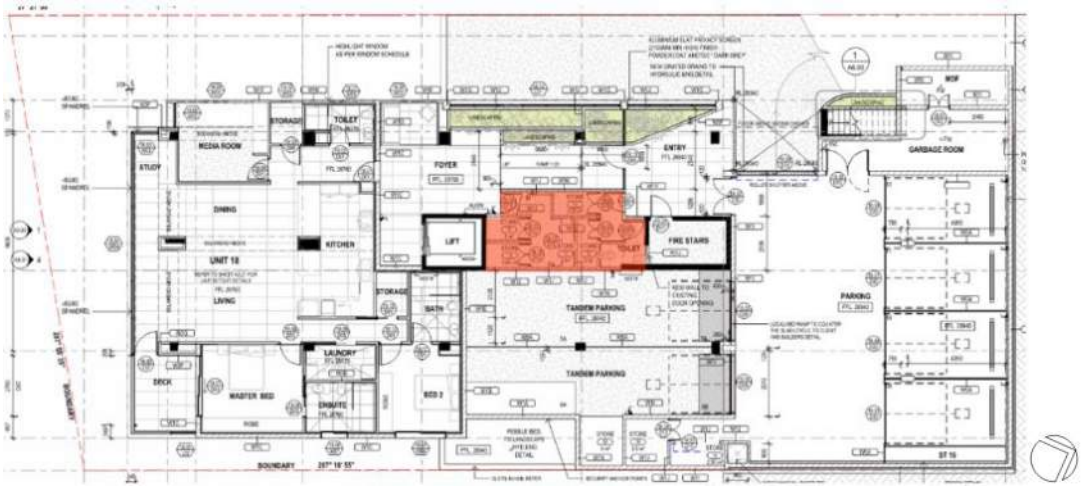


Figure 5: Proposed new storage portion on the ground level

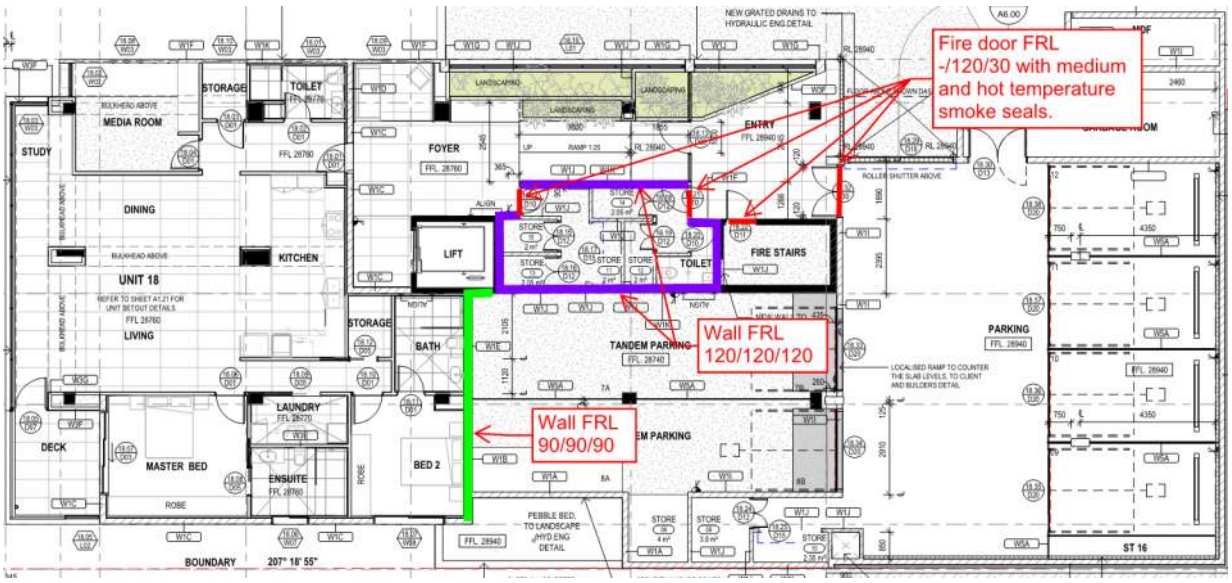


Figure 6: Proposed additional fire and smoke separation on the ground level

5.3.7 Smoke detection and alarm system

The undercroft, the lower ground level, the ground level and the carparking portion on level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store room or car space on the lower ground level, the ground level and level 1 that is separated from the adjoining areas by physical barriers, such as walls and fences, is to be provided with at least one smoke or heat detector and in accordance with the detector spacing stipulated in AS 1670.1:2015.

A heat detector is to be provided in each of the proposed new apartments on the ground level and at the undercroft, and be located not more than 1.5 m horizontal distance from the doorway within the SOU. The abovementioned heat detectors shall conform to AS 7240.5-2004 (Amdt 1) and are to be of Class A1R detector as defined in the Standard with a static response temperature between 54°C and 65°C as well as rate-of-rise capability. The heat detectors are to form part of the smoke detection and alarm system for the building, that is, when a heat detector is activated, the building general alarm conditions, including the building occupant warning system (BOWS), shall be automatically activated.

A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout the areas under the proposed development, being the undercroft, the lower ground level, the ground level and the carparking portion on level 1. The BOWS shall be extended into each of the proposed new residential SOUs on ground levels and at the undercroft such that a sound pressure level of at least 75 dB(A) is achieved at each bedhead with all doors of the SOU closed.

5.3.8 Automatic fire sprinkler system

The undercroft, the lower ground level, the ground level and the carparking portion on level 1 are to be provided with an automatic fire sprinkler system. The sprinkler system shall be based on AS2118.4-2012 with the following enhancements and parameters included:

- Sprinkler heads are not required in the areas that are permitted to excepted under AS2118.4-2012 section 2.2.3 based on the limited quantity of combustibles anticipated in these areas and the fact that these are isolated areas that open into protected areas.
- Sprinkler heads in all non-residential areas such as storage, carpark, garbage rooms shall be protected with sprinkler heads having K factor of 8.0 and minimum discharge of 60L/s per head.
- Extended coverage residential sprinkler heads are permitted to be used inside SOU's. the maximum spacing and area of coverage for each head can be determined in accordance with the manufacturer's data sheets in lieu of AS2118.4-2012 table 4.4.
- The hydraulic design shall cater for the five (5) least hydraulically favourable heads in the installation operating simultaneously with each head operating at the minimum pressure required for the coverage achieved by that head or the minimum operating pressure nominated by the manufacturer – whichever is the greatest. Information regarding coverage vs pressure shall be taken form the manufacturer's data sheet for the sprinkler heads selected. Note that this design methodology aligns with the requirements of AS2118.1-2017 for residential occupancies.
- Water supply can be fed from the fire hydrant system in accordance AS2118.4-2012 clause 3.2(d).
- As the water supply is drawn from the hydrant system, the pump requirements of AS2118.4-2012 section 3.5 are not applicable. The hydrant pumpset is to be retained as part of the water supply for the sprinkler system.
- The existing fire brigade hydrant booster connection is upstream of the sprinkler system and therefore can be retained to fulfil the requirement of a sprinkler fire brigade booster under AS2118.4-2012 section 3.8. An additional fire brigade booster to serve only the sprinkler system is not required to be provided.
- The sprinkler system shall incorporate an alarm signalling equipment (ASE), such that in the event of the system operating a signal is transmitted to the building's FIP which in turn will commence building fire mode operations including occupant warning and automatically alerting the fire brigade.
- Design documentation for the sprinkler system shall comply in full in accordance with AS2118.4-2012 section 4.2, noting that reference to this FER should also be included for as per clause 4.2.1 point (q).

- Identification, site plan, emergency instructions and system interface diagrams in accordance with the requirements of AS2118.4-2012 sections 4.6, 4.7, 4.8 and 4.10 shall be located at the fire hydrant booster assembly.

5.3.9 Wayfinding

An illuminated exit sign is to be provided to the fire door from the carpark to the main lobby area on the ground level in accordance with AS 2293.1-2005.

5.3.10 Signage

A permanent, fade-resistant and water-resistant sign stating the following in capital letters, not less than 50 mm high and in a colour contrasting with the background “NO STORAGE OF COMBUSTIBLE MATERIALS & FUNITURE WITHIN THIS AREA” is to be provided to the following locations:

- within the covered building main entrance area on the ground level,
- within the lift lobby/foyer area on the ground level,
- within the car entrance area on the lower ground floor.

5.3.11 Management in Use (MIU)

A building management-in-use policy is to be implemented, which is to be included in the building annual fire safety statement, and checked and certified annually, and include the following:

- inhibiting any combustible materials and furniture to be stored within all common property areas at all times.
- maintaining all egress pathways within the building free of obstructions.

5.3.12 Maintenance:

Ensure all essential services and equipment listed in Section 15.2 are correctly commissioned. Essential services must be maintained in accordance with this report, relevant Australian Standards, and the Environmental Planning and Assessment Regulation 2000. Failure to do so will render the outcomes of this Fire Engineering Report (FER) invalid, null and void. Up to date logbooks must also be provided on site.

All routine maintenance and testing shall be carried out by companies that are accredited under the Fire Protection Accreditation Scheme (FPAS) administered by Fire Protection Association Australia.

5.3.13 Other requirements:

No excessive quantity of hazardous, flammable, explosive or highly combustible materials may be stored on site.

All other items of fire and life safety and BCA 2016 requirements are to be installed and fully complied with, unless otherwise being determined by the Consent Authority, which are not specifically addressed in the report.

No changes to the aforementioned requirements without explicit approval in writing by BCA Logic Pty Ltd and all Performance Solutions to the BCA 2016 described herein are to be incorporated into the building design.

The requirements listed in this section are Essential Services and as such all fire safety systems should be identified as requiring maintenance and certification at appropriate intervals relative to their corresponding Australian Standard.

6 FIRE ENGINEERING ANALYSIS METHODS AND ACCEPTANCE CRITERIA

The fire safety engineering analysis for the Performance Solution has been carried out in accordance with the International Fire Engineering Guidelines (1) (IFEG) 2005 and addresses the relevant Performance Requirements of the BCA, using Sub-Systems A, B, C, D, E and F where appropriate as defined in the IFEG 2005.

Analysis tools and techniques which may be used include calculations from first principles, computational models and the like. All source data will be fully referenced.

Input parameters, calculations, models used and the form of analysis will be recorded to facilitate future analysis of any through life changes to the Building.

The fire engineering analysis has been limited to the design objectives applicable to this project as identified in Section 2.

The assumptions, analysis methods and acceptance criteria are summarised below.

6.1 Assumptions

For the purpose of this report, it has been assumed that the new building works will in all aspects comply with the DTS Provisions (other than the Performance Solutions formulated in this report) and the following assumptions are made:

1) The subject building has been constructed in accordance with the required FRL's referred to in Table 3 of Specification C1.1 of BCA 2016 for a building of Type A Construction, with the exception to the deviations from DTS Provisions addressed within this report.
2) Access and Egress to the building will comply with the DTS Provisions of the BCA, with the exception to the deviations from DTS Provisions addressed within this report.
3) All fire protection measures required under Section E of the BCA have been installed in and serve the subject building in accordance with the DTS Provisions of the BCA, with the exception to the deviations from DTS Provisions addressed within this report.

6.2 Fire Engineering Analysis Methods

6.2.1 Approach

With respect to the proposed Performance Solution 1, a comparative, deterministic, and quantitative approach has been undertaken for the fire engineering analysis.

With respect to the proposed Performance Solution 2, an absolute, deterministic, and quantitative approach has been undertaken for the fire engineering analysis.

With respect to the proposed Performance Solutions 3– 6 and 9, an absolute, deterministic, and qualitative approach has been undertaken for the fire engineering analysis.

With respect to the proposed Performance Solution 7 and 8, a comparative, deterministic, and qualitative approach has been undertaken for the fire engineering analysis.

6.2.2 Design fire scenarios and design fires

6.2.2.1 Performance Solutions 1, 2 and 3

As these Performance Solutions are related to fire resistance performance of building elements, potential vertical fire spread, the appropriate design fire scenario and design fire is considered by BCA Logic to be a fully developed fire in the building.

6.2.2.2 Performance Solutions 4, 5 and 6

As these Performance Solutions are related to egress provisions, the appropriate design fire scenario and design fire is considered by BCA Logic to be a flaming fire which requires the occupants in the building to evacuate. Smouldering design fire scenarios need not be considered as the provision of smoke alarms in the residential apartments is regarded to have addressed the sleeping risk to the degree necessary. Fully

1 Australian Building Codes Board, International Fire Engineering Guidelines, 2005.

developed design fire scenarios need not be considered as an automatic fire sprinkler system is provided in the lower parts of the building to control fire spread and prevent flashover.

6.2.2.3 Performance Solution 7

As this Performance Solution is related to the emergency lift to the building, the appropriate design fire scenario and design fire is considered by BCA Logic to be a large flaming fire that has the potential to grow to a fully developed fire on the lower ground level and the undercroft.

6.2.2.4 Performance Solutions 8 & 9

As this Performance Solution is related to the non-provision of an intercom and emergency warning system, and a potential fire hydrant impairment, the appropriate design fire scenarios and design fires are considered by BCA Logic to be a large flaming fire that has the potential to grow to a fully developed fire as well as a fully developed fire within the building.

6.2.3 Redundancy

This section lists the fire protection systems that introduce a level of redundancy into the overall fire safety design for the subject building.

The means by which a fire can be detected are as follows:

- Detection by building occupants
- Automatic fire detection system

The means by which fire and smoke may be limited from spreading are as follows:

- Fire stopping system
- Fire-rated building elements
- Medium temperature smoke seals and intumescent fire seals

The means by which a fire alarm may be raised are as follows:

- Building occupant warning system
- Notification by occupants

The means by which fire may be suppressed are as follows:

- Portable extinguishers
- Fire hose reels (to carpark areas only)
- Fire hydrants

7 PERFORMANCE SOLUTION 1 – TO ALLOW PROVISION OF SPANDREL THAT IS 400 MM ABOVE THE FLOOR SLAB ON THE GROUND LEVEL IN LIEU OF 600

7.1 Introduction

As shown in Figure 3 and Figure 4, a spandrel is to be provided on the ground level, which is to be 400 mm above the slab in lieu of 600 mm, have a total length of at least 900 mm, and have an FRL of at least 60/60/60. The slab of the ground level is to extend outwards approximately 1.3 m beyond the external walls of the lower ground level and form a patio for the undercroft. The opening at the undercroft has a length of approximately 11 metres and a height of approximately 2.7 metres. The opening on the lower ground level has a length of approximately 11 metres and a height of approximately 2.1 metres.

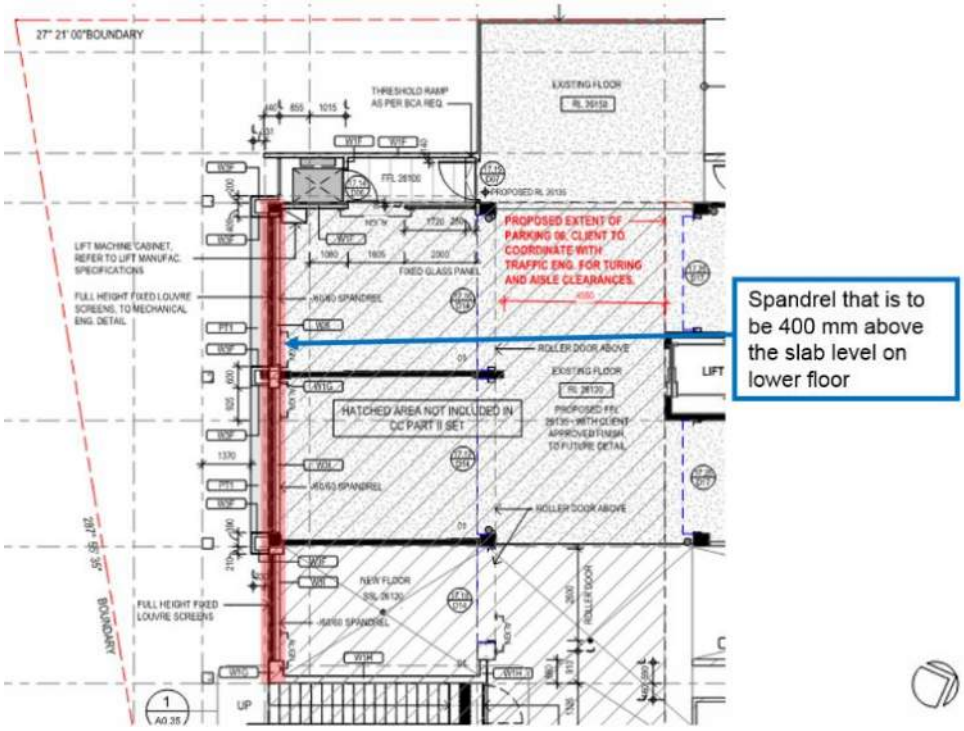


Figure 7: Location of the proposed spandrel that is 400 mm above the slab level on the ground level (ground level shown)

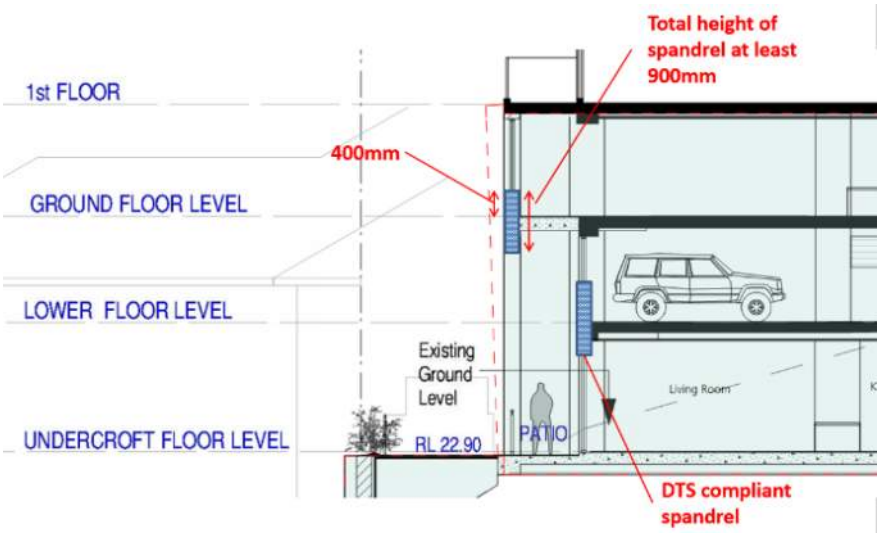


Figure 8: Location of the proposed spandrel that is 400 mm above the slab level of the ground level (south / rear section shown)

7.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirement is CP2, and the DTS Provisions applicable to this Performance Solution is Clause C2.6 of BCA 2016 that states:

C2.6 Vertical separation of openings in external walls

(a) If in a building of Type A construction, any part of a window or other opening in an external wall is above another opening in the storey next below and its vertical projection falls no further than 450 mm outside the lower opening (measured horizontally), the openings must be separated by—

(i) a spandrel which—

(A) is not less than 900 mm in height; and

(B) extends not less than 600 mm above the upper surface of the intervening floor; and

(C) is of non-combustible material having an FRL of not less than 60/60/60;

7.3 Acceptance Criteria

The Performance Solution is considered acceptable if it can be demonstrated that level of spandrel protection offered by the proposed Performance Solution is equivalent or greater than that afforded by the DTS Provisions.

The relevant DTS Solution features the similar building layout, fire load, potential fire intensity and fire hazard, except

- the spandrel is 600 mm above the slab level on the ground level; and
- the slab of the ground level is in line with the external walls of the lower ground level and undercroft.

7.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with the BCA Clauses A0.3 (a) (ii) and A0.5 (d), to demonstrate compliance with the relevant Performance Requirements CP2, using a comparative, deterministic, and quantitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the International Fire Engineering Guidelines (IFEG) 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system C – Fire Spread and Impact and Control

According to the Guide to NCC Volume One 2016, the intention of spandrel protection to minimise the risk of fire spreading from one floor to another via openings in external walls in buildings of Type A construction.

Fire spread via openings in external walls may occur when a fully developed fire (post-flashover fire) is present in the enclosure of fire origin, where flame extension through the external opening is commonly observed in such type of fires due to insufficient ventilation in the enclosure of fire origin to support combustion of all pyrolysed flammable vapours.

Flames issuing from an unprotected opening tend to curl back and impinge on the wall above the opening, generating convective and radiant heat fluxes to that wall [2]. If the combined heat flux is high enough, a fire hazard could be presented to the storeys above; such hazard is typically addressed in building codes by requiring a minimum height of spandrel or depth of a horizontal projection above the opening.

Comparison of key design parameters

Table 4 summarises the comparison results of the key design parameters offered by the proposed Performance Solution and the BCA 2016 DTS Provisions:

[2] I. Oleszkiewicz, "Vertical separation of windows using spandrel walls and horizontal projections," Fire Technology, pp. 334-340, November 1991.

Table 4: Comparison of design parameters of both the proposed Performance Solution and the BCA DTS Solution

Key parameters	DTS Solution	Proposed Performance Solution
Geometric parameters of unprotected openings at the undercroft, lower ground level and the ground level	Equivalent	Equivalent
Geometric parameters of the enclosure of fire origin at the undercroft and lower ground level	Equivalent	Equivalent
Expected fire development within the Enclosure of fire origin including fire load, potential fire intensity and fire hazards.	Equivalent	Equivalent
Minimum FRL of the Spandrel on the ground level	60/60/60	60/60/60
Overall spandrel length	900 mm	900 mm
Length of spandrel above the slab of the ground level	600 mm	400 mm
Horizontal projection of slab on the ground level	0 m	1.3 m
Flame length needed for the emerging flames to reach the top of the spandrel section	0.6 m	1.7 m

Analysis of flame length

The following flame length calculations are based on the design approach by Law [3] and the methodology developed by Law and O'Brien [4] for ventilation controlled post-flashover fires. The relevant parameters associated with the calculations are the width (W), depth (D) and height (H) of the enclosure, the width (w) and height (h) of the window/door opening as shown in Figure 9.

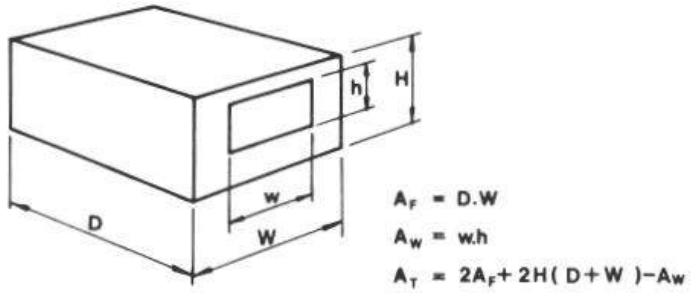


Figure 9: Enclosure of fire origin geometric parameters

The rate of burning for a ventilation controlled fire, R (kg/s), in the enclosure can be represented by the following equation:

$$R = \frac{0.18\left(1-e^{-0.036\eta}\right)A_W h^{\frac{1}{2}}}{\left(\frac{D}{W}\right)^{\frac{1}{2}}} \quad \text{(Equation 1)}$$

Where $\eta = \frac{A_T}{A_W h^{\frac{1}{2}}}$ (Equation 2)

The effective flame boundary is defined to be the location/contour of the flame that has a temperature of 540°C that is consistent with the definition of the flame tip. The assumed trajectories of emerging flames for natural draught are shown in Figure 10.

3 Margaret Law and Turlogh O'Brien, "Fire safety of bare external structural steel," The Steel Construction Institute, 1990.

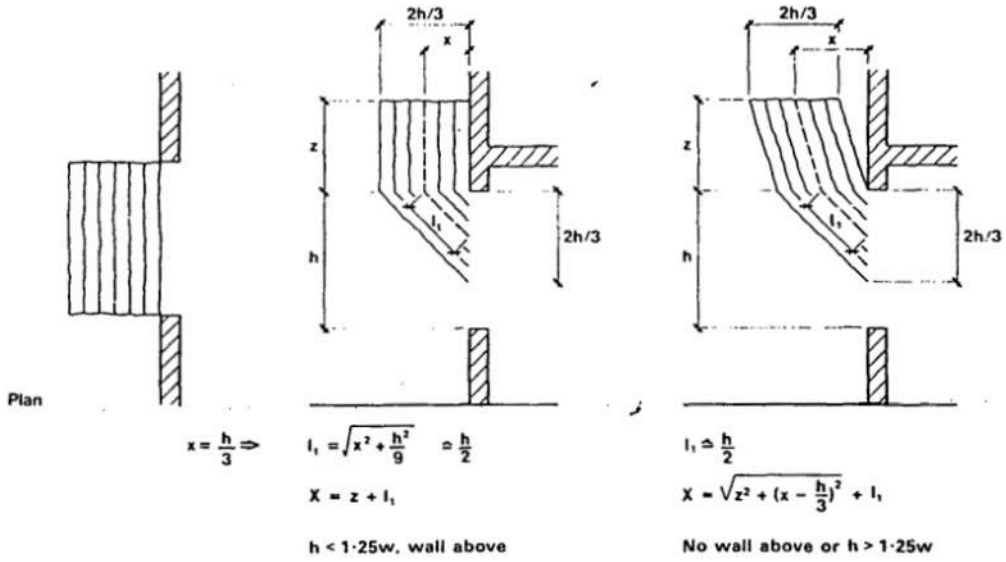


Figure 10: Assumed trajectories of emerging flames for natural draft scenarios

The recommended correlations for the flame length are [4]:

$$z + h = 12.8 \left(\frac{R}{w}\right)^{2/3} \quad \text{(Equation 3)}$$

$$x\ (no\ wall\ above\ or\ h > 1.25w) = 0.60h \left(\frac{z}{h}\right)^{1/3} \quad \text{(Equation 4)}$$

$$x\ (wall\ above\ or\ h < 1.25w) = 0.45h \left(\frac{1}{n}\right)^{0.53} \quad \text{(Equation 5)}$$

As detailed in Table 4, for both the proposed Performance Solution and the DTS Provisions, all the parameters associated with Equations–1 - 5 are expected to be equivalent. As such, the results of the calculations of flame lengths based on Equations–1 - 5, for both the proposed Performance Solution and the DTS Solution, are expected to be same.

Analysis of flame exposure

The effect of horizontal projection above the window/door opening has been considered in Ref. [4] and reproduced in Figure 11.

B3.1.8 Effect of projection above window

Any projection above a window that has sufficient fire resistance to remain in place when subjected to heating by flames, must be considered for its effect on the flame trajectory.

After being deflected horizontally by a balcony, awning or other projection, the flame will return to the undeflected trajectory, but since the value of X will be unchanged, the height of the flame tip will be reduced as illustrated in Fig. 10. It is assumed that once the flame extends beyond the awning or balcony it deflects back again at an angle of 45° until it reaches the undeflected trajectory.

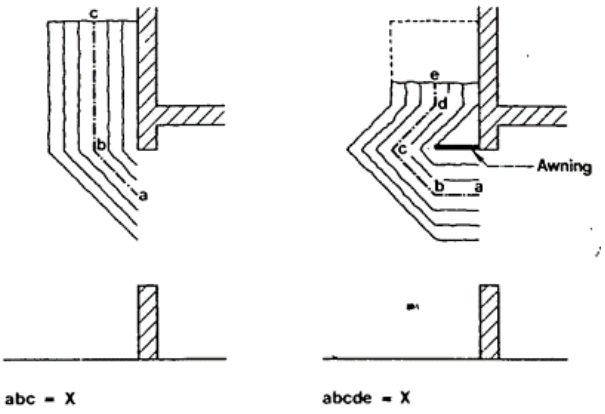


Figure 11: Deflection of flame by awning (adopted from Ref. [4])

4 Margaret Law and Turlogh O'Brien, "Fire safety of bare external structural steel," The Steel Construction Institute, 1990.

The BCA 2016 DTS Provisions stipulate that the part of the spandrel above the slab shall be at least 600 mm in height. If the flame projected from the levels below does not extend beyond the spandrel, the risk of fire spread between levels is considered to be low. Otherwise, the unprotected openings on the level served by the spandrel will expose to the significant heat generated by the flame. The higher the flame tips above the top of the spandrel can reach, the more heat the unprotected openings will receive, and hence, the higher the risk of fire spread between levels will be.

The proposed Performance Solution is to extend the ground level slab outwards by 1.3 m beyond the building façade of the lower levels, and provide a spandrel that is 400 mm in lieu of 600 mm that is stipulated by the DTS Provisions. As such, the potential flame projected from a lower level will be forced to travel approximately 1.3 m horizontally prior to going upwards along the spandrel.

Assuming:

- The flame length is X (= $z + h$, as illustrated in Figure 10), which is same for both the proposed Performance Solution and the DTS Solution.
- For the proposed Performance Solution, the length of the flame section that is above the top of the spandrel is L_{PS}.
- For the DTS Solution, the length of the flame section that is above the top of the spandrel is L_{DTS}.

We have:

- L_{PS} = 0, L_{DTS} = 0, when X < 0.6 m
- L_{PS} = 0, L_{DTS} = X – 0.6, when 0.6 m ≤ X < 1.7 m
- L_{PS} = X – 1.7, L_{DTS} = L – 0.6, when X ≥ 1.7 m

As such, we can conclude that L_{PS} is always equal to or less than L_{DTS}, which means that the excessive flame length that is above the top of the spandrel for the proposed Performance Solution is always equivalent to or less than that of the DTS Solution.

On the basis of the analyses above, it is considered by BCA Logic Pty Ltd that the proposed Performance Solution can prevent fire spread between levels, to a degree that is equal to or greater than that offered by the DTS Solution.

7.5 FRNSW FEBQ Comments

FRNSW Comment: In principle support is provided subject to all analysis inputs and assumptions being detailed in the FER and agreed upon by all relevant stakeholders, and the analysis demonstrating compliance with the Performance Requirements of the NCC.

BCA Logic Pty Ltd: Noted.

7.6 Peer Reviewer's FEBQ Comments

PGA: No further comments.

BCA Logic: Noted.

7.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 7.4, it is considered by BCA Logic Pty Ltd that the Performance Requirements CP2 have been satisfied.

CP2

	Matters for Consideration	Remarks
(a)	*A building must have elements which will, to the degree necessary, avoid the spread of fire–*	
	(i) to exits; and	Not applicable to this Performance Solution.
	(ii) to sole-occupancy units and public corridors; and	The fire engineering analysis has demonstrated that the level of spandrel protection offered by the proposed Performance Solution is equivalent or greater than that afforded by the DTS Solution.
	(iii) between buildings; and	Not applicable to this Performance Solution.
	(iv) in a building.	The fire engineering analysis has demonstrated that the level of spandrel protection offered by the proposed Performance Solution is equivalent or greater than that afforded by the DTS Solution.
(b)	*Avoidance of the spread of fire referred to in (a) must be appropriate to–*	
	(i) the function or use of the building; and	The fire engineering analysis has taken into account the usage of the buildings, being a residential building containing carparking areas.
	(ii) the fire load; and	The fire load of the Performance Solution is equivalent to that associated with a DTS Solution.
	(iii) the potential fire intensity; and	The potential fire intensity of the Performance Solution is equivalent to that associated with a DTS Solution.
	(iv) the fire hazard; and	The fire hazard in the building identified in section 3.7 of this report has been considered.
	(v) the number of storeys in the building; and	The number of storeys has been considered by Type A construction and fire safety measures stipulated by the BCA DTS Solution.
	(vi) its proximity to other property; and	Not applicable to this Performance Solution.
	(vii) any active fire safety systems installed in the building; and	The building is to be provided with a smoke detection and alarm system and a building occupant warning system.
	(viii) the size of any fire compartment; and	The size of the fire compartment is within the limits stipulated by the BCA DTS Solution.
	(ix) fire brigade intervention; and	Fire brigade intervention has conservatively not been included in the fire engineering analysis to determine the likelihood of fire spread between levels.
	(x) other elements they support; and	Not applicable to this Performance Solution.
	(xi) the evacuation time.	Not applicable to this Performance Solution.

8 PERFORMANCE SOLUTIONS 2 & 3 – RATIONALISATION OF FRL FOR THE CARPARK PORTIONS ON THE LOWER GROUND LEVEL, THE NEW TANDUM CARPARKING PORTION ON THE GROUND LEVEL AND THE NEW STORAGE AREA ON THE GROUND LEVEL

8.1 Introduction

As shown in Figure 12 to Figure 14, it is proposed to allow:

(i) the existing carparking portion on the lower ground carparking level to have an FRL of 90/90/90 in lieu of 120/120/120;

(ii) the proposed tandem carparking portion on the ground level to have a minimum FRL of 90/90/90 in lieu of 120/120/120; and

(iii) the proposed storage portion on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.

It is noted that building elements or parts of the building elements outside the abovementioned areas that are subject to the proposed rationalization of FRLs are to have a minimum FRL in accordance with the BCA 2016 DTS provisions.

Subject to the following condition, building elements or parts of the building elements inside the abovementioned areas that are subject to the proposed rationalization of FRLs are to have a minimum FRL in accordance with either the BCA 2016 DTS provisions or the aforementioned FRLs proposed by the Performance Solution.

- Condition: The reduction of FRL within the abovementioned areas in accordance with the proposed Performance Solution is to not affect the minimum FRL of the building elements or parts of the building elements outside the abovementioned areas.

It is understood that the detailed structural design and assessment is to be undertaken by a professional structural engineer.

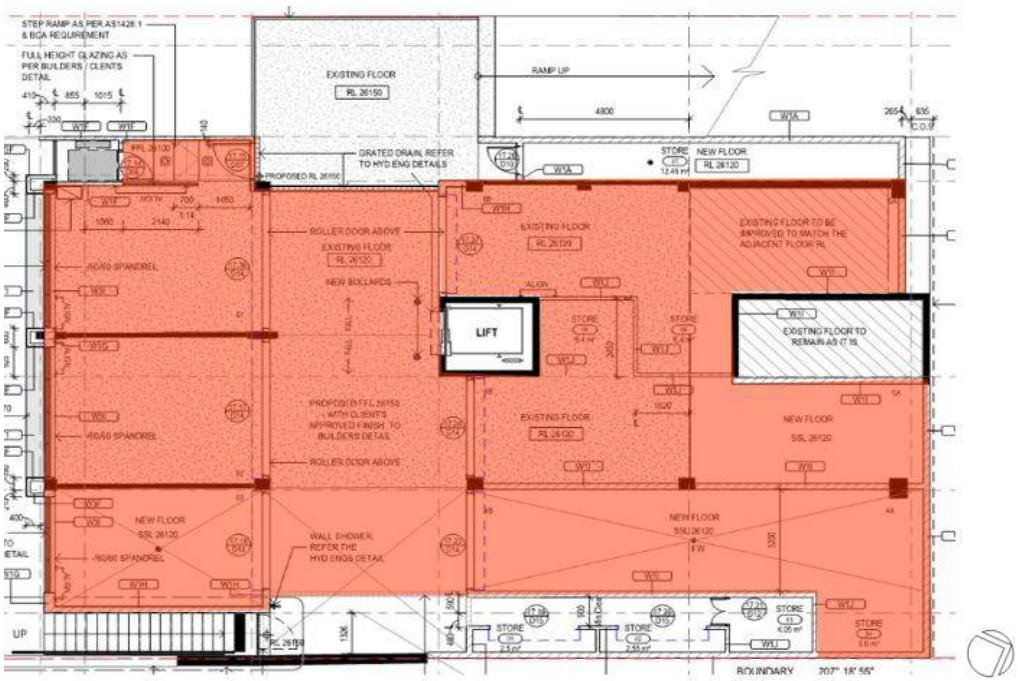


Figure 12: Existing carparking portion on the lower ground level

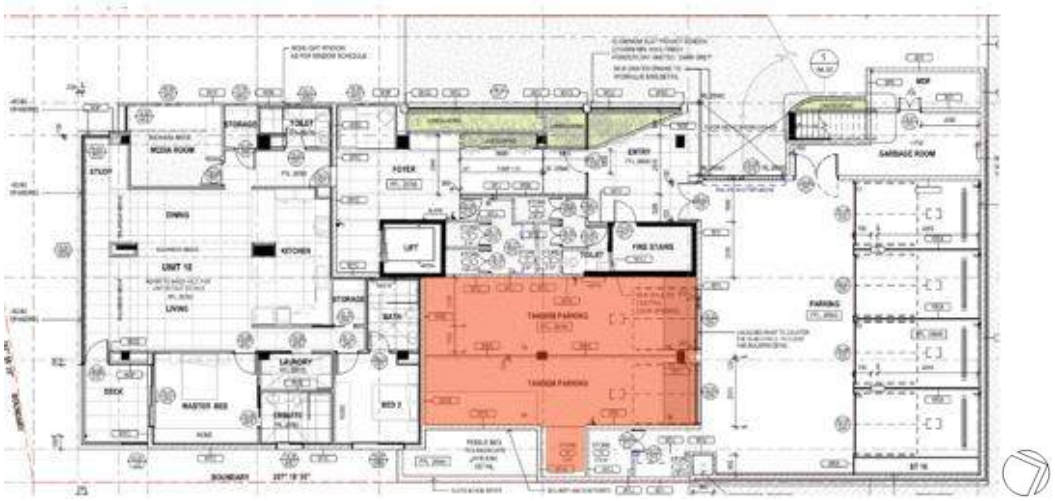


Figure 13: Proposed new tandem carparking area on the ground level

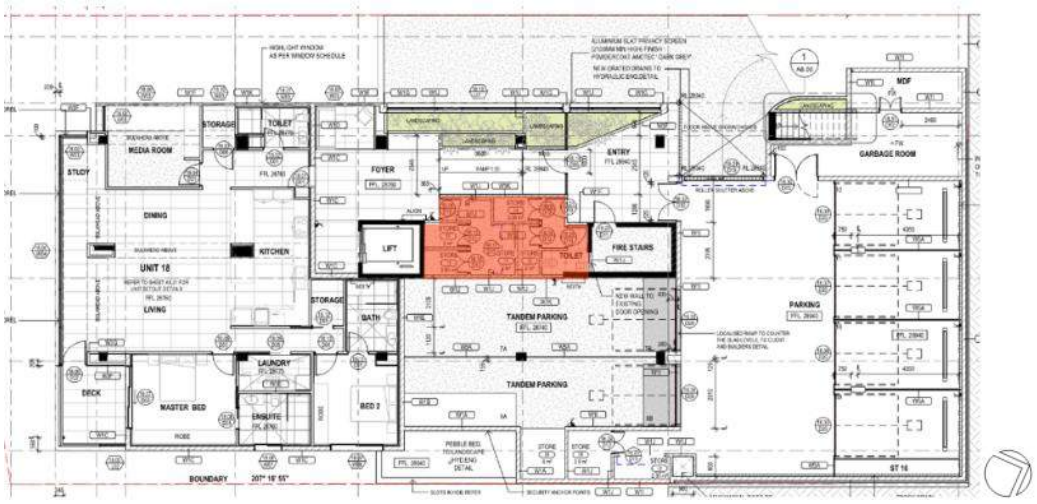


Figure 14: Proposed storage area on the ground level

8.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirements are CP1 and CP2, and the DTS Provision applicable to this Performance Solution are Clauses C1.1, C2.8 and C2.9, and Table 3 of Specification C1.1 of the BCA 2016 which states:

C1.1 Type of construction required

(a) The minimum Type of fire-resisting construction of a building must be that specified in Table C1.1 and Specification C1.1, except as allowed for—

(i) certain Class 2, 3 or 9c buildings in C1.5; and

(ii) a Class 4 part of a building located on the top storey in C1.3(b);

(iii) open spectator stands and indoor sports stadiums in C1.7.

*(iv) * * * **

(b) Type A construction is the most fire-resistant and Type C the least fire-resistant of the Types of construction.

Table C1.1 TYPE OF CONSTRUCTION REQUIRED

Rise in storeys	Class of building	
	2, 3, 9	5, 6, 7, 8
4 OR MORE	A	A
3	A	B
2	B	C
1	C	C

Table 3 TYPE A CONSTRUCTION: FRL OF BUILDING ELEMENTS

Building element	Class of building — FRL: (in minutes) *Structural adequacy/Integrity/Insulation*			
	2, 3 or 4 part	5, 7a or 9	6	7b or 8
EXTERNAL WALL (including any column and other building element incorporated therein) or other external building element, where the distance from any *fire-source feature* to which it is exposed is—				
For *loadbearing* parts—				
less than 1.5 m	90/ 90/ 90	120/120/120	180/180/180	240/240/240
1.5 to less than 3 m	90/ 60/ 60	120/ 90/ 90	180/180/120	240/240/180
3 m or more	90/ 60/ 30	120/ 60/ 30	180/120/ 90	240/180/ 90
For non-*loadbearing* parts—				
less than 1.5 m	–/ 90/ 90	–/120/120	–/180/180	–/240/240
1.5 to less than 3 m	–/ 60/ 60	–/ 90/ 90	–/180/120	–/240/180
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
EXTERNAL COLUMN not incorporated in an *external wall*—				
For *loadbearing* columns—	90/–/–	120/–/–	180/–/–	240/–/–
For non-*loadbearing* columns—	–/–/–	–/–/–	–/–/–	–/–/–
COMMON WALLS and FIRE WALLS—	90/ 90/ 90	120/120/120	180/180/180	240/240/240
INTERNAL WALLS—				
Fire-resisting lift and stair *shafts*—				
Loadbearing	90/ 90/ 90	120/120/120	180/120/120	240/120/120
Non-*loadbearing*	–/ 90/ 90	–/120/120	–/120/120	–/120/120
Bounding *public corridors*, public lobbies and the like—				
Loadbearing	90/ 90/ 90	120/–/–	180/–/–	240/–/–
Non-*loadbearing*	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Between or bounding *sole-occupancy units*—				
Loadbearing	90/ 90/ 90	120/–/–	180/–/–	240/–/–
Non-*loadbearing*	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Ventilating, pipe, garbage, and like *shafts* not used for the discharge of hot products of combustion—				
Loadbearing	90/ 90/ 90	120/ 90/ 90	180/120/120	240/120/120
Non-*loadbearing*	–/ 90/ 90	–/ 90/ 90	–/120/120	–/120/120

Table 3 TYPE A CONSTRUCTION: FRL OF BUILDING ELEMENTS — continued

Building element	Class of building — FRL: (in minutes) *Structural adequacy/Integrity/Insulation*			
	2, 3 or 4 part	5, 7a or 9	6	7b or 8
OTHER LOADBEARING INTERNAL WALLS, INTERNAL BEAMS, TRUSSES and COLUMNS—	90/–/–	120/–/–	180/–/–	240/–/–
FLOORS	90/ 90/ 90	120/120/120	180/180/180	240/240/240
ROOFS	90/ 60/ 30	120/ 60/ 30	180/ 60/ 30	240/ 90/ 60

C2.8 Separation of classifications in the same storey

If a building has parts of different classifications located alongside one another in the same storey—

(a) each building element in that storey must have the higher FRL prescribed in Specification C1.1 for that element for the classifications concerned; or

(b) the parts must be separated in that storey by a fire wall having—

(i) the higher FRL prescribed in Table 3 or 4; or

(ii) the FRL prescribed in Table 5,

of Specification C1.1 as applicable, for that element for the Type of construction and the classifications concerned;

C2.9 Separation of classifications in different storeys

If parts of different classification are situated one above the other in adjoining storeys they must be separated as follows:

(a) Type A construction — The floor between the adjoining parts must have an FRL of not less than that prescribed in Specification C1.1 for the classification of the lower storey.

(b) Type B or C construction — If one of the adjoining parts is of Class 2, 3 or 4, the floor separating the part from the storey below must—

(i) be a floor/ceiling system incorporating a ceiling which has a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes; or

(ii) have an FRL of at least 30/30/30; or

(iii) have a fire-protective covering on the underside of the floor, including beams incorporated in it, if the floor is combustible or of metal.

8.3 Acceptance Criteria

The Performance Solution is considered acceptable if it can be demonstrated that

(i) the building elements of the existing southern carparking portion and the driveway on the lower ground level that have an FRL of 90/90/90 can withstand a total burnout of a fully developed fire therein, i.e. the estimated fire severity in the form of equivalent time of fire exposure is less than 90 minutes;

(ii) the building elements of the existing northern carparking portion on the lower ground level which is fire separated from the adjacent area by fire resisting construction that has an FRL of at least 90/90/90, can withstand the worst credible flaming fire initiated within the subject storage area and adjacent area;

(iii) the building elements of the proposed tandem carparking portion on the ground level which is fire separated from the adjacent area by fire resisting construction that has an FRL of at least 90/90/90, can withstand the worst credible flaming fire initiated within the subject storage area and adjacent area; and

(iv) the building elements of the proposed storage portion on the ground level which is fire separated from the adjacent area by fire resisting construction that has an FRL of at least 120/120/120, can withstand the worst credible flaming fire initiated within the subject storage area and adjacent area.

8.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with the BCA Clauses A0.3 (a) (i) and A0.5 (b) (ii), to demonstrate compliance with the relevant Performance Requirements CP1 and CP2, using an absolute, deterministic, and quantitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the International Fire Engineering Guidelines (IFEG) 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system C – Fire Spread and Impact and Control

A fire severity analysis using the Eurocode formula [5] has been carried out. The required input parameters include the dimensions of the enclosure, the area available for ventilation, fire load density, and materials of the bounding construction. The calculations have been detailed in Annexure C to this report. The equivalent times of fire exposure for subject areas have been calculated as follows:

- Ground floor storage – 96 minutes.
- Ground floor garage – 81 minutes.
- Lower ground floor garage – 71 minutes.

Accordingly, it is considered that building elements are expected to be able to withstand a total burnout of the subject areas based on the following FRL's being provided:

- Carparking areas – 90/90/90
- Storage areas – 120/120/120

Based on the above assessment the acceptance criteria have been fulfilled.

8.4.1 Sensitivity and redundancy

The performance solution does not rely on any active systems to achieve their fire resistance and in this respect the performance solution is not sensitive to failure.

The passive fire compartmentation is in fact a redundant system in itself. The subject areas are provided with an automatic sprinkler system which as described in AS2118.4-2012 is designed to "Aid in the control of fires" and "Prevent flashover in the room or area of fire origin."

It is therefore unlikely that a fully developed compartment fire will actually develop. In the event that the sprinkler system fails to operate as intended and a fully developed fire does occur the performance solution assessment has shown that the building elements are expected to be able to withstand a total burnout regardless.

8.5 FRNSW FEBQ Comments

In relation to the existing carparking portion on the lower ground floor

FRNSW: Fire load density should be determined for the proposed fire severity calculation.

FRNSW: Where fire severity / time equivalence calculations are undertaken the following should be considered:

- The limitations on ventilation parameters as specified in Equations 5.14 and 5.15 of Structural Design for Fire Safety (Buchanan, 2001) should be adhered to for all methods.
- The conversion factor kb should be taken as 0.09 (Fire Engineering Design Guide, Third Edition, p58 & Structural Design for Fire Safety, p103), unless the lining materials of the compartment are identified and form part of the Trial Design requirements to ensure future compliance. A conversion factor appropriate to these lining materials may then be selected based on those recommended for "large compartments" in Table 5.4 of Structural Design for Fire Safety (Buchanan, 2001).

5 Eurocode 1: Basis of design and design actions on structures. Part 2-2: actions on structures exposed to fire. European Committee for Standardisation, Brussels, Belgium, 1994.

Clear justification of ventilation to equivalent fire severity calculation area is to be included. A variety of potential ventilation areas are to be evaluated and justified. In this regard, consideration should be given to height of openings, the size of the openings and their relationship to the height of the external wall [e.g. in a full height window only the upper portion may fail (See CIB Publication 269 – Rational Fire Safety Engineering approach to Fire Resistance of buildings)]. For this reason FRNSW recommend that a scenario with no more than 50% window breakage/failure be undertaken. Where it can be demonstrated that more than 50% breakage is likely to occur appropriate justification is to be included in the FER (e.g. modelling to demonstrate temperatures are sufficient to cause window breakage).

BCA Logic Pty Ltd: A kb value of 0.07 has been used in the assessment, which is still a conservative value given that the wall, floor and ceiling finishes are known to be gyprock, brick and concrete.

In relation to the proposed storage area and the tandem carparking portion on the ground level,

FRNSW Comment: FRNSW recommends appropriate reference be provided to verify the above statement with respect to the oxygen concentration for self-extinguishment.

BCA Logic Pty Ltd: Please refer to the following: “A fire can be extinguished by removing its oxygen or by reducing the oxygen level in the air to below 16%”, Maritime Training Advisory Board (U.S.) 1994, Marine Fire Prevention, Firefighting and Fire Safety: A Comprehensive Training and Reference Manual, P.76. See also Reference 15 in this FER.

In principle support is provided subject to the following:

- All FRNSW comments be adequately addressed.
- The analysis in the FER demonstrating compliance with the performance requirements of the NCC.

BCA Logic Pty Ltd: Noted.

8.6 Peer Reviewer’s FEBQ Comments

PGA: It should be clarified whether this also relates to other building elements to the ground level and lower level.

BCA Logic: Noted. Please refer to the updated Section 8.1 or Section 5.3.

In relation to the proposed carpark portions on the lower ground level and the ground level are to be provided with large louvres and perforated roller shutters, to facilitate ventilation of hot combustion products from the carpark.

PGA: These requirements should be detailed in the fire safety strategy.

BCA Logic: The following requirement is added to the trial fire safety strategy.

It is understood that the following conditions on which the proposed Performance Solutions of this report are based are to be provided or maintained:

(i) The lift landing doors of the central lift on the lower ground level and the ground level are to have an FRL of −/60/− in accordance with the BCA 2016 DTS Provisions.

(ii) The louvres that are to be provided to the openings within the southern external walls on the lower ground level are to have at least 50% free area.

(iii) The existing western and eastern ends of the driveway on the low ground level is to directly open to air without any doorway or roller shutter.

In relation to the storage area on the ground level,

PGA: It should be clarified whether the storage area is less than 10% of the floor area of the ground level.

BCA Logic: As advised by the BCA consultant, the subject ground level has more than two different building classifications, and therefore the 10% rule does not apply and the storage area has its own classification.

PGA: No further comments.

BCA Logic: Noted

8.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 8.4, it is considered by BCA Logic Pty Ltd that the Performance Requirements CP1 and CP2 have been satisfied.

CP1

	Matters for consideration	Remarks
A building must have elements which will, to the degree necessary, maintain structural stability during a fire appropriate to–		
(a)	*The function or use of the building; and*	The fire engineering analysis has taken into account the use of the subject carpark portions and the subject residential storage area.
(b)	*the fire load; and*	The fire load densities in the subject areas have been considered in the fire engineering analysis.
(c)	*the potential fire intensity; and*	The potential fire intensity is that of a fully developed fire.
(d)	*the fire hazard; and*	The fire hazards in the building have been considered in Section 3.7 of this report.
(e)	*the height of the building; and*	The subject building has a rise in storey of eleven (11).
(f)	*its proximity to other property; and*	Not applicable to this Performance Solution.
(g)	*any active fire safety systems installed in the building; and*	The proposed smoke detection system is to provide early warning to occupants within the building.
(h)	*the size of any fire compartment; and*	The carpark portion on the lower ground level has a compartment size of approximately 400 m². The carpark portion on the ground level has a compartment size of approximately 80 m². The storage area on the ground level has a floor area of approximately 22 m².
(i)	*fire brigade intervention; and*	Contribution of fire brigade intervention has been conservatively excluded in the fire engineering analysis.
(j)	*other elements they support; and*	The loadbearing building elements for the subject areas on the lower ground level or the ground level support the upper levels of the building.
(k)	*the evacuation time.*	The fire engineering analysis has demonstrated that the proposed minimum FRLs for the building elements are expected to withstand a total burnout of or the credible worst flaming fire within the subject areas, thus evacuation of occupants on the upper floors and adjacent areas is not affected.

CP2

	Matters for consideration	Remarks
(a)	*A building must have elements which will, to the degree necessary, avoid the spread of fire–*	
	(i) to exits; and	The fire engineering analysis has demonstrated that the proposed minimum FRLs for the building elements are expected to withstand the credible worst flaming fire within the subject areas.
	(ii) to sole-occupancy units and public corridors; and	
	(iii) between buildings; and	Not applicable to this Performance Solution.
	(iv) in a building.	The fire engineering analysis has demonstrated that the proposed minimum FRLs for the building elements are expected to withstand the credible worst flaming fire within the subject areas.
(b)	*Avoidance of the spread of fire referred to in (a) must be appropriate to–*	
	(i) the function or use of the building; and	The fire engineering analysis has taken into account the use of the subject carpark portions and storage area.
	(ii) the fire load; and	The fire load density in the carpark portions has been considered in the fire engineering analysis.
	(iii) the potential fire intensity; and	The potential fire intensity is that of a fully developed fire.
	(iv) the fire hazard; and	The fire hazards in the building have been considered in Section 3.7 of this report.
	(v) the number of storeys in the building; and	The subject building has a rise in storey of eleven (11).
	(vi) its proximity to other property; and	Not applicable to this Performance Solution.
	(vii) any active fire safety systems installed in the building; and	Not applicable to this Performance Solution.
	(viii) the size of any fire compartment; and	The total carpark portion on the lower ground level has a floor area of approximately 400 m². The carpark portion on the ground level has a floor area of approximately 80 m². The storage area on the ground level has a floor area of approximately 22 m².
	(ix) fire brigade intervention; and	Contribution of fire brigade intervention has been conservatively excluded in the fire engineering analysis.
	(x) other elements they support; and	The loadbearing building elements for the carpark portions on the lower ground level and the ground level support the upper levels of the existing residential parts of the subject building.
	(xi) the evacuation time.	The fire engineering analysis has demonstrated that the proposed minimum FRLs for the building elements are expected to withstand the worst credible flaming fire within the subject areas, thus evacuation of occupants on the upper floors and adjacent areas is not affected.

9 PERFORMANCE SOLUTION 4 – UNDERCROFT AND GROUND FLOOR SOU EGRESS

9.1 Introduction

It is proposed to permit the following egress DTS non-conformances for the non-fire isolated exits serving the new undercroft and ground floor residential units:

- One exit is provided in lieu of two.
- The pathway from exit discharge to a road involves travel via an incline greater than 1:8.

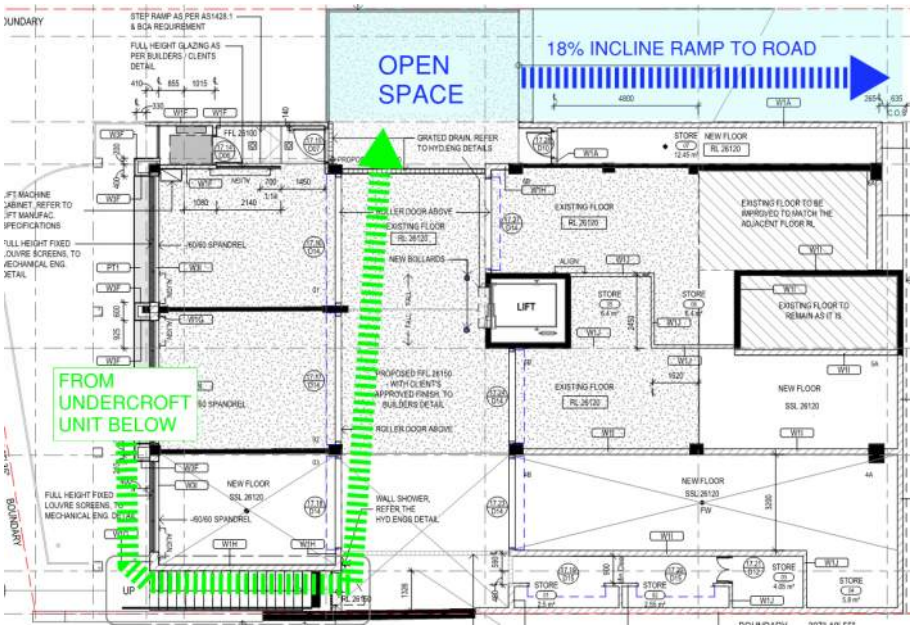


Figure 15: Egress from undercroft SOU

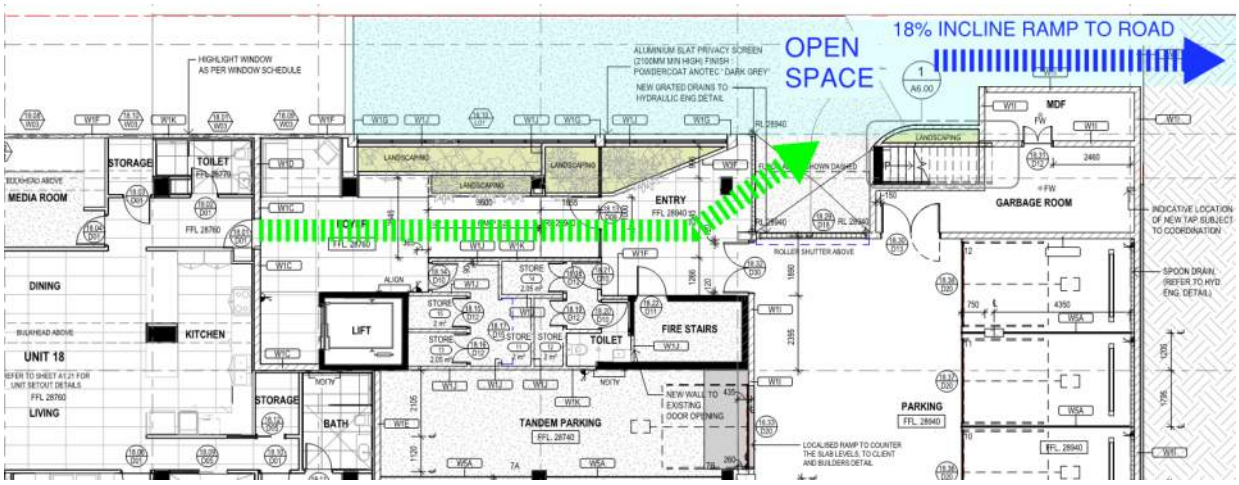


Figure 16: Egress from ground floor SOU

9.2 BCA Performance Requirements and DTS Provisions

The relevant Performance Requirements are DP4 and EP2.2, and the DTS Provisions applicable to this Performance Solution are Clauses D1.2 and D1.10(c) of BCA 2016 which states:

D1.2 Number of exits required

(b) Class 2 to 8 buildings — In addition to any horizontal exit, not less than 2 exits must be provided from the following:

(i) Each storey if the building has an effective height of more than 25 m.

(ii) A Class 2 or 3 building subject to C1.5.

D1.10 Travel via non-fire-isolated exits

(c) if an exit discharges to an open space that is at a different level than the public road to which it is connected, the path of travel to the road must be by —

(i) a ramp or other incline having a gradient not steeper than 1:8 at any point…

9.3 Acceptance Criteria

The Performance Solution is considered to be acceptable if it can be demonstrated that occupants from the proposed new units at the undercroft and on the ground level and the main lobby area are not expected to be exposed to untenable conditions due to the proposed variations to the egress provisions, and that the external ramp provides a suitable path of travel to a road from open space.

9.4 Fire Engineering Analysis

9.4.1 Methodology

A fire engineering analysis of this Performance Solution has been carried out in accordance with the BCA Clauses A0.3 (a) (i) and A0.5 (b) (ii), to demonstrate compliance with the relevant Performance Requirements DP4 & EP2.2, using an absolute, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the International Fire Engineering Guidelines (IFEG) 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system B – Smoke development and spread and control
- Sub-system C – Fire spread and impact and control
- Sub-system D – Fire Detection, Warning and Suppression
- Sub-system E – Occupant evacuation and control

According to the Guide to the BCA, the prescriptive requirement in Clause D1.2 is to provide the provision of sufficient exits to enable safe egress in case of an emergency. Clause D1.10 is to provide a person using a non-fire-isolated stairway or ramp with a safe evacuation path.

9.4.2 Single exit in lieu of two

Common characteristics of both the proposed new units on the ground level and at the undercroft are listed below:

- Both proposed new units are to be the only unit located on the relevant levels.
- Both proposed units are to be located on or next to the level that provides direct access to the existing external ramp (driveway).
- Both proposed units are to have two bedrooms and likely accommodate three residents in each unit. The residents of both proposed units are expected to be familiar with the pathways which lead them to enter the units and the layout of the building parts in which they are to live.
- Proposed management-in-use policy and signage to ensure no combustible materials and furniture to be stored within the egress pathways from the proposed new units.

As such, occupants of both the proposed units are expected to not be exposed to the high level of fire risk associated with a building that is large, tall or having complex egress design. Although each of the proposed units is to be served by a single exit, the fire risk of the occupants of the proposed units is considered to be similar to that of the occupants of a low rise residential building who are also served by a single exit.

Moreover, it is proposed that the undercroft, the lower ground level, the ground level and the carparking portion on level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and ground level separated from the other areas by physical barriers is to be provided with at least one smoke or heat detector and in accordance with the detector spacing stipulated in AS 1670.1:2015.

A heat detector is to be provided in each of the proposed new apartments on the ground level and at the undercroft and be located not more than 1.5 m horizontal distance from the doorway within the SOU. The abovementioned heat detectors shall conform to AS 7240.5-2004 (Amdt 1) and are to be of Class A1R detector as defined in the Standard with a static response temperature between 54°C and 65°C as well as rate-of-rise capability. The heat detectors are to form part of the smoke detection and alarm system for the building, that is, when a heat detector is activated, the building general alarm conditions, including the building occupant warning system (BOWS), shall be automatically activated.

A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout. The BOWS shall be extended into each of the proposed new residential SOUs on the ground level and at the undercroft such that a sound pressure level of at least 75 dB(A) is achieved at each bedhead with all doors of the SOU closed.

As such, early fire alarm is expected to be provided to the occupants within the proposed new units at the early phase of the fire development.

A permanent, fade-resistant and water-resistant sign stating the following in capital letters, not less than 50 mm high and in a colour contrasting with the background “NO STORAGE OF COMBUSTIBLE MATERIALS & FUNITURE WITHIN THIS AREA” is to be provided to the following locations:

- within the covered building main entrance area on the ground level,
- within the lift lobby/foyer area on the ground level,
- within the car entrance area on the lower ground floor.

9.4.3 Travel via Existing External Ramp (Driveway) Connecting to a Road

An existing ramp (driveway) has been serving the occupants of the subject building as the only path of travel to a public road for about 50 years. The Assessment Report for Application for Modification of the subject property by Northern Beaches Council, Application Number Mod2016/0077, described the existing ramp as follows:

> *The subject site contains a steep slope which has a diagonal fall of 18% in a north to south direction (from Queenscliff Road) towards Queenscliff Beach.*

The BCA 2016 clause D1.10 stipulates, for the subject residential building, that the path of travel to the road must be by a ramp that have a gradient not steeper than 1:8 (12.5%) at any part, or not steeper than 1:14 if required by the Deemed-to-Satisfy Provisions of Part D3; otherwise a stairway is to be provided.

It is understood that the relevant access issues are outside the scope of this report, which are to be assessed by others and determined during the fire order process.

Based on the number of bedrooms, the proposed two new units on the lower ground level and the ground level are likely to add about merely 6 residents to the total number of occupants of the whole building, which is expected to not have significant impact on the use of the existing ramp to the public road.

It is understood that a BCA2016 DTS compliant stairway can be provided to facilitate the occupants to safely evacuation to open road in order to comply with the BCA Performance Requirement. However, during the fire order process, a letter from FRNSW (NSWFB at the time) dated 19.10.2010 stated the following:

> *The NSWFB does not consider the provision of an external stairway along the side of the driveway leading to the road will significantly improve egress from the building in the event of a fire. Additionally, the provision of this stair way will reduce the width of the driveway, which may restrict NSWFB operations in the event of a fire at the premises and also the ability of other emergency services to conduct operations may also be restricted in the event of another emergency at the premises.*
>
> *Accordingly, the NSWFB recommends that a handrail and non-slip finish be provided to the driveway to assist occupants in the evacuation of the premises in lieu of providing the stairway.*

It is understood the abovementioned fire brigades' recommendations are to be considered during the on-going fire order process.

9.4.4 Impact on the upper levels due to the proposed units

The Performance Solution provides for sprinkler protection to be provided throughout the area of works, including lower ground and ground floors adjacent to the existing lift shaft and fire exit discharge. As described in AS2118.4-2012 the sprinkler system is designed to:

- Aid in the control of fires.
- Prevent flashover in the room or area of fire origin.
- Improve the chance for occupants to escape or be evacuated.

Based on the provision of sprinklers in the affected areas and the management in use policy to prevent storage of combustible items in common property areas it is considered that the project will have no adverse impact on existing building parts with respect to protection of egress paths from the effect of smoke and fire.

9.5 FRNSW FEBQ Comments

FRNSW: Adequate egress must be provided from the new SOU in the undercroft. As the access to the beach is not considered as an exit, FRNSW does not support the proposal in which occupants need to retreat to their unit, which will put their life in great danger.

For a fire in one of the garages on the lower ground level, safe egress must be provided to ensure occupants in the new SOU in the undercroft can safely evacuate.

FRNSW: As stated previously, FRNSW does not support the proposal in which occupants need to retreat to their unit and be trapped there as this will put their life in great danger.

Noted that from Issue number 8 that the building is not proposed to be provided with a sprinkler system. If a fire occurring in one of the garages on the lower level, occupants may not be able to travel past the fire due to lack of sprinklers and would be very likely to be trapped within the building as pointed out by the FEBQ.

BCA Logic Pty Ltd: Note that the performance solution has been revised subsequent to FEBQ revision 4, in that an automatic fire sprinkler system has now been provided to the subject area. Except for the two non-conformances that are the subject of this revised performance solution the egress from the two new SOU' complies with the relevant BCA DTS provisions, including:

- Distance from ground floor SOU door to the exit to the driveway is less than 20m – being approximately 11m.
- Distance from the undercroft SOU door to the non-fire isolated stair is less than 6m – being approximately 5m.
- Distance from the undercroft SOU doorway to the final exit travelling via a non-fire isolated stair is less than 60m – being approximately 25m.
- The non-fire isolated stair serving the undercroft unit discharges on a level at which egress to open space is available and is less than 15m from egress to open space – being approximately 14m.
- An automatic fire sprinkler system is provided to the subject areas.

9.6 Peer Reviewer's FEBQ Comments

PGA: The requirement for the fire doors in the figure above should be detailed in the fire safety strategy.

BCA Logic: Noted. The storage next to the vehicular entry on the lower ground level is to be provided with a self-closing fire door having an FRL of at least −/120/30.

PGA: Requirements relating to the combustibility of the furniture to the ground level foyer should be described.

BCA Logic: A permanent fade-resistant and water resistant sign is to be provided to the following locations:

- within the covered building main entrance area
- within the lift lobby/foyer area on the ground level
- stating the following in capital letters, not less than 50 mm high and in a colour contrasting with the background:

NO STORAGE OF

COMBUSTIBLE MATERIALS & FUNITURE

WITHIN THE FOYER

A building management-in-use policy is to be implemented, which is to be included in the building annual fire safety statement, and check and certified annually, and include the following:

- inhibiting any combustible materials and furniture to be stored within all public areas at all times, excluding the following areas:
  - the private carparking spaces, for vehicles or bicycles only;
  - the garages; and
  - the storage areas.

- inhibiting any parking or stopping a vehicle at the carpark entries on the lower ground level and the ground level at all times;
- inhibiting any obstruction being put under any of the fire or smoke curtains at all times; and
- maintaining all egress pathways within the building free of obstructions.

PGA: The acceptance criteria relating to the gradient of the existing ramp from Queenscliff Road to the subject building should be described.

BCA Logic: This has been included.

PGA: No further comments.

BCA Logic: Noted.

9.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 9.4, it is considered by BCA Logic Pty Ltd that the Performance Requirements DP4 and EP2.2 have been satisfied.

DP4

	Matters for consideration	Remarks
Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to–		
(a)	*the travel distance; and*	Travel distances are within the limits of the BCA DTS Provisions.
(b)	*the number, mobility and other characteristics of occupants; and*	The number, mobility and other characteristics of occupants have been considered in Section 9.4 in details.
(c)	*the function or use of the building; and*	The function or use of the building has been discussed in Section 9.4 in details.
(d)	*the height of the building; and*	The subject area is on the undercroft and ground levels and is not affected by the height of the building.
(e)	*whether the exit is from above or below ground level.*	The exit serving the proposed unit on the ground level is at the ground level. The exit serving the proposed unit at the undercroft is below the lower ground level.

EP2.2

	Matters for consideration	Remarks
(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that–		
	(i) the temperature will not endanger human life; and	The fire engineering analysis has demonstrated that occupants are adequately facilitated to safely evacuate from the building prior to the onset of untenable conditions.
	(ii) the level of visibility will enable the evacuation route to be determined; and	
	(iii) the level of toxicity will not endanger human life.	
(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to–		
	(i) the number, mobility and other characteristics of the occupants; and	The number, mobility and characteristics of the occupants that have been considered are detailed in Section 4.
	(ii) the function or use of the building; and	The fire engineering analysis has taken into account the function or use of the subject building part being Class 2 residential .
	(iii) the travel distance and other characteristics of the building; and	Travel distances are consistent with the DTS Solution and the building has an effective height over 25 m as defined by the current BCA.
	(iv) the fire load; and	The fire load is expected to be as per a typical residential building.
	(v) the potential fire intensity; and	The potential fire intensity is expected to be similar to a typical residential apartment building.
	(vi) the fire hazard; and	The considered fire hazards are detailed in Section 3.7.
	(vii) any activate fire safety systems installed in the building; and	The fire engineering analysis has considered that the building is to be provided with automatic sprinkler system and automatic smoke detection and alarm system.

	Matters for consideration	Remarks
	(viii) fire brigade intervention.	Fire brigade intervention has conservatively not been considered in the fire engineering analysis for suppressing and extinguishing the fire. It is understood that the relevant fire brigade recommendations are to be implemented. The Performance Solution is not expected to have an adverse impact on fire services operations.

10 PERFORMANCE SOLUTION 5 – TO ALLOW VARIATIONS IN EGRESS PROVISIONS RELATED TO THE CARPARKING AND STORAGE AREAS ON THE LOWER GROUND, GROUND LEVEL AND LEVEL 1

10.1 Introduction

As shown in the following figures it is proposed to permit:

- a single exit to serve the carparking areas on levels lower ground, ground and level 1; and
- a minimum egress width of 810mm in lieu of 1,000mm from Level 1; and
- a minimum egress width of 800mm in lieu of 1m from the lower ground floor storage are, including storage cupboard door of 550mm and egress door width 630mm; and
- a single exit to serve the carparking area on level 1; and
- extended travel distances of up to approximately 22 m from the carparking areas to a single exit on the ground level; and
- A minimum egress width of 900mm at base of stairs serving level 1.

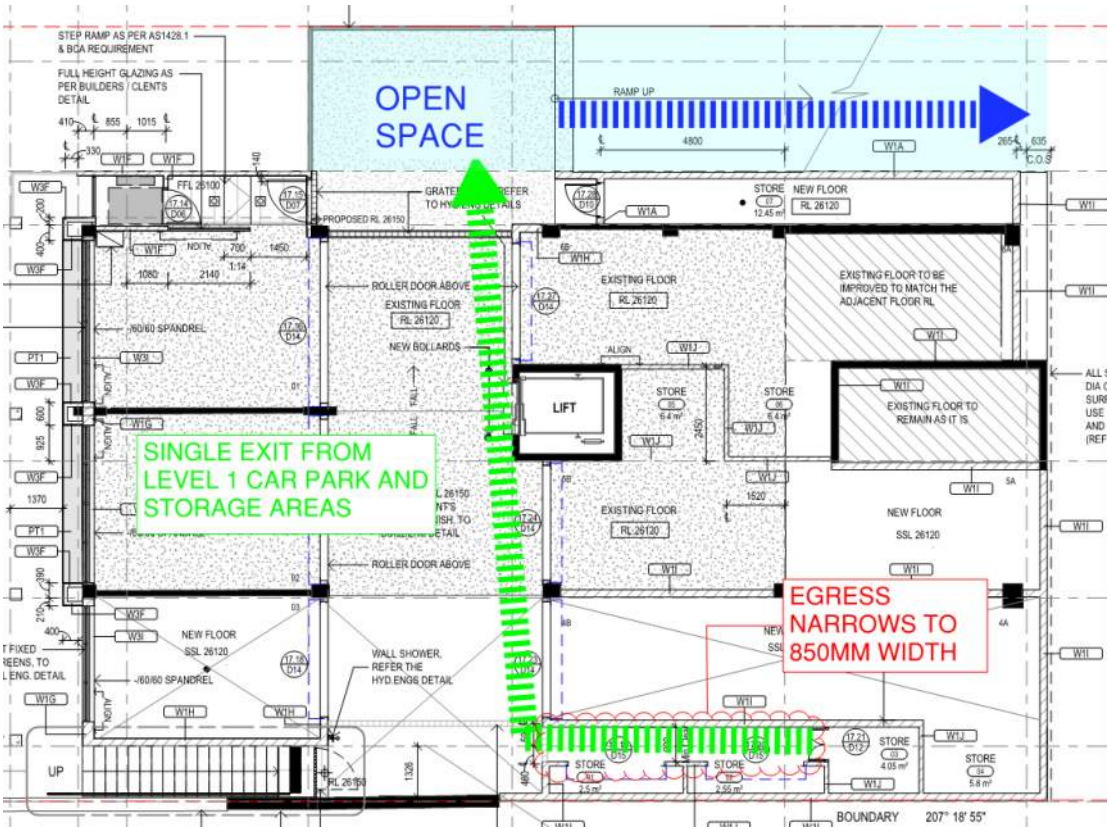


Figure 17: Egress from carparking and storage areas on the lower ground level

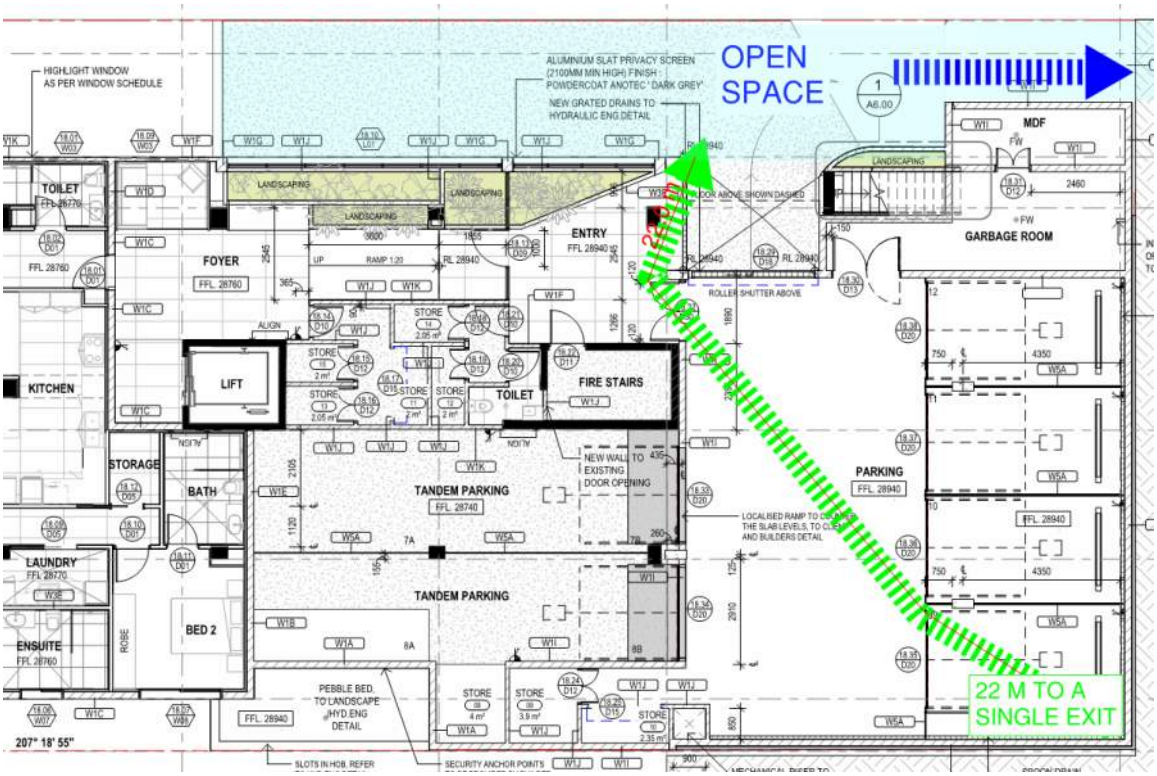


Figure 18: Egress from carparking and storage areas on the ground level

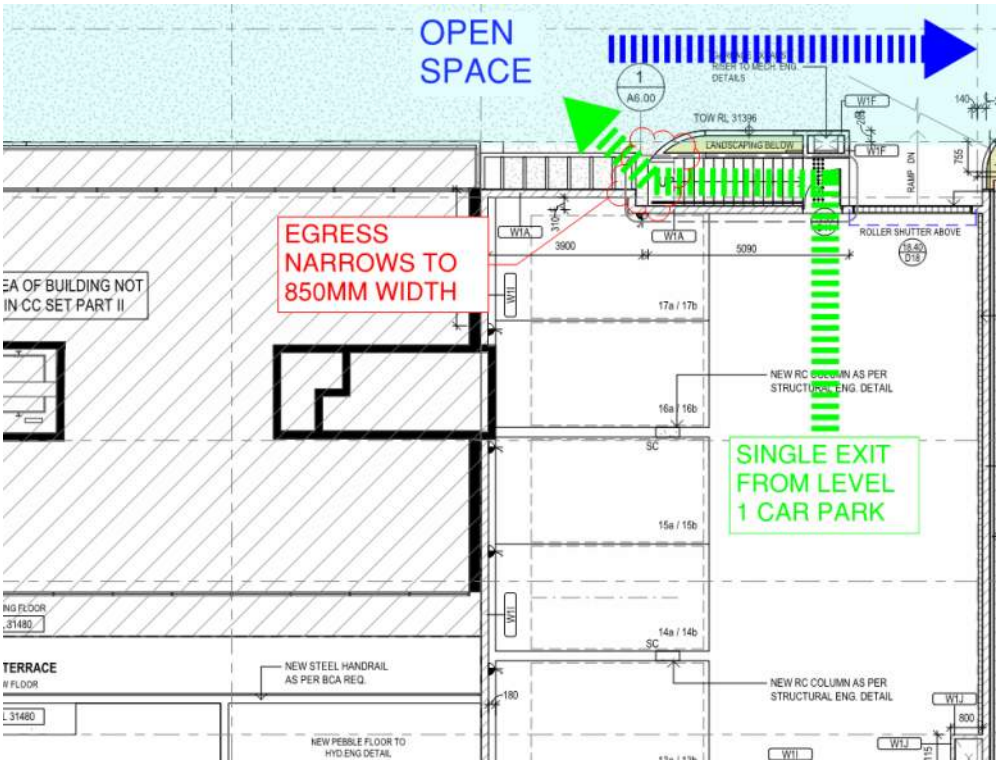


Figure 19: Egress from carparking area on level 1

10.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirements are DP5, DP6 and EP2.2, and the DTS Provision applicable to this Performance Solution are Clause D1.2. D1.4 and D1.6 of the BCA 2016 which states:

D1.2 Number of exits required

(b) Class 2 to 8 buildings — In addition to any horizontal exit, not less than 2 exits must be provided from the following:

(i) Each storey if the building has an effective height of more than 25 m.

(ii) A Class 2 or 3 building subject to C1.5.

D1.4 Exit travel distances

(c) Class 5, 6, 7, 8 or 9 buildings — Subject to (d), (e) and (f)—

(i) no point on a floor must be more than 20 m from an exit, or a point from which travel in different directions to 2 exits is available, in which case the maximum distance to one of those exits must not exceed 40 m; and

(ii) in a Class 5 or 6 building, the distance to a single exit serving a storey at the level of access to a road or open space may be increased to 30 m.

D1.6 Dimensions of exits and paths of travel to exits

In a required exit or path of travel to an exit—

(c) The unobstructed width of each exit or path of travel to an exit, except for doorways, must not be less than—

(i) 1 m;

10.3 Acceptance Criteria

The Performance Solution is considered to be acceptable if it can be demonstrated that occupants from the carparking areas on the ground level and level 1 are not expected to be trapped within the building, or exposed to untenable conditions due to the proposed variations to the egress provisions.

10.4 Fire Engineering Analysis

10.4.1 Methodology

A fire engineering analysis of this Performance Solution has been carried out in accordance with Clauses A0.3 (a) (i) and A0.5 (b) (ii) of the BCA to demonstrate compliance with the relevant Performance Requirements DP4 and EP2.2, using an absolute, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the IFEG 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system B – Smoke Development and Spread and Control
- Sub-system C – Fire spread and impact and control
- Sub-system D – Fire Detection, Warning and Suppression
- Sub-system E – Occupant Evacuation and Control

According to the Guide to the BCA, the prescriptive requirement of clause D1.2 is to require the provision of sufficient exits to enable safe egress in case of an emergency. Clause D1.4 is to maximise the safety of occupants by enabling them to be close enough to an exit to safely evacuate. Clause D1.6 is to allow occupants to evacuate safely within a reasonable time.

10.4.2 Number of exits and distance to an exit

The occupants within the carparking areas are likely to be awake and alert. There are only four and five carparking spaces within the carpark on the ground level and level 1 respectively. Considering generally infrequent access to the carparking areas by the residents, the population within the carparking areas on the ground level and level 1 are expected to be low and transient.

The carparking areas feature:

- The proposed tandem carparking area on the ground floor and the whole carparking area on level 1 are fire separated from the adjacent area, which is expected to limit the fire and smoke spread from and to adjacent areas.
- open layout level plans, which enable the occupants to easily detect the fire situation and locate the exits when they are outside the garages and secured carparking spaces.

The subject areas are to be provided with smoke detection and alarm system in accordance with AS 1670.1:2015, with additional requirement of heat detectors within each garage, store room and car space which are separated from the rest the areas by physical barriers, such as walls and fences. Early alarm is expected to be provided to the occupants within the carparking areas and the rest of the building at the early phase of the fire growth.

The carparking area on the ground level is fire separated from the main lobby area by fire resisting walls and associated fire door fitted with smoke seals and fire seals. As such, once occupants leave the carpark via the fire door, they are considered to reach a safe area where they are protected from the exposure of products of combustion and facilitated to safely travel to the open space. To assist occupants in locating the egress pathway, an illuminated exit sign is to be provided above the aforementioned fire door. The travel distance from the subject carparking area to the aforementioned fire door is approximately 18 metres, which is less than 20 m. It is therefore considered that occupants within the subject carparking area can reach a protected safe place by travelling less than 20 m.

As such, occupants within the carparking areas on the ground level and level 1 are expected to be facilitated with early fire alarms to safely evacuate the building prior to the onset of untenable conditions.

The subject areas are located on the lower levels within a building that is considered to be over 25 m under the definition in BCA 2016. The existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portion being repurposed is to occur at the lower levels only, the fire and life safety level therein is independent from the number of storeys above.

10.4.3Egress width

The width of a path of travel to an exit is specified to allow for safe exit from the building. The table below shows the mean dimensions of humans as a comparison to the stair widths using data in the Standards Australia Handbook for British adults. Recent research by Ward suggested that using at least both the UK and USA data sources may be better, if designing for Australia, than the British data alone. Accordingly, USA data have also been included in the table for reference.

Table 5: Anthropometric data

Data source	Body part	Male percentiles			Female percentiles		
	Hip Width	5th	50th	95th	5th	50th	95th
UK	Shoulder Width	310mm	360mm	405mm	310mm	370mm	435mm
	Hip Width	420mm	465mm	510mm	355mm	395mm	435mm
USA	Shoulder Width	310mm	356mm	402mm	328mm	380mm	432mm
	Hip Width	416mm	454mm	492mm	348mm	390mm	432mm

Based on the table above it can be seen that in general, the shoulder widths of occupants present as the greatest dimension of concern. It is noted that the provided clearance will at least be greater than shoulder width and will accommodate the majority of the population with a margin without needing to turn the body.

The width of the stairway and storage corridor is not considered to significantly delay or prevent persons from reaching required exits in an emergency. Both the proposed design and a prescriptive DTS solution 1m clear dimension would only permit the travel of persons in a single file arrangement.

Studies referenced within the SFPE Handbook of Fire Protection Engineers 4th Edition discuss that when persons travel, they have the propensity to sway in a lateral motion and need to maintain minimum clearances between obstructions to ensure balance and unimpeded movement. The Handbook specifies that a minimum of 150mm needs to be maintained each side from the enclosing walls or side of stair treads to ensure effective travel.

Therefore, the minimum effective width required to be maintained for unimpeded travel down a stair way would be at least **810mm** = 510mm (being a person's shoulder width) + 300mm (being minimum clearances). It is understood that the final provided clearance, being at least 810mm, will meet or exceed this.

Regarding the storage corridor and associated doorways the minimum width of 630 through a door and 800mm along the walkway exceed the maximum biometric width of 510mm, and therefore would be adequate for a single file passage. Further, the area in question can only be accessed via the subject doors and passage – therefore any person seeking egress through the passage would already have gained access via that passage and therefore has demonstrated they are physically able to do so.

10.4.4Conclusion

Based on the discussion above, it is considered that the occupants of the carparking areas on the ground level and level 1 are not expected to be adversely affected by the proposed variation in egress provisions of the carparking areas.

10.5 FRNSW FEBQ Comments

FRNSW: Refer to our previous comments regarding the effective height.

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

BCA Logic Pty Ltd: Noted.

10.6 Peer Reviewer's FEBQ Comments

PGA: It should be clarified whether this Performance Solution should also relate to the carpark to the lower level based on the proposed changes to this level.

BCA Logic: In accordance with the advice from the PCA, the variations on the lower ground level are existing conditions that are outside the scope of this report.

PGA: No further comments.

BCA Logic: Noted.

10.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 10.4, it is considered by BCA Logic Pty Ltd that the Performance Requirements DP4 and EP2.2 have been satisfied.

DP4

	Matters for consideration	Remarks
Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to–		
(a)	*the travel distance; and*	The assessment has demonstrated that occupants from the carparking areas on the ground level and level 1 are not expected to be trapped within the building, or exposed to untenable conditions before completion of evacuation due to the proposed variations to the egress provisions.
(b)	*the number, mobility and other characteristics of occupants; and*	The number, mobility and characteristics of the occupants that have been considered are considered in Section 4 and discussed in detailed in Section 10.4.
(c)	*the function or use of the building; and*	The subject area is a small carparking areas on the ground level and level 1 within a residential building.
(d)	*the height of the building; and*	The effective height of the proposed building is over 25 m under the definition of the BCA2016. The subject areas are on the ground level and level 1.
(e)	*whether the exit is from above or below ground level.*	The exit is above the ground level.

DP6

	Matters for consideration	Remarks
So that occupants can safely evacuate the building, paths of travel to exits must have dimensions appropriate too–		
(a)	*the number, mobility and other characteristics of occupants; and*	The assessment has demonstrated that the paths of travel are suitable for the occupants.
(b)	*the function or use of the building; and*	The function of the affected spaces is car parking and storage – ie not normally occupied.

EP2.2

	Matters for consideration	Remarks
(a) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that–		
	(i) the temperature will not endanger human life; and	The fire engineering analysis has demonstrated that occupants from the carparking areas on the ground level and level 1 are not expected to be trapped within the building, or exposed to untenable conditions before completion of evacuation due to the proposed variations to the egress provisions.
	(ii) the level of visibility will enable the evacuation route to be determined; and	
	(iii) the level of toxicity will not endanger human life.	
(b) The period of time occupants take to evacuate referred to in (a) must be appropriate to–		
	(i) the number, mobility and other characteristics of the occupants; and	The number, mobility and characteristics of the occupants that have been considered are considered in Section 4 and discussed in detailed in Section 10.4.
	(ii) the function or use of the building; and	The fire engineering analysis has taken into account the function or use of the subject area being a carpark within residential apartment building.
	(iii) the travel distance and other characteristics of the building; and	The fire engineering analysis has demonstrated that occupants from the carparking areas on the ground level and level 1 are not expected to be trapped within the building, or exposed to untenable conditions before completion of evacuation due to the proposed variations to the egress provisions.
	(iv) the fire load; and	The fire engineering analysis has assumed there is sufficient fire load in the residential apartments to allow the fire to proceed to the post-flashover phase.
	(v) the potential fire intensity; and	The fire engineering analysis has considered a post-flashover fire in the carparking areas.
	(vi) the fire hazard; and	The fire hazards in the building that have been considered are detailed in Section 3.7.
	(vii) any activate fire safety systems installed in the building; and	The fire engineering analysis has considered that the building is to be provided with an automatic smoke detection and alarm system, building occupant warning system.
	(viii) fire brigade intervention.	Fire brigade intervention has conservatively not been considered in the fire engineering analysis for suppressing and extinguishing the fire. The Performance Solution is not expected to have an adverse impact on fire services operations.

11 PERFORMANCE SOLUTION 6 – TO ALLOW THE EXISTING CENTRAL FIRE-ISOLATED STAIRWAY TO DISCHARGE INTO A COVERED AREA ON THE GROUND LEVEL

11.1 Introduction

As shown in Figure 20, it is proposed to allow the existing central fire-isolated stairway to discharge into a point within the confines of the building used only for pedestrian and vehicle movement; however, this area is open for 1/3 its perimeter in lieu of 2/3 its perimeter.

In addition, the existing carpark entry and residential lobby door is within 6 m of the egress pathway from the central fire-isolated stairway.

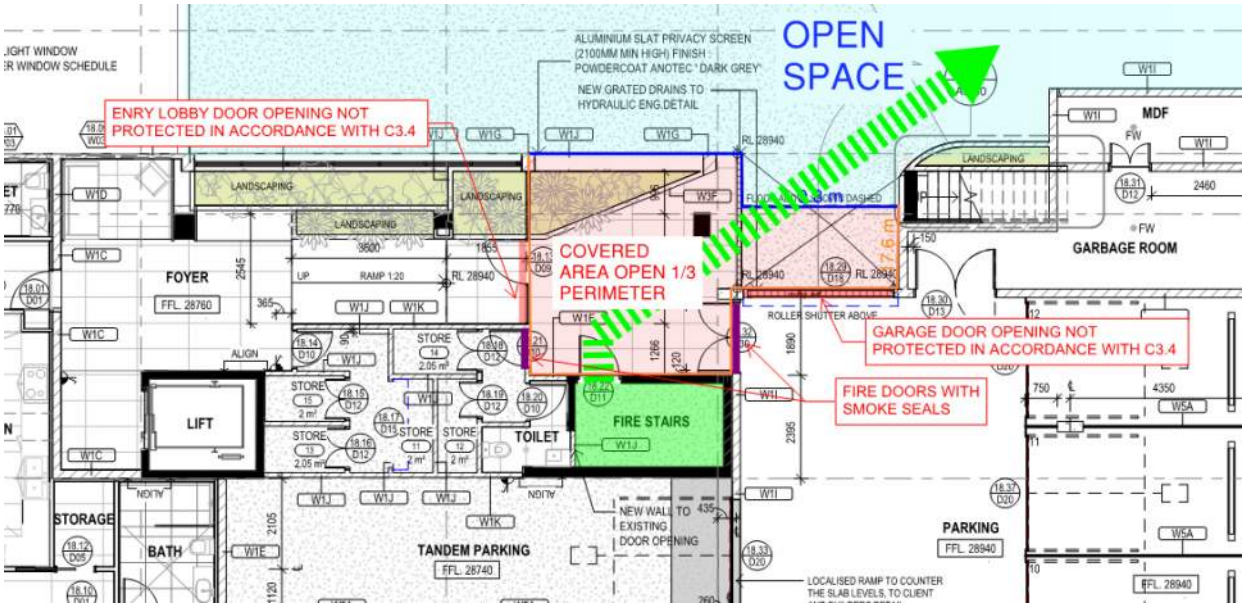


Figure 20: Fire exit discharge

11.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirements are DP5 and EP2.2, and the DTS Provision applicable to this Performance Solution is Clause D1.7 of the BCA 2016 which states:

D1.7 Travel via fire-isolated exits

(b) Each fire-isolated stairway or fire-isolated ramp must provide independent egress from each storey served and discharge directly, or by way of its own fire-isolated passageway —

(i) to a road or open space; or

(ii) to a point —

(A) in a storey or space, within the confines of the building, that is used only for pedestrian movement, car parking or the like and is open for at least 2/3 of its perimeter; and

(B) from which an unimpeded path of travel, not further than 20 m, is available to a road or open space; or

(iii) into a covered area that — …

(c) Where a path of travel from the point of discharge of a fire isolated exit necessitates passing within 6m of any part of an external wall of the same building, measured horizontally at right angles to the path of travel, that part of the wall must have —

(i) an FRL of not less than 60/60/60; and

(ii) any openings protected internally in accordance with C3.4

11.3 Acceptance Criteria

The Performance Solution is considered acceptable if it can be demonstrated that the occupants from the fire-isolated stair discharge into a safe area from which they can travel to a road or open space due to the proposed variations in DTS egress provisions.

11.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with Clauses A0.3 (a) (i) and A0.5 (b) (ii) of the BCA to demonstrate compliance with the relevant Performance Requirement DP5 and EP2.2, using an absolute, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the IFEG 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system B – Smoke Development and Spread and Control
- Sub-system C – Fire spread and impact and control
- Sub-system D – Fire Detection, Warning and Suppression
- Sub-system E – Occupant Evacuation and Control

According to the Guide to the BCA, the prescriptive requirement of Clause D1.7 is to enable occupants to discharge to a safe location.

The likelihood of a fire actually occurring in the areas that affect the fire exit discharge and path of travel to open space will be limited by the following performance solution attributes:

- The entry lobby will have a management in use policy and signage that prohibits any storage of combustible materials and furniture within the discharge area. As such this area is considered to be sterile. The building main entry door that is within 6m from the discharge of the fire-isolated stair is therefore proposed to not be protected.
- The garage door protects an opening for space that is only used for vehicle movements. By the definition of the use of the space it is not expected that any combustible material could be present here for any significant period of time as it is the only access into and out of the vehicle carparking.

Moreover, the building is to be provided with a smoke detection and alarm system throughout, which is expected to provide early fire alarm to the occupants at the early phase of the fire development. The subject covered discharge area is approximately 4 metre sway from the existing external ramp (driveway). The minor increase of travelling time for occupants to reach the existing external ramp (driveway) is not expected to affect the occupant evacuation.

Further still, the affected areas are fully sprinkler protected. In the unlikely event that a fire does occur in proximity to the unprotected openings the sprinkler system is expected to limit fire growth and temperature within the fire affected compartment such that radiant heat exposure from the fire compartment will not cause untenable conditions for occupants passing by the openings.

In the unlikely event of a fire, the covered area is provided with natural ventilation for 1/3 of its perimeter which is expected to provide natural smoke ventilation provisions, consistent with provisions for a covered area outside a building envelope permitted under BCA DTS D1.7(b)(c).

Based on the discussion above, it is considered that the occupants from the fire-isolated stair will discharge into a safe place from which they can travel to the external ramp (driveway) without being exposed to untenable conditions.

11.5 FRNSW FEBQ comments

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

BCA Logic Pty Ltd: Noted.

11.6 Peer Reviewer's FEBQ Comments

PGA: This Performance Solution should also address the ground level carpark roller door which is not protected in accordance with Clause D1.7(c) of the BCA.

BCA Logic: The issue has now been addressed in the performance solution.

PGA: No further comments.

BCA Logic: Noted.

11.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 11.4, it is considered by BCA Logic Pty Ltd that the Performance Requirements DP5 and EP2.2 have been satisfied.

DP5

	Matters for consideration	Remarks
To protect evacuating occupants from a fire in the building exits must be fire-isolated to the degree necessary, appropriate to—		
(a)	*the number of storeys connected by the exits; and*	The number of storeys connected by the fire-isolated stairway is 11.
(b)	*the fire safety system installed in the building; and*	The fire engineering analysis has considered that the building is to be provided with an automatic smoke detection and alarm system, fire extinguishers and fire hydrant system.
(c)	*the function or use of the building; and*	The fire engineering analysis has taken into account the function or use of the building being Class 2, residential apartments.
(d)	*the number of storeys passed through by the exits; and*	The number of storeys passed through by the fire-isolated stairway is 10.
(e)	*fire brigade intervention.*	Fire brigade intervention has conservatively not been considered in the fire engineering analysis for suppressing and extinguishing the fire. The Performance Solution is not expected to have an adverse impact on fire services operations.

EP2.2

	Matters for consideration	Remarks
(c) In the event of a fire in a building the conditions in any evacuation route must be maintained for the period of time occupants take to evacuate the part of the building so that–		
	(i) the temperature will not endanger human life; and	The fire engineering analysis has demonstrated that the occupants would not be exposed to hazardous conditions whilst they are in the covered area, i.e. the entry lobby.
	(ii) the level of visibility will enable the evacuation route to be determined; and	
	(iii) the level of toxicity will not endanger human life.	
(d) The period of time occupants take to evacuate referred to in (a) must be appropriate to–		
	(i) the number, mobility and other characteristics of the occupants; and	The number, mobility and characteristics of the occupants that have been considered are detailed in Section 4.
	(ii) the function or use of the building; and	The fire engineering analysis has taken into account the function or use of the building being Class 2, residential apartments.
	(iii) the travel distance and other characteristics of the building; and	The fire engineering analysis has considered that the travel distances are consistent with the DTS Solution and the building has an effective height over 25 m under the definition of BCA2016.
	(iv) the fire load; and	The fire engineering analysis has assumed that the entry lobby is a sterile area.
	(v) the potential fire intensity; and	The fire engineering analysis has considered the entry lobby is a sterile area.

	Matters for consideration	Remarks
	(vi) the fire hazard; and	The fire hazards in the building that have been considered are detailed in Section 3.7.
	(vii) any activate fire safety systems installed in the building; and	The fire engineering analysis has considered that the building is to be provided with an automatic smoke detection and alarm system nand building occupant warning system.
	(viii) fire brigade intervention.	Fire brigade intervention has conservatively not been considered in the fire engineering analysis for suppressing and extinguishing the fire. The Performance Solution is not expected to have an adverse impact on fire services operations.

12 PERFORMANCE SOLUTION 7 – TO ALLOW THE LIFT SERVING THE NEW UNIT AT THE UNDERCROFT NOT TO BE AN EMERGENCY LIFT

12.1 Introduction

As shown in Figure 21, it is proposed to allow the lift serving the new unit at the undercroft to not be an emergency lift.

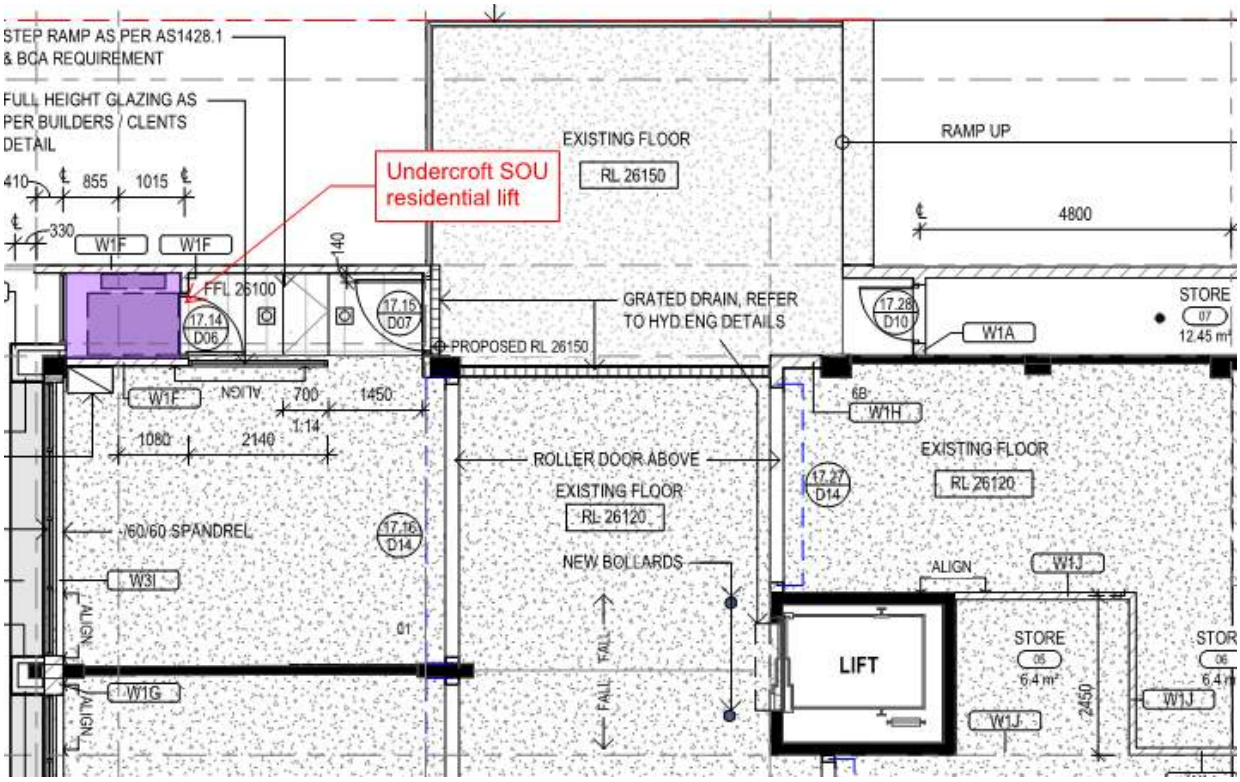


Figure 21: The proposed fire door on the lower ground level to the lift serving the new unit at the undercroft

12.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirement is EP3.2, and the DTS Provision applicable to this Performance Solution is Clause E3.4 of the BCA 2016 which states:

E3.4 Emergency lifts

(a) At least one emergency lift complying with (d) must be installed in—

(i) a building which has an effective height of more than 25 m; and

(ii) a Class 9a building in which patient care areas are located at a level that does not have direct egress to a road or open space.

(a) An emergency lift may be combined with a passenger lift and must serve those storeys served by the passenger lift so that all storeys of the building served by passenger lifts are served by at least one emergency lift.

(b) Where two or more passenger lifts are installed and serve the same storeys, excluding a lift that is within an atrium and not contained wholly within a shaft—

(i) at least two emergency lifts must be provided to serve those storeys; and

(ii) if located within different shafts, at least one emergency lift must be provided in each shaft.

(c) An emergency lift must—

(i) be contained within a fire-resisting shaft in accordance with C2.10; and

(ii) in a Class 9a building serving a patient care area—

(A) have minimum dimensions, measured clear of all obstructions, including handrails, etc complying with Table E3.4; and

(B) be connected to a standby power supply system where installed; and

(iii) if the building has an effective height of more than 75 m, have a rating of at least—

(A) 600 kg if not provided with a stretcher facility; or

(B) 900 kg if provided with a stretcher facility.

12.3 Acceptance Criteria

The Performance Solution is considered to be acceptable if it can be demonstrated that the level of access provided to the emergency service personnel is equivalent to than that offered by the DTS Solution.

The relevant DTS Solution would feature an SOU located at the undercroft, which has the similar building layout and is not provided with a private lift.

12.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with Clauses A0.3 (a) (ii) and A0.5 (d) of the BCA to demonstrate compliance with the relevant Performance Requirement EP3.2, using a comparative, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the IFEG 2005:

- Sub-system F – Fire Services Intervention

According to the Guide to the BCA, the prescriptive requirement of Clause E3.4 is to require that lifts be suitable for their purpose and also be available for emergency services personnel. E3.4(a) to (d) only applies to buildings with an effective height above 25 metres, and in certain Class 9a buildings.

The subject area and subject lift are located on a level with direct access to open space and serves only one level below. Given that access to the area served by the lift is readily accessible by emergency intervention personnel via a single flight of stairs the provision of an emergency lift would be far over and above what is necessary to facilitate the needs of emergency services personnel.

Further, the subject lift is to be provided with a fire-resisting landing door. The lift is considered to be fully within SOU bounding construction and to serve the SOU only, which is therefore considered as a private lift for the SOU at the undercroft.

In comparison with the DTS Solution which does not provide a private lift, the emergency service personnel is considered to be facilitated to access the unit at the undercroft.

It is understood that the existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portion being repurposed is to occur at the undercroft only, which is unlikely to be affected by the change of the definition of the effective height of the subject building.

Based on the discussion above, compared with the DTS Solution, it is considered that level of the access to the undercroft unit provided to the emergency personnel is unlikely to be adversely affected by adding a private lift that is not emergency lift.

12.5 FRNSW FEBQ comments

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

BCA Logic Pty Ltd: Noted.

12.6 Peer Reviewer's FEBQ Comments

PGA: The lift also serves the carpark to the lower level.

BCA Logic: Noted. It is understood that the private lift is completely within the bounding construction of the undercroft unit and to be used by the occupants of the undercroft unit only.

PGA: The features within an emergency lift should also be compared to the proposed lift.

BCA Logic: The private lift does not comply with the requirements of an emergency lift and is not intended to be used as an emergency lift. A sign is to be provided to advise the emergency personnel to not use the lift as an emergency lift, which has been included in the FER.

PGA: No further comments.

BCA Logic: Noted.

12.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 12.4, it is considered by BCA Logic Pty Ltd that the Performance Requirement EP3.2 has been satisfied.

EP3.2

	Matters for consideration	Remarks
	One or more passenger lifts fitted as emergency lifts to serve each floor served by the lifts in a building must be installed to facilitate the activities of the fire brigade and other emergency services personnel. *Application:* *EP3.2 only applies to—* *(a) a building with an effective height of more than 25 m; and* *(b) a Class 9a building in which patient care areas are located at a level that does not have direct access to a road or open space.*	The fire engineering analysis has demonstrated that the level of access provided to the emergency service personnel is equivalent to than that offered by the DTS Solution.

13 PERFORMANCE SOLUTION 8 – TO ALLOW THE PROPOSED BUILDING PORTIONS BEING REPURPOSED TO NOT BE PROVIDED WITH A SSISEP

13.1 Introduction

It is proposed to not provide a Sound System and Intercom System for Emergency Purposes (SSISEP) to the building portions under the proposed development which are located at the undercroft and on the lower ground level, the ground level and level 1.

13.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirement is EP4.3 and the DTS Provision applicable to this Performance Solution is Clauses E4.9 of the BCA 2016 which state:

E4.9 Sound systems and intercom systems for emergency purposes

A sound system and intercom system for emergency purposes complying where applicable with AS 1670.4 must be installed—

(a) in a building with an effective height of more than 25 m; and

(b) in a Class 3 building having a rise in storeys of more than 2 and used as—

(i) the residential part of a school; or

(ii) accommodation for the aged, children or people with a disability; and

(c) in a Class 3 building used as a residential aged care building, except that the system—

(i) must be arranged to provide a warning for occupants; and

(ii) in areas used by the residents, may have its alarm adjusted in volume and content to minimise trauma consistent with the type and condition of residents; and

(d) in a Class 9a building having a floor area of more than 1000 m2 or a rise in storeys of more than 2, and the system—

(i) must be arranged to provide a warning for occupants; and

(ii) in a ward area, may have its alarm adjusted in volume and content to minimise trauma consistent with the type and condition of patients; and

(e) in a Class 9b building—

(i) used as a school and having a rise in storeys of more than 3; or

(ii) used as a theatre, public hall, or the like, having a floor area more than 1000 m^2 or a rise in storeys of more than 2.

13.3 Acceptance Criteria

The Performance Solution is considered acceptable if it can be demonstrated that, although non-provision of a SSISEP to the repurposed areas, the level of fire and life safety for occupants in the repurposed area is at least equivalent to that offered by the BCA DTS Solution.

The relevant BCA DTS Solution would feature the same building layout as the repurposed area, which includes two units and carparking areas on the undercroft, lower ground level, the ground level and level 1 within a building that has an effective height of less than of 25 m.

13.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with Clauses A0.3 (a) (ii) & A0.5 (d) of the BCA to demonstrate compliance with the relevant Performance Requirement EP4.3, using a comparative, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the IFEG 2005:

- Sub-system E – Occupant evacuation and control
- Sub-system F – Fire Services Intervention

According to the Guide to the BCA, the prescriptive requirement in Clause E4.9 is to minimise the risk of death or injury to occupants through lack of knowledge that an emergency exists or an evacuation is required.

The BCA DTS Provisions require a SSISEP to be provided to mitigate the specific hazards associated with the occupants when the entire building has an effective height of over 25 m.

It is understood that the occupants located on the upper levels that are over 25 m generally need more time to evacuate the building.

In a building with a larger number of occupants, such as an office building, when compared with residential buildings, the egress stairs may not be sufficient to facilitate all occupants evacuating at the same time. Therefore, a phased evacuation strategy utilising a SSISEP is commonly adopted and occupants are to evacuate the building in turn. As fire wardens are assigned in an office environment, an intercom system can be helpful for communication during the evacuation process.

The repurposed areas are on the floors are much lower than 25 m effective height. A building having an effective height of less than 25 m, under a DTS Solution, is not required to provide a SSISEP.

The repurposed areas are to be provided with additional horizontal fire and smoke separation between two adjacent areas as well as fire and smoke separation between two levels vertically. As such, a fire within the repurposed areas is unlikely to affect the upper levels.

Compared with the DTS Solution, the proposed Performance Solution includes the provision of a smoke detection and alarm system throughout the undercroft, the lower ground level, the ground level and level 1. Thus, an early fire alarm is expected to be provided to occupants in the repurposed areas.

The total number of occupants in the proposed apartments at the undercroft and on the ground level is expected to be approximately 6 persons; the number of occupants within the carparking areas on the lower ground level, the ground level and level 1 is estimated to be 36 persons, who are generally expected to be awake and alert and transient. In reality, the presence of all 36 persons in three levels of parking at the same time is highly unlikely because the daily schedule of each resident is different.

The conservatively estimated total of 42 occupants on these levels are to be facilitated with egress pathways that has the sufficient width, are directly discharged to open space, and are separated from the fire-isolated stairway serving the upper levels. Hence, queueing at the exits is unlikely to occur on these levels. As such, occupants in the repurposed areas are expected to be facilitated to evacuate the building as safe as that offered by the DTS Solution despite the non-provision of a SSISEP.

Since the egress pathway is sufficient for all the occupants within the repurposed areas to evacuate the building, compared with the DTS Solution, immediate and simultaneous evacuation following the fire alarms is considered to be more appropriate than a phased evacuation. In addition, since there is not a warden system for residential buildings, communication among the residents or between the resident with fire brigade personnel via the emergency intercom system in a fire emergency is not expected. As such, the non-provision of a SSISEP is not expected to adversely affect the life and fire safety level of the occupants in the repurposed areas.

Since the reproposed areas are located at the lower levels, fire brigades are expected to have easy access to the repurposed areas. Moreover, the existing fire protection system is connected to a remote fire monitoring centre. Quick fire brigade dispatch and shorter fire intervention time is therefore expected. As such, fire brigade intervention is unlikely to be adversely affected by the proposed non-provision of a SSISEP.

It is understood that the existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portions being repurposed are to occur at the undercroft the ground level, and level 1 only, and do not increase the agreed effective height of the building.

On the basis of the analysis above, the non-provision of a SSISEP to the existing building is not expected to have an adverse impact on the existing fire and life safety level of occupants on the higher level, and occupants within the repurposed areas are considered by BCA Logic Pty Ltd to be provided with a level of fire and life safety protection that is equivalent to or higher than that offered by the DTS Solution.

13.5 FRNSW FEBQ comments

FRNSW Comment: As commented previously, the effective height for the building should be determined based on the latest version BCA due to the fact that the definition of the effective height has been revised since 2016.

FRNSW Comment: FRNSW do not support the proposal. Given the fact that the building is greater than 25 m under the current BCA, it is FRNSW's position that the building should be provided with a sprinkler system throughout.

BCA Logic Pty Ltd: It is understood that the existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portions being repurposed are to occur at the undercroft, the lower ground level, the ground level and level 1 only, and do not increase the existing height of the subject building, and do not adversely affect the fire and life safety level of the occupants on the upper levels. It should be noted that the existing fire and life safety level of the occupants on the upper levels of the subject building is not affected by the recent change of definition of the effective height in the BCA because no building work is to be carried out on the upper levels.

13.6 Peer Reviewer's FEBQ Comments

PGA: This should comply with the performance requirements as an absolute assessment is proposed as detailed below.

BCA Logic: The typo has been rectified in the FER report.

PGA: The acceptance criteria should also relate to an assessment of the need for a sprinkler system based on the height of the building.

PGA: Fire brigade intervention should also be assessed in consideration of the height of the building.

BCA Logic: Fire brigade intervention has been discussed in Section 13.4.

13.7 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 13.4, it is considered by BCA Logic Pty Ltd that the Performance Requirement EP4.3 has been satisfied.

EP4.3

	Matters for consideration	Remarks
To warn occupants of an emergency and assist evacuation of a building, a sound system and intercom system for emergency purposes must be provided, to the degree necessary, appropriate to—		
(a)	*the floor area of the building; and*	The fire engineering analysis has demonstrated that despite the non-provision of a SSISEP to the repurposed areas, the level of fire and life safety for occupants in the repurposed area under the proposed Performance Solutions in this fire engineering report is at least equivalent to that offered by the BCA DTS Solution.
(b)	*the function or use of the building; and*	
(c)	*the height of the building.*	

14 PERFORMANCE SOLUTION 9 – TO ALLOW THE PROPOSED EXTERNAL ATTACK FIRE HYDRANT TO BE LOCATED APPROXIMATELY 4.5 M FROM THE NEAREST UNPROTECTED OPENING IN LIEU OF 10 M FROM THE BUILDING

14.1 Introduction

As shown in Figure 22, a proposed external attack fire hydrant is to be located approximately 4.5 m from the nearest unprotected opening in lieu of 10 m from the building that is stipulated in AS 2419.1-2005. The external attack fire hydrant is to be of dual pillar type that is designed to provide coverage to the lower ground level carpark and storage area, as well as the undercroft residential unit.

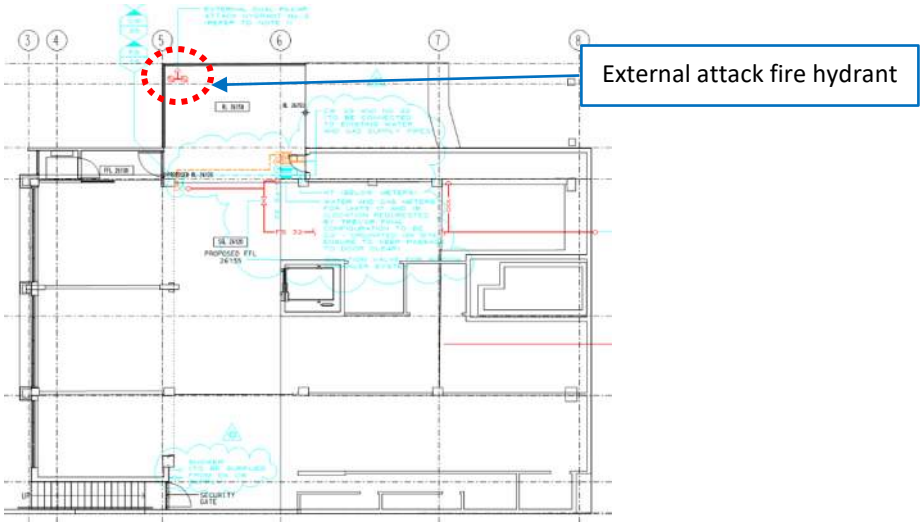


Figure 22: Location of the proposed external attack fire hydrant on the lower ground level

The nearest internal fire hydrant is located within the fire-isolated stairway on the ground level. The area where the proposed external fire hydrant is located can be covered by a 30 m hose run + 10m hose stream from this internal fire hydrant, as illustrated in Figure 23.

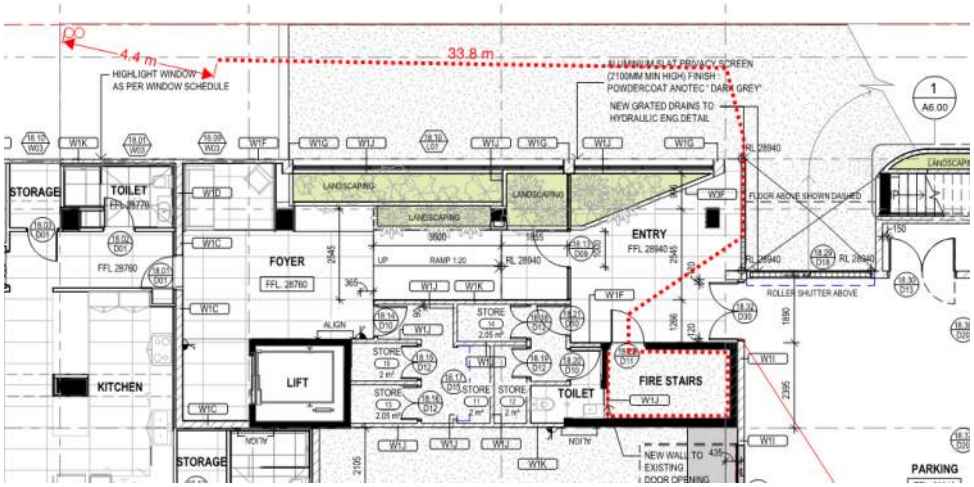


Figure 23: Indicative fire hydrant coverage from the nearest fire hydrant on the ground floor

As shown in Figure 24, it is understood that openings on the undercroft level, lower ground level, and ground level that are within 3m from the fire-source feature are to be protected in accordance with the BCA 2016 DTS Provisions.

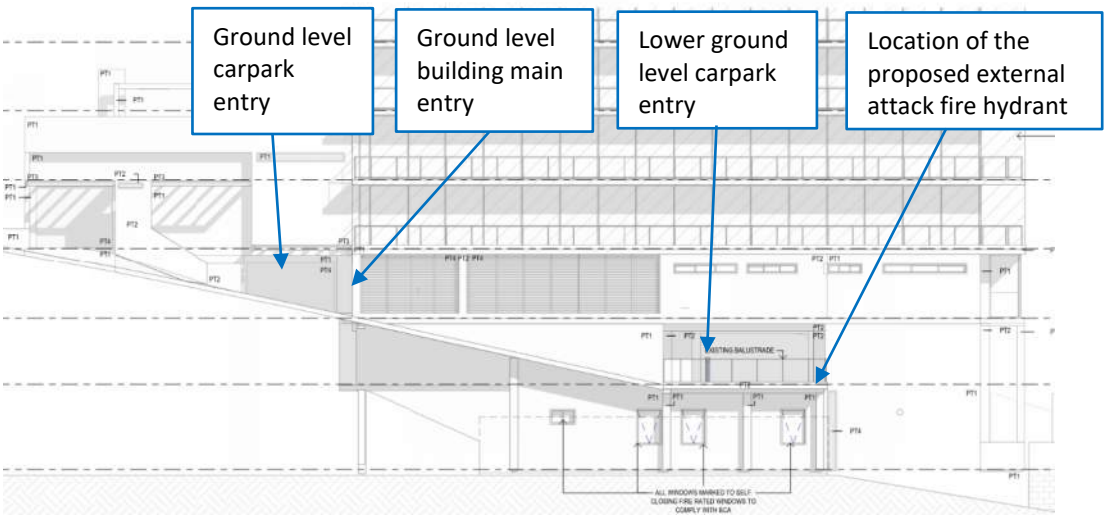


Figure 24: External openings on the western elevation of the proposed development

14.2 BCA Performance Requirements and DTS Provisions

The relevant BCA Performance Requirement is EP1.3, and the DTS Provision applicable to this Performance Solution is Clause E1.3 of the BCA 2016 which states:

E1.3 Fire hydrants

(a) A fire hydrant system must be provided to serve a building—

(i) having a total floor area greater than 500 m^2; and

(ii) where a fire brigade is available to attend a building fire.

(b) The fire hydrant system—

(i) must be installed in accordance with AS 2419.1 , except a Class 8 electricity network substation need not comply with clause 4.2 of AS 2419.1 if—

(A) it cannot be connected to town main supply; and

(B) one hour water storage is provided for firefighting; and

(ii) where internal fire hydrants are provided, they must serve only the storey on which they are located except that a sole-occupancy unit —

(A) in a Class 2 or 3 building or Class 4 part of a building may be served by a single fire hydrant located at the level of egress from that sole-occupancy unit; or

(B) of not more than 2 storeys in a Class 5, 6, 7, 8 or 9 building may be served by a single fire hydrant located at the level of egress from that sole-occupancy unit provided the fire hydrant can provide coverage to the whole of the sole-occupancy unit.

AS 2419.1-2005 states that:

3.2.2.2 *Location*

External fire hydrants shall be located as follows:

(a) In a position that provides pedestrian access to the building for the fire brigade.

(b) When installed as a feed fire hydrant [See Figure 3.2.2.2(a), (b), (d) and (e)], within 20 m of a hardstand such that when a fire brigade pumping appliance is connected to it—

(i) all portions of the building shall be within reach of a 10 m hose stream, issuing from a nozzle at the end of a 60 m length of hose laid on the ground; and

(ii) a minimum of 1 m of hose shall extend into any room served.

(c) Where installed as an attack fire hydrant [see Figure 3.2.2.2(f)], within 50 m of a hardstand such that when connected directly to the external attack fire hydrant—

(i) all portions of the building shall be within reach of a 10 m hose stream, issuing from nozzle at the end of a 60 m length of hose laid on the ground; and

(ii) a minimum of 1 m of hose shall extend into any room served.

(d) Where installed in a system fitted with a fire brigade booster assembly and having feed fire hydrant performance only, within 20 m of a fire brigade pumping appliance located on a hardstand. All portions of the building shall be within reach of a 10 m hose stream, issuing from a nozzle at the end of 60 m length of hose laid on the ground with a minimum of 1 m of hose extending into any room served—

(i) where the hose is connected directly to the external fire hydrant [see Figure 3.2.2.2(c)]; and

(ii) where the hose is connected to a fire brigade pumping appliance fed from the fire hydrant.

(e) In a position not less than 10 m from the building it is protecting unless safeguarded by construction—

(i) having a FRL of not less than 90/90/90;

(ii) extending 2 m each side of the fire hydrant outlet; and

(iii) extending not less than 3 m above the ground adjacent to the fire hydrant or the height of the building, whichever is the lesser.

(f) In a position not less than 10 m from any high voltage main electrical distribution equipment such as transformers and distribution boards, and from liquefied petroleum gas and other combustible storage.

(g) In a position so that the fire hydrant is not obstructed or obscured by obstacles, stored goods, vehicles, vegetation etc.

(h) In a position so that the fire hydrant is protected from possible mechanical damage by vehicles.

C3.2.2.2(d) *This arrangement is typical for low rise industrial buildings and shopping complexes equipped with external fire hydrants and a booster assembly. In such circumstances these hydrants are located as attack hydrants but only require an unassisted performance necessary for initial connection to a fire brigade pumping appliance(s) as feed hydrants, thus, in many cases, negating the need for on-site pumps. The first brigade pump appliance to arrive can use the external hydrants as feed fire hydrants and commence fighting the fire using hoses connected to the pumping appliance; however, if the fire escalates, a greater flow demand is required or, if the first pumping appliance is threatened by the fire, a later arriving pumping appliance can connect to the booster assembly. Firefighters will then be able to fight the fire using hoses directly connected to the external hydrants (now boosted to higher pressure) and the threatened fire appliance can be withdrawn to a safer location.*

C3.2.2.2(e) *The 10 m clearance distance required from the building is intended to provide access to the fire hydrant under radiant heat from the fire and give a degree of protection in the event of structural collapse due to fire.*

C3.2.2.2(f) *The 10 m clearance distance required from the electrical equipment is essential to avoid a potential electrical hazard.*

14.3 Acceptance Criteria

The Performance Solution is considered acceptable if it can be demonstrated that the fire brigade intervention is not expected to be adversely affected by the location of the proposed external attack fire hydrant.

14.4 Fire Engineering Analysis

A fire engineering analysis of this Performance Solution has been carried out in accordance with Clauses A0.3 (a) (i) and A0.5 (b) (ii) of the BCA to demonstrate compliance with the relevant Performance Requirement EP1.3, using an absolute, deterministic, and qualitative assessment approach.

The assessment has considered the following fire safety sub-systems as defined in the IFEG 2005:

- Sub-system A – Fire Initiation and Development and Control
- Sub-system C – Fire spread and impact and control
- Sub-system D – Fire Detection, Warning and Suppression
- Sub-system F – Fire Services Intervention

According to the Guide to the BCA, the prescriptive requirement in Clause E1.3 is to require the installation of suitable fire hydrant systems to facilitate the fire brigade's firefighting operations.

The proposed external attack fire hydrant is located at the end of the driveway on the lower ground level, which is approximately 4.5 away from the building, and exposed to the carpark entry on the lower ground level.

A sprinkler system is to be provided in the areas adjacent to the subject hydrant. Therefore the proposed external attack fire hydrant is not expected to be adversely affected by a fire initiated within a garage.

As the driveway on the lower ground level is the only vehicular access to the lower ground level, the proposed management-in-use policy and signage are expected to further ensure the driveway and the carpark entry to be free of combustible materials except the transient passing vehicles. As such, it is considered that a fire is not expected to be initiated within the driveway.

In an unlikely event that a vehicle has stalled at the carpark entry or at the internal carpark driveway near the carpark entrance on the lower ground level and caught a fire, which in turn blocks the access to the proposed external attack fire hydrant, fire fighters can use the internal fire hydrant located within the fire-isolated stair on the ground level to fight the car fire on the lower ground level.

On the basis of the analysis above, the location of the proposed external attack fire hydrant is not expected to have a significant adverse impact on fire brigade intervention.

14.5 Compliance with the BCA Performance Requirements

Based on the discussion presented in Section 14.4, it is considered by BCA Logic Pty Ltd that the Performance Requirement EP1.3 has been satisfied.

EP1.3

	Matters for consideration	Remarks
A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to–		
(a)	*fire-fighting operations; and*	The fire engineering analysis has demonstrated that the fire brigade intervention is unlikely to be adversely affected by the location of the proposed external attack fire hydrant.
(b)	*the floor area of the building; and*	
(c)	*the fire hazard.*	

15 COMMISSIONING, MANAGEMENT, USE AND MAINTENANCE

15.1 Delivery 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 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.

15.2 Essential Fire or Other Safety Measures

The following fire safety measures are required to be installed in the building according to the BCA DTS Provisions. This table may be required to be updated as the design develops and options for compliance are confirmed.

#	Proposed Essential Fire Safety Measure	Minimum Standard of Performance
1.	Access panels, doors and hoppers to fire resisting shafts	BCA 2016 Clause C3.13, Spec C3.4, and AS 1905.1:2015.
2.	Automatic fail safe devices (if provided)	BCA 2016 Clauses D2.19, D2.21, AS1670.1:2015 and Manufacturer's Specification.
3.	Automatic fire detection and alarm system	BCA 2016 Clause E2.2a, Clause 3, 5, 6 of Specification E2.2a, AS1670.1-2015 and AS 3786:2014. **Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**
4.	Automatic fire sprinkler system	AS2118.4-2012. **Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**
5.	Emergency lighting	BCA 2016 Clauses E4.2 & E4.4, AS2293.1-2005.
6.	Exit signs	BCA 2016 Clauses E4.5, E4.6 & E4.8, AS2293.1-2005.
7.	Fire dampers	BCA 2016 Specification C3.15, AS/NZS1668.1:2015, AS1682.1 & 2:2015.
8.	Fire doors	BCA 2016 Clause C2.13 (Electricity Supply Systems), Clause C3.8 (Fire Isolated Exits), Clause C3.11 (Bounding Construction), Spec C3.4 & AS 1905.1:2015, Clause C3.10 (Lift Shafts) and AS 1735.11 – 1986, and **Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**
9.	Fire hose reel system	BCA 2016 Clause E1.4, AS2441-2005.
10.	Fire hydrant system	BCA 2016 Clause E1.3, AS2419.1-2005, Fire & Rescue NSW Fire Safety Guideline Technical Information D15/45534 "FRNSW compatible hose connections" Version 06 dated 11 April 2017, and **Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**
11.	Fire seals protecting openings in fire resisting components of the building	BCA 2016 Clause C3.15 & Specification C3.15.
12.	Lightweight Fire Rated Construction	BCA 2016 Clause / Specification C1.8.
13.	Mechanical air handling systems to carpark	BCA 2016 Clause F4.5, F4.11, AS1668.2-2012

#	Proposed Essential Fire Safety Measure	Minimum Standard of Performance
14.	Paths of travel, stairways, passageways or ramps	BCA 2016 Section D & EP&A Regulation 2000 Clause 184 to 186, and **Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd**
15.	Portable fire extinguishers	BCA 2016 Clause E1.6, and AS2444-2001
16.	Smoke seals and intumescent fire seals	**Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**
17.	Swing of exit doors	BCA 2016 Clause D2.20 (Swinging Doors).
18.	Warning and operational signs	BCA 2016 Clause D2.23, EP&A Regulation 2000 Clause 183
19.	**Fire Engineering Report Issues:** • **To allow the provision of spandrel that is 400 mm above the floor slab on the ground level in lieu of 600mm.** • **To allow the existing carpark portion on the lower ground level and the proposed new carparking portion on the ground level to have a minimum FRL of 90/90/90 in lieu of 120/120/120.** • **To allow the storage area on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.** • **To allow the following variations in egress provisions related to the proposed residential areas at the undercroft, on the lower ground level and on the ground level:** ○ **a single exit to serve the proposed new residential units located at the undercroft;** ○ **a single exit to serve the proposed new residential units located on the ground level;** • **To allow the following variations in egress provisions related to the carparking and storage areas:** ○ **a single exit to serve the carparking areas on levels lower ground, ground and level 1; and** ○ **a minimum egress width of 810mm in lieu of 1,000mm from level 1; and** ○ **a minimum egress width of 800mm in lieu of 1m from the lower ground floor storage are, including storage cupboard door of 550mm and egress door width 630mm; and** ○ **a single exit to serve the carparking area on level 1; and** ○ **extended travel distances of up to approximately 22 m from the carparking areas to a single exit on the ground level; and** ○ **a minimum egress width of 900mm at base of stairs serving level 1.**	**Fire Engineering Report Ref No. 107347-FER-r4 prepared by BCA Logic Pty Ltd.**

#	Proposed Essential Fire Safety Measure	Minimum Standard of Performance
	• **To allow the existing central fire-isolated stairway to discharge into a covered area on the ground level.** • **To allow the lift serving the new unit at the undercroft not to be an emergency lift.** • **To allow the proposed building portion being repurposed to not be provided with a Sound Systems and Intercom Systems for Emergency Purposes (SSISEP).** • **To allow the proposed external attack fire hydrant to be located approximately 4.5 m from the nearest unprotected opening in lieu of 10 m from the building.**	

15.3 Management in Use Issues

As a result of formulating the Performance Solutions, the following matters were identified which require inclusion within a Management in Use Plan which is to be included in the Essential Services Register, and therefore compliance with its contents must be certified on an annual basis. The specific matters to be addressed are:

- inhibiting any combustible materials and furniture to be stored within all common property areas at all times.
- maintaining all egress pathways within the building free of obstructions.

15.4 Maintenance

All essential services are to be maintained and tested annually in accordance with the requirements of AS 1851-2012 and/or their system-specific Australian Standards detailed in the table above.

All routine maintenance and testing shall be carried out by companies that are accredited under the Fire Protection Accreditation Scheme (FPAS) administered by Fire Protection Association Australia.

In accordance with Clauses 1.4.5, 1.5.5, 1.6.5, 1.7.5, 1.8.5 and 1.9.5 of the IFEG the fire safety measures referred to above must be maintained strictly in accordance with the content and recommendations of this document. The following specific extracts from the IFEG are also provided for further reference:

Sub System A – Fire Initiation and Development and Control

The development of the design fires for the analysis in this Sub-system relies on various assumptions regarding:

- ignition sources;
- the nature of the fuel and its disposition;
- the enclosure characteristics; and
- the intervention of various protective measures.

It is essential that these assumptions are not negated during the construction phase and are verified during commissioning. The greater challenge is to ensure the assumptions continue to hold true during the management, use and maintenance of the building through documented procedures and schedules.

This applies particularly to the ignition sources and fuels, which are not generally the subject of building regulation, but fundamental to a fire engineering analysis. It may be possible to ensure this verification through the essential safety provisions for buildings that may apply in some jurisdictions.

Sub System B – Smoke Development and Spread and Control

Smoke management equipment often comprises a complex assembly of many interactive components and requires close attention in order to be reliable. Smoke management equipment is often considered to have a relatively low probability of successful operation. To improve the probability of successful

operation of smoke management equipment, its incorporation into the necessary occupant comfort systems used on a daily basis (e.g. air-conditioning) will be of benefit.

In order to achieve the required performance of the equipment (assumed or calculated during the analysis), attention needs to be paid to construction, commissioning, management in use and maintenance as assumed or required by the fire engineering evaluation (as articulated in the Report – see Chapter 1.11). It may be possible to ensure that the required maintenance is done through the essential safety provisions that may apply in some jurisdictions.

Particular attention should be paid to the commissioning procedures and the performance required. Normal commissioning procedures should be followed (measurement of airflows, pressure gradients, etc.) but these need to be supplemented for a fire engineered design.

Testing with heated artificial smoke ('hot smoke' tests) is sometimes carried out as part of the commissioning process to evaluate the correct operation of smoke management equipment.

Sub System C – Fire Spread and Impact and Control

The principal issues with regard to construction and commissioning of fire spread and impact control measures are:

- the integrity of the barriers;
- materials and components are to specification;
- operable systems, such as auto-closing fire doors, work as required; and
- appropriate operation and maintenance manuals are available.

Passive components of a fire safety system, such as fire rated walls, are prone to be overlooked in building repairs and modifications subsequent to the original construction. Management procedures designed to ensure the ongoing identification and integrity of these fire safety components need to be considered as an essential part of the use of the building.

In general, passive fire protection barriers require little routine maintenance. Active barriers, such as automatically closing fire doors, require a maintenance schedule that should include operational tests. Inspection to preserve the integrity of fire spread control features should be part of the requirements of a maintenance program. Documents should define the maintenance requirements and record the outcomes. It may be possible to ensure that this is done through the requirements for essential safety provisions for buildings that may apply in some jurisdictions.

Sub System D – Fire Detection Warning and Suppression

Fire detection, warning and suppression equipment ('active' fire protection measures) often use complex electronic components and therefore need particular attention in order to ensure that:

- they are properly installed during construction of the building
- commissioning confirms the performance assumed or required by the fire engineering evaluation
- management and use is in accordance with any requirements of the fire engineering evaluation
- maintenance is carried out in accordance with the relevant codes, standards, manufacturer's literature and specific maintenance requirements recommended by the fire engineer, it may be possible to ensure that this is done through the essential safety provisions that may apply in some jurisdictions

Sub System E – Occupant Evacuation and Control

The evacuation measures that contribute t’ a building's fire safety system comprises both physical measures (egress paths, fire corridors and exits, signage, etc.) and an emergency organization and procedures (emergency planning committee, emergency control organization, emergency procedures, evacuation plans, education and training, testing and maintaining).

These aspects should be addressed during the design and construction phase. The emergency procedures for new buildings should be developed by, or with input from, the fire engineering team.

For existing buildings, the existing emergency plan may need to be modified to reflect the assumptions and the recommendations of the fire engineering study. Again, this should be carried out by, or with input from, the fire engineer.

Comment: Evacuation procedures

Documented evacuation procedures should include the following:

- recommended procedures for the controlled evacuation of buildings, structures and workplaces during emergencies.
- guidelines on the appointment of an emergency planning committee and an emergency control organization.
- setting up of an emergency control organization, the preparation of emergency plans and procedures.
- the role and authority of emergency control organization personnel while executing their duties.
- an education and training programme.

The document should take into account fire engineering assumptions and particular recommendations of the fire engineering evaluation.

During commissioning both the physical provisions and the emergency organizational structure and emergency procedures need to be critically assessed: a cause / consequence analysis may be appropriate. This may result in some refinements to organization and procedures to better reflect the building as constructed.

Once a structure and procedures have been adopted, it becomes the responsibility of the building management to establish the emergency planning committee, emergency control organization, appointments, education and training programs, testing procedures, and to review and amend them as necessary.

Sub System F – Fire Services Intervention

There are some construction, commissioning, management, use and maintenance requirements directly related to fire service intervention. In particular, the design and maintenance of the following items is needed to facilitate effective fire services intervention:

- the egress and access paths and elevators that the fire service would use during intervention
- the fire protection measures that provide a safe environment for the fire service during intervention (e.g. structural stability, sprinklers, smoke management, emergency warning and intercommunications)
- all equipment that the fire service would utilize during intervention (for example, hydrants).

Routine Maintenance

Maintenance is another building management responsibility which includes the following:

- Maintenance of the physical measures. The building management should ensure, through regular checks that egress paths are kept clear of any obstructions, all doors operate as required and all signage is in good condition.
- Maintenance of the emergency organization and procedures. The building management should ensure that the organization meets at appropriate times, training sessions are carried out, evacuation exercises are carried out, emergency procedures are reviewed, tested and updated, all trained personnel positions are filled and records are kept.

It may be possible to ensure that the above measures are maintained through the essential safety provisions for buildings that may apply in some jurisdictions.

16 CONCLUSIONS / SUMMARY

The following conclusion can be drawn based on the results presented in Sections 7 to 14 within this report:

(1) The proposed spandrel on the ground level is to provide the level of fire spread protection that is equivalent or higher than that afforded by the DTS Solution.

(2) The building elements of the existing lower ground level and the proposed carparking portion on the ground level that have an FRL of 90/90/90 can withstand a total burnout of a fire, or the creditable worst flaming fire.

(3) The building elements of the proposed storage area on the ground level, which is fire separated from the adjacent area by fire resisting construction that has an FRL of 120/120/120, can withstand a total burnout of the subject storage area and adjacent area.

(4) Occupants from the proposed new units at the undercroft and the ground level are not expected to be trapped within the building due to the proposed variations in egress provisions.

(5) Occupants from the carparking areas on the ground level and level 1 are not expected to be trapped within the building due to due to the proposed variations in egress provisions.

(6) Occupants from the central fire-isolated stair are expected to be discharge into a safe area (the entry lobby) from which they can travel to a road or open space.

(7) Emergency services personnel is provided with the level of access to the new unit at the undercroft equivalent to that offered by the DTS Solution.

(8) Although non-provision of a SSISEP is proposed for areas under the proposed development, a level of fire and life safety for occupants in the repurposed area that is at least equivalent to that offered by the BCA 2016 DTS Solution.

(9) The location of the proposed external attack fire hydrant is unlikely to adversely affect the fire brigade intervention.

As a result of the study undertaken, it is considered that the proposed Performance Solutions for the subject building satisfies the relevant Performance Requirements of the BCA 2016, provided that:

- The assumptions and limitations specified in this report are fully satisfied;
- The fire safety measures that are required to support the Performance Solution as described in Section 5.3 of this report are fully implemented; and
- The standards of construction, commissioning, management in use, and maintenance described in Section 15 of this report are fully complied with.

ANNEXURE A

DESIGN DOCUMENTATION

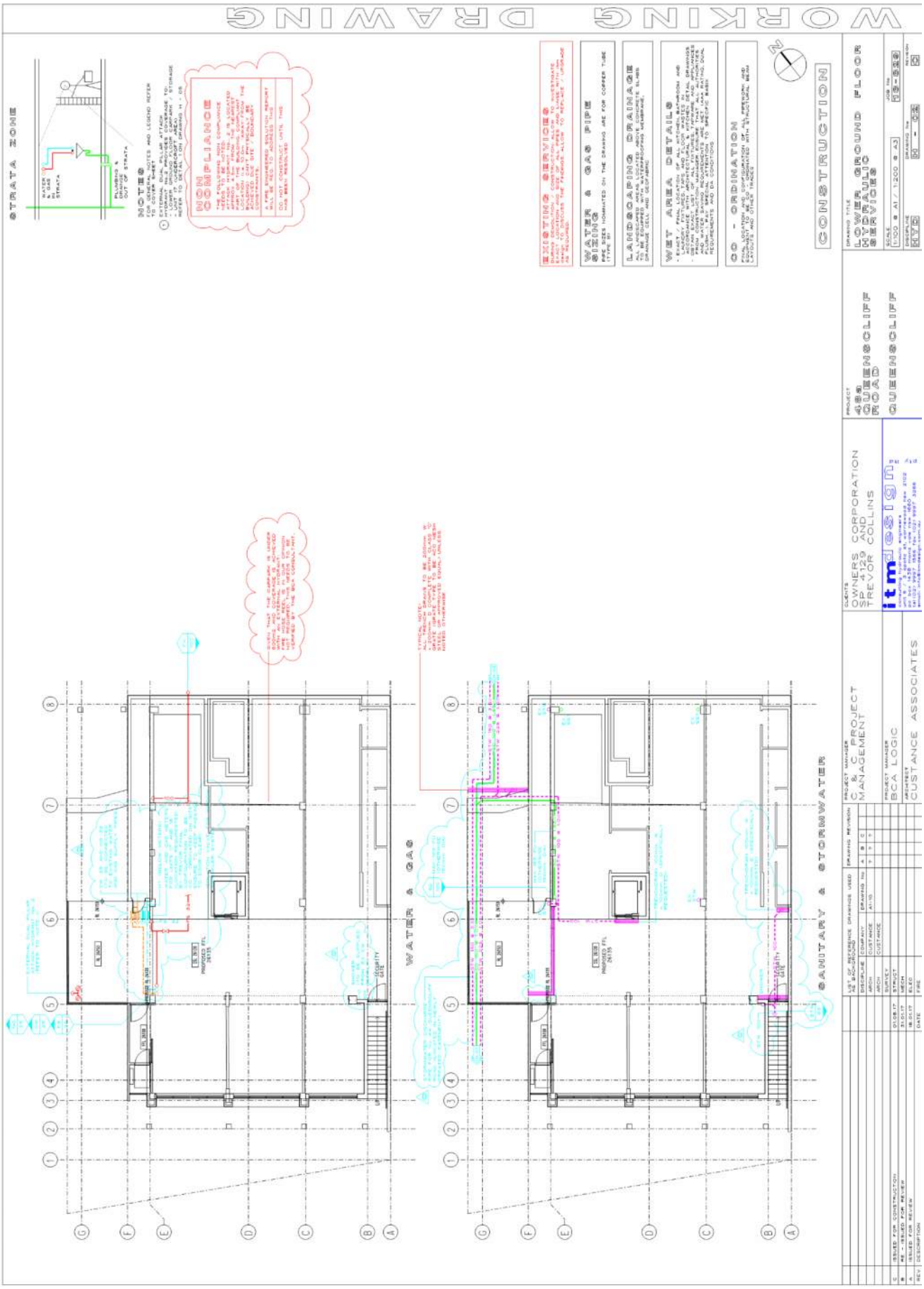
ANNEXURE A - DESIGN DOCUMENTATION

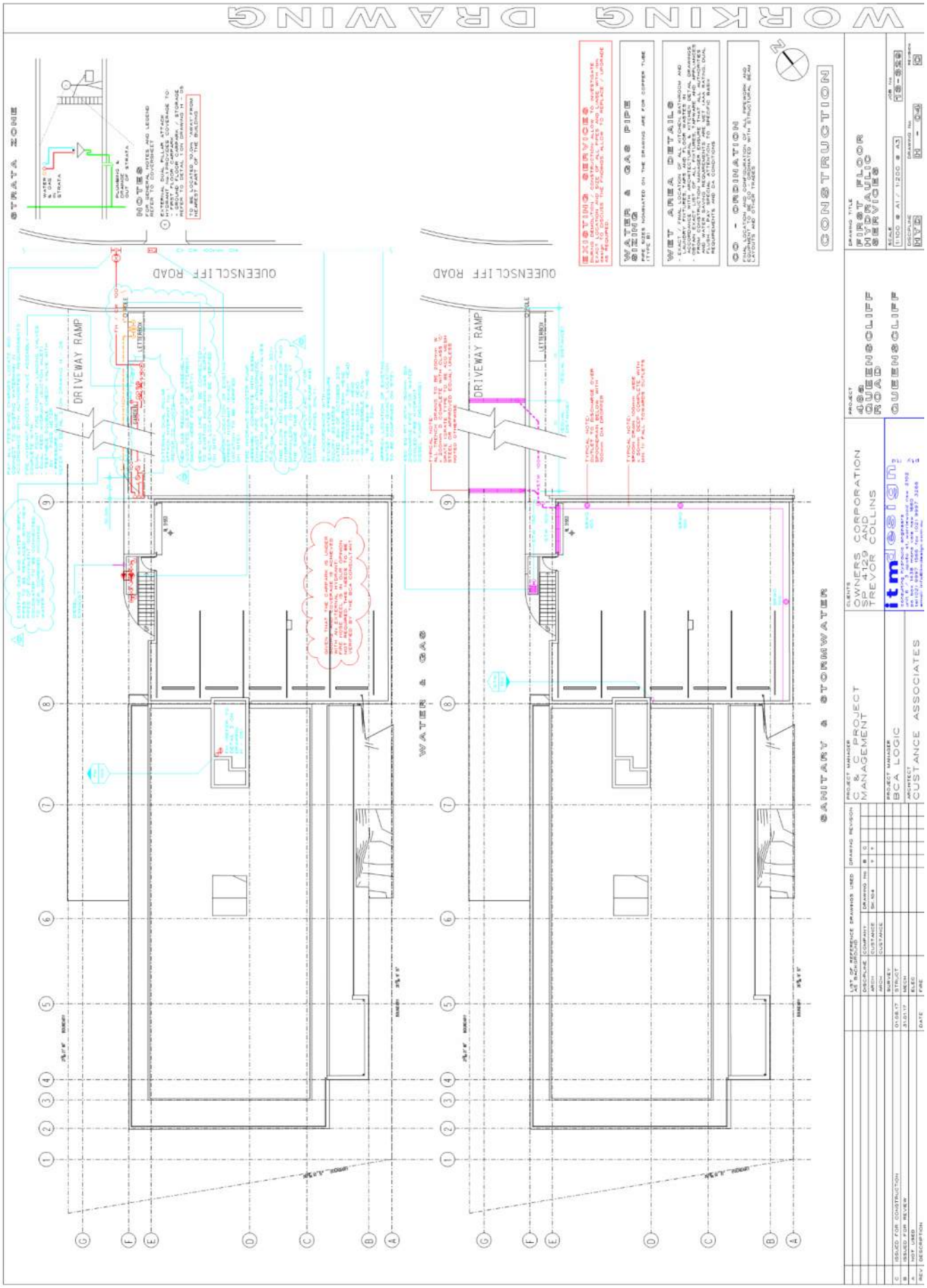
This report has been based on the following architectural design documentation outlined in the table below.

Architectural Plans Prepared by Custance Associate Australia Pty Ltd			
Drawing Number	**Revision**	**Title**	**Date**
A1.10	D	General Arrangement Plan Undercroft Level	29/08/2017
A1.11	D	General Arrangement Plan Lower Level	13/07/2017
A1.12	D	General Arrangement Plan Ground Level	29/08/2017
A1.13	C	General Arrangement Plan First Level	13/07/2017
A1.14	C	General Arrangement Plan Second Level	13/07/2017
A3.00	E	External Elevation 01	29/08/2017
A3.02	D	External Elevation 02	13/07/2017

The following initial fire hydrant system plans are attached in this report to indicate the locations of the proposed fire hydrant booster assembly and pump assembly.

Fire Hydrant System Plans Prepared by ITM Design Pty Ltd			
Drawing Number	**Revision**	**Title**	**Date**
H-02	C	Lower Ground level Hydraulic Services	01.08.17
H-04	C	First Floor Hydraulic Services	01.08.17


WORKING DRAWING
STRATA ZONE
NOTES
NON COMPLIANCE
EXISTING SERVICES
WATER & GAS PIPE SIZING
LANDSCAPING DRAINAGE
WET AREA DETAIL
CO - ORDINATION
CONSTRUCTION
LOWER GROUND FLOOR SERVICES
48a QUEENSCLIFF ROAD QUEENSCLIFF
OWNERS CORPORATION 48 & 48A QUEENSCLIFF ROAD
TREVOR COLLINS
itm design
PROJECT MANAGEMENT
BCA LOGIC
CUSTANCE ASSOCIATES
WATER & GAS
STORMWATER & SANITARY


WORKING DRAWING
STRATA ZONE
QUEENSCLIFF ROAD
DRIVEWAY RAMP
WATER & GAS
SANITARY & STORMWATER
CONSTRUCTION
WET AREA DETAIL
WATER & GAS PIPE
EXISTING SERVICES
48a QUEENSCLIFF ROAD QUEENSCLIFF
FOR DEVELOPMENT APPLICATION
CUSTANCE ASSOCIATES

ANNEXURE B

REFERENCES / GLOSSARY

ANNEXURE B – REFERENCES / GLOSSARY

B1: The following references have been considered in the preparation of this report:

- Australian Building Codes Board, International Fire Engineering Guidelines, Edition 2005,
- DiNenno, P. J. Editor, 2008, The SFPE Handbook of Fire Protection Engineering, 4th Edition, National Fire Protection Association, USA. In particular

Chapter 2 – 6: Purser, David A., Assessment of Hazards to Occupants from Smoke, Toxic Gases, and Heat

Chapter 3 – 11: Bryan, John L., Behavioural Response to Fire and Smoke

Chapter 3 – 12: Proulx, Guylene, Evacuation Time

Chapter 3 – 14: Ramachandran, G., Stochastic Models of Fire Growth

- Building Code of Australia 2016 version (BCA 2016).
- Drysdale, Dougal, An Introduction to Fire Dynamics, 2nd Edition, John Wiley & Sons, April 2000.
- Fire Brigade Intervention Model," Australasian Fire Authorities Council, 2004.
- Fire Code Reform Research Program Technical Report FCRC-TR 97-12 dated 12th February 1997.
- Guide to the BCA – Australian Building Codes Board, 2016
- Johnson, P., Gildersleeve, C., and Boverman, D., "Design Fires - How do We Know We Have Them Right?" Charting–he Course -- Proceedings of Society of Fire Safety 10th International Conference, 2009.
- M. Spearpoint, 'Fire Engineering Design Guide', Third Edition, New Zealand Centre for Advanced Engineering, University of Canterbury Campus, New Zealand, pp.225-227, 2008.
- Practice Note for Tenability Criteria in Building Fires,' Version 2.0, Society of Fire Safety NSW Chapter, Engineers Australia, 03.04.2014.

B2: The following glossary items are provided based on the definitions generally set out in the BCA and IFEG, and may or may not necessarily apply specifically to this particular project in this instance:

Assessment Method

A method used for determining that a Building Solution complies with the Performance Requirements.

Available Safe Evacuation Time (ASET)

The time between ignition of a fire and the onset of the defined untenable conditions in a specific part of the building.

Building Solution

A solution which complies with the Performance Requirements and is a:

a) Performance Solution, or

b) Deemed-to-Satisfy Solution; or

c) combination of (a) and (b)

Deemed-to-Satisfy Provisions

The prescriptive provisions of a code that are deemed to satisfy the Performance Requirements.

Deemed-to-Satisfy Solution

A method of satisfying the Deemed-to-Satisfy Provisions.

Design Fire

A mathematical representation of a fire that is characterised by the variation of heat output and species yield with time within a design fire scenario.

Design Fire Scenario

A specific fire scenario of which the sequence of events will be quantified and a fire safety engineering analysis will be conducted.

Deterministic Method

A methodology based on physical relationships derived from scientific theories and empirical results that for a given set of conditions will always produce the same outcome.

Engineering Judgement

Process exercised by a professional who is qualified because of training, experience and recognised skills to complement, supplement, accept or reject elements of a fire engineering analysis.

Evacuation

The process of occupants becoming aware of a fire-related emergency and going through a number of behavioural stages before and/or while they travel to reach a place of safety, internal or external, to their building.

Expert Judgement

The judgement of an expert who has the qualifications and experience to determine whether a Building Solution complies with the Performance Requirements.

Field model

Field models divide the volume to be simulated into a three dimensional grid of cells (control volumes). The field model then calculates changes in each control volume by using fundamental equations of fluid dynamics that consist generally of a set of three-dimensional, time dependant, non-linear partial differential equations, referred to as the Navier-Stokes equations. These equations express conservation of mass, momentum, and energy. The numerical process of solving the fundamental fluid dynamics equations with computers is commonly referred to as Computational Fluid Dynamics (CFD).

Fire

The process of unwanted combustion.

Fire Engineering Brief (FEB)

A documented process that defines the scope of work for the fire safety engineering analysis and the basis for fire engineering analysis as agreed by stakeholders.

Fire Engineering Report (FER)

A document which reports the results of the fire engineering analyses, arguments, calculations and modelling used to evaluate the trial design.

Fire Hazard

The danger in terms of potential harm and degree of exposure arising from the start and spread of fire and the smoke and gases that are thereby generated.

Fire Safety System

One or any combination of the methods used in a building to:

a) minimize the risk of accident ignition,

b) detect and warn people of an emergency,

c) provide for safe evacuation,

d) restrict the spread of fire, or

e) extinguish a fire.

It includes both active and passive systems.

Fire Scenario

The ignition, growth, spread, decay or burnout of a fire in a building as modified by the fire safety system of the building. A fire scenario is described by the times of occurrence of the events that comprise the fire scenario.

Flaming Fire

A fire involving the production of flames (including flashover fires).

Flashover

The rapid transition from a localised fire to the combustion of all exposed surfaces within a room or compartment.

Fuel Load

The quantity of combustible material within a room or compartment measured in terms of calorific value.

Hazard

The outcome of a particular set of circumstances that has the potential to give rise to unwanted consequences.

Performance Requirement

A requirement which states the level of performance which a Building Solution must meet.

Performance Solution (Alternative Solution)

A method of complying with the Performance Requirements other than by a Deemed-to-Satisfy Solution.

Place of Safety

A place within a building or within the vicinity of a building, from which people may disperse after escaping the effects of a fire. It may be an open space (such as an open court) or a public space (such as a foyer or roadway).

Qualitative Analysis

Analysis that involves a non-numerical and conceptual evaluation of the identified processes.

Quantitative Analysis

Analysis that involves numerical evaluation of the identified processes.

Rate of Heat Release (RHR)

The rate at which heat energy is released by a fire.

Required Safe Evacuation Time (RSET)

The time required for safe evacuation of occupants to a place of safety.

Response Time

The time it takes for occupants to respond to an alarm or cues and decide to evacuate the building.

Risk

Product of the probability of a hazardous event occurring and its consequences.

Sensitivity Analysis

A guide to the level of accuracy and/or criticality of individual parameters determined by investigating the response of the output parameters to changes in these individual parameters.

Smoke

The airborne solid and liquid particles and gases evolved when a material undergoes pyrolysis or combustion, together with the quantity of air that is entrained or otherwise mixed into the mass.

Smouldering Fire

The solid phase combustion of a material without flames but with smoke and heat production.

Sterile

An environment with no combustible furnishings other than wall/ceiling or floor linings (i.e. no couches, etc.); the Group Number of wall/ceiling linings and the critical radiant flux of floor linings fully comply with the BCA requirements.

Sub-System

A part of a fire safety system that comprises fire safety measures to protect against a particular hazard (e.g. smoke spread). Note: The IFEG arbitrarily defines six sub-systems.

To The Degree Necessary

Consideration of all the criteria referred to in the Performance Requirement to determine the outcome appropriate to the circumstances, whereby in certain situations it may not be necessary to incorporate any specific measures to meet the Performance Requirement.

Trial Design

A fire safety design that is to be assessed using fire engineering techniques.

Untenable Conditions

Environmental conditions associated with a fire in which human lives are threatened.

Zone Model

Zone models divide the enclosures to be simulated into several distinct zones or regions of consistent fire behaviour. The number of zones may be as few as one but typically there could be four or five. The possible zones in the enclosure of fire origin might be the flaming combustion zone, the rising thermal plume above the combustion zone, the hot gas layer accumulated under the ceiling, and the lower cold layer of air. Within these zones, experimentally based empirical expressions are used to describe the physical behaviour of the fire. The interaction between zones is carried out in such a way as to maintain the observance of fundamental conservation principles in classical physics.

ANNEXURE C

FIRE SEVERITY CALCULATIONS

C1: Introduction

A fire severity analysis has been carried out for the carpark portions and storage areas on ground, lower ground and undercroft using the Eurocode method. A commercial spreadsheet was used to calculate the equivalent times of exposure for the subject areas, with the key areas and measurements shown in the following figures.

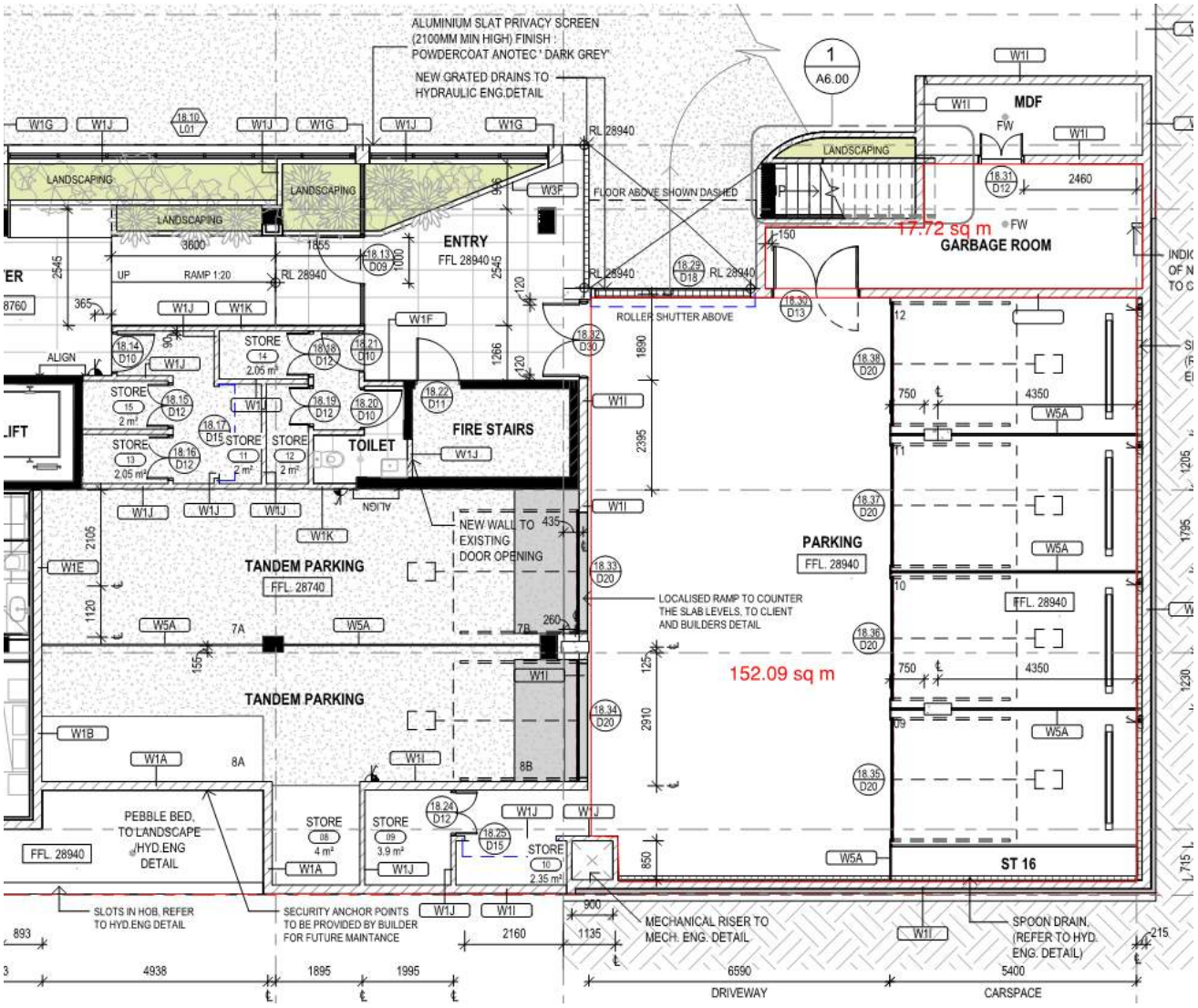


Figure 25: Ground level

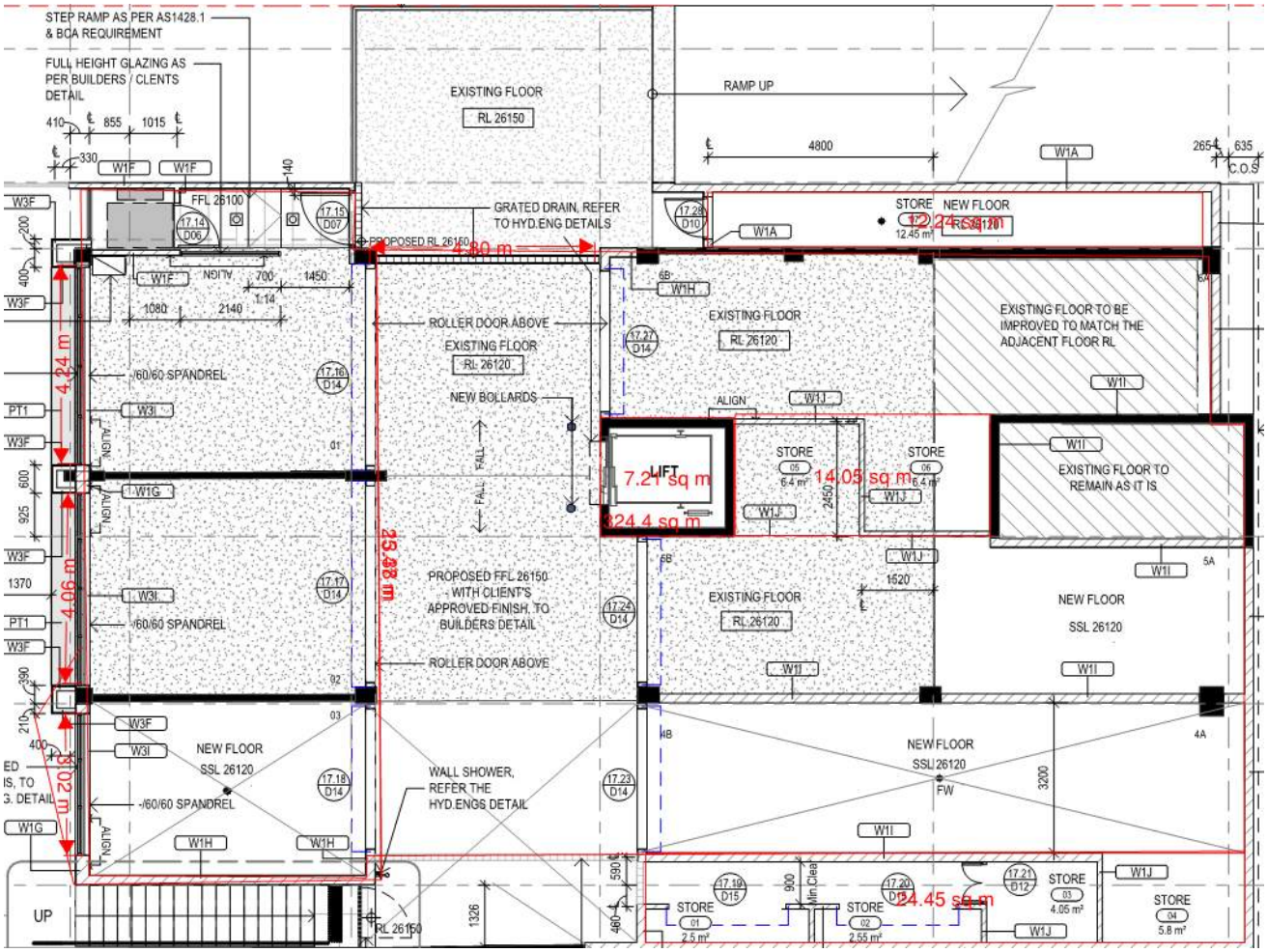


Figure 26: Lower ground level

C2: Calculation formulas and parameters

The equivalent time of standard fire exposure, t_e (minutes), is defined in the Eurocode as:

$t_e = q_f \times k_b \times w_f \times k_c$

where

q_f is the design fire load density (MJ/m²)

k_b is the conversion factor (min.m²/MJ)

w_f is the ventilation factor

k_c is the correction factor function

The value of k_b is 0.07 min.m²/MJ has been adopted, based on the thermal property b = $\sqrt{(\rho c \lambda)}$ of the carpark enclosures being of 1678 J/s$^{0.5}$m²K, considering modification recommended by Kirby et al for large spaces [6].

6 Kirby, B.R. et al, "Natural fires in large scale compartments," International Journal on Engineering Performance Based Fire Codes, Vol. 1(2), pp. 43-58, 1999.

Table 6: Conversion factor kb depending on the thermal properties of the enclosure

$b = \sqrt{(\rho c \lambda)}$ (J/m²s½K)	K_b (min.m²/MJ)	K_b (min.m²/MJ) in large compartments [Error! Bookmark not defined.]
b > 2500	0.04	0.05
720 ≤ b ≤ 2500	0.055	0.07
b < 720	0.07	0.09

The ventilator factor w_f is calculated as:

$$w_f = \left(\frac{6.0}{H}\right)^{0.3}\left[\frac{0.62 + 90(0.4 - \alpha_v)^4}{(1 + b_v\alpha_h)}\right] \geq 0.5$$

where

H is the height of the fire compartment (m)

$\alpha_v = A_v/A_f$ is the area of vertical openings in the façade (A_v) related to the floor area of the compartment (A_f), and $0.025 \leq \alpha_v \leq 0.25$.

$\alpha_h = A_h/A_f$ is the area of horizontal openings in the roof (A_h) related to the floor area of the compartment (A_f).

$b_v = 12.5\ (1 + 10\alpha_v - \alpha_v^2) \geq 10.0$

For small fire compartments ($A_f < 100m^2$) without roof openings, the factor w_f may also be calculated as:

$w_f = O^{½} \times A_f / A_t$

where

O is the opening factor according to annex A of the Eurocode.

In a fully developed fire, the enclosure temperature is expected to be in the range of 1,000°C. A series of full-scale experiments on crack and fallout of toughened glass (7) indicates that in an enclosure fire where the glass pane is partly exposed to an upper hot smoke layer and partly to a lower cool air layer, the 6 mm glass panes broke and fell out when the temperature difference at the glazing edge exposed to fire was about 330-380°C. Assuming an ambient temperature of 20°C at the time of the experiment, the exposed glass surface temperature at breakage would be about 350-400°C. The aluminium louvres likely have a melting point of approximately 660°C. It is conservatively assumed that the open area of the openings covered by louvres remains 50% in a fire.

The building materials for the ceiling, walls and flooring of the carpark areas are generally concrete. Based on a simplified geometry of the carpark portions, the thermal inertia of each of the six surfaces of the carpark portions can be estimated as 1678 J/s$^{0.5}$m²K.

Fire loads were determined as follows:

- With respect to fire load density for carpark, Table 3.4.1a in the International Fire Engineering Guidelines (IFEG 2005) reports an average value of 200 MJ/m². Section 3.4.1 in (IFEG 2005) states that for well-defined occupancies that are rather similar or with very limited differences in furniture

The fire load density for the residential store rooms was considered to be 1300 MJ/m², which is twice of the value of the average fire load density of 650 MJ/m² for store rooms of apartment houses, provided in the FCRC Project 3 report (1). The subject storage areas

The calorific value of the fuel was determined by assuming 50% of the fuel by mass was cellulosic (assumed to be timber; 18 MJ/kg) and 50% of the fuel by mass was synthetic (assumed to be polyurethane foam; 28.5 MJ/kg (2)), which gave a mass weighted value of 23.3 MJ/kg.

1 → ABCB, 1999, FCRC Project 3 Fire Resistance and Non-Combustibility Report – Part 2.
2 → Averaged value in Table A.31, Appendix A, M.J. Hurley (Editor-in-Chief), The SFPE Handbook of Fire Protection Engineering, 5th Edition, Society of Fire Protection Engineers, Springer New York, 2016.

7 Q.Y. Xie et al, "Full-scale experimental study on crack and fallout of toughened glass with different thicknesses," Fire and Materials, Vol.32, pp. 293-306, 2008.

and stored goods, the 90% fractile value should be 1.35 to 1.65, and therefore, 1.65 x 200 = 330 MJ/m² will be used in the calculations.

C3: Results

Project No.: 107347 - 48a Queenscliff Road, Queenscliff - lower ground floor carpark portion

Fire Severity Analysis (Eurocode 1 Annex F Method)				te = qfd x kb x wf x kc						
te =	qfd	×	kb	×	wf	×	kc	=	70.6	minutes
	design fire load density		conversion factor		ventilation factor		correction factor for material			
qfd =	467.7840909	MJ/m²			qfd Fuel load based on 330MJ for car parking and 1300MJ for storage areas within the LG compartment.					
kb =	0.07	min.m²/MJ			kb = 0.07 if no detailed assessment of enclosure thermal properties;					
					kb = 0.04 if b > 2,500; kb = 0.055 if 720 ≤ b ≤ 2,500; kb = 0.07 if b < 720.				b = (k*rho*c)^0.5	
					kb = 0.05 if b > 2,500; kb = 0.07 if 720 ≤ b ≤ 2,500; kb = 0.09 if b < 720, for large spaces > 23 x 5.5 x2.7m high.					
H, height of compartment =			2.74	m						
Av, area of vert openings in façade =			24.2	m²						
Af, floor area of compartment =			352	m²						
Ah, area of hori openings in roof =			0	m²						
Alpha_v, = Av / Af			0.069							
Alpha_h, = Ah / Af =			0.000							
bv = 12.5(1 + 10 Alpha_v - Alpha_v²) =			21.0		If bv ≥ 10, then OK.					
wf = (6/H)^0.3[0.62 + 90(0.4 - Alpha_v)^4/(1 + bv*Alpha_h)] =				2.16	If wf ≥ 0.5 for large fire compartment, i.e. Af > 100m², then OK.					
wf = O^0.5 x Af / At =				0.02	for small fire comaprtment, i.e. Af < 100m², and 0.02 ≤ O ≤ 0.2.					
O = Av * h_{eq}^0.5/At, where h_{eq} is weighted average of window heights on walls and At is total area of enclosure including openings =									0.0157	
kc =	1.0		kc = 1.0 for reinforced concrete and protected steel, kc = 13.7 x O for non-protected steel							

Ventilation for the lower ground floor garage is achieved via permanent openings.

Project No.: 107347 - 48a Queenscliff Road, Queenscliff - ground floor carparking

Fire Severity Analysis (Eurocode 1 Annex F Method)				te = qfd x kb x wf x kc						
te =	qfd	×	kb	×	wf	×	kc	=	81.2	minutes
	design fire load density		conversion factor		ventilation factor		correction factor for material			
qfd =	432.7058824	MJ/m²			qfd Fuel load based on 330MJ for car parking and 1300MJ for storage areas within the LG compartment.					
kb =	0.07	min.m²/MJ			kb = 0.07 if no detailed assessment of enclosure thermal properties;					
					kb = 0.04 if b > 2,500; kb = 0.055 if 720 ≤ b ≤ 2,500; kb = 0.07 if b < 720.				b = (k*rho*c)^0.5	
					kb = 0.05 if b > 2,500; kb = 0.07 if 720 ≤ b ≤ 2,500; kb = 0.09 if b < 720, for large spaces > 23 x 5.5 x2.7m high.					
H, height of compartment =			2.35	m						
Av, area of vert openings in façade =			7.92	m²						
Af, floor area of compartment =			170	m²						
Ah, area of hori openings in roof =			0	m²						
Alpha_v, = Av / Af			0.047							
Alpha_h, = Ah / Af =			0.000							
bv = 12.5(1 + 10 Alpha_v - Alpha_v²) =			18.3		If bv ≥ 10, then OK.					
wf = (6/H)^0.3[0.62 + 90(0.4 - Alpha_v)^4/(1 + bv*Alpha_h)] =				2.68	If wf ≥ 0.5 for large fire compartment, i.e. Af > 100m², then OK.					
wf = O^0.5 x Af / At =				0.01	for small fire comaprtment, i.e. Af < 100m², and 0.02 ≤ O ≤ 0.2.					
O = Av * h_{eq}^0.5/At, where h_{eq} is weighted average of window heights on walls and At is total area of enclosure including openings =									0.0051	
kc =	1.0		kc = 1.0 for reinforced concrete and protected steel, kc = 13.7 x O for non-protected steel							

Ventilation for the ground floor garage is achieved via vehicle access door.
The door is not fire rated and therfeore is expected to fail open in the event of a fully involved fire.

Project No.: 107347 - 48a Queenscliff Road, Queenscliff - Ground floor storage

Fire Severity Analysis (Eurocode 1 Annex F Method) te = qfd x kb x wf x kc

te =	qfd	×	kb	×	wf	×	kc	=	95.6	minutes
	design fire load density		conversion factor		ventilation factor		correction factor for material			

qfd = 1300 MJ/m²

kb = 0.07 min.m²/MJ

kb = 0.07 if no detailed assessment of enclosure thermal properties;
kb = 0.04 if b > 2,500; kb = 0.055 if 720 ≤ b ≤ 2,500; kb = 0.07 if b < 720. b = (k*rho*c)^0.5
kb = 0.05 if b > 2,500; kb = 0.07 if 720 ≤ b ≤ 2,500; kb = 0.09 if b < 720, for large spaces > 23 x 5.5 x2.7m high.

H, height of compartment =	2.74	m
Av, area of vert openings in façade =	1.8	m²
Af, floor area of compartment =	10	m²
Ah, area of hori openings in roof =	0	m²
Alpha_v, = Av / Af	0.180	
Alpha_h, = Ah / Af =	0.000	
bv = 12.5(1 + 10 Alpha_v - Alpha_v²) =	34.6	If bv ≥ 10, then OK.
wf = (6/H)^0.3[0.62 + 90(0.4 - Alpha_v)^4/(1 + bv*Alpha_h)] =	1.05	If wf ≥ 0.5 for large fire compartment, i.e. Af > 100m², then OK.
wf = O^0.5 x Af / At =	0	for small fire comaprtment, i.e. Af < 100m², and 0.02 ≤ O ≤ 0.2.

O = Av * h_{eq}^0.5/At, where h_{eq} is weighted average of window heights on walls and At is total area of enclosure including openings = 0.0012

kc = 1.0 kc = 1.0 for reinforced concrete and protected steel, kc = 13.7 x O for non-protected steel

The G storage is expected to be air-tighted and a fire is likey to be choked.
This calculation is for the scenario that the fire door fails to be closed in the event of a fire.

ANNEXURE D

No longer used

ANNEXURE E

STAKEHOLDER CORREPSONDENCE

BCA LOGIC
Building Regulation, BCA, Fire, Access and Energy Consultants

Level 1, 71-73 Archer Street, Chatswood NSW 2067
All Correspondence to: PO Box 1580, Chatswood NSW 2057
BCA Logic ABN: 29 077 183 192 | Unit Trust ABN: 96 402 469 940
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24 March 2016

Architectural Projects Pty Ltd
The Foundry,
Suite 1, 181 Lawson Street,
DARLINGTON NSW 2008

Attn: Jennifer Hill

Dear Jennifer,

Re: 48a Queenscliff Avenue, Queenscliff
Effective Height Discussion

Reference is made to our recent discussions and engagement by the Owners Corporation to provide advice on the issue of the Effective Height of the existing building taking into consideration the current BCA2015 definition as well as the proposed new definition coming into force on 1st May 2016.

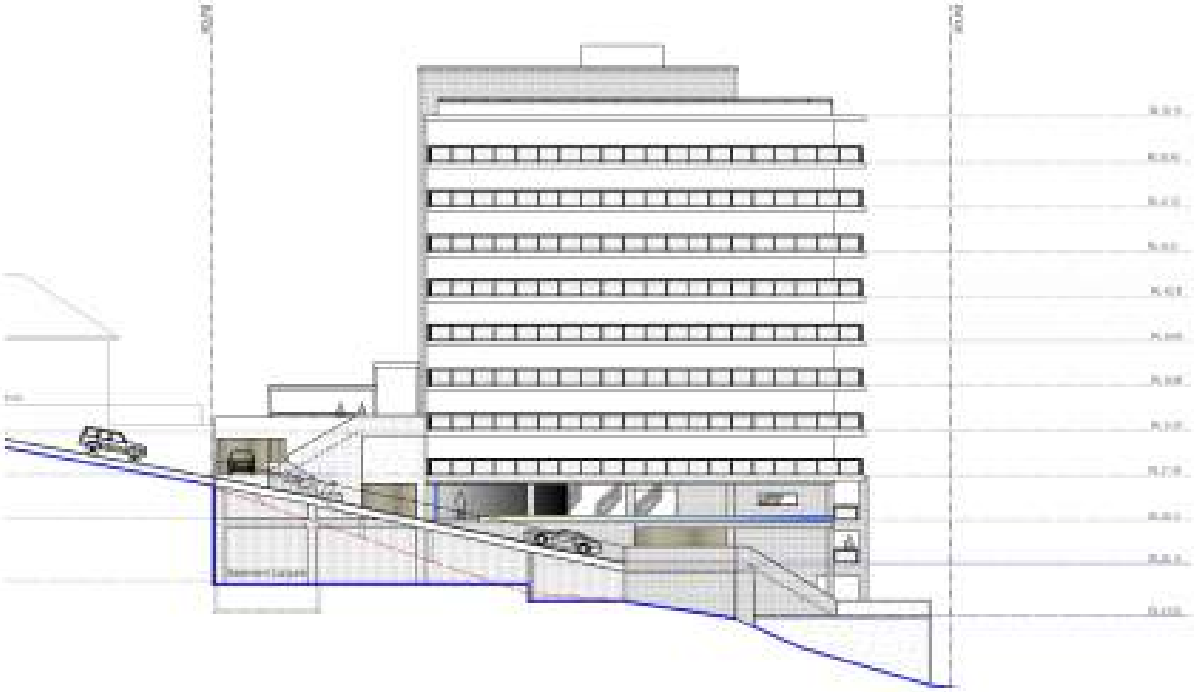
The current Effective Height Definition under BCA2015 (which has not changed since circa 1993) states as follows:

> *Effective height means the height to the floor of the topmost storey (excluding the topmost storey if it contains only heating, ventilating, lift or other equipment, water tanks or similar service units) from the floor of the lowest storey providing direct egress to a road or open space.*

In assessing the existing building against this definition as has been assessed in the past on this project, the following comments were made in BCA Audit and Upgrade Report dated 1 September 2009 which was at the time of the Warringah Council's Fire Order formally accepted:

> *Based on measurements made on-site, the floor to floor height is estimated at being (on average) 2.7m. A strict or literal interpretation of the definition of effective height (BCA Clause A1.1) would designate the Basement level as the 'lowest storey providing direct egress to a road or open space', and accordingly the building would have an effective height of 27m.*
>
> *However, there is no direct access to or egress from the Basement Level from/to within the building, such being available only via vehicle and either the non-pedestrian graded vehicular ramp way on the western side, or via an external stairway on the eastern side, the latter normally being accessed from*
>
> *the open carpark portion of the Ground Floor, although it is noted that at the moment this has been partitioned off.*
>
> *Furthermore, the very nature of this site and the absence of either a driveway or any suitable flat hardstand area within but not closer than 10m from the building, that could support a Fire Brigade appliance, means that Fire Brigade access to this building using ladder based appliances etc. is simply not feasible. Access by the Brigade can therefore only be achieved by foot down the driveway and in via the fire isolated stairway at the northern or property entry end of the building i.e. at Ground Floor level, in which case the effective height from this level is (approximately) 24.3m and therefore less than 25m.*
>
> *Even if vehicular access could be achieved down to the northern end of the building, access by the Brigade into the main part of the tower would be separate from that to the Basement Level and achieved from a point on or about the Ground Floor level.*

Accordingly, it is considered that a basis exists for this existing building to be assessed as similar or equal to a building with an effective height less than 25m.



At the time – correspondence was issued by NBSW Fire & Rescue dated 19 October 2010 that stated:

The NSWFB has no objection to the Fire Safety Upgrade Strategy detailed in the abovementioned Fire Safety Report being implemented provided the following comments are addressed:

1. In this instance the NSWFB does not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report.

As such historically this particular building has been treated as equating to a Building with an Effective Height of less than 25m

However, since that time – whilst the Effective Height definition has not changed in the BCA - there have been a number of recent Court Cases and Fire incidents that have altered the interpretation of the Effective Height Definition.

In a recent court case "*The Owners – Strata Plan No 69312 v Rockdale City Council*", the judgment determined that the lowest level providing egress does not necessarily have to simply result in required pedestrian egress and could also involve vehicular egress and the like. Thus irrespective of where the egress to the street occurs – if such egress required or non-required is available at a lower level and then occupants have to walk up through a site via non-compliant gradients – the lowest level is still considered.

Due to the judgement of this particular court case as well as direction and opinions given by other Authorities, the interpretation currently by building practitioners is taken extremely conservatively and is based on the lowest level in a building where any egress to open space is available – not just required pedestrian egress.

To provide some clarity on this issue – the new definition in the BCA2016 version due to be implemented on 1st May 2016 states as follows:

> *Effective height*
> *Is a measure of the height of a building. It is used to determine when various provisions are required to be implemented and when certain concessions cannot apply.*
> *Effective height is the vertical distance between:*
> • *the floor level of the topmost storey in the building (excluding a storey which only contains equipment as listed); and*
> • *the floor level of the lowest storey which is included in a determination of rise in storeys (see C1.2).*

Thus based on the BCA2016 definition – the effective height of the subject building would be measured from RL23.0 to RL 53.18 which results in an effective height of 30.18.

Hoping the above affords some clarity to the Effective Height definition when applied to this particular building.

There are separate issues that also need to be taken into consideration when alterations and additions are carried out to existing buildings under Clauses 93 and 94 of the EP & A Regulations as well as under Clause 143 of the EP & A Regulations 2000 in so far as existing buildings do not necessarily have to be upgraded to meet the current BCA standards provided the level of occupant fire and life safety is not reduced to that which exists onsite already. This assessment under Clause 143 of the EP & A Regulations 2000 is made by the Accredited Certifying Authority engaged to issue the Construction Certificate for the proposed alterations and additions.

If you require any further information or explanation of the above, please do not hesitate to contact the undersigned.

Yours faithfully,

Stuart Boyce
Director
BCA Logic Pty Ltd

Fri 20/07/2018 4:44 PM

Gary Rafferty <grafferty@viclilli.com.au>

RE: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

To Wallace Zhong; Kate Gassmann; Stuart Boyce

Cc 'Trevor Collins'; MC Hui; markus@itmdesign.com.au

You replied to this message on 20/07/2018 7:14 PM.

Message 48a Queenscliff Road Hydraulics for Tender.zip (6 MB)

All,

As long as the new works has compliant hydrant coverage we are satisfied that no new alternative solution would be required.

As the existing building was part of a previous upgrade from Council and related to the existing building not having compliant hydrant coverage, we consider the matter satisfied.

I have contacted Markus at ITM and left a message, to confirm that the new works achieve compliant hydrant coverage, once this is confirmed then the FER should be released.

Hope this clarify' s a few things.

Regards,

Gary Rafferty
A1 Building Certifier
NSW, VIC, QLD

VIC LILLI & PARTNERS
| Vic Lilli & Partners | A.B.N. 60 119 432 094 | t 9715 2555 | m 0409 301 061 | f 9715 2333
| Suite 7, Level 2, 1-17 Elsie Street Burwood NSW 2134 | grafferty@viclilli.com.au

Wed 4/07/2018 9:39 AM

Gary Rafferty <grafferty@viclilli.com.au>

RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

To Wallace Zhong; Kate Gassmann; 'Peter Gardner'

Cc Stuart Boyce; 'Trevor Collins'; MC Hui

Hi Wallace,
As per our conversation as no works proposed on Lower Ground floor and no upgrade order has been issued by Council this will not require assessing in the FER.

Regards,

Gary Rafferty
A1 Building Certifier
NSW, VIC, QLD

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| Suite 7, Level 2, 1-17 Elsie Street Burwood NSW 2134 | grafferty@viclilli.com.au

To Kate Gassmann; 'Peter Gardner'; Wallace Zhong

Cc Stuart Boyce; 'Trevor Collins'; MC Hui

Kate/Wallace,

See VLP comments in **Green below.**

Regards,

Gary Rafferty
A1 Building Certifier
NSW, VIC, QLD

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| Vic Lilli & Partners | A.B.N. 60 119 432 094 | t 9715 2555 | m 0409 301 061 | f 9715 2333
| Suite 7, Level 2, 1-17 Elsie Street Burwood NSW 2134 | grafferty@viclilli.com.au

From: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Sent: Friday, 29 June 2018 11:58 AM
To: 'Peter Gardner' <peterg@pg-a.com.au>; 'Wallace Zhong' <wzhong@bcalogic.com.au>; Gary Rafferty <GRafferty@viclilli.com.au>
Cc: 'Stuart Boyce' <sboyce@bcalogic.com.au>; 'Trevor Collins' <trevor@foreshores.com>; 'MC Hui' <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic
Importance: High

Thanks Peter.

Hi Gary – are you able to comment on Wallace's questions in purple in the email from 22nd June below please?

Kind Regards,

Kate Gassmann

Director

C&C PROJECT MANAGEMENT

P. (+61) 0400 254 091
E. kate.gassmann@ccprojectmanagement.com
w. www.ccprojectmanagement.com

From: Peter Gardner <peterg@pg-a.com.au>
Sent: Thursday, 28 June 2018 8:10 AM
To: 'Kate Gassmann' <kate.gassmann@ccprojectmanagement.com>; 'Wallace Zhong' <wzhong@bcalogic.com.au>
Cc: 'Stuart Boyce' <sboyce@bcalogic.com.au>; 'Trevor Collins' <trevor@foreshores.com>; 'MC Hui' <mhui@bcalogic.com.au>; 'Gary Rafferty' <grafferty@viclilli.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

↑ Next ↓ Previou

Kate / Wallace

In relation to the roller door, my FEBQ comment was that this Performance Solution should also address the ground level carpark roller door which is not protected in accordance with Clause D1.7(c) of the BCA.

Regards

Peter Gardner
PGA Pty Ltd
+61 (0)435 184 053
peterg@pg-a.com.au

From: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Sent: Wednesday, 27 June 2018 3:58 PM
To: 'Wallace Zhong' <wzhong@bcalogic.com.au>; 'Gary Rafferty' <grafferty@viclilli.com.au>; peterg@pg-a.com.au
Cc: 'Stuart Boyce' <sboyce@bcalogic.com.au>; 'Trevor Collins' <trevor@foreshores.com>; 'MC Hui' <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Dear Peter and Gary – appreciate your response ASAP to Wallace's purple comments (below in email of 22nd June). Let me know if you need a meeting?

Kind Regards,

Kate Gassmann

Director

C&C PROJECT MANAGEMENT

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E. kate.gassmann@ccprojectmanagement.com
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From: Wallace Zhong <wzhong@bcalogic.com.au>
Sent: Wednesday, 27 June 2018 3:24 PM
To: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>; 'Gary Rafferty' <grafferty@viclilli.com.au>; peterg@pg-a.com.au
Cc: Stuart Boyce <sboyce@bcalogic.com.au>; 'Trevor Collins' <trevor@foreshores.com>; MC Hui <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Dear Kate, Gary and Peter,

We are trying to understand the required changes of the FER based on the new comments.

My questions are in purple in my email dated 2 June 2018 below. Could you please provide answers so that I can update the FER accordingly?

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
Wallace Zhong
Fire Safety Engineer

(D) 8484 4039 | (T) 9411 5360 | (M) 0416 072 618 | (F) 9411 5420
(E) wzhong@bcalogic.com.au | (W) www.bcalogic.com.au
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PO Box Q1440, Queen Victoria Building NSW 1230

From: Gary Rafferty <grafferty@viclilli.com.au>
Sent: Tuesday, 26 June 2018 9:17 AM
To: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>; 'Stuart Boyce' <sboyce@bcalogic.com.au>; 'Wallace Zhong' <wzhong@bcalogic.com.au>
Cc: peterg@pg-a.com.au; 'Trevor Collins' <trevor@foreshores.com>; 'MC Hui' <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Kate,
See VLP Comments in orange below for point 4

Regards,

Gary Rafferty
A1 Building Certifier
NSW, VIC, QLD

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| Suite 7, Level 2, 1-17 Elsie Street Burwood NSW 2134 | grafferty@viclilli.com.au

From: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Sent: Monday, 25 June 2018 10:10 AM
To: 'Stuart Boyce' <sboyce@bcalogic.com.au>; 'Wallace Zhong' <wzhong@bcalogic.com.au>; Gary Rafferty <GRafferty@viclilli.com.au>
Cc: peterg@pg-a.com.au; 'Trevor Collins' <trevor@foreshores.com>; 'MC Hui' <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Dear Wallace, Gary and Peter,

Please see comments below. Stuart Boyce's comments are in Red and mine in Black.

Gary – Can you please comment on point number 4?

Appreciate a quick response as our builder is charging us holding fees from Wednesday onwards.

Kind Regards,

Kate Gassmann

Director

C&C PROJECT MANAGEMENT

From: Wallace Zhong
Sent: Friday, 22 June 2018 6:07 PM
To: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Cc: peterg@pg-a.com.au; Trevor Collins <trevor@foreshores.com>; MC Hui <mhui@bcalogic.com.au>; Stuart Boyce <sboyce@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Hi Kate,

Please find the attached updated FEBQ. Please provide the following information to Peter, which is required by his FEBQ comments, since I do not have such information and MC is away.

1. The new effective height that is to be measured form the floor of the undercroft unit to the floor of the topmost storey according to the following: The effective height is accepted as being in excess of 25m – hence the reason for inclusion of the issues in the FER. The actual works though are in a portion of the building that is beneath the 25m height plane

> **Effective height** means the vertical distance between the floor of the lowest *storey* included in the calculation of *rise in storeys* and the floor of the topmost *storey* (excluding the topmost *storey* if it contains only heating, ventilating, lift or other equipment, water tanks or similar service units).

2. The gradient of the existing external ramp from Queenscliff Road to the subject building. Irrespective of the gradient of the existing ramp our commentary will simply be the occupants to the area of new works will be utilising the egress to the footpath as per current onsite situation. We will to be justifying a steeper ramp than 1:8 is acceptable buy merely occupants will utilise the existing ramp system to the street which is no worse than currently exists on site and occupants can get away from a building fire.

3. Drawings indicating the locations of the hydrant booster assembly, the fire pumps and the fire control centre.
[KG] *attached are:*

   a. *the hydraulic engineer drawings showing:*
      i. *the 2 attack hydrants – one on the lower ground and one on the southern section of the driveway ramp,*
      ii. *the booster pump on the southern section of the driveway ramp and*
      iii. *the booster valve assembly at the street level (next to letterbox)*
   b. *The architectural drawings showing more accurately the placement of the:*
      i. *the booster pump on the southern section of the driveway ramp and*
      ii. *the booster valve assembly at the street level (next to letterbox)*

4. Confirmation by the certifying authority whether the followings meet the BCA DTS provisions:
   - fire hydrant system not incorporating a tank, pumps and a ring main
   - SSISEP - Technically as the building is above 25m in height then the new works undertaken should include for the installation of SSISEP, or the non-installation be addressed through an alternative solution.

     BCA Logic: This is a new Performance Solution that we will add it to the FER. **Could Gary please confirm whether we need to consult FRNSW?**
     VLP are happy to accept the new alt sol being placed in the updated FER which we will lodge with a Clause 144 lodgement. The FER should be accompanied by a consistency letter from BCA Logic which highlights any new alternative solutions from the FEBQ to FER.

   - emergency lifts – The non-compliance has been detailed in the FER alternative solution 7.
   - stair pressurisation systems – As the building now has an effective greater than 25m and the building any fire isolated stairway serving a storey above 25m in effective height, should be provided with stair pressurisation or the non-installation addressed through an alternative solution.

     BCA Logic: Sorry I have asked Gary a wrong question. The stair pressurisation system was not mentioned in Peter FEBQ comments. It is understood that the levels to be affected by the proposed development are the undercroft, the lower ground level and the ground level. The undercroft has its own open stairway; whilst both the lower ground level and the ground level have direct access to open space. **Could Gary please confirm whether the fire-isolated stairway is affected by the proposed development or not? Do we need a Performance Solution for the non-provision of a stairway pressurisation system to the fire-isolated stairway or not? Do we need to consult FRNSW? As the works affected by the proposed development are in the undercroft and as the undercroft has its own open stairway, and the lower ground and the ground level have direct egress to open space we do not believe that this is required be addressed with the FER.**

- fire control centre – A fire control centre should be provided as per page 103 of the fire engineering report.
- hydrant booster assembly and pumps – Compliance with BCA DTS Provisions & Australian Standards to be provided to the fire engineer by the hydraulic consultant.
- the entry roller shutter of the carpark on the ground floor – Roller shutter requirements are detailed on page 8 of the FER (shown below) – The FER pages 8 & 9 and figure 25 details fire shutter requirements.

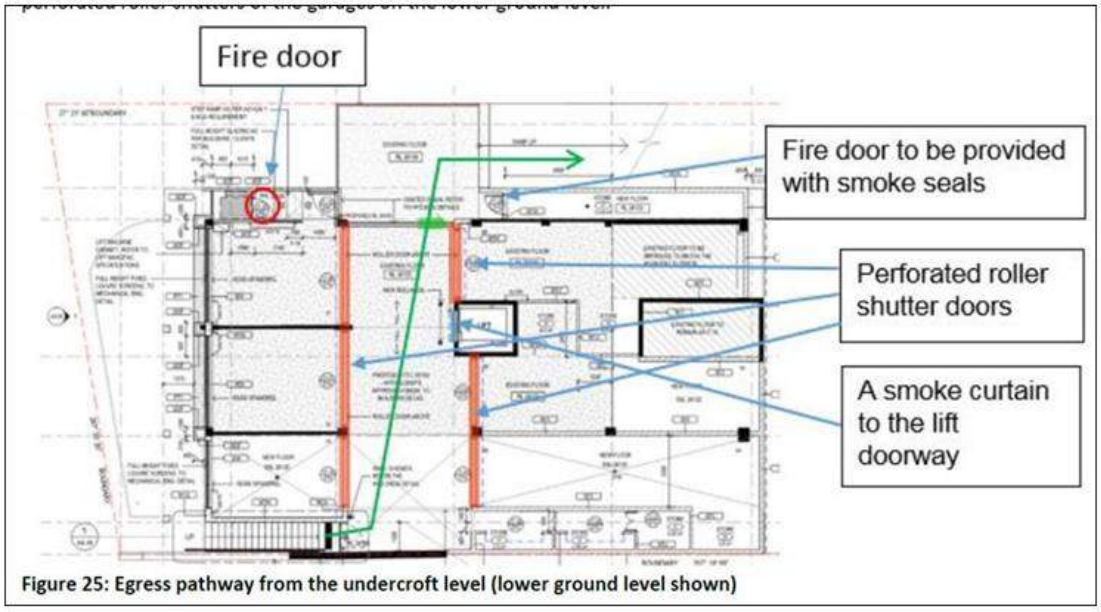

Figure 25: Egress pathway from the undercroft level (lower ground level shown)

BCA Logic: Regarding Gary's comment, the picture above shows the lower ground level instead of the ground level. **Could Peter please confirm whether this is the roller shutte that you concerned?**

Confirmation by the certifying authority whether the variation of single exit on level 1 is an existing condition. BCA Logic would only be addressing issues of the new works – any existing latent non compliant conditions to areas of the building that area remaining unaltered or unaffected will not be included in the FER – also Council has not included any conditions about a fire upgrade of the existing building in the DA.

BCA Logic: **Could Gary please confirm whether level 1 is to be affected by proposed development or not? Currently the FER includes one travel distance issue on level 1. Do we remove it?** Agree, this was an existing non-compliance of the building, and no Clause 94 upgrade has been placed on the existing building by Council, therefore if no works are proposed in this area then it can be removed from any FER.

Confirmation by the building management (owner) that the proposed private lift is only to be used by the occupants of the undercroft unit. This issue will be a condition of our FER that the private lift is contained wholly inside the SOU bounding construction.

Hopeful Peter could agree to review the FER based on the information being provided.

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
Wallace Zhong
Fire Safety Engineer

BCA LOGIC

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(E) wzhong@bcalogic.com.au | (W) www.bcalogic.com.au
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PO Box Q1440, Queen Victoria Building NSW 1230

From: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Sent: Tuesday, 19 June 2018 9:30 AM
To: 'Wallace Zhong' <wzhong@bcalogic.com.au>
Cc: 'Trevor Collins' <trevor@foreshores.com>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Hi Wallace,

Please find attached.

Kind Regards,

Kate Gassmann

Director

C&C PROJECT MANAGEMENT

P. (+61) 0400 254 091
E. kate.gassmann@ccprojectmanagement.com
w. www.ccprojectmanagement.com

From: Wallace Zhong <wzhong@bcalogic.com.au>
Sent: Tuesday, 19 June 2018 9:09 AM
To: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

Hi Kate,

Thanks! As MC is away, it is difficult for me to find the FEBQ comments given by Peter Gardner. Could you please send me a copy directly?

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
Wallace Zhong
Fire Safety Engineer

BCA LOGIC

(D) 8484 4039 | (T) 9411 5360 | (M) 0416 072 618 | (F) 9411 5420
(E) wzhong@bcalogic.com.au | (W) www.bcalogic.com.au
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From: Stuart Boyce <sboyce@bcalogic.com.au>
Sent: Sunday, 24 June 2018 12:38 PM
To: Wallace Zhong <wzhong@bcalogic.com.au>; Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Cc: peterg@pg-a.com.au; Trevor Collins <trevor@foreshores.com>; MC Hui <mhui@bcalogic.com.au>
Subject: RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic

All,

Refer my additional comments in red below:

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
Stuart Boyce
Director

BCA LOGIC

(D) 8484 4022 | (T) 9411 5360 | (M) 0413 457 773 | (F) 9411 5420
(E) sboyce@bcalogic.com.au | (W) www.bcalogic.com.au
Level 6, 210 Clarence Street, Sydney NSW 2000 | Map
PO Box Q1440, Queen Victoria Building NSW 1230

LinkedIn

From: Gary Rafferty <grafferty@viclilli.com.au>
Sent: Monday, 16 April 2018 11:55 AM
To: Stuart Boyce <sboyce@bcalogic.com.au>; Vic Lilli <vlilli@viclilli.com.au>
Cc: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>; MC Hui <mhui@bcalogic.com.au>
Subject: RE: 48a Queenscliff Road, Queenscliff - CC J160166A

Hi Stuart,

We do not have any issues with the comments below expect for item 3 & 7.
We believe that both these non-compliances are 'technical' non-compliances with the BCA that must be addressed through alterative solutions.

3. Lift to the undercroft unit is required to be an emergency lift (BCA E3.4) – To be addressed in the FER
   a. *[KG] To be addressed by BCA Logic*
   b. (SB) – We dont agree with this – this is a private lift contained wholly within a SOU. If we provide a -/60/30 fire rated door at lower level where it opens to the carpark – then the lift and shaft are deemed to be contained wholly inside the SOU.

7. Ramp from the lower level to have a gradient no greater than 1:8 (BCA D1.10) – To be addressed in the FER, although it is existing, new works are required to make use of the non-compliant ramps.
   a. *[KG] Existing – to be addressed by BCA logic*
   b. (SB) These ramps area existing and are already being used by the current building occupants for egress. There is nothing in the DA conditions that require upgrade of this component, thus in our opinion not an issue that needs to be addressed in a FER – in any case – how do you justify it – it is what it is.

Regards,

Gary Rafferty
A1 Building Certifier
NSW, VIC, QLD

VIC LILLI & PARTNERS

↑ Next ↓ Previous

From: Stuart Boyce <sboyce@bcalogic.com.au>
Sent: Thursday, 29 March 2018 8:46 AM
To: Vic Lilli <VLilli@viclilli.com.au>; Gary Rafferty <GRafferty@viclilli.com.au>
Cc: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>; MC Hui <mhui@bcalogic.com.au>
Subject: FW: 48a Queenscliff Road, Queenscliff - CC J160166A

Vic / Gary,

Further to Alex's previous email from your office and in order to give you an update on the various issues to be resolved– outlined below is an updated comment on the various issues raised by Alex.

Font in Red – Alex's initial comments

Font in Blue - Kates Response

Font in green – our updated comments

1. Location of the Hydrant Booster – Plans will be provided with the location of the booster shown
   a. ***[KG] Now shown on attached***
   b. (SB) Item Resolved
2. External pump rooms within 6m of any non-sprinkler protected building require enclosing fire rated walls. – Within 6m of a building it is protecting (phew) (ie the garage)
   a. ***[KG] Pump will be more than 6 from the building but the enclosure will not have 1m clearance on all sides***
   b. (SB) Item Resolved – the issue of not achieving the 1.0m clearance is in our view interperative – provided a maintenance contractor can access the equipment from the one side which often occurs in pump rooms then issue considered acceptable – we dont believe this to be a FER issue
3. Lift to the undercroft unit is required to be an emergency lift (BCA E3.4) – To be addressed in the FER
   a. ***[KG] To be addressed by BCA Logic***
   b. (SB) – We dont agree with this – this is a private lift contained wholly within a SOU. If we provide a -/60/30 fire rated door at lower level where it opens to the carpark – then the lift and shaft are deemed to be contained wholly inside the SOU.
4. Single exit from the undercroft SOU (BCA D1.2) FEBQ shall not rely on the beach access unless an easement is sought – Single exit provided from a building >25m. To be addressed in the FER

a. *[KG] To be addressed by BCA Logic*

b. (SB) Included in the FER

5. Fire door to be provided to elevator -/60/30 (BCA C3.11) – To be shown on the door schedule or similar

a. *[KG] -/120/- is shown*

b. (SB) Item Resolved

6. Confirm the hob height to balcony door is in accordance with AS4654 - Waterproofing membranes for external above-ground use – Provide note on plans that hob height is in accordance with AS4654 or confirmation from supplier of compliance

a. *[KG] Not for BCA logic – VL&P to refer to detail 01 on sheet A5.10*

b. (SB) Item Resolved

7. Ramp from the lower level to have a gradient no greater than 1:8 (BCA D1.10) – To be addressed in the FER, although it is existing, new works are required to make use of the non-compliant ramps.

a. *[KG] Existing – to be addressed by BCA logic*

b. (SB) These ramps area existing and are already being used by the current building occupants for egress. There is nothing in the DA conditions that require upgrade of this component, thus in our opinion not an issue that needs to be addressed in a FER – in any case – how do you justify it – it is what it is.

8. Doorway from lower level to undercroft level does not achieve compliant with AS 1428.1 and will require door hardware compliant door hardware (BCA D2.21) – Removed from recent plans

a. *[KG] Not for BCA Logic - This was a gate and is now at the southern end of the beach stairs*

b. (SB) Item Resolved

9. Opening within 3m of the property boundary will require protection (BCA C3.2) – To be addressed in the most recent revision of the plans

a. *[KG] To be addressed by BCA logic – Blde wall?*

b. (SB) as discussed a blade wall on the boundary will afford 30/-/- protection to the openings as permitted by Clause 2.1 of Spec C1.1 of BCA to the height of the subject opening.

10. Entrance to undercroft unit is more than 6m from an exit [22.65m] (BCA D1.4) – The stair will be considered a non-fire-isolated exit, distance complies, number of exits does not as per point 4

a. *[KG] To be addressed by BCA logic*

b. (SB) This matter is considered to be addressed under Point 4 above and has already been included in the FER.

11. Handrails required to both sides of the stair to the undercroft unit (AS 1428.1) – Will be shown on plans

a. *[KG] To be addressed by BCA Logic - handrail able to be included by the handrail will have to stop at the last tread on the western side of the landing to not 'jut' out into the egress of lot 17*

b. (SB) As discussed the handrail is to be terminated at the last tread on one side to allow access into the unit area.

12. Confirm head heights to ground level apartment (BCA F3.1) – Head lights less than 2.4m to habitable areas shall be addressed by an alternate solution prepared by an access consultant.

a. *[KG] Sheets A4.01 – A4.03, show the heights in section and cross section being 2740mm (external RL's) and 2540mm (internal FFL to ceiling).*

b. (SB) Item Resolved

13. Spandrel required to media room window and lobby windows (BCA C2.6) – To be shown compliant on next revision of plans

a. *[KG] Is now updated on the attached*

b. (SB) Item Resolved

14. FEBQ does not address the opening to the parking level when addressing the non-compliant fire stair discharge – FER will address door to parking

a. *[KG] To be addressed by BCA logic*

b. (SB) This issue to be addressed in the FEBQ and FER

WZ: The doorway between the carpark portion and the fire-isolated stair discharge area on the ground level is to be a self-closing fire door having an FRL of at least –/120/30, which is in accordance with the BCA DTS provisions.

15. Stairs and landing from parking level does not achieve compliance with AS1428.1 – Access consultant to address any non-compliances that are unable to be made DTS

a. *[KG] To be addressed by BCA logic*

b. (SB) these issues can be addressed if necessary under a separate access letter advice by our office.

16. Ground level parking only provided with a single exit (BCA D1.2) – Single exit provided from a building >25m. To be addressed in the FER

a. *[KG] To be addressed by BCA logic*

b. (SB) This matter has already been included in the FER / FEBQ

17. Ground level parking has extended travel distances [23.01m](D1.4) – To be addressed in the FER

a. *[KG] To be addressed by BCA logic*

b. (SB) This matter will be included in the FER / FEBQ

18. Fire stairs require pressurisation (BCA E2.2) – As it is existing will not be required to be addressed

a. *[KG] Not required to be addressed*

b. (SB) Issue resolved

19. Confirmation of sound insulation ratings of walls to be provided (BCA F5) – (and floors) see below
    a. *[KG] Not for BCA Logic - Is now updated on the attached. Drawings says: "W1E APPROX 275mm THICK EXTERNAL WALL COMPRISING 190mm THICK CONCRETE BLOCK WALL (CORE FILLED) / NO FINISH TO THE EXTERNAL FACE / 16mm CAVITY /51mm STEEL STUD WITH INSULATOIN /13mm THICK MOISTURE RESISTANCE PLASTERBOARD/ 15mm TILE LINING TO INTERNAL FACE. FINISH TO SCHEDULE"*
    b. (SB) Issue resolved
20. Opening to unit 18 within 3m of the property boundary will require protection (BCA C3.2) – To be addressed in latest plan revision
    a. *[KG] Addressed on the attached drawings A8.20*
    b. (SB) Issue resolved
21. Single exit provided to first level parking in lieu of two (BCA D1.2) - Single exit provided from a building >25m. To be addressed in the FER
    a. *[KG] To be addressed by BCA logic*
    b. This matter will be included in the FER / FEBQ
22. Carpark exhaust located within 6m or property boundary on the second level (AS 1668.1) – Will discuss with Vic
    a. *[KG] Not for BCA Logic- Jones Nicholson certification sent through to VL&P on 10th Nov and 13th Dec*
    b. (SB) Issue assumed resolved

Can you please review the above comments and come back to me as we are keen to finalise the FEBQ / FER and complete the fire engineering scope to allow the final CC to be issued.

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
Stuart Boyce
Director

BCA LOGIC

(D) 8484 4022 | (T) 9411 5360 | (M) 0413 457 773 | (F) 9411 5420
(E) sboyce@bcalogic.com.au | (W) www.bcalogic.com.au

From: Kate Gassmann [mailto:kate.gassmann@ccprojectmanagement.com]
Sent: Thursday, 14 December 2017 4:54 PM
To: Stuart Boyce <sboyce@bcalogic.com.au>
Subject: RE: 48a Queenscliff Road, Queenscliff - CC J160166A

Dear Stuart,

Thank you for your time today in going over the final items for 48a Queenscliff Road.

The one thing I forgot to talk with you about were the **dimensions of the pump enclosure.** Our Hydraulic Engineer has said that AS 2941 states that there must be 1m clearance on all sides of the pump for maintenance. There is nowhere on the site meeting the location requirements that would allow such a size. The pump is already 3350mm (L) x 1000mm (w) x 1850 (h) so that would require an enclosure of 5350 (L) x 3000mm (w). The companies that manufacture and sell the pumps also sell enclosures that are nothing like those dimensions (they are a snug fit with one full long side openable with doors). Are you able to add the dimension of the enclosure (not meeting AS 2941) to the alternate solution?

For the rest of the items we discussed today I have provided an update in blue below for BCA Logic to address.

Many thanks Stuart.

Kind Regards,

Kate Gassmann

Director

C&C PROJECT MANAGEMENT

From: Alex Imre [mailto:aimre@viclilli.com.au] ↑ Next ↓ Previous
Sent: Wednesday, 11 October 2017 6:39 PM
To: 'Trevor Collins' <trevor@foreshores.com>; Kate Gassmann <kate.gassmann@ccprojectmanagement.com>; To: 'MC Hui' <mhui@bcalogic.com.au>
Subject: FW: 48a Queenscliff Road, Queenscliff - CC J160166A

Hi All,

Regarding today's meeting, please see below

Regards,

Alex Imre
Building Surveyor

VIC LILLI & PARTNERS

From: Alex Imre
Sent: Thursday, 14 September 2017 6:02 PM
To: 'Kate Gassmann' <kate.gassmann@ccprojectmanagement.com>
Subject: 48a Queenscliff Road, Queenscliff - CC J160166A

Hi Kate,

I have reviewed the plans provided and not the following non-compliances that will need to be addressed:

1. Location of the Hydrant Booster – Plans will be provided with the location of the booster shown
    a. ***[KG] Now shown on attached***
2. External pump rooms within 6m of any non-sprinkler protected building require enclosing fire rated walls. – Within 6m of a building it is protecting (phew) (ie the garage)
    a. ***[KG] Pump will be more than 6 from the building but the enclosure will not have 1m clearance on all sides***
3. Lift to the undercroft unit is required to be an emergency lift (BCA E3.4) – To be addressed in the FER
    a. ***[KG] To be addressed by BCA Logic***
4. Single exit from the undercroft SOU (BCA D1.2) FEBQ shall not rely on the beach access unless an easement is sought – Single exit provided from a building >25m. To be addressed in the FER
    a. ***[KG] To be addressed by BCA Logic***
5. Fire door to be provided to elevator -/60/30 (BCA C3.11) – To be shown on the door schedule or similar
    a. ***[KG] -/120/- is shown***
6. Confirm the hob height to balcony door is in accordance with AS4654 - Waterproofing membranes for external above-ground use – Provide note on plans that hob height is in accordance with AS4654 or confirmation from supplier of compliance
    a. ***[KG] Not for BCA logic – VL&P to refer to detail 01 on sheet A5.10***
7. Ramp from the lower level to have a gradient no greater than 1:8 (BCA D1.10) – To be addressed in the FER, although it is existing, new works are required to make use of the non-compliant ramps.
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    a. ***[KG] Not for BCA Logic - This was a gate and is now at the southern end of the beach stairs***

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    a. *[KG] To be addressed by BCA logic – Blade wall?*
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    a. *[KG] To be addressed by BCA logic*
11. Handrails required to both sides of the stair to the undercroft unit (AS 1428.1) – Will be shown on plans
    a. *[KG] To be addressed by BCA Logic - handrail able to be included by the handrail will have to stop at the last tread on the western side of the landing to not 'jut' out into the egress of lot 17*
12. Confirm head heights to ground level apartment (BCA F3.1) – Head lights less than 2.4m to habitable areas shall be addressed by an alternate solution prepared by an access consultant.
    a. *[KG] Sheets A4.01 – A4.03, show the heights in section and cross section being 2740mm (external RL's) and 2540mm (internal FFL to ceiling).*
13. Spandrel required to media room window and lobby windows (BCA C2.6) – To be shown compliant on next revision of plans
    a. *[KG] Is now updated on the attached*
14. FEBQ does not address the opening to the parking level when addressing the non-compliant fire stair discharge – FER will address door to parking
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15. Stairs and landing from parking level does not achieve compliance with AS1428.1 – Access consultant to address any non-compliances that are unable to be made DTS
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16. Ground level parking only provided with a single exit (BCA D1.2) – Single exit provided from a building >25m. To be addressed in the FER
    a. *[KG] To be addressed by BCA logic*
17. Ground level parking has extended travel distances [23.01m](D1.4) – To be addressed in the FER
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18. Fire stairs require pressurisation (BCA E2.2) – As it is existing will not be required to be addressed
    a. *[KG] Not required to be addressed*
19. Confirmation of sound insulation ratings of walls to be provided (BCA F5) – (and floors) see below
    a. *[KG] Not for BCA Logic - Is now updated on the attached. Drawings says: "W1E APPROX 275mm THICK EXTERNAL WALL COMPRISING 190mm THICK CONCRETE BLOCK WALL (CORE FILLED) / NO FINISH TO THE EXTERNAL FACE / 16mm CAVITY /51mm STEEL STUD WITH INSULATOIN /13mm THICK MOISTURE RESISTANCE PLASTERBOARD/ 15mm TILE LINING TO INTERNAL FACE. FINISH TO SCHEDULE"*
20. Opening to unit 18 within 3m of the property boundary will require protection (BCA C3.2) – To be addressed in latest plan revision
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21. Single exit provided to first level parking in lieu of two (BCA D1.2) - Single exit provided from a building >25m. To be addressed in the FER
    a. *[KG] To be addressed by BCA logic*
22. Carpark exhaust located within 6m or property boundary on the second level (AS 1668.1) – Will discuss with Vic
    a. *[KG] Not for BCA Logic- Jones Nicholson certification sent through to VL&P on 10th Nov and 13th Dec*

Please see the attached plans for clarification.

Regards,

Alex Imre
Building Surveyor
VIC LILLI & PARTNERS

Fri 1/06/2018 10:22 AM

MC Hui

RE: Letter Out - Cover Letter - FEBQ V2 - 48a Queenscliff Road Queenscliff - BCA Logic 107347

To Wallace Zhong

You replied to this message on 4/06/2018 9:51 AM.

Action Items + Get more a

Wallace,

Kate just confirmed there are no garage doors on both east and west ends, so smoke from a car fire is expected to be vented to the atmosphere with a relatively thin smoke layer in the lower ground carpark.

Since they have already wall-wetting sprinklers for a number of windows, we can recommend the roller garage doors to be protected with wall-wetting sprinklers too.

DP4 says to "allow", not "require" occupants to evacuate...

If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
MC Hui
Fire Engineering Manager

(D) 8484 4040 | (T) 9411 5360 | (M) 0429 023 958 | (F) 9411 5420
(E) mhui@bcalogic.com.au | (W) www.bcalogic.com.au
Level 6, 210 Clarence Street, Sydney NSW 2000 | Map
PO Box Q1440, Queen Victoria Building NSW 1230
LinkedIn

Fri 1/06/2018 10:18 AM

Kate Gassmann <kate.gassmann@ccprojectmanagement.com>

RE: 48A Queenscliff Road - Lower Ground Level Carpark 107347

To MC Hui

Cc Wallace Zhong

Hello MC,

Correct. We were told that this is an egress for Lot 17 to the street and as we couldn't fit in the required opening outward door as well as a garage door we did not include either – it is open.

Kind Regards,

Kate Gassmann

Director

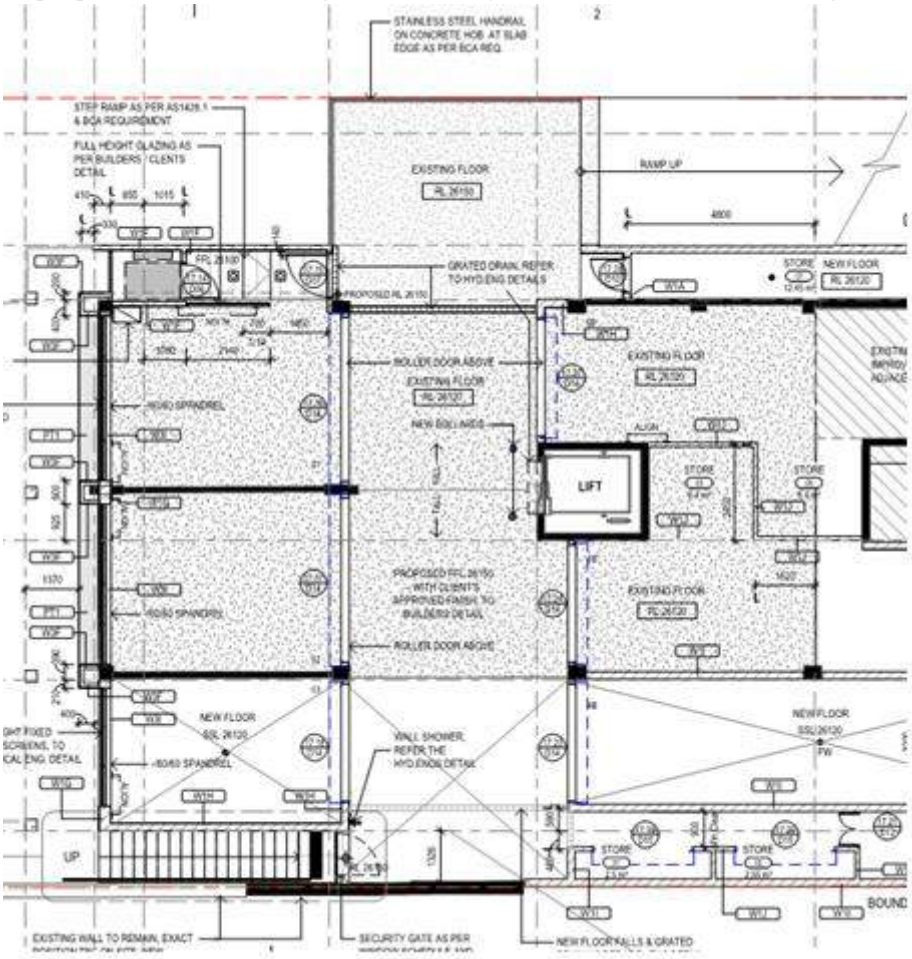
C&C PROJECT MANAGEMENT

P. (+61) 0400 254 091
E. kate.gassmann@ccprojectmanagement.com
W. www.ccprojectmanagement.com

To: Kate Gassmann <kate.gassmann@ccprojectmanagement.com>
Cc: Wallace Zhong <wzhong@bcalogic.com.au>
Subject: 48A Queenscliff Road - Lower Ground Level Carpark 107347

Hi Kate,

According to drawing A1.11 Rev D (CC issue dated 13.07.2017) for the lower ground level, extract below, am I right in saying that there will be no garage doors at the western entry from the driveway and the eastern end that links to the open stair to the unit below?



If you have any queries or require any further information, please do not hesitate to contact me.

Please note our payment details have recently changed, the new details can be found at the bottom of your future invoices or alternatively ask a BCA Logic Staff member. Please ensure this is updated for any future payments.

Regards,
MC Hui
Fire Engineering Manager

(D) 8484 4040 | (T) 9411 5360 | (M) 0429 023 958 | (F) 9411 5420
(E) mhui@bcalogic.com.au | (W) www.bcalogic.com.au
Level 6, 210 Clarence Street, Sydney NSW 2000 | Map
PO Box Q1440, Queen Victoria Building NSW 1230

ANNEXURE F

NSW FIRE BRIGADE RECOMMENDATIONS DURING THE FIRE ORDER PROCESS

Warringah Council

Civic Centre 725 Pittwater Road
Dee Why NSW 2099
DX 9118
Telephone (02) 9942 2111
Facsimile (02) 9971 4522
Website www.warringah.nsw.gov.au
Email council@warringah.nsw.gov.au
ABN 31 565 396 496

26 October 2010

Owners Corporation - Strata Plan 4129
c/- Mr John Jocumsen
Robinson Strata Management
P O Box 280
FRESHWATER NSW 2096

Dear Mr Jocumsen

Re: Proposed Fire Safety Upgrade to existing Multi Level Residential Building 48A Queenscliff Road Queenscliff

Please find enclosed a copy of the NSW Fire Brigades comments/recommendations dated 19 October 2010 following a site inspection and perusal of the proposed Fire Safety Upgrade Strategy dated 1 September 2009 prepared by Mr Ross Payne BCA Logic.

Prior to Council issuing a Notice of Intention to issue an Order 6 (Fire Safety) requiring the implementation of the Proposed Fire Safety Upgrade Council affords you the opportunity to:

1. Review the BCA Assessment & Fire Safety Upgrade Report dated 1 September 2009 including upgrading Strategy (Section 4.2) and Schedule of Essential Fire Safety Measures (Section 4.3).
2. Incorporate where necessary into the Strategy (Section 4.2) the Brigade's comments/recommendations.
3. Provide a time frame of not more than five years (as discussed) for the implementation of the Fire Safety Upgrade.

Should you require any further information on this matter, please contact Alan White, Fire Safety Specialist, weekdays, on telephone number **9942 2616**, or at any time on facsimile number **9971 4522** or via council@warringah.nsw.gov.au

Yours faithfully

Alan White
Fire Safety Specialist – Compliance

cc Mr T Collins
P O Box 359
Round Corner NSW 2159

cc Mr Ross Payne
BCA Logic Pty Ltd
Locked Bag 8
Chatswood NSW 2067

COPY

NSW FIRE BRIGADES

COMMUNITY SAFETY DIVISION
BUILDING COMPLIANCE UNIT
Amarina Avenue Greenacre NSW 2190
Locked Bag 12 Greenacre NSW 2190

www.fire.nsw.gov.au info@fire.nsw.gov.au ABN 12 593 473 110

Your Reference:
File No: NFB/01239
Contact Officer: Stephan Netting

Telephone: (02) 9742 7400
Facsimile: (02) 9742 7483
Email: BuildingComplianceUnit@fire.nsw.gov.au

04729 bAb 008

19 October 2010

The General Manager
Warringah Council
Civic Centre
725 Pittwater Road
DEE WHY NSW 2099

council@warringah.nsw.gov.au

Attention: Alan White

Dear Mr White,

RE: Fire Safety Upgrade – 48a Queenscliff Road Queenscliff

I refer to the joint inspection of the abovementioned premises conducted by Officers of the NSW Fire Brigades (NSWFB) and Council in accordance with the provisions of Section 118L (3) of the Environmental Planning and Assessment (EP&A) Act 1979.

The following details are provided for your information under Section 118L (4) and Section 121ZD (1) of the EP&A Act 1979.

Reference is also made to Council's correspondence dated 24 March 2010 and 30 September 2010 requesting the NSWFB comments on the proposed Fire Safety Upgrade Strategy detailed in the Fire Safety Report prepared by Ross Payne of BCA Logic Pty Ltd numbered 101014-r2/rp dated 1 September 2009.

COMMENT

The NSWFB has no objection to the Fire Safety Upgrade Strategy detailed in the abovementioned Fire Safety Report being implemented provided the following comments are addressed:

1. In this instance the NSWFB does not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report.

PREVENT PREPARE PROTECT

COPY

UNITS

Although, consideration should be given to requiring the installation of a smoke detection and alarm system that complies with the requirements of Australian Standard (AS) 1670.1 – 2004 throughout the building that is provided with an alarm acknowledgement facility in accordance with Clause 3.2 of AS 1670.1 – 2004 and that is also connected to a fire alarm monitoring system connected to a fire brigade dispatch centre in accordance with AS 1670.3 - 2004, so that an early warning is provided throughout the whole building to allow occupants evacuate safely and for the early intervention by the NSWFB in the event of a fire at the premises.

AS RECOMMENDED

X 2. The NSWFB does not consider the provision of an external stairway along the side of the driveway leading to the road will significantly improve egress from the building in the event of a fire. Additionally, the provision of this stair way will reduce the width of the driveway, which may restrict NSWFB operations in the event of a fire at the premises and also the ability of other emergency services to conduct operations may also be restricted in the event of another emergency at the premises.

BUT NOT BCA COMPLIANT

Accordingly, the NSWFB recommends that a handrail and non-slip finish be provided to the driveway to assist occupants in the evacuation of the premises in lieu of providing the stairway.

✓ 3. The NSWFB requests that Council require the provision of a Fire Hydrant System to the building that is compliant with Clause E1.3 of the Building Code of Australia (BCA) and AS 2419.1 – 2005.

AS ALREADY RECOMMENDED.

The Fire Hydrant Booster Assembly provided to this system, is to be located adjacent to the vehicle entry at the top of the driveway and the installation of the Fire Hydrants within the fire-isolated stairs is not to further restrict the width of the path of egress provided within the fire-isolated stair.

✓ 4. The NSWFB does not object to Fire Hose Reels not being installed in the residential levels of the building for the reasons detailed within the Fire Safety Upgrade Report. Although, consideration should be given to requiring Fire Hose Reel coverage to be provided to the carpark levels of the building in accordance with Clause E1.4 of the BCA and AS 2441 – 2005.

AGREED.

RECOMMENDATIONS

The NSWFB recommends that Council take … nts addressed in the Fire Safety Upgrade of the s…

Please contact the abovementioned officer sh… ce from the NSWFB in relation to this matter.

Yours faithfully

Electronically approved for release.

For Commissioner

- CONFIRM AS 1670.1 to ALL OF BUILDING I.E TO UNITS.
  ↓
  NSWFB EXPERIENCE WITH MORM ACKNOW-LEGEMENT AND/OR ALTERNATIVE OF THERMAL IN THE UNIT?
- WIDTH OF NON-SLIP SURFACE TO DRIVEWAY.

PREVENT PREPARE PROTECT

ANNEXURE G

FIRE ENGINEERING PEER REVIEW REPORT OF 10 JULY 2018

Original BCA Logic Pty Ltd Response to the Peer Review Report

Item No.	Section of Fire Engineering Report	Peer Review Findings	Response by BCA Logic Pty Ltd
1	Executive Summary page 7 and others	It should be clarified whether the water supply requirement is to be based on the drenchers plus the fire hydrants operating together.	The water supply of the fire curtain incorporating a wall-wetting sprinkler system at the carpark entry on the ground level is to be sufficient to allow simultaneous water flow of said wall-wetting sprinkler system and the building fire hydrant system.
2	Executive Summary page 10	The FRL requirement of the fire doors should be described.	The FRL requirement of the fire doors have been specified in trial concept design.
3	Executive Summary page 10	The smoke curtains may not comply with AS 1905.2-2005 which relates to fire-resistant roller shutters.	The requirement has been changed.
4	Executive Summary page 11	The FRL requirement of the fire separated areas should be described.	The FRL requirements of the fire separated areas have been specified.
5	Executive Summary page 12	The following statements within the report should be revised as they are not considered to be correct. It has been assumed in the fire engineering analysis that other than the specific deviation from the DTS Provisions documented in this report, all other BCA fire safety related Performance Requirements are to be met by complying with the DTS Provisions for the existing development. All other aspects of the building not specifically discussed in this report are beyond the scope of this report and must comply with the DTS Provisions of the BCA 2016 or addressed separately. This includes the essential fire safety systems listed in Section 14.2 of this report, and the existing conditions determined by the Consent Authority during the fire order process.	The statements have been revised.
6	3.3	The actual effective height of the building should be described.	The effective height has been described. A technical letter regarding the effective height of the building has been provided by the architect, which is included in Annexure E to this report.
7	3.8	Emergency lifts are not proposed which should be corrected. A fire control centre should be proposed and also described in the report.	The item, Emergency lifts, has been deleted. The item, fire control centre, has been added and discussed.
8	7.4 page 38	The FEBQ stated that flame projection calculations are to be carried out for both the proposed Performance Solution and the BCA DTS solution employing Law and Turlogh's correlations. This has not been undertaken. The calculations on page 38 should be further explained.	This comparative analysis has been revised. The length of the flame is expected to be same to both the Performance Solution and the DTS Solution, therefore not calculated in details. The trajectories of emerging flames for both the proposed Performance Solution and the DTS Solution are expected to be different. As such, the flame lengths above the spandrel has been calculated accordingly.
9	8.4 page 44	The large opening areas referred to should be confirmed as being provided as the eastern elevation shows a solid balustrade.	The analysis has been revised based on a new mark-up drawing provided by the client, which is included in Annexure C to this report.

Item No.	Section of Fire Engineering Report	Peer Review Findings	Response by BCA Logic Pty Ltd
10	8.6	The ventilation requirements relating to the carpark on the lower ground level and the non-provision of ventilation relating to the carpark on the ground level should be described and also included in the Trial Concept Design.	The analysis has been revised based on a new mark-up drawing provided by the client, which is included in Annexure C to this report.
11	9.4 page 54	The gradient of the ramp should be described and assessed in accordance with the Performance Requirements of the BCA.	The existing external ramp (driveway) has been discussed in section 3.12 of this report.
12	9.6	The fire door to the store room to the lower level should be included in the Trial Concept Design.	The fire door to the store room on the lower level is to be -/120/30 as specified in the Trial fire safety design of this report.
13	11.4 and 11.6	The fire shutter to the carpark entry should be described and assessed. The following item within the report should be resolved. BCA Logic: Confirmation of the compliance of the entry roller shutter of the carpark vehicular entry on the ground level has been requested. A new egress pathway through the existing landscape and the external walls on the ground level as detailed in section 11.4 of this report are included as part of the trial fire safety design, which is intended to meet the BCA DTS Provisions and to be confirmed by the Certifying Authority.	The carpark entry on the ground level is to be protected by a fire shutter incorporating a wall-wetting sprinkler system, which is to achieve an FRL of -/120/120 in a fire test in accordance with AS1530.4-2005/2014. The relevant assessment is detailed in section 9, Performance Solution 4 (item 3) of this report.
14	13.4	The analysis should consider the entire building and its effective height and not just the proposed parts of the building given that the proposed building works results in a requirement for the building to comply with Performance Requirements EP1.4 and EP3.4 of the BCA. It is not considered sufficient to state that the upper levels have been assessed by the Consent Authority and accepted by FRNSW during the recent fire order process and therefore the proposal is acceptable.	The analysis has been revised.
15	Annexure C	The fire severity calculations undertaken should consider the following:- The ceiling height is described as 2.4m however, 2.59m has been used in the calculations. The spandrels provided to the southern elevation. The actual free open area of the louvres. The roller doors (with drenchers) provided to the individual carparking areas that may be closed.	The fire severity calculation has been revised based on the revised protection of opening method, fire curtains to be provided to the garage roller shutters on the lower ground level.
16	FEBQ comment	It should be confirmed whether a fire engineering Performance Solution needs to be undertaken for the fire hydrant system not incorporating a tank, pumps and ring main.	The Certifying Authority has confirmed that no fire engineering solution is required. The relevant email is included in Annexure E to this report.
17	FEBQ comment	The location of the new boosters and pump should be described in the report.	The locations of the fire hydrant booster and pump have been described in section 3.8 of this report.

Other changes since the peer review report dated 10 July 2018 been issued:

- A new Performance Solution 14 has been added.
- It was recently advised that the fire safety upgrade of the Fire Order process has been partially implemented. As such it is considered by this report the Fire Order process is ongoing.
- Minor changes have been made across this report.

Further changes under the Revision 4 updated of the FER:

- A fire sprinkler system is proposed to be provided to the subject areas.
- Accordingly, Performance Solutions 2, 3, 5, 6, 7, 8 and 9 have been updated.

PETER GARDNER & ASSOCIATES

PEER REVIEW REPORT

48a Queenscliff Road, Queenscliff, NSW

Report Number: 17084-R1-V1
Date: 10 July 2018

Client:
The Owners Corporation SP 4129
c/- C&C Project Management
25 Everview Avenue
Mosman NSW 2088

Fire Engineering and Building Code Consulting

AUTHORISATION

Version	Comment / reason for Issue	Issue date	Prepared by*
1	Peer Review of Fire Engineering Report.	10.7.18	P. Gardner Peter Gardner C10 – Accredited Certifier – Fire Safety Engineering Compliance, BPB, Accreditation No. BPB0131

REVISION HISTORY

Version	Comment / reason for Issue	Issue date	Prepared by*

* For and on behalf of PGA Pty Ltd.

CONTACT INFORMATION

PGA Pty Ltd
Fire Engineering and Building Code Consulting
ABN 95 619 710 511 M: +61 (0)435 184 053
PO Box 519 E: peterg@pg-a.com.au
Five Dock NSW 2046 W: www.pg-a.com.au

EXECUTIVE SUMMARY

PGA Pty Ltd has been engaged by The Owners Corporation SP 4129 c/- C&C Project Management for professional fire engineering services to undertake a peer review of the Fire Engineering Report in relation to the proposed alterations and additions to an existing residential building located at 48a Queenscliff Road, Queenscliff, NSW.

This Peer Review Report is undertaken in accordance with the peer review parameters detailed within the International Fire Engineering Guidelines (IFEG) and has considered the relevant provisions of the National Construction Code 2016, Amendment 1, Volume One, Building Code of Australia (BCA). The report highlights whether the proposed Performance Solutions are considered to satisfy the relevant Performance Requirements of the BCA.

From the peer review undertaken of the Fire Engineering Report, it is considered that the Fire Engineering Report is acceptable and satisfies the relevant Performance Requirements of the BCA subject to all items detailed within Table 2.1 of this report being comprehensively addressed.

CONTENTS

1 INTRODUCTION

1.1 PROJECT

The project relates to proposed alterations and additions to an existing residential building consisting of the following internal modifications to both the undercroft and the ground level of the building:

- to convert the undercroft area to become a new residential unit;
- to convert of a portion of the carpark area to a new residential unit on the ground floor; and
- to convert of a small portion of the carpark area to a storage area on the ground floor.

1.2 CLIENT

The Owners Corporation SP 4129, c/- C&C Project Management, 25 Everview Avenue, Mosman NSW 2088.

1.3 PROJECT ADDRESS

48a Queenscliff Road, Queenscliff, NSW.

1.4 DESCRIPTION OF WORK

PGA Pty Ltd has been engaged for professional fire engineering services to undertake a peer review of the Fire Engineering Report. This Peer Review Report is undertaken in accordance with the peer review parameters detailed within the International Fire Engineering Guidelines (IFEG) and has considered the relevant provisions of the National Construction Code 2016, Amendment 1, Volume One, Building Code of Australia (BCA). The report highlights whether the proposed Performance Solutions are considered to satisfy the relevant Performance Requirements of the BCA.

The Certificate of Accreditation of Peter Gardner is listed in Appendix A.

1.5 SCOPE AND LIMITS OF REPORT

Vic Lilli of Vic Lilli & Partners is the Authority Having Jurisdiction for the purposes of considering an application for a Construction Certificate relating to the subject development in accordance with the relevant statutory provisions.

This report does not relieve any party from their responsibilities under the Environmental Planning & Assessment Act 1979 and the Environmental Planning & Assessment Regulation 2000.

The analysis does not specifically consider arson (other than as a source of initial ignition), multiple simultaneous ignition sources, acts of terrorism, protection of property (other than adjoining property), business interruption or losses, or personal or moral obligations of the owner/occupier.

PGA Pty Ltd does not accept liability for the use of the findings outside the set design criteria or by any third party and it does not accept liability for the accuracy of the documents or other information provided by others which form the basis of this report. It is a condition of this report that all documentation and other information that enables the report to be undertaken has been provided.

This report assumes that the building complies with the BCA DtS Provisions except as detailed within the Fire Engineering Report or as accepted by the Certifying Authority.

This report is not a Compliance Certificate in accordance with Clause 144A of the Environmental Planning & Assessment Regulation 2000.

It should be noted that it is not possible to totally eradicate the risk from fire in, or from, a building.

1.6 REGULATORY FRAMEWORK

The following legislation has been considered in the formulation of this Fire Engineering Report:

(i) NSW Environmental Planning & Assessment Act, 1979.

(ii) NSW Environmental Planning & Assessment Regulation, 2000.

(iii) National Construction Code 2016, Amendment 1, Volume One, Building Code of Australia Class 2 to Class 9 Buildings, Australian Building Codes Board, Second edition, March 2018 (BCA).

1.7 REFERENCE TEXTS

The following texts have been used as reference documents in the formulation of this report:

(i) International Fire Engineering Guidelines (IFEG), Australian Building Codes Board, 2005.

(ii) Guide to NCC Volume One 2016, Amendment 1, Building Code of Australia Class 2 to Class 9 Buildings, Australian Building Codes Board, Second edition, March 2018.

1.8 INFORMATION CONSIDERED FOR REPORT

The following information has been considered in the formulation of this report:

1. Fire Engineering Report prepared by BCA Logic Pty Ltd, Revision 107347-FER-r2, dated 5.7.18.
2. Fire Engineering Brief Questionnaire prepared by BCA Logic Pty Ltd, including comments from PGA Pty Ltd, Ver. 03, dated 6.6.18.

2 PEER REVIEW FINDINGS

The peer review findings are detailed in Table 2.1 below.

Table 2.1 – Peer review findings

Item No.	Section of Fire Engineering Report	Peer Review Findings
1.	Executive Summary page 7 and others	It should be clarified whether the water supply requirement is to be based on the drenchers plus the fire hydrants operating together.
2.	Executive Summary page 10	The FRL requirement of the fire doors should be described.
3.	Executive Summary page 10	The smoke curtains may not comply with AS 1905.2-2005 which relates to fire-resistant roller shutters.
4.	Executive Summary page 11	The FRL requirement of the fire separated areas should be described.
5.	Executive Summary page 12	The following statements within the report should be revised as they are not considered to be correct. *It has been assumed in the fire engineering analysis that other than the specific deviation from the DTS Provisions documented in this report, all other BCA fire safety related Performance Requirements are to be met by complying with the DTS Provisions for the existing development.* *All other aspects of the building not specifically discussed in this report are beyond the scope of this report and must comply with the DTS Provisions of the BCA 2016 or addressed separately. This includes the essential fire safety systems listed in Section 14.2 of this report, and the existing conditions determined by the consent authority during the fire order process.*
6.	3.3	The actual effective height of the building should be described.
7.	3.8	Emergency lifts are not proposed which should be corrected. A fire control centre should be proposed and also described in the report.
8.	7.4 page 38	The FEBQ stated that flame projection calculations are to be carried out for both the proposed Performance Solution and the BCA DTS solution employing Law and Turlogh's correlations. This has not been undertaken. The calculations on page 38 should be further explained.
9.	8.4 page 44	The large opening areas referred to should be confirmed as being provided as the eastern elevation shows a solid balustrade.

Item No.	Section of Fire Engineering Report	Peer Review Findings
10.	8.6	The ventilation requirements relating to the carpark on the lower ground level and the non-provision of ventilation relating to the carpark on the ground level should be described and also included in the Trial Concept Design.
11.	9.4 page 54	The gradient of the ramp should be described and assessed in accordance with the Performance Requirements of the BCA.
12.	9.6	The fire door to the store room to the lower level should be included in the Trial Concept Design.
13.	11.4 and 11.6	The fire shutter to the carpark entry should be described and assessed. The following item within the report should be resolved. *BCA Logic: Confirmation of the compliance of the entry roller shutter of the carpark vehicular entry on the ground floor has been requested. A new egress pathway through the existing landscape and the external walls on the ground floor as detailed in section 11.4 of this report are included as part of the trial fire safety design, which is intended to meet the BCA DTS Provisions and to be confirmed by the certifying authority.*
14.	13.4	The analysis should consider the entire building and its effective height and not just the proposed parts of the building given that the proposed building works results in a requirement for the building to comply with Performance Requirements EP1.4 and EP3.4 of the BCA. It is not considered sufficient to state that the upper levels have been assessed by the consent authority and accepted by FRNSW during the recent fire order process and therefore the proposal is acceptable.
15.	Annexure C	The fire severity calculations undertaken should consider the following:- • The ceiling height is described as 2.4m however, 2.59m has been used in the calculations. • The spandrels provided to the southern elevation. • The actual free open area of the louvres. • The roller doors (with drenchers) provided to the individual carparking areas that may be closed.
16.	FEBQ comment	It should be confirmed whether a fire engineering Performance Solution needs to be undertaken for the fire hydrant system not incorporating a tank, pumps and ring main.
17.	FEBQ comment	The location of the new boosters and pump should be described in the report.

3 CONCLUSION

From the peer review undertaken of the Fire Engineering Report, it is considered that the Fire Engineering Report is acceptable and satisfies the relevant Performance Requirements of the BCA subject to all items detailed within Table 2.1 of this report being comprehensively addressed.

4 VALIDITY, DISCLAIMER AND CONDITIONS OF USE

This report is prepared in relation to the Fire Engineering Report for the proposed alterations and additions to an existing residential building located at 48a Queenscliff Road, Queenscliff, NSW and should not be applied to other buildings.

Any modifications or changes to the building, fire safety management system, or building usage from that described may invalidate the findings of this report. Should such changes occur, a re-assessment should be sought.

Arson has been shown statistically to contribute to fire. This report has considered the incidence of minor forms of arson as a single ignition source; however, major arson involving accelerants and/or multiple ignition sources are beyond the scope of this analysis and therefore have been excluded from the report.

APPENDIX A CERTIFICATE OF ACCREDITATION

NSW GOVERNMENT Fair Trading

Building Professionals Board

Certificate of Individual Accreditation

This is to certify that

Peter Gardner

is accredited as an accredited certifier in New South Wales under the *Building Professionals Act 2005* in the following categories as set out in Schedule 1 of the Building Professionals Regulation 2007:

A1 - Accredited Certifier - Building Surveying Grade 1
C10 - Accredited Certifier - Fire Safety Engineering Compliance

This accreditation is subject to the conditions prescribed in the Building Professionals Regulation 2007.

Period of Accreditation: 16 March 2018 to 15 March 2019

Registration No: BPB0131

Jacqueline Yalda
Accreditation Officer
Building Professionals Board

PGA
PETER GARDNER & ASSOCIATES

ANNEXURE H

FRNSW COMMENTS ON FEBQ

Fire & Rescue NSW

Fire Engineering Brief Questionnaire (FEBQ)

1 Document control

Applicant reference number 107347

FRNSW reference number FRN12/2085
BFS18/1161

Ver.	Author	Organisation	Status	Date
01	M.C. Hui & Wallace Zhong	BCA Logic Pty Ltd	Initial submission	3/05/2018
02	Jason Wang	FRNSW (3427)	Comment on V01	30/05/2018

2 Applicant

2.1 Role of applicant

☐ Local government authority ☐ Certifying authority ☑ Fire safety engineer
☐ Development owner ☐ Other Provide details

Note: The applicant is expected to have the consent of the development owner to act on their behalf.

2.2 Agreement

As the applicant, I confirm the following:

- I agree to pay Fire & Rescue NSW (FRNSW) the charges set out in Clause 46 of the *Fire Brigades Regulation 2014* (see Section 10).
- I agree to forward with this application the following documentation for FRNSW to review and provide advice on the assessment methods and acceptance criteria proposed for the given alternative solution:
  - ☑ Copy of proposed building plans and specifications (e.g. relevant floor plans, elevations, site plan, section views, hydrant plan and schematic)
  - ☐ BCA report or letter from an accredited certifier that identifies all non-compliances (if available)
  - ☐ CFD/zone modelling inputs form (if applicable)
  - ☐ Report extract of the trial design requirements/proposed fire safety measures (optional).

Name of applicant	M.C. Hui
Applicant phone number	02 8484 4040
Applicant email address	mhui@bcalogic.com.au

2.3 Remittance advice information

Invoices will be issued based on the information provided below:

Company / vendor name	BCA Logic Pty Ltd		
Australian business number	29 077 183 192	Trading name	BCA Logic Pty Ltd
Remittance contact name	Joanne Shah		
Remittance street address	Level 6, 210 Clarence Street, NSW 2000		
Remittance postal address	PO Box Q1440, Queen Victoria Building, NSW 1230		
Remittance email address	info@bcalogic.com.au		
Remittance phone number	02 9411 5360	Remittance fax number	02 9411 5420

3 Consultation

3.1 Stakeholders

Role	Name and BPB number	Organisation and phone	Email address
Fire safety engineer	M.C. Hui, BPB 1721 Wallace Zhong, BPB3072	BCA Logic Pty Ltd 02 8484 4040	mhui@bcalogic.com.au
BCA consultant	Stuart Boyce BPB 0044	BCA Logic Pty Ltd (02) 8484 4022	sboyce@bcalogic.com.au
Certifying authority	Vic Lilli BPB 0229	Vic Lilli & Partners (02) 9715 2555	vlilli@viclilli.com.au
FRNSW reviewers	SO Darren Bofinger Jason Wang	Fire & Rescue NSW 02 9742 7434	firesafety@fire.nsw.gov.au

3.2 Meeting details

In conjunction with the written comments provided in response to this FEBQ, FRNSW may hold a meeting with the applicant to discuss aspects of the proposed alternative solution. The meeting will be at the discretion of FRNSW.

Type of meeting preferred ☑ No meeting ☐ Telephone meeting ☐ Face-to-face meeting

4 Project details

4.1 Premises

Premises name	Premises name (if applicable)
Primary street address	48a Queenscliff Road
Secondary street address	Secondary street address (if applicable)
Premises suburb	Queenscliff NSW
Lot and DP numbers	Lot CP SP 4129

4.2 Proposed works

☐ New building
☐ Refurbishment of an existing building
☑ Extension of an existing building
☐ Change in use within an existing building
☐ Other: (provide details)

Applicable NCC: NCC 2016

For existing buildings:
Approximate year of construction: 1960's
Building code when constructed: Unknown

How many alternative solution issues are proposed in this FEBQ? 8

Note: The number of alternative solution issues must address all identified non-compliances.

Have all departures from the deemed-to-satisfy (DtS) provisions of the *National Construction Code* (*NCC*) been identified for this proposed design (i.e. a BCA report or letter from an accredited certifier)? Yes

Note: Any advice given is subject to all non-compliances being identified. Any new DtS departures identified, including any from the certifying authority determining the application for construction certificate, may affect FRNSW advice in respect to this alternative solution.

The BCA consultant from BCA Logic have been engaged to identify all departures from the deemed-to-satisfy (DtS) provisions of the National Construction Code (NCC), which have been confirmed by the certifying authority.

Identify if any previous alternative solution applies to the building:

None that we are aware of.

Identify if any application has been/will be submitted under Clause 188 of the *Environmental Planning and Assessment Regulation 2000*:

None that we are aware of.

Identify if the premises is or will be subject to any development application (DA) conditions or special regulatory approvals (e.g. BPB conditions, ministerial conditions, crown building works):

Note: FRNSW will not comment on existing buildings subject to voluntary upgrade or change of use prior to the issue of any DA conditions of consent or Section 96 amendments. Comment will also not be provided if an order has been issued unless the Council agrees. The Council may seek advice during the DA review.

None that we are aware of.

In relation to this matter where FRNSW comments contradict or are not consistent with any condition of development consent, further consultation with FRNSW is required to refine the proposed fire safety strategy.

Will the premises be subject to a fire safety study, risk assessment or dangerous goods study? No

Note: Any study/risk assessment should be completed prior to submitting this FEBQ, and should be attached to this application.

4.3 Description of building occupancy

Main occupancy class	2	Other occupancy classes	7a & 7b
Type of construction	A	Largest fire compartment (m^2)	Approximately 700
Effective height (m)	<25m for earlier BCA and the existing building; >25m per BCA 2016 FRNSW: The determination of effective height should be in accordance with the latest version BCA which is greater than 25 m.	Ground floor area (m^2)	Approximately 700
Rise in storeys	11	Total floor area (m^2)	Approximately 6,000
Levels contained	12	Total volume (m^3)	Approximately 18,000

Note: The definition of effective height has changed in *NCC 2016*. For any other applicable *NCC*, consideration must be given to the NSW Supreme Court case [2012] NSWSC 1244.

Outline any additional building characteristics:

The existing residential building has a rise in storey of eleven (11) that includes a basement level for carparking, and an undercroft area. The building is a concrete / masonry structure and has type A construction. Part of the ground level and the whole of levels 1 to 9 are being used as residential accommodation (apartments), the ground level and the basement levels are being used for carparking.

As shown in Figure 1, the subject building is bounded by other similar multi-dwelling residential properties to the immediate east (42 Queenscliff Road), the north (44 Queenscliff road) and the west (1 & 1A Greycliffe Street & 50A Queenscliff Road), and abuts and overlooks Queenscliff Beach to the south. An existing driveway between the adjoining properties to the east (44 Queenscliff Road) and the west (50 & 50A Queenscliff Road) provides pedestrian and vehicular access to the subject building from Queenscliff Road.

The subject building was the subject of a Council Fire Order No. 6 issued by Warringah Council on 20 April 2011. The proposed fire safety upgrade strategy has been agreed and implemented with the Council and Fire and Rescue NSW. In particular, FRNSW (NSWFB at the time) did not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report (Comment item 1 in NSWFB letter File Ref. NFB/01239 dated 19 October 2010) which means that the subject building was not required to be provided with an automatic sprinkler system and a stair pressurisation system as accepted by NSWFR.

FRNSW: Noted that the building could be interpreted having an effective height of less than 25 m. However, given the fact that the definition of effective height has been changed since 2016, the determination of effective height should be in accordance with the latest version of BCA and the provision of fire safety measures should therefore be based on the newly determined effective height which is greater than 25 m.

As shown in Figure 2, it is currently proposed to modify the undercroft area to become a residential unit (new Unit A) and to introduce a new residential unit (new Unit 18) on the ground level and a small portion of the ground level to become a storage area. All levels above the ground level and the existing ramp to Queenscliff Road are to remain unchanged. As a result, this FEBQ for the subject development relates to the seven (grouped) identified deviations from the Deemed-to-Satisfy (DTS) Solutions that would require to be assessed in accordance with Section A0.5 of the BCA 2016 to demonstrate that the deviations comply with the relevant Performance Requirements.

Figure 1 Site overview (Courtesy of Google Map)

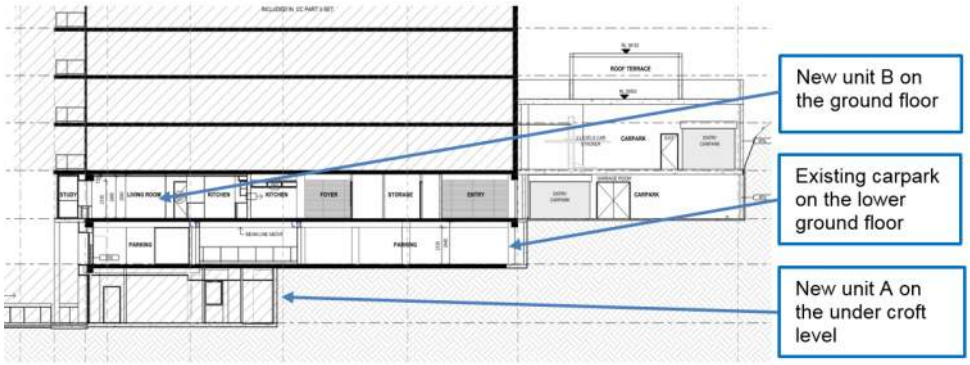


Figure 2: Location of the proposed alteration to the existing building (section view shown)

List key occupant characteristics for the building:

Occupants in the building will mainly be the residents who are familiar with the building layout and location of fire exits; any visitors in the apartments may not be familiar with the building but expected to be aware of the way by which they access the building.

The apartment units will contain sleeping occupants. Occupants in the car park are expected to be awake and alert. As with the general population, a portion of the occupants in the building is expected to have some mobility impairment and will require assistance from their caregiver(s) or family member(s) for evacuation.

5 Hazards

Outline any hazards unique to the building:

Ignition sources	Cooking appliances
	Household appliances
	Heating and air-conditioning system
	Electrical power supply and lighting system
	Motor vehicles
Fuel sources	Furniture
	Furnishing
	Electrical appliances
	Personal belongings
	Motor vehicles
Activities	Occupants sleeping
	Improper use of appliances
	Minor arson

☐ Insulated sandwich panels
☐ Electrical hazards (substations/switchboards etc.)
☐ Other:
☐ Dangerous / hazardous goods storage
☐ Alternative electrical generation (e.g. solar, tri-gen)

6 Preventative and protective measures

Identify fire safety measures that are, or will be, provided throughout the building, including anything undecided, which should be mentioned as part of the FEBQ review. Additional information may be added to the comments section below to better describe any systems or indicate systems that may be subject to alternative solution.

Occupant warning system

- ☑ Building occupant warning
- ☐ EWIS
- ☐ SSISEP
- ☐ Break glass unit
- ☐ Visual / tactile alarm devices

Signage

- ☑ Emergency lighting
- ☑ Exit and direction signs
- ☑ Warning and operational signs

Facilities for emergency services

- ☑ Emergency lifts
- ☑ Fire control centre
- ☐ Fire control room
- ☐ Perimeter vehicular access
- ☐ Standby power supply system

Smoke hazard management

- ☐ Zone smoke control
- ☐ Purge system (existing building)
- ☐ Smoke and heat vents
- ☐ Smoke exhaust
- ☐ Smoke baffles
- ☐ Ridge vents
- ☐ Stair pressurisation
- ☐ Impulse / jet fans (in carpark)
- ☑ Other: Mechanical air handling system in accordance with BCA clauses F4.5, F4.11 & AS/NZS 1668.2-2012

Hydrant system

- ☑ AS 2419.1-2005
- ☐ AS 2419.1-1994 (existing building)
- ☐ Ordinance 70 (existing building)
- ☐ External hydrants
- ☑ Internal hydrants
- ☐ Street hydrant coverage only
- ☑ Hydrant booster assembly
- ☑ Pumpset
- ☐ Other: (provide details)

Firefighting equipment

- ☑ Portable fire extinguishers
- ☑ Fire hose reels (non-residential area only)

Water supply

- ☐ Grade 1
- ☐ Grade 2
- ☐ Grade 3
- ☐ Onsite storage tank
- ☐ Dual supply

Detection system

- ☑ AS 3786-1993 / AS 3786:2014
- ☑ AS 1670.1:2004
- ☐ AS/NZS 1668.1:2015
- ☑ AS 1670.3-2004 (monitored)
- ☑ Smoke alarms
- ☐ Heat alarms
- ☑ Smoke detectors
- ☑ Heat detectors
- ☐ Flame detectors
- ☐ CO detectors
- ☐ Multi-criteria fire detectors
- ☐ Aspirated smoke detection
- ☐ Beam detection
- ☐ Other: (provide details)

Suppression system

- ☐ CA16 (existing building)
- ☐ AS 2118.1-1999
- ☐ AS 2118.1-2006
- ☐ AS 2118.2-2010 (wall-wetting)
- ☐ AS 2118.3-2010 (deluge)
- ☐ AS 2118.4-2012 (residential)
- ☐ AS 2118.5-2006 (domestic)
- ☐ AS 2118.6-2012 (combined)
- ☐ Fast response heads
- ☐ ESFR
- ☐ Storage mode sprinklers
- ☐ Gaseous suppression system
- ☐ Water mist system
- ☐ Other: (provide details)

Protection of openings

- ☑ Fire doors
- ☐ Smoke doors
- ☐ Solid core doors
- ☑ Fire windows
- ☐ Fire shutters
- ☑ Wall-wetting sprinklers
- ☐ Fire & smoke curtain
- ☑ Smoke curtain
- ☐ Safety curtain for openings
- ☑ Fire dampers
- ☐ Smoke dampers
- ☑ Fire seals (intumescent)
- ☑ Hot smoke seals (>200ºC)
- ☑ Medium temp. smoke seals
- ☐ Other:

Additional information:

- Spandrel protection:
  - Spandrel on the existing lower ground level is to be compliant with the BCA DTS Provisions;
  - Spandrel that is 400mm above the slab in lieu of 600 mm, has an FRL of 60/60/60, and has a total length of at least 900 mm is to be provided to the ground level (subject to a Performance Solution); and the slab of the ground level is to extend approximately 1.3 m beyond the external walls of the lower ground level and form a patio for the undercroft level.

- The lift openings on the ground level and the lower ground level are to be provided with smoke curtains to prevent smoke to the upper levels, in the event of a fire in either of the proposed new units.
- The fire walls separating the Class 7b storage area from the adjoining lobby and carpark areas on the ground level are to have a minimum FRL 120/120/120 (subject to a Performance Solution).
- The doorways for access to the storage areas from the foyer on the ground level are to be provided with −/120/30 self-closing fire doors.
- The door connecting the lobby and carparking areas on the ground level is to be provided with a fire door having an FRL of at least -/120/30, in accordance with C3.4 of BCA 2016.
- The following doorways are to be fitted with medium-temperature smoke seals and intumescent fire seals on all four edges of each door:
    - the doorway of the central fire-isolated stairway on the ground level;
    - the entry doorway of the proposed new residential unit on the ground level;
    - the doorways from the lobby areas for access to the storage areas on the ground level; and
    - the door (highlighted in amber in Figure 12) that connects the entry lobby and carparking areas on the ground level, which is to be a self-closing fire door having an FRL of at least -/120/30.

  The abovementioned medium-temperature smoke seals shall be able to withstand smoke at 200 ^{o}C for 30 minutes and to have been tested to AS 1530.7-2007 to demonstrate that the smoke leakage rate is not more than 3 m^3 per hour per metre of the door perimeter gap at standard temperature and pressure conditions.

  The abovementioned intumescent fire seals shall have been tested to AS 1530.4 to demonstrate that they do not comprise the fire resistance performance of the fire doors to which the seals are to be fitted.

  The abovementioned fire doors shall have the required clearances (2.5mm to 3mm) to accommodate the installation of the smoke seals and fire seals so that the reliability of the seals is not compromised by the door opening/closing actions.
- The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the ground level and level 1 separated from the other areas is to be provided with at least one smoke or heat detector and in accordance with the detector spacing stipulated in AS 1670.1:2015.
- A thermal detector is to be provided in the proposed new apartments on the ground floor and the undercroft level and be located not more than 1.5 m horizontal distance from the doorway within the SOU. The abovementioned thermal detectors shall conform to AS 7240.5-2004 (Amdt 1) and are to be of Class A1 detector as defined in the Standard with a static response temperature between 54°C and 65°C as well as rate-of-rise capability. The thermal detectors are to form part of the smoke detection and alarm system for the building, that is, when a thermal detector is activated, the building general alarm conditions, including the building occupant warning system (BOWS), shall be automatically activated.
- A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout. The BOWS shall be extended into each of the proposed new residential SOUs on ground levels and the undercroft level such that an sound pressure level of at least 75 dB(A) is achieved at each bedhead with all doors of the SOU closed.
- A building management-in-use policy is to be implemented and included in the building annual fire safety statement, which inhibits combustible materials to be stored within all public areas excluding the following areas:
    - the carparking spaces;
    - the garages; and
    - the storage areas.

7 Departures from the Deemed-to-Satisfy provisions

Issue number: 1 **Title: To allow provision of spandrel that is 400 mm above the level slab on the ground level in lieu of 600 mm**

Details of departures from DtS provisions:

As shown in Figure 3 and Figure 4, a spandrel that is 400 mm above the slab in lieu of 600 mm, is to have an FRL of 60/60/60, and a total length of at least 900 mm is to be provided on the ground level.

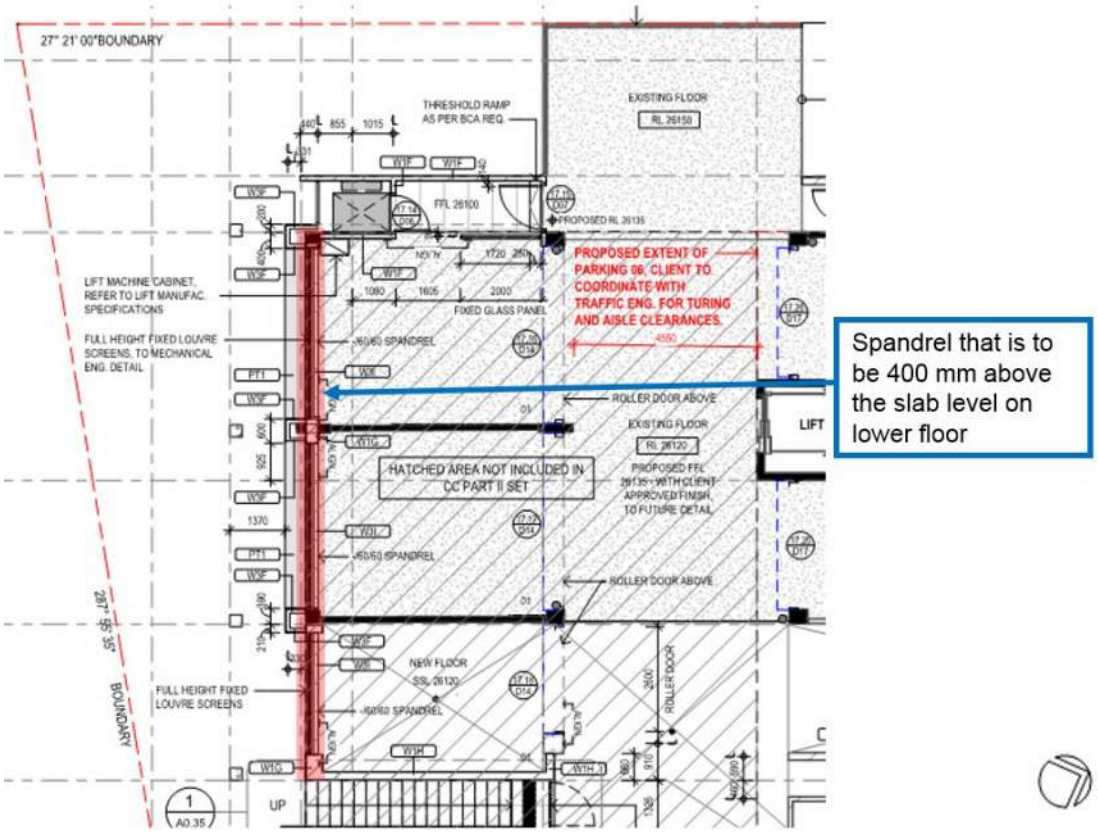


Figure 3: Location of the proposed spandrel that is 400 mm above the slab level on the ground level

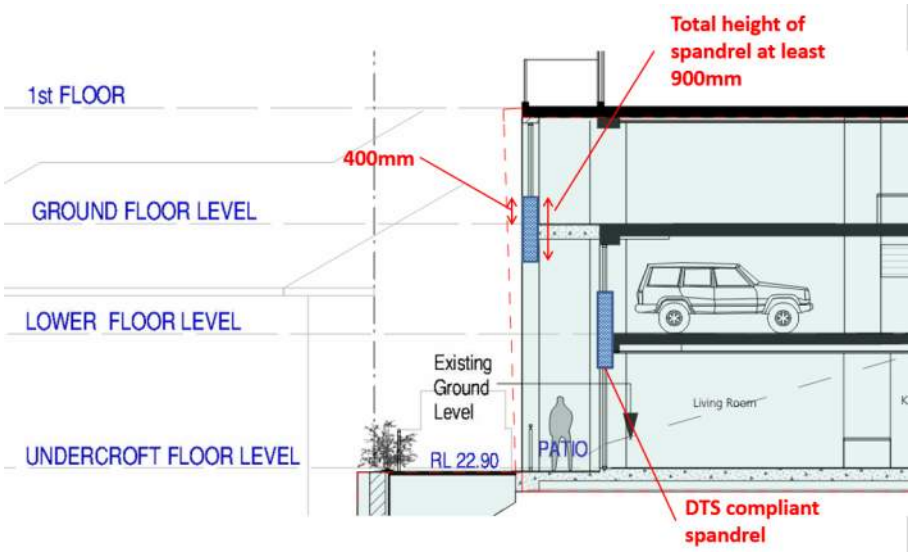


Figure 4: Location of the proposed spandrel that is 400 mm above the slab level of the ground level (south / rear elevation shown)

Applicable DtS provisions:	Clause C2.6	Performance requirements:	CP2

List key fire safety measures:

The proposed spandrel that is 400mm above the slab in lieu of 600 mm, has an FRL of 60/60/60, and has a total length of at least 900 mm is to be provided to the ground level (subject to a Performance Solution); and The slab of the ground level is to extend approximately 1.3 m beyond the external walls of the lower ground level and form a patio for the undercroft level.

Proposed alternative solution:

It is proposed to allow the spandrel panel for the ground level to have up to 400 mm in height above the ground level slab in lieu of 600 mm specified in the BCA DTS Provisions.

Performance solution:

- ☐ A0.3(a)(i) - Comply with the performance requirements
- ☑ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

- ☐ A0.5(a) - Evidence of suitability
- ☐ A0.5(b)(i) - Verification methods in the NCC
- ☐ A0.5(b)(ii) - Other verification methods
- ☐ A0.5(c) - Expert judgement
- ☑ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☑ Comparative	☐ Qualitative	☑ Deterministic
☐ Absolute	☑ Quantitative	☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control	☐ D – Fire detection, warning and suppression
☐ B – Smoke development and spread and control	☐ E – Occupant evacuation and control
☑ C – Fire spread and impact and control	☐ F – Fire services intervention

Acceptance criteria and factor of safety:

The acceptance criterion is that the risk of external vertical fire spread associated with the proposed Performance Solution is equivalent to or lower than that afforded by the DTS Solution.

The relevant DTS Solution features the similar building layout and fire load, except that the spandrel is 600 mm above the slab level on the ground level, and the slab of the ground level is in line with the external walls of the lower ground level and undercroft level.

Fire scenarios and design fire parameters:

A large flaming fire in the lower ground carpark level that has the potential to flashover is to be considered.

Describe how fire brigade intervention will be addressed or considered:

Adverse impact on fire brigade intervention is not expected.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

As this is a comparative study, sensitivity and redundancy studies are not required.

Provide details on proposed modelling/assessment tools:

Flame projection calculations are to be carried out for both the proposed Performance Solution and the BCA DTS solution employing Law and Turlogh's correlations [1].

FRNSW Comment: In principle support is provided subject to all analysis inputs and assumptions being detailed in the FER and agreed upon by all relevant stakeholders, and the analysis demonstrating compliance with the Performance Requirements of the NCC.

1 Margaret Law & Turlogh O'Brien 1990, "Fire safety of bare external structural steel", The Steel Construction Institute.

Issue number: 2 **Title: To allow the proposed carpark portions on the ground level and the lower ground level to have a minimum FRL of 90/90/90 in lieu of 120/120/120**

Details of departures from DtS provisions:

As shown in Figure 5 and 6, it is proposed to allow the proposed new carparking portion on the ground level and the existing lower ground carparking level to have a minimum FRL of 90/90/90 in lieu of 120/120/120. This proposed departure from the BCA 2016 DTS Provisions will be subject to the results of equivalent time of fire exposure calculations.

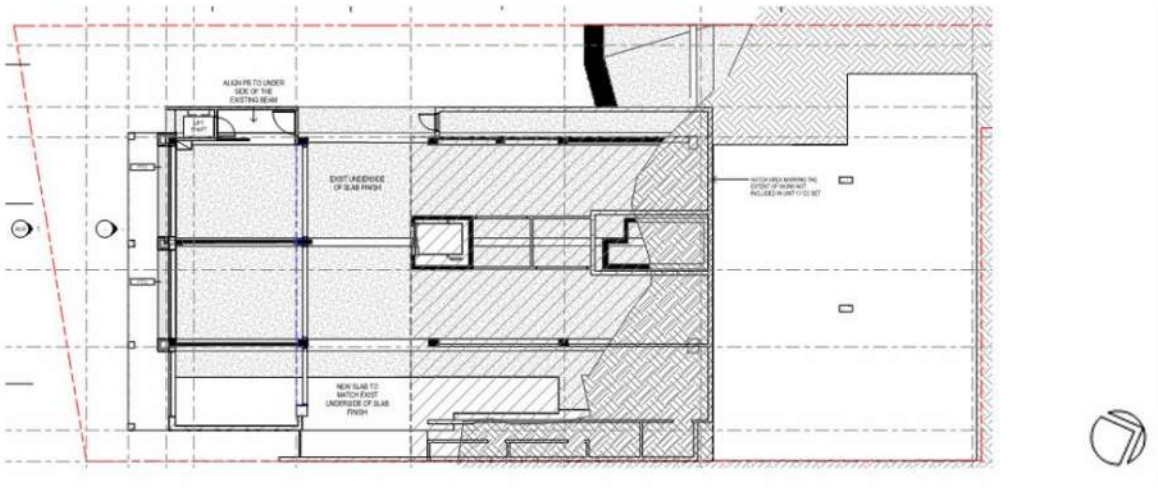


Figure 5: Existing lower ground carpark level

Figure 6: Proposed new carparking portion on the ground level

Applicable DtS provisions:	Table 3 of Specification C1.1	Performance requirements:	CP1

List key fire safety measures:

- The carpark portion on the ground level is to be fire separated from the storage area and the rest of the residential areas by FRL 120/120/120 fire walls with associated self-closing fire doors that have a minimum FRL of −/120/30 complete with medium-temperature smoke seals and intumescent fire seals.
- The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and the ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015.

Proposed alternative solution:

- It is proposed to allow the level slabs for the ground and lower ground levels to have an FRL of 90/90/90 in lieu of 120/120/120.

- The proposed carpark portions on the lower ground level and the ground level are to be provided with large louvres and perforated roller shutters, to facilitate ventilation of hot combustion products from the carpark.

Performance solution:

☑ A0.3(a)(i) - Comply with the performance requirements
☐ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

☐ A0.5(a) - Evidence of suitability
☐ A0.5(b)(i) - Verification methods in the NCC
☑ A0.5(b)(ii) - Other verification methods
☐ A0.5(c) - Expert judgement
☐ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☐ Comparative ☐ Qualitative ☑ Deterministic
☑ Absolute ☑ Quantitative ☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☐ B – Smoke development and spread and control
☑ C – Fire spread and impact and control
☐ D – Fire detection, warning and suppression
☐ E – Occupant evacuation and control
☐ F – Fire services intervention

Acceptance criteria and factor of safety:

The accepted criterion is that the estimated fire severity is less than the existing and proposed fire resistance level (90/90/90) of the building elements.

Fire scenarios and design fire parameters:

A large flaming fire on the lower ground level, which may have the potential to progress into the post-flashover phase, i.e. a fully developed fire, because it is during the post-flashover phase of fire development that the building elements may reach temperature at which they may fall [(2)].

FRNSW: Fire load density should be determined for the proposed fire severity calculation.

Describe how fire brigade intervention will be addressed or considered:

The structure is to be capable of resisting a complete burn-out of the combustible contents. As such, it is not expected to adversely affect fire brigades' operations by the proposed variation in the fire resistance level for the level slabs of the proposed new car park portions on the ground level and of the existing lower ground level.

Verification/validation analyses:

☑ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☐ None

Fire severity calculations are to be conducted by using multiple methods, and 90th percentile fire load density in accordance with IFEG 2005 Chapter 3.4.1.

Provide details on proposed modelling/assessment tools:

Fire severity calculations are to be conducted by using the Law's method, the CIB WG14 method, and the Eurocode method.

FRNSW: Where fire severity / time equivalence calculations are undertaken the following should be considered:

- The limitations on ventilation parameters as specified in Equations 5.14 and 5.15 of Structural Design for Fire Safety (Buchanan, 2001) should be adhered to for all methods.

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2 Walton W. and Thomas P., Estimating Temperatures in Compartment Fires, The SFPE Handbook of Fire Protection Engineering, 4th Edition, National Fire Protection Association, Quincy, Massachusetts, Section 3 Chapter 6, pp. 3-213 to 3-216, 2008.

- The conversion factor k_b should be taken as 0.09 (Fire Engineering Design Guide, Third Edition, p58 & Structural Design for Fire Safety, p103), unless the lining materials of the compartment are identified and form part of the Trial Design requirements to ensure future compliance. A conversion factor appropriate to these lining materials may then be selected based on those recommended for “large compartments” in Table 5.4 of Structural Design for Fire Safety (Buchanan, 2001).
- Clear justification of ventilation to equivalent fire severity calculation area is to be included. A variety of potential ventilation areas are to be evaluated and justified. In this regard, consideration should be given to height of openings, the size of the openings and their relationship to the height of the external wall [e.g. in a full height window only the upper portion may fail (See CIB Publication 269 – Rational Fire Safety Engineering approach to Fire Resistance of buildings)]. For this reason FRNSW recommend that a scenario with no more than 50% window breakage/failure be undertaken. Where it can be demonstrated that more than 50% breakage is likely to occur appropriate justification is to be included in the FER (e.g. modelling to demonstrate temperatures are sufficient to cause window breakage).

Issue number: 3 **Title: To allow the storage area on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240**

Details of departures from DtS provisions:

As shown in Figure 7, it is proposed to allow the proposed storage portion on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.

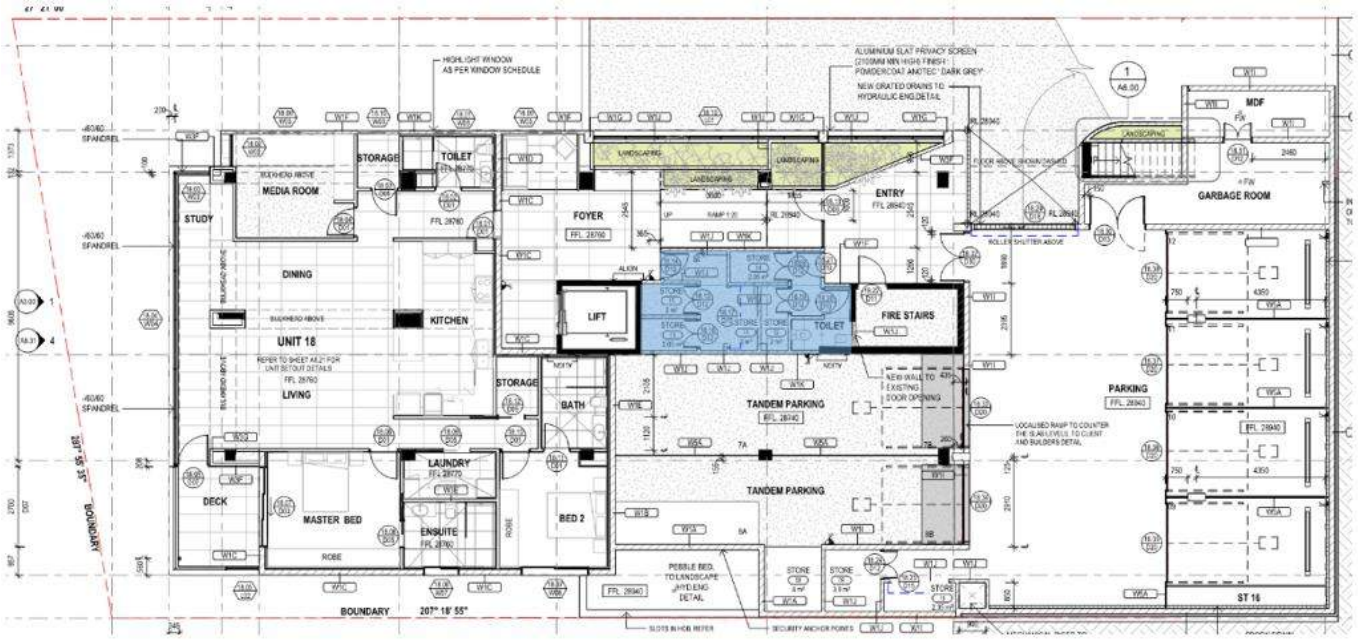

Figure 7: Proposed storage portion on the ground level

Applicable DtS provisions:	Table 3 of Specification C1.1	Performance requirements:	CP1, CP2

List key fire safety measures:

The proposed storage portion on the ground level is to be fire separated from the adjoining areas by FRL 120/120/120 fire walls with associated self-closing fire doors that have a minimum FRL of −/120/30 complete with medium-temperature smoke seals and intumescent fire seals.

The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1-2015. Each carparking garage, store or car space separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1-2015.

Proposed alternative solution:

It is proposed to allow the storage area on the ground level to have a minimum FRL of 120/120/120 in lieu of 240/240/240.

Performance solution:

- ☑ A0.3(a)(i) - Comply with the performance requirements
- ☐ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

- ☐ A0.5(a) - Evidence of suitability
- ☐ A0.5(b)(i) - Verification methods in the NCC
- ☑ A0.5(b)(ii) - Other verification methods
- ☐ A0.5(c) - Expert judgement
- ☐ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☐ Comparative ☑ Qualitative ☑ Deterministic
☑ Absolute ☐ Quantitative ☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☐ B – Smoke development and spread and control
☑ C – Fire spread and impact and control
☐ D – Fire detection, warning and suppression
☐ E – Occupant evacuation and control
☐ F – Fire services intervention

Acceptance criteria and factor of safety:

The potential fire impact is less than the existing and proposed fire resistance level (120/120/120) of the building elements.

Fire scenarios and design fire parameters:

A large flaming fire in the storage area on the ground level is not to progress to the flashover phase and likely to be choked, due to the lack of any opening within the storage area.

Describe how fire brigade intervention will be addressed or considered:

The proposed storage portion on the ground level is a relatively small area that is enclosed by FRL 90/90/90 level slabs, FRL 120/120/120 fire walls, and FRL –/120/30 self-closing fire doors complete with smoke seals. The lack of ventilation in the storage area is expected to restrict fire growth. As such, the building elements for the storage area are not expected to be exposed to the temperature of a fully developed fire.

As such, it is not expected to adversely affected fire brigades' operations by the proposed variation in the fire resistance level to the existing storage portions on the ground level.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☐ None
N/A; qualitative assessment.

Provide details on proposed modelling/assessment tools:

Fire severity calculations are not to be conducted. The proposed storage area on the ground level is nearly air tight and the fire is expected to be self-extinguished when the oxygen concentration therein drops to 13 to 15%.

FRNSW Comment: FRNSW recommends appropriate reference be provided to verify the above statement with respect to the oxygen concentration for self-extinguishment.

In principle support is provided subject to the following:

- All FRNSW comments be adequately addressed.
- The analysis in the FER demonstrating compliance with the performance requirements of the NCC.

Issue number: 4 **Title: Egress provisions for the proposed new residential units on the ground level and the undercroft level**

Details of departures from DtS provisions:

It is proposed to allow:

- a single exit to serve the proposed new residential units located on the undercroft level
- a single exit to serve the proposed new residential units located on the ground level
- the egress pathway from the unit entrance door to open space to be exposed to the openings of the garages on the ground level
- the existing ramp from Queenscliff Road to the subject building to have a gradient steeper than 1:8

As shown in Figure 8, the proposed new residential unit on the undercroft level is to be provided with an egress pathway, which is for the occupants to travel via an external stairway that discharges to the lower ground carpark area, and then to the existing driveway that connects to Queenscliff Road. This egress pathway is to be exposed to the perforated roller shutters of the garages on the lower ground level.

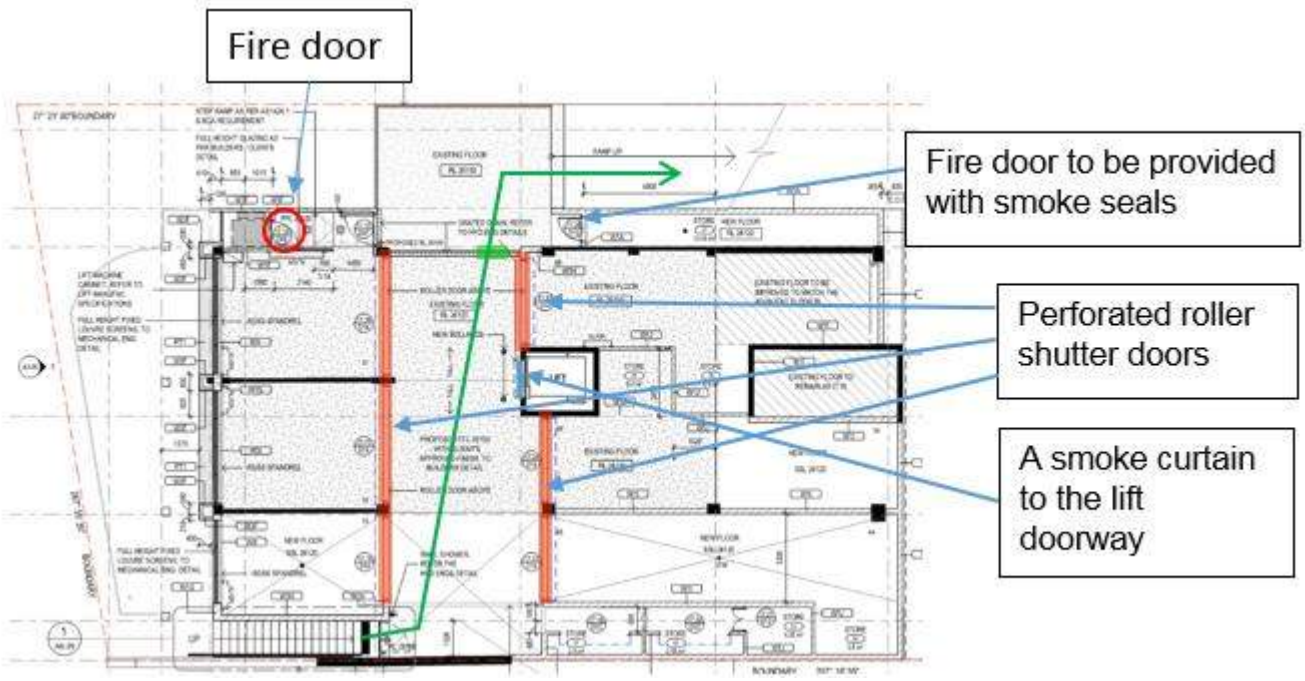

Figure 8: Egress pathway from the undercroft level (lower ground level shown)

As shown in Figure 9, the proposed new residential unit on the ground level is to be provided with an egress pathway via the foyer then the main entry area on the ground level and then to the existing driveway that connects to Queenscliff Road. The proposed fire and smoke resisting construction is shown in Figure 9.

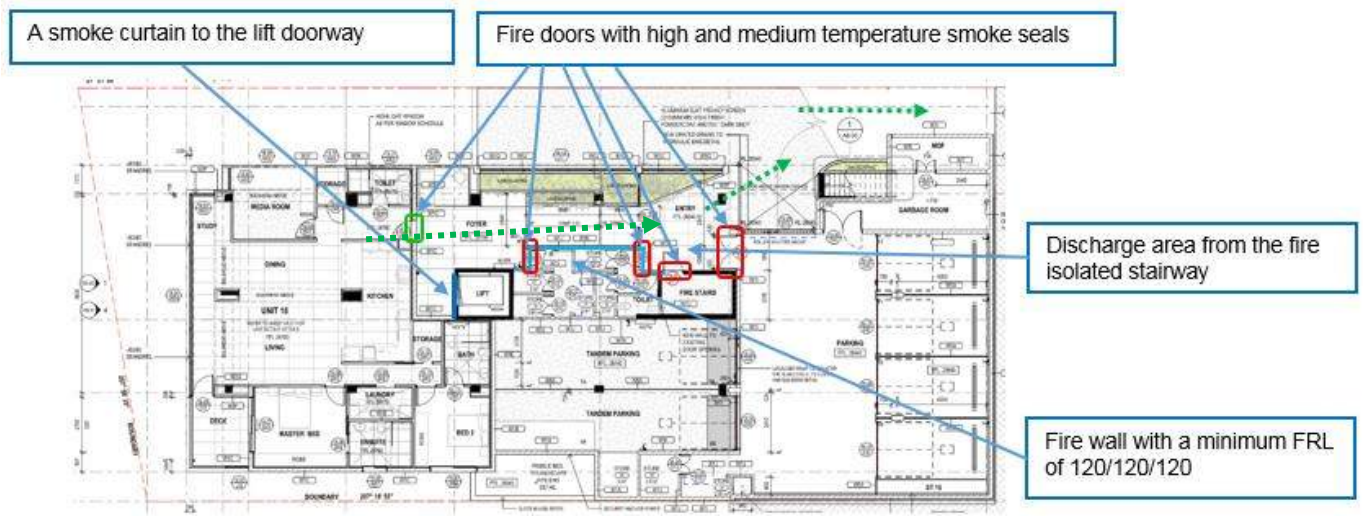

Figure 9: Proposed fire resisting construction on the ground level

Applicable DtS provisions:	Clauses D1.2, D1.9, D1.10	Performance requirements:	DP4 and EP2.2

List key fire safety measures:

- The undercroft, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and the ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015.
- All garages on the lower ground level are separated from each other by masonry construction.
- The walls separating the main entry & foyer area from the storage area on the ground level are to be fire walls with an FRL of not less than 120/120/120.
- The entrance doors of both the proposed new units on the undercroft level and the ground level are to be self-closing fire doors having an FRL of at least −/60/30.
- Smoke curtains are to be provided to the lift doors on the lower ground level and the ground level to prevent smoke spread to the upper levels above.
- The following doors are to be fitted with medium-temperature smoke seals and intumescent fire seals on all four edges of each of the following doors:
    - the door of the central fire-isolated stairway on the ground level
    - the entry door of proposed new residential unit on the ground level
    - the two doors from the lobby areas to the storage areas on the ground level
    - the door (highlighted in amber in Figure 12) that connects the entry lobby and carparking areas on the ground level, which is to be a self-closing fire door having an FRL of at least -/120/30.
- A thermal detector is to be provided in the proposed new apartments on the ground floor and the undercroft level and be located not more than 1.5 m horizontal distance from the doorway within the SOU. The abovementioned thermal detectors shall conform to AS 7240.5-2004 (Amdt 1) and are to be of Class A1 detector as defined in the Standard with a static response temperature between 54°C and 65°C as well as rate-of-rise capability. The thermal detectors are to form part of the smoke detection and alarm system for the building, that is, when a thermal detector is activated, the building general alarm conditions, including the building occupant warning system (BOWS), shall be automatically activated.
- A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout. The BOWS shall be extended into each of the proposed new residential SOUs on ground levels and the undercroft level such that an sound pressure level of at least 75 dB(A) is achieved at each bedhead with all doors of the SOU closed.

- A building management-in-use policy is to be implemented and included in the building annual fire safety statement, which inhibits combustible materials to be stored within all public areas excluding the following areas:
    - the carparking space;
    - the garages; and
    - the storage areas.

Proposed alternative solution:

The undercroft, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015. As such, early fire alarm is expected to be provided to the occupants at the early phase of the fire development.

For the egress provisions related to the new residential units located in the undercroft and travel via the lower ground level, the following three fire scenarios are to be considered:

1. In the event of a fire on the upper level above the lower ground level, occupants from the new unit on the undercroft level are considered to be able to travel via an egress pathway to open space, which is unlikely to be affected by the fire.
2. In the event of a fire within the new SOU in the undercroft, once occupants have evacuated from the SOU, they are considered to be relatively safe, as the fire will be contained within the SOU for a significant period of time.
3. In the event of a fire on the lower ground level, especially within a garage adjacent to the egress pathway from the new SOU in the undercroft to open space, occupants are expected to detect the fire ahead and can retreat to the SOU. Due to the space between the SOU and the carparking area features natural ventilation and the buoyance effect of a fire, the occupants are unlikely to be affected by either fire or smoke for a significant period of time. Note that the building occupants are currently provided with a direct access to the public beach, which is a relative safe place away from the building fire. However, the current beach access is not considered as an exit and may be subject to changes in future.

FRNSW: Adequate egress must be provided from the new SOU in the undercroft. As the access to the beach is not considered as an exit, FRNSW does not support the proposal in which occupants need to retreat to their unit, which will put their life in great danger.

For a fire in one of the garages on the lower ground level, safe egress must be provided to ensure occupants in the new SOU in the undercroft can safely evacuate.

For the egress provisions related to the new residential unit located on the ground level, the egress pathway is protected by fire resisting construction, thus the evacuees are unlikely to be exposed to either fire or smoke within the adjacent carparking and storage areas. As the building main circulation space, these egress pathways are considered to be sterile, which is further reinforced by the proposed management-in-use policy to not store combustible materials within public areas.

The Performance Solution also proposes to protect the lift shafts by smoke curtains and protect the fire-isolated stairway by smoke seals, which are expected to limit the smoke spread from the proposed new unit to the existing upper levels.

Based on the number of bedrooms, the proposed new unit on the lower ground level and the ground level are likely to add about merely 6 residents to the total number of occupants of the whole building, which is expected to have insignificant impact on the use of the existing ramp to the public road. The existing ramp has being serving the building occupants for about 50 years, and accepted by the previous Fire Order process involving FRNSW. As such, the proposed development is not expected to adversely affect the current level of fire and life safety associated with the existing ramp.

Performance solution:

☑ A0.3(a)(i) - Comply with the performance requirements
☐ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

☐ A0.5(a) - Evidence of suitability
☐ A0.5(b)(i) - Verification methods in the NCC
☑ A0.5(b)(ii) - Other verification methods
☐ A0.5(c) - Expert judgement
☐ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☐ Comparative ☑ Qualitative ☑ Deterministic
☑ Absolute ☐ Quantitative ☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☑ B – Smoke development and spread and control
☑ C – Fire spread and impact and control
☑ D – Fire detection, warning and suppression
☑ E – Occupant evacuation and control
☑ F – Fire services intervention

Acceptance criteria and factor of safety:

The Performance Solution is considered to be acceptable if it can be demonstrated that occupants of the proposed new SOUs either being trapped within the building or being exposed to untenable conditions due to the proposed variations to the egress provisions are unlikely to occur.

FRNSW: As stated previously, FRNSW does not support the proposal in which occupants need to retreat to their unit and be trapped there as this will put their life in great danger.

Noted that from Issue number 8 that the building is not proposed to be provided with a sprinkler system. If a fire occurring in one of the garages on the lower level, occupants may not be able to travel past the fire due to lack of sprinklers and would be very likely to be trapped within the building as pointed out by the FEBQ.

Fire scenarios and design fire parameters:

A large flaming fire occurs on the undercroft level, the lower ground level and the ground level occur respectively, which requires the occupants to evacuate.

Describe how fire brigade intervention will be addressed or considered:

The garage area on the lower ground level features natural ventilation and is in close proximity to the final exit doorway. Fire brigades are expected to have easy access to the fire origin in the event of a fire initiated in the garage area.

The proposed new unit on the ground level is provided with an egress pathway to the existing outdoor ramp via the main entry area that is to be protected by the proposed fire resisting construction. As such fire brigades access to, or via, this area is expected to be shielded from the fire.

Additional smoke curtains and smoke seals are to be provided to the lift doorways and fire-isolated stairways on the ground level and lower ground level, to prevent smoke spreading to the upper levels. It is understood that the existing conditions of the upper levels, as well as the existing ramp, were accepted by FRNSW during the previous Fire Order process. As such, all upper levels of the existing building remain unchanged, and are expected to not be adversely affected by the construction of the proposed new units on the lower levels.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

N/A; qualitative assessment only.

Provide details on proposed modelling/assessment tools:

N/A, qualitative assessment is proposed.

Issue number: 5 **Title: Egress provisions for the existing carparking areas on the ground level and level 1**

Details of departures from DtS provisions:

It is proposed to allow

- a single exit to serve the carparking area on the ground level
- a single exit to serve the carparking area on level 1
- an extended travel distances of up to approximately 24 m from the carparking areas to a single exit on the ground level

As shown in Figure 10, as advised by the certifying authority, the extended travel distance to a single exit within the carparking area on the ground level is up to 24 m. As show in Figure 11, the existing carparking area on level 1 is served by a single exit.

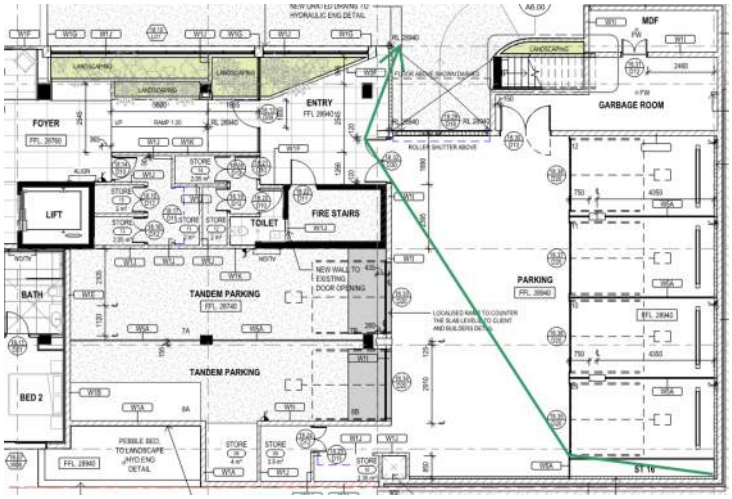

Figure 10: Extended travel distances to an exit on the ground level

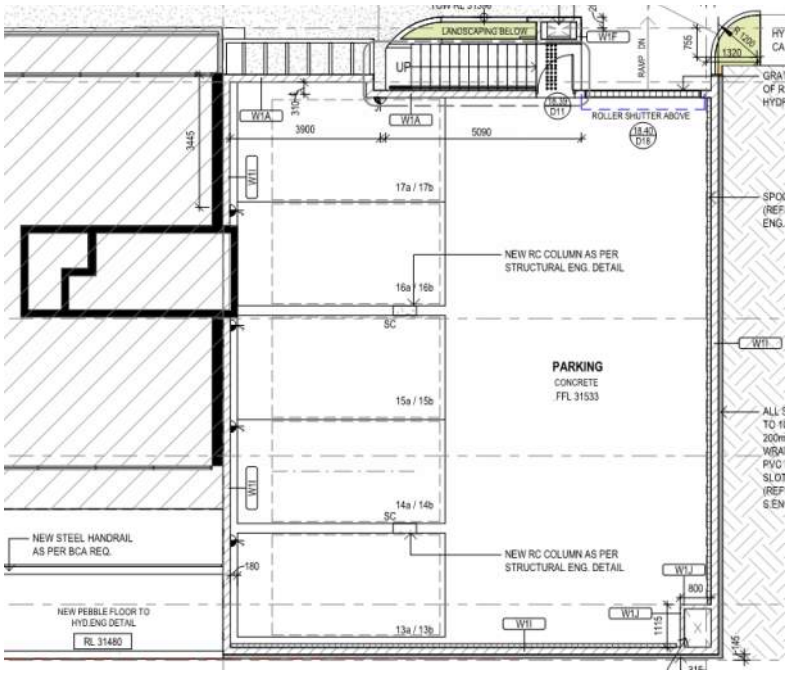

Figure 11: Carparking area on level 1

Applicable DtS provisions:	Clauses D1.2, D1.4	Performance requirements:	DP4 and EP2.2

List key fire safety measures:

- The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1-2015. Each carparking garage, store or car space on the lower ground level and ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015.
- A building management-in-use policy is to be implemented and included in the building annual fire safety statement, which inhibits combustible materials to be stored within all public areas excluding the following areas:
  - the carparking space;
  - the garages; and
  - the storage areas.
- A fire door with smoke seals to separate the carparking area and the discharging area of the fire-isolated stairway.

Proposed alternative solution:

The occupants within the carparking areas are likely to be awake and alert. There are only four and five carparking space on the ground level and level 1 respectively. Considering generally infrequent access to the carparking areas by the residents, the population within the carparking areas on the ground level and level 1 are expected to be low and transient.

The carparking areas feature:

- separated garages or car spaces, which is expected to separate the fuel loads, and limit the fire and smoke spread within the subject areas.
- open layout level plans, which enable the occupants to easily detect the fire situation and locate the exits when they are outside the garages and secured carparking spaces.

The subject areas are provided with smoke detection and alarm system in accordance with AS 1670.1:2015, with additional requirement of heat detectors within each carparking, store and car space which are separated from the rest the areas by physical separation, such as walls and fences. Early alarm is expected to be provided to the occupants within the carparking areas and the rest of the building at the early phase of the fire growth.

The carparking area is fire separated from the discharge area of the central fire-isolated stairway. As such, once occupants leave the carpark via the fire door with smoke seals, they are considered to reach a safe area where they are protected from the exposure of products of combustion and therefore are facilitated to safely travel to the open space.

The subject areas are located on the lower levels within a building that is considered to be over 25 m by the definition in BCA 2016. The existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portion being repurposed is to occur on the undercroft level and the ground level only, and does not increase the existing agreed effective height of the subject building.

FRNSW: Refer to our previous comments regarding the effective height.

The ground level and level 1 carparks are located well below the 25m effective height and the fire and life safety risk therein is independent from the number of storeys above them.

Performance solution:

☐ A0.3(a)(i) - Comply with the performance requirements
☑ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

☐ A0.5(a) - Evidence of suitability
☐ A0.5(b)(i) - Verification methods in the NCC
☐ A0.5(b)(ii) - Other verification methods
☐ A0.5(c) - Expert judgement
☑ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☑ Comparative ☑ Qualitative ☑ Deterministic
☐ Absolute ☐ Quantitative ☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☑ B – Smoke development and spread and control
☑ C – Fire spread and impact and control
☑ D – Fire detection, warning and suppression
☑ E – Occupant evacuation and control
☑ F – Fire services intervention

Acceptance criteria and factor of safety:

The Performance Solution is considered to be acceptable if it can be demonstrated that the level of protection of life and fire safety within the subject carparking areas on the ground level and level 1, which is associated with the proposed Performance Solution, is considered to be equivalent to or higher than that offered by the DTS Solution.

The relevant DTS Solution: A carpark would feature:

- having up to 39 vehicles
- being served by a single exit
- located on the ground level or level 1 within a low-rise building
- the travel distance to an exit being 20 m.
- not being protected with a smoke detection and alarm system
- not being served by a fire door with smoke seals, which can be considered as a horizontal exit

Fire scenarios and design fire parameters:

A large flaming fire occurs within the subject carparking areas, which requires the occupants to evacuate.

Describe how fire brigade intervention will be addressed or considered:

The carparking areas have relatively small level area and located on the low levels. As such, it is not expected to affect the fire brigade operations.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

N/A; comparative and qualitative assessment.

Provide details on proposed modelling/assessment tools:

N/A, comparative and qualitative assessment is proposed.

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

Issue number: 6 **Title: To allow the existing central fire-isolated stairway to discharge into a covered area on the ground level**

Details of departures from DtS provisions:

It is proposed to allow the existing central fire-isolated stairway to discharge into a covered area (entry lobby) on the ground level, which is not open for at least 2/3 of its perimeter.

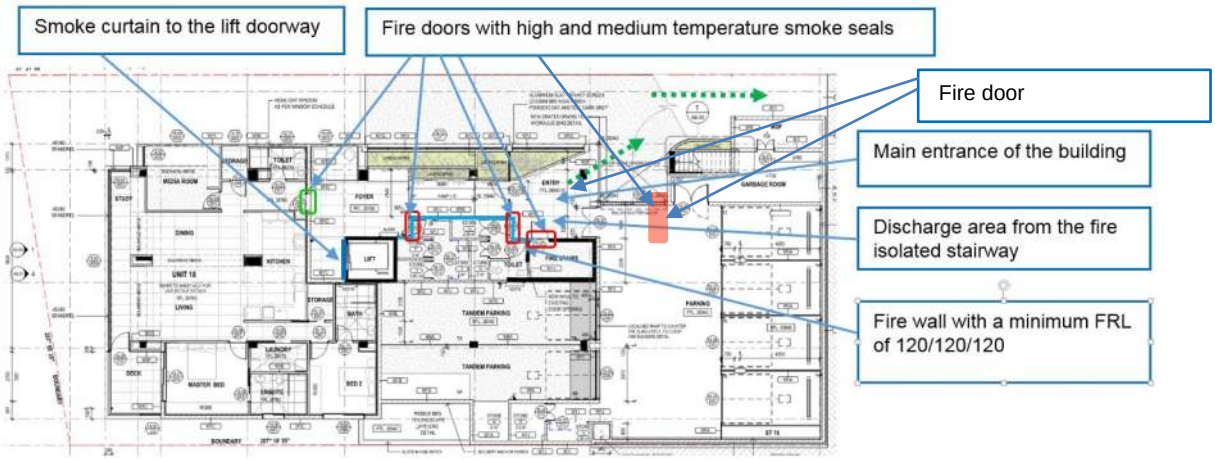

Figure 12: Proposed fire and smoke resisting construction (in addition to the BCA DTS Provisions) on the ground level

Applicable DtS provisions:	Clauses D1.7, C3.4	Performance requirements:	DP5 and EP2.2

List key fire safety measures:

- The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and the ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015;
- The walls separating the foyer and main entry area from the storage area on the ground level are to be fire walls with an FRL of not less than 120/120/120;
- The door connecting the lobby and carparking areas on the ground level is to be provided with a fire door having an FRL of at least -/120/30, in accordance with C3.4 of BCA 2016.
- The following doorways are to be fitted with medium-temperature smoke seals and intumescent fire seals on all four edges of each door:
  - the doorway of the central fire-isolated stairway on the ground level;
  - the entry doorway of proposed new residential unit on the ground level;
  - the two doorways from the lobby areas to the storage areas on the ground level; and
  - the door (highlighted in amber in Figure 12) that connects the entry lobby and carparking areas on the ground level, which is to be a self-closing fire door having an FRL of at least -/120/30.
- A building management-in-use policy is to be implemented and included in the building annual fire safety statement, which inhibits combustible materials to be stored within all public areas excluding the following areas:
  - the carparking space;
  - the garages; and
  - the storage areas.

Proposed alternative solution:

To allow the existing central fire-isolated stairway to discharge into a covered area.

The discharge area is to be fire and smoke separated from the rest of the building by the proposed fire resisting construction.

Performance solution:

- ☑ A0.3(a)(i) - Comply with the performance requirements
- ☐ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

- ☐ A0.5(a) - Evidence of suitability
- ☐ A0.5(b)(i) - Verification methods in the NCC
- ☑ A0.5(b)(ii) - Other verification methods
- ☐ A0.5(c) - Expert judgement
- ☐ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☐ Comparative	☑ Qualitative	☑ Deterministic
☑ Absolute	☐ Quantitative	☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control	☑ D – Fire detection, warning and suppression
☑ B – Smoke development and spread and control	☑ E – Occupant evacuation and control
☑ C – Fire spread and impact and control	☐ F – Fire services intervention

Acceptance criteria and factor of safety:

The Performance Solution is considered to be acceptable if it can be demonstrated that the discharging occupants are not exposed to the defined untenable conditions due to the proposed discharge of the fire-isolated stairway into a covered area.

Fire scenarios and design fire parameters:

A large flaming fire within a residential unit or the adjoining carpark and storage areas on the ground level of the subject building.

Describe how fire brigade intervention will be addressed or considered:

The subject area is right next to the entry door of the building. Fire brigades can approach the building via the existing outdoor ramp and have direct access to the subject area that is fire and smoke separated from the rest areas by the proposed fire resisting construction. The Performance Solution is therefore expected to not adversely affect the fire brigade intervention.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

N/A; qualitative assessment only.

Provide details on proposed modelling/assessment tools:

N/A, qualitative assessment is proposed.

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

Issue number: 7 **Title: To allow the lift serving the new unit in the undercroft not to be an emergency lift**

Details of departures from DtS provisions:

As shown in Figure 13, it is proposed to allow the lift serving the new unit on the undercroft level to not be an emergency lift.

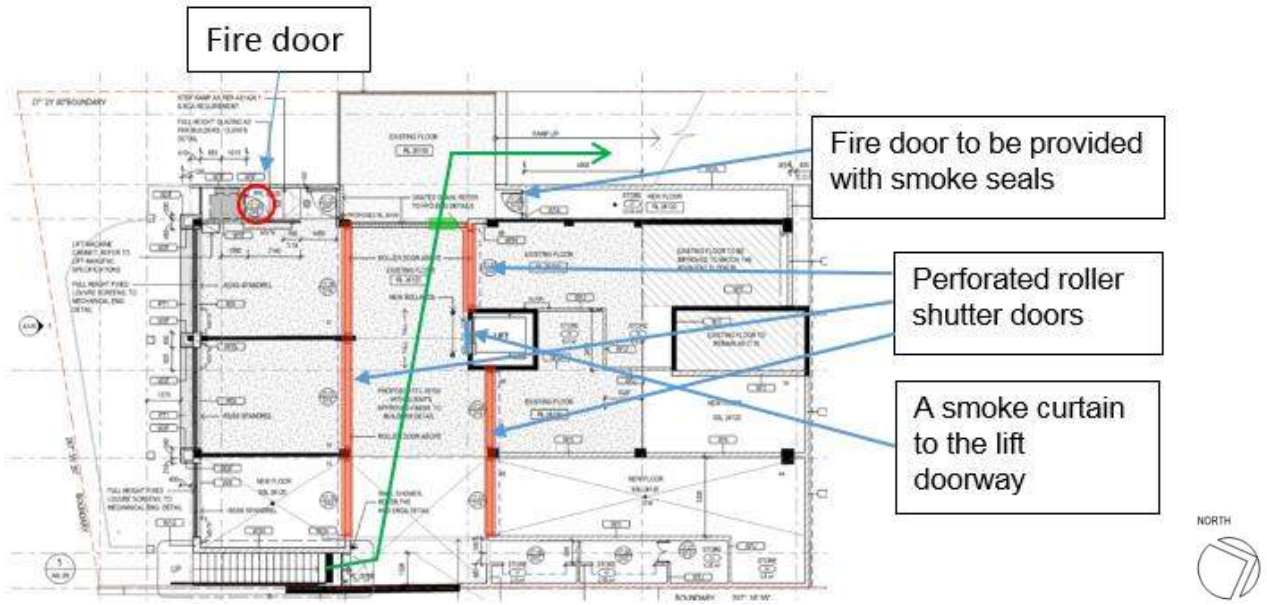

Figure 13: Proposed fire door to the lift serving the new unit on the undercroft level on the lower ground level

Applicable DtS provisions:	Clauses E3.4	Performance requirements:	EP3.2

List key fire safety measures:

- The lift located on the western end of the lower ground level is to serve the proposed unit located in the undercroft only.
- The lift landing door is to be a self-closing fire door having an FRL of at least -/60/30.

Proposed alternative solution:

The subject lift is to be provided with a fire rated landing door. The lift is considered to be fully within SOU bounding construction and to serve the SOU only. It is therefore considered as a private lift for the SOU in the undercroft.

Performance solution:

☐ A0.3(a)(i) - Comply with the performance requirements
☑ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

☐ A0.5(a) - Evidence of suitability
☐ A0.5(b)(i) - Verification methods in the NCC
☐ A0.5(b)(ii) - Other verification methods
☐ A0.5(c) - Expert judgement
☑ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☑ Comparative	☑ Qualitative	☑ Deterministic
☐ Absolute	☐ Quantitative	☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☐ B – Smoke development and spread and control
☐ C – Fire spread and impact and control
☐ D – Fire detection, warning and suppression
☐ E – Occupant evacuation and control
☑ F – Fire services intervention

Acceptance criteria and factor of safety:

The Performance Solution is considered to be acceptable if it can be demonstrated that the level of protection to the occupants within the proposed new SOU is equivalent to or higher than that offered by the DTS Solution.

The relevant DTS Solution would feature a SOU located on the undercroft level, which has the similar building layout and is not provided with a private lift.

Fire scenarios and design fire parameters:

A large flaming fire that would grow to a fully developed fire in the new unit in the undercroft is considered.

Describe how fire brigade intervention will be addressed or considered:

The lift is to be provided with bounding construction as a private lift within the SOU. Adding a private lift to a SOU on the undercroft level is not expected to adversely affect the fire brigades firefighting operations.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

N/A; qualitative assessment only.

Provide details on proposed modelling/assessment tools:

N/A, qualitative assessment is proposed.

FRNSW Comment: In principle support is provided subject to the analysis in the FER demonstrating compliance with the performance requirements of the NCC.

Issue number: 8 **Title: To allow the proposed building portion being repurposed to not be provided with sprinkler protection**

Details of departures from DtS provisions:

It is proposed to not provide sprinkler protection to the building portion that is being repurposed.

Applicable DtS provisions:	Clauses E1.5	Performance requirements:	EP1.4

List key fire safety measures:

- The NSWFB, in its letter dated 19 October 2010 to Warringah Council, has no objection to the proposed Fire Safety Upgrade Strategy detailed in the Fire Safety Upgrade Report Ref. 101014-r2/rp prepared by BCA Logic Pty Ltd and dated 1 September 2009, and did not object to the building being described as having an effective height of less than 25 metres as discussed in Part 2 of the Fire Safety Upgrade Report.

FRNSW Comment: As commented previously, the effective height for the building should be determined based on the latest version BCA due to the fact that the definition of the effective height has been revised since 2016.

- Fire detection and alarm system is to be provided throughout the building. The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the lower ground level and the ground level separated from the other areas is to be provided with at least one smoke or heat detectors and in accordance with the detector spacing stipulated in AS 1670.1:2015.
- Two smoke curtains are to be provided to the lift doorways on the ground level and the lower ground level to prevent smoke spread to the upper levels.
- The following doorways are to be fitted with medium-temperature smoke seals and intumescent fire seals on all four edges of each door:
  - doorway of the central fire-isolated stairway on the ground level
  - entry doorway of proposed new residential unit on the ground level
  - two doorways from the lobby areas to the storage areas on the ground level

Proposed alternative solution:

It is proposed to allow the proposed building portion being repurposed to not be provided with sprinkler protection.

As demonstrated by the Performance Solutions 1-7 of this report, the proposed departures from the BCA DTS Provisions is considered to satisfy the relevant BCA Performance Solutions without the needs of a fire sprinkler system.

The following additional fire safety measures are to be provided:

- The following doorways are to be fitted with medium-temperature smoke seals and intumescent fire seals on all four edges of each door:
  - the doorway of the central fire-isolated stairway on the ground level;
  - the entry doorway of the proposed new residential unit on the ground level;
  - the doorways from the lobby areas for access to the storage areas on the ground level; and
  - the door (highlighted in amber in **Error! Reference source not found.**) that connects the entry lobby and carparking areas on the ground level, which is to be a self-closing fire door having an FRL of at least -/120/30.
- The lift openings on the ground level and the lower ground level are to be provided with smoke curtains to prevent smoke to the upper levels, in the event of a fire in either of the proposed new units.
- The undercroft level, the lower ground level, the ground level and level 1 are to be provided with a smoke detection and alarm system throughout in accordance with AS 1670.1:2015. Each carparking garage, store or car space on the ground level and level 1 separated from the other areas is to be provided with at least one smoke or heat detector and in accordance with the detector spacing stipulated in AS 1670.1:2015.
- A thermal detector is to be provided in each of the proposed new apartments on the ground floor and the undercroft level and be located not more than 1.5 m horizontal distance from the doorway within the SOU. The abovementioned thermal detectors shall conform to AS 7240.5-2004 (Amdt 1) and are to be of Class A1

detector as defined in the Standard with a static response temperature between 54°C and 65°C as well as rate-of-rise capability. The thermal detectors are to form part of the smoke detection and alarm system for the building, that is, when a thermal detector is activated, the building general alarm conditions, including the building occupant warning system (BOWS), shall be automatically activated.

- A BOWS that complies with BCA 2016 DTS Provisions clause 6 of Specification E2.2a shall be provided throughout. The BOWS shall be extended into each of the proposed new residential SOUs on ground levels and the undercroft level such that an sound pressure level of at least 75 dB(A) is achieved at each bedhead with all doors of the SOU closed.

As such, fire and smoke spread from the lower levels to the upper levels, due to the proposed building work, is unlikely to occur. The occupants of all upper levels are to be facilitated with early fire alarm in the event of a fire initiated within the areas affected by the proposed building works.

Hence, the fire and life safety level of all upper levels of the existing building is considered to not be adversely affected by the proposed construction of two new units on the ground floor and the undercroft.

It is understood that the existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The building portion being repurposed is to occur on the undercroft level and the ground level only, and does not increase the existing agreed effective height of the subject building.

On the basis of the analysis above, reproposing of omitting fire sprinkler system to the existing building is not expected to adversely affect the fire safety level of the existing building.

Performance solution:

☐ A0.3(a)(i) - Comply with the performance requirements
☑ A0.3(a)(ii) - Be at least equivalent to the DtS provisions

Assessment methods:

☐ A0.5(a) - Evidence of suitability
☐ A0.5(b)(i) - Verification methods in the NCC
☑ A0.5(b)(ii) - Other verification methods
☐ A0.5(c) - Expert judgement
☐ A0.5(d) - Comparison with the DtS provisions

Assessment approach:

☐ Comparative ☑ Qualitative ☑ Deterministic
☑ Absolute ☐ Quantitative ☐ Probabilistic

IFEG sub-systems used in the analysis:

☑ A – Fire initiation and development and control
☑ B – Smoke development and spread and control
☑ C – Fire spread and impact and control
☑ D – Fire detection, warning and suppression
☑ E – Occupant evacuation and control
☑ F – Fire services intervention

Acceptance criteria and factor of safety:

The Performance Solution is considered acceptable if it can be demonstrated that

- the proposed Performance Solutions 1-7 can satisfy the relevant BCA Performance Solutions without the needs of a fire sprinkler system; and
- reproposing non-provision of fire sprinkler system is not to adversely affect the fire and life safety level of the occupants of the existing upper levels of the existing building.

Fire scenarios and design fire parameters:

A large flaming fire in the building portion being repurposed, which has the potential to grow to a fully developed fire.

Describe how fire brigade intervention will be addressed or considered:

The existing building was the subject of a Warringah Council Fire Order. As part of the Fire Order process FRNSW (NSWFB at the time) agreed the building to be described as having an effective height of less than 25 metres. The

building portion being repurposed is to occur on the undercroft level and the ground level only, and does not increase the existing agreed effective height of the subject building.

An additional smoke curtain is to be provided to the lift doorway on the ground level, and smoke seals are to be provided to the doorway of the central fire-isolated stairway on the ground level, so as to prevent smoke spread from the ground level to the upper levels. As such, the fire and life safety level of all upper levels of the existing building is considered to remain unchanged, and not expected to be adversely affected by the proposed construction of two new units on the ground level and in the undercroft.

Verification/validation analyses:

☐ Sensitivity studies ☐ Redundancy studies ☐ Uncertainty studies ☑ None

N/A; qualitative assessment only.

Provide details on proposed modelling/assessment tools:

N/A, qualitative assessment is proposed.

FRNSW Comment: FRNSW do not support the proposal. Given the fact that the building is greater than 25 m under the current BCA, it is FRNSW's position that the building should be provided with a sprinkler system throughout.

8 Construction, commissioning, management, use and maintenance

What considerations does the alternative solution require during the construction phase?

Considerations during the construction phase would be the same as a building adopting the DTS Solutions.

How will the alternative solution affect commissioning of the systems (e.g. listed on fire safety schedule as essential or critical measure, combined new and old installations)?

Commissioning of the fire systems is to be carried out in accordance with the relevant Australian Standards. Commissioning and integrated function testing of all fire safety systems including interfaces is to be carried out to ensure proper function.

How will the alternative solution be addressed for ongoing building management and use (e.g. details to be provided in a 'fire safety management plan' for the building manager)?

All essential fire safety measures in the building, including the Performance Solutions, will be included in the fire safety schedule that will be checked on an annual basis.

How will any restrictions on fuel load/use/populations within the alternative solution be managed and enforced (e.g. details to be provided in 'emergency management plan')?

A building management-in-use plan is to be prepared and implemented on site, and to be included in the building annual fire safety statement, which inhibits combustible materials to be stored within all public areas excluding the following areas:

- the carparking space;
- the garages; and
- the storage areas.

How will the alternative solution be addressed for maintenance (e.g. details included on fire safety schedule, location of fire engineering report on site, plain English summary adjacent to FIP)?

All essential services are to be maintained and tested annually in accordance with the requirements of AS1851-2012 and/or their system-specific Australian Standards.

All routine maintenance and testing shall be carried out by companies that are accredited under the Fire Protection Accreditation Scheme (FPAS) administered by Fire Protection Association Australia.

The Performance Solutions and associated fire safety measures will be included on the fire safety schedule. A copy of the Fire Engineering Report is to be kept within the FIP enclosure.

9 Additional comments

None

Note: Any in principle support extended for alternative solution issues through consultation is contingent upon all assumptions, analyses and conclusions in the fire engineering report being fully justified, and referenced as appropriate, to demonstrate how the relevant performance requirements have been satisfied to the extent required by the agreed acceptance criteria.

10 Scheduled charges

FRNSW charge for the provision of services performed in connection with statutory fire safety as per the schedule of charges identified in clause 46 and schedule 3 of the *Fire Brigades Regulation 2014*.

The charge applicable is $2,600 for each day (or part of a day) spent by the Commissioner or a fire brigade member providing advisory, assessment or consultancy services.

Note: For a full description of the charges applicable including terms, payment options, applying for a waiver or reduction of the charges, please refer to the FRNSW website at firesafety.fire.nsw.gov.au.

11 Contact us

For further information contact the Fire Safety Branch on (02) 9742 7434 or email firesafety@fire.nsw.gov.au.