

**Sydney Metro**

**PITT STREET SOUTH OVER STATION  
DEVELOPMENT**

Appendix R. Fire Engineering Review

**State Significant Development,  
Development Application (SSD DA)**

Prepared for **Pitt Street Developer South Pty Ltd**

19 May 2020

Revision C

Issue for SSD DA

[SMCSWSPS-WAR-OSS-PL-REP-000001](#)

**warringtonfire**

## Quality management

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## Executive summary

The fire engineering review has been prepared to accompany the Stage 2 SSD DA submission for Pitt Street South OSD.

The fire safety design will generally satisfy the performance requirements of the NCC by complying with the Deemed-to-Satisfy provisions. Some aspects have been developed as performance based fire engineering to achieve compliance.

Based on the current design documentation received to date it is considered that there are no issues that will significantly affect the building layout arising from fire safety, as such consent should not be withheld.

Engagement with Fire and Rescue NSW has commenced and no objections have been raised. Further engagement will occur during design development and prior to construction certificate.

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## 1. Introduction

This report has been prepared to accompany a State Significant Development (SSD) Development Application (DA) for a residential Over Station Development (OSD) above the new Sydney Metro Pitt Street South Station. The detailed SSD DA is consistent with the Concept Approval (SSD 17\_8876) granted for the maximum building envelope on the site, as proposed to be modified. The Minister for Planning, or their delegate, is the consent authority for the SSD DA and this application is lodged with the NSW Department of Planning, Industry and Environment (NSW DPIE) for assessment.

This report has been prepared in response to the following Condition of Consent for the State Significant Development Concept (SSD 8876) for the OSD summarised in Table 1.

The detailed SSD DA seeks development consent for the construction and operation of:

- New residential tower with a maximum building height of RL 171.6, including residential accommodation and podium retail premises, excluding station floor space.
- Use of spaces within the CSSI 'metro box' building envelope for the purposes of:
  - Retail tenancies.
  - Residential communal facilities, residential storage, bicycle parking, and operational back of house uses.
  - Shared vehicle loading and service facilities on the ground floor.
  - Landscaping.
  - Utilities and services provision.
  - Stratum subdivision (Station/OSD).
- Integration with the approved CSSI proposal including though not limited to:
  - Structures, mechanical and electronic systems, and services; and
  - Vertical transfers.

**Table 1 Concept approval of Conditions of Consent**

Item	Description of requirement	Section reference (this report)
B13 - Fire and Rescue Assessment	Draft Fire and Rescue Assessment / Engineering Brief prepared in consultation with Fire and Rescue NSW providing relevant details of:	An initial engineering briefing with Fire and Rescue NSW (FRNSW) was undertaken on the 10 <sup>th</sup> of December 2019. Future documentation and consultation with FRNSW for the OSD tower will be undertaken in the form of a Fire Engineering Brief Questionnaire. This submission can be made to FRNSW on receipt of a DA number.
	(a) The various sectors within the Pitt Street South Metro site served by independent fire systems (such as the OSD, the underground and aboveground metro sector, etc)	Sections 4 and 5.1.
	(b) Fire engineering analysis of the pedestrian connection interfaces between the sectors and the sectors themselves, having regard to emergency occupant egress, fire and smoke compartmentation, smoke hazard management and fire fighting intervention	Section 5.2.
	(c) Adequacy of fire and life safety systems within the Pitt Street South Metro site in relation to the fire hazards of the Sydney Metro	Sections 4 and 5.3.
	(d) Design of fire hydrant systems for OSD elements that exceed 135m	Not applicable to OSD South as it is less than 135m in effective height.
	(e) Future consultation to be undertaken with Fire and Rescue NSW in respect of the final design and construction of the OSD and operational compatibility of the Pitt Street South Metro site's proposed fire and life safety systems.	Section 5.4.



## 2.2 Sydney Metro description

Sydney Metro is Australia's biggest public transport program. A new standalone railway, this 21st century network will revolutionise the way Sydney travels.

There are four core components:

- **Sydney Metro Northwest (formerly the 36km North West Rail Link)**

This project is now complete and passenger services commenced in May 2019 between Rouse Hill and Chatswood, with a metro train every four minutes in the peak. The project was delivered on time and \$1 billion under budget.

- **Sydney Metro City & Southwest**

Sydney Metro City & Southwest project includes a new 30km metro line extending metro rail from the end of Metro Northwest at Chatswood, under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the ultimate capacity to run a metro train every two minutes each way through the centre of Sydney.

Sydney Metro City & Southwest will deliver new metro stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and new underground metro platforms at Central Station. In addition it will upgrade and convert all 11 stations between Sydenham and Bankstown to metro standards.

In 2024, customers will benefit from a new fully-air conditioned Sydney Metro train every four minutes in the peak in each direction with lifts, level platforms and platform screen doors for safety, accessibility and increased security.

- **Sydney Metro West**

Sydney Metro West is a new underground railway connecting Greater Parramatta and the Sydney CBD. This once-in-a-century infrastructure investment will transform Sydney for generations to come, doubling rail capacity between these two areas, linking new communities to rail services and supporting employment growth and housing supply between the two CBDs.

The locations of seven proposed metro stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays.

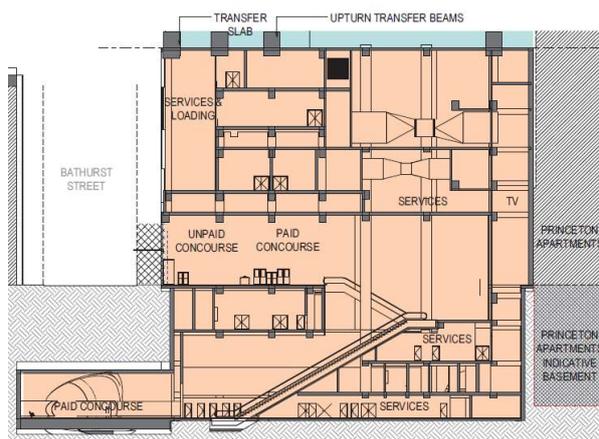
The NSW Government is assessing an optional station at Pyrmont and further planning is underway to determine the location of a new metro station in the Sydney CBD.

- **Sydney Metro Greater West**

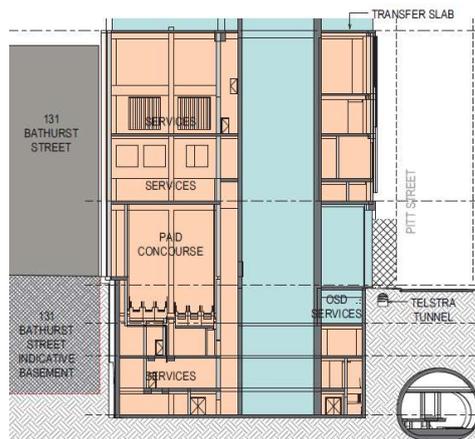
Metro rail will also service Greater Western Sydney and the new Western Sydney International (Nancy Bird Walton) Airport. The new railway line will become the transport spine for the Western Parkland City's growth for generations to come, connecting communities and travellers with the rest of Sydney's public transport system with a fast, safe and easy metro service. The Australian and NSW governments are equal partners in the delivery of this new railway.

The Sydney Metro Project is illustrated in Figure 2.





**Figure 3 Pitt Street station (North-South section)**



**Figure 4 Pitt Street station (East-West section)**

**LEGEND**

- METRO PROPERTY BOUNDARY
- OSD DEVELOPMENT - SUBJECT TO SEPARATE ASSESSMENT PROCESS
- STATION

Source: CSSI Preferred Infrastructure Report (TfNSW)

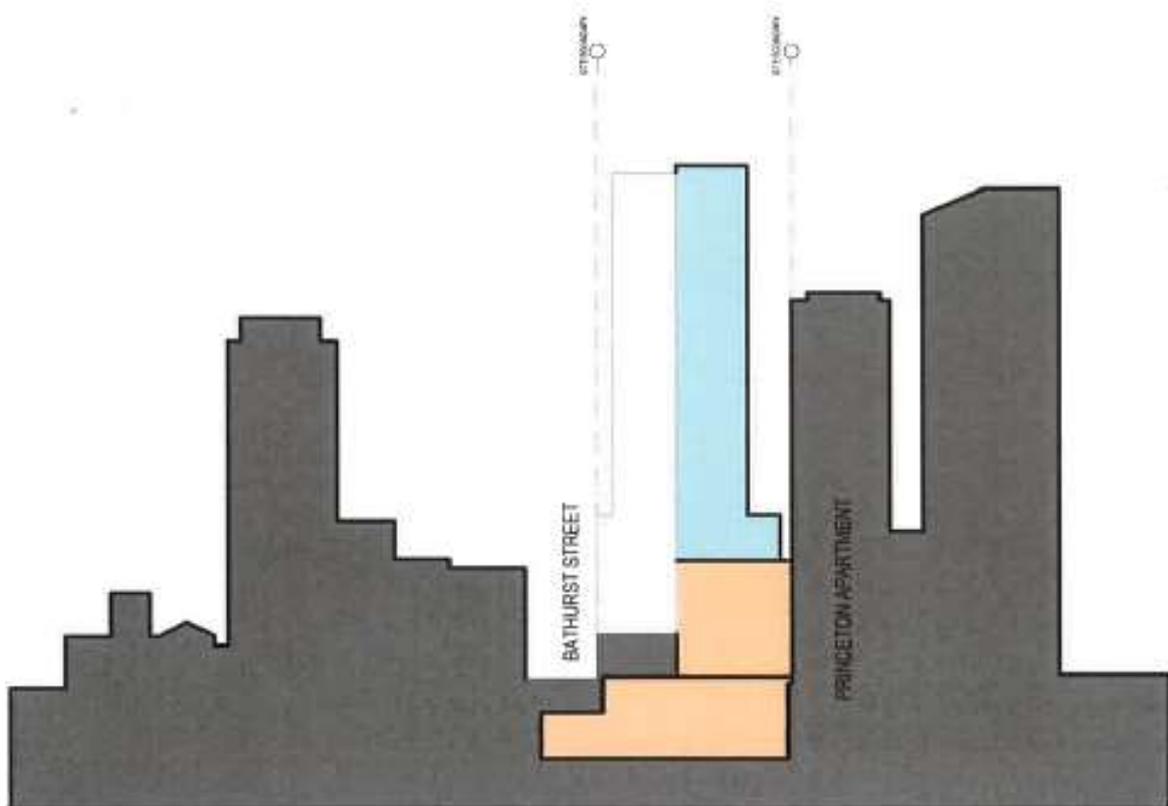
The Preferred Infrastructure Report (PIR) noted that the integration of the OSD elements and the metro station elements would be subject to the design resolution process, noting that the detailed design of the “metro box” may vary from the concept design assessed within the planning approval.

As such in summary:

- The CSSI Approval provides consent for the construction of all structures within the approved “metro box” envelope for Pitt Street South.
- The CSSI Approval provides consent for the fit out and use of all areas within the approved “metro box” envelope that relate to the ongoing use and operation of the Sydney Metro.
- The CSSI Approval provides consent for the embellishment of the public domain, and the architectural design of the “metro box” envelope as it relates to the approved Sydney Metro and the approved Pitt Street South Station Design & Precinct Plan.
- Separate development consent however is required to be issued by the NSW DPIE for the use and fit-out of space within the “metro box” envelope for areas related to the OSD, and notably the construction and use of the OSD itself.

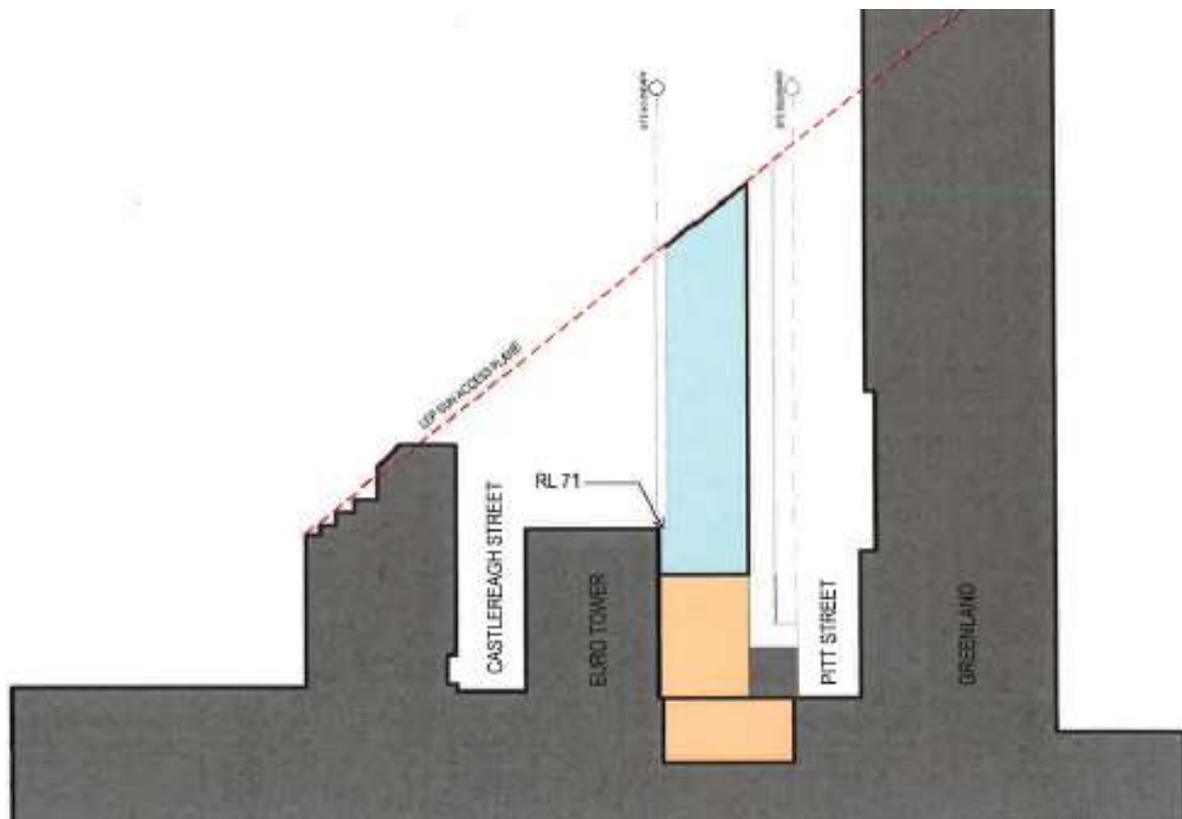
As per the requirements of clause 7.20 of the Sydney Local Environmental Plan 2012, as the OSD exceeds a height of 55 metres above ground level (among other triggers), development consent is first required to be issued in a Concept (formerly known as Stage 1) DA. This is described below.





Source: SSD 8876 Concept Stamped Plans

Figure 6 Pitt Street South Concept SSD DA – North South Section



Source: SSD 8876 Concept Stamped Plans

Figure 7 Pitt Street South Concept SSD DA – East West Section

### 3. Description of the building and performance solutions

#### 3.1 Building description

Table 2<sup>1</sup> shows the main characteristics of the building for determining compliance with the NCC. Table 3 shows the proposed use and classification of the building or part in accordance with part A6 of the NCC.

**Table 2 Main building characteristics**

Characteristic	NCC provision	Description
Effective height	Schedule 3	131.7m
Type of construction required	C1.1	Type A
Rise in storeys	C1.2	38
Levels contained	-	40

**Table 3 Use and classification**

Part of building	Use	Classification (A6)
Basement 01 Mezzanine	Fire hydrant and sprinkler pump room	Ancillary to Class 2
Ground level	Loading dock Entry lobby	Class 7b Ancillary to Class 2
Level 1	Plant space and residential BOH Substation	Ancillary to Class 2 Class 8
Level 2	Restaurant and kitchen Resident amenities	Class 6 Ancillary to Class 2
Level 3	Residents storage	Class 7b
Level 4-5	Plant space and residential BOH	Ancillary to Class 2
Level 6	Residents amenities & courtyard	Ancillary to Class 2
Levels 7-34	Residential Sole-Occupancy Units (SOUs)	Class 2
Level 35	Residential SOUs Residential facilities	Class 2 Ancillary to Class 2
Level 36	Residential SOUs	Class 2
Level 37-38	Plant space	Ancillary to Class 2

<sup>1</sup> Philip Chun and Associates, 17 February 2020, BCA assessment report, SMCSWSPS-PCH-OSS-PL-REP-000001 (19-213762 R03).

### 3.2 Performance solutions

Where areas do not comply with the DTS provisions of the NCC<sup>2</sup> we intend to use a performance solution to meet relevant performance requirements of the NCC. Table 4 outlines the NCC requirements associated with the performance solutions.

**Note:** Performance solutions relating to the station design and OSD enabling shell will be documented within the station fire engineering report for the CSSI SSD DA. Separate reports are proposed to facilitate future fitout changes to the OSD without impacting on the station and vice versa.

**Table 4 NCC requirements associated with the performance solutions**

No	Description of performance solutions	DTS provision	Performance requirements	Proposed fire safety measures and performance solution
1.	The OSD South Tower will be separated from the station building by a combination of vertical and horizontal fire and smoke rated construction instead of vertical fire walls. The station and OSD towers will be treated as separate buildings for the purposes of approvals.	C2.7	CP2, EP1.1, EP1.3, EP1.4, EP1.6, EP2.2, EP3.2 and EP4.3	A performance solution for the building design and treatment as separate buildings is considered reasonable on the basis of providing an integrated fire systems design and system response matrix.
	The OSD South Tower is considered to be a separate building from the station. This performance solution focuses on the fire services system and ancillary areas affected by the separation however various elements of fire services infrastructure will be shared on common floors.	E1.3, E1.4, E1.5, E1.8, E2.2, E3.4 and E4.9		
2.	Protection of openings above an effective height of 36m is not proposed at the north western façade, adjacent to the Edinburgh Castle Hotel, which stands less than 3m from a side boundary.	C3.2 and C3.4	CP2	A performance solution for the unprotected openings above 36m is considered reasonable on the basis of sprinkler protection of this building and potential future buildings on adjoining sites with a fire exposure above a height of 36m. This height is based on a potential future adjoining building with max effective height of 25m with an additional 5m allowance for the topmost storey and then 6m vertical protection above that.  A performance solution for the level 3 stair pressurisation intake louvres is considered reasonable on the basis potential fuel load behind the openings are shielded by a fire rated construction.
	Level 3 has openings in the external wall of the building located within 3m of the side boundary bordering Princeton Apartments that are not protected in accordance with clause C3.4 of the BCA.  Stair pressurisation intake louvres are set back from the subject openings in the external wall and are to be shielded by a fire rated blade wall.			

<sup>2</sup> Philip Chun and Associates, 17 February 2020, BCA assessment report, 19-213762 R03.

No	Description of performance solutions	DTS provision	Performance requirements	Proposed fire safety measures and performance solution
3.	Plant areas on level 05 will only be served by a single exit due to constraints created by the station tunnel ventilation plenums and services reticulation.	D1.2	DP4	Performance solutions for the number of exits and travel distances are considered reasonable based on fire separation of SOUs, sprinkler protection, smoke detection and occupant warning systems including AS1670.1 detection in residential corridors.  Architect has confirmed that access to exits on level 05 and 37-38 are constrained by the tunnel ventilation plenums and building services reticulation.  The designer has determined that it is not reasonably practical to provide access to two exits.
4.	Plant levels 37-38 will only be served by a single exit on level 37 due to constraints created by the building services reticulation. Level 38 is accessed via an open internal stair from level 37.	D1.2, D1.7	DP4	
5.	Travel distance to the closest exit and between alternative exits on level 2 will potentially be up to 50m and 70m instead of 40m and 60m respectively.  Two of the alternative exits will also be located at least 6m apart instead of 9m.	D1.4 and D1.5	DP4 and EP2.2	
6.	The travel distance to a point of choice or single exit will potentially be up to 30m instead of 20m from plant and communal areas on levels 3-4, 6, 35 and 37-38 to provide flexibility for reasonable fitouts and installation of equipment.	D1.4	DP4 and EP2.2	
7.	The travel distance to a point of choice on SOU floors level 7-34 and 36 is up to 13m instead of 6m.	D1.4	DP4 and EP2.2	
8.	Level 2, with a population of 355 persons, is served by a reduced unobstructed exit width of 3.2m instead of 3.5m (which would allow 380 persons).	D1.6	DP4 and EP2.2	
9.	Fire stairs serving the OSD and station BOH converge at the point of discharge on Bathurst Street.	D1.7	DP4	
10.	Alternate fire stair serving basement mezzanine level B01 will be accessed via the OSD fire pump room.	D1.7	DP4	
11.	Doors leading to the fire-isolated stairs serving the substation swing against the direction of egress as a Supply Authority requirement.	D2.20	DP2	
12.	The fire hydrant system is proposed to be designed to AS 2419.1-2017 instead of the 2005 version of the standard which is referenced in NCC 2019.	E1.3 and AS 2419.1	EP1.3	
13.	The main Fire Control Room (FCR) serving the station will be designed to only have a single entrance from the street instead of two paths of access.	E1.8	EP1.6	

No	Description of performance solutions	DTS provision	Performance requirements	Proposed fire safety measures and performance solution
14.	Zone smoke control is not proposed to the station and retail and storage areas of the OSD enabling levels.	E2.2	EP2.2	A performance solution for the omission of zone smoke control from the station and OSD enabling levels is considered reasonable based on the provision of sprinklers and smoke lobbies in front of lifts connecting to the high-rise residential levels.
15.	The basement stair serving the hydraulic plant and fire pump room on basement mezzanine level 01 is not proposed to be provided with stair pressurisation.	E2.2	EP2.2	A performance solution for the omission of stair pressurisation from the basement stair flight is considered reasonable based on the low occupant numbers and that only a single basement level is served.

## 4. Fire safety measures – OSD South

The following fire safety measures are proposed for the OSD South Tower to achieve compliance with the relevant performance requirements of NCC 2019 for the fire safety engineering assessment:

### 4.1 General

1. The design must comply with the current DTS provisions of the NCC relating to fire safety unless specifically stated. This section does not provide a comprehensive list of fire safety measures required by the DTS provisions of the NCC. The fire safety measures listed here only relate to the performance solutions and must be read together with the DTS provisions.
2. This report and the requirements listed in this section must be implemented into the design and identified on the fire safety schedule for the building. They must be maintained and certified in accordance with the Environmental Planning and Assessment Regulations 2000 and relevant Australian standards.
3. We recommend periodic inspection, testing and maintenance of all fire safety measures be undertaken in accordance with AS 1851:2012.

### 4.2 Structural fire resistance and compartmentation

4. The FRLs of the building elements must be designed in accordance with the requirements of specification C1.1 of the NCC for a building of type A construction except where otherwise specified.
5. The OSD must be fire separated from Pitt Street station by construction achieving an FRL of not less than 120/120/120 or higher if required by NCC Specification C1.1, eg the restaurant requires FRL 180/180/180 and the loading dock requires FRL 240/240/240.
6. The fire separation between the level 2 restaurant and the Bathurst Street station entry is proposed to include toughened laminated glazing with not less than 10mm thick glass panes and wall-wetting sprinklers compliant with the Tyco WS specification or equivalent. See Figure 12.
7. Emergency equipment required to operate during a fire and equipment having a high fire hazard or potential for explosion must be enclosed in construction which achieves an FRL of not less than 120/120/120 as required by clauses C2.12 and C2.13 of the NCC, or as directed by the utility authority who may have additional requirements.
8. The rooftop lounge on level 35 must be treated as a SOU and fire separated from the residential corridor in accordance with NCC specification C1.1.
9. The external walls and all attachments are understood to be non-combustible and fire rated where required by the NCC deemed-to-satisfy provisions.
10. Protection of openings will be provided in accordance with clauses C3.2 and C3.4 of the NCC up to a height of 36m from street level. Above this height openings are proposed to be unprotected.
11. The level 3 fire rated external wall bordering the Princeton Apartments is to be extended to provide a blade wall so that the distance via a direct line of sight between the side boundary and the stair pressurisation intake louvres is not less than 3m – refer to Figure 8. The blade wall must achieve an FRL of not less than -/60/- and be neither transparent nor translucent.
12. Plant areas on levels 4 and 5 are to be protected by fire rated walls extending not less than 3m from the side boundary in accordance with clause C3.2 of the NCC. Refer to Figure 14 and Figure 15.

Fire rated wall to ensure >3m between boundary and any combustibles beyond the intake louvres

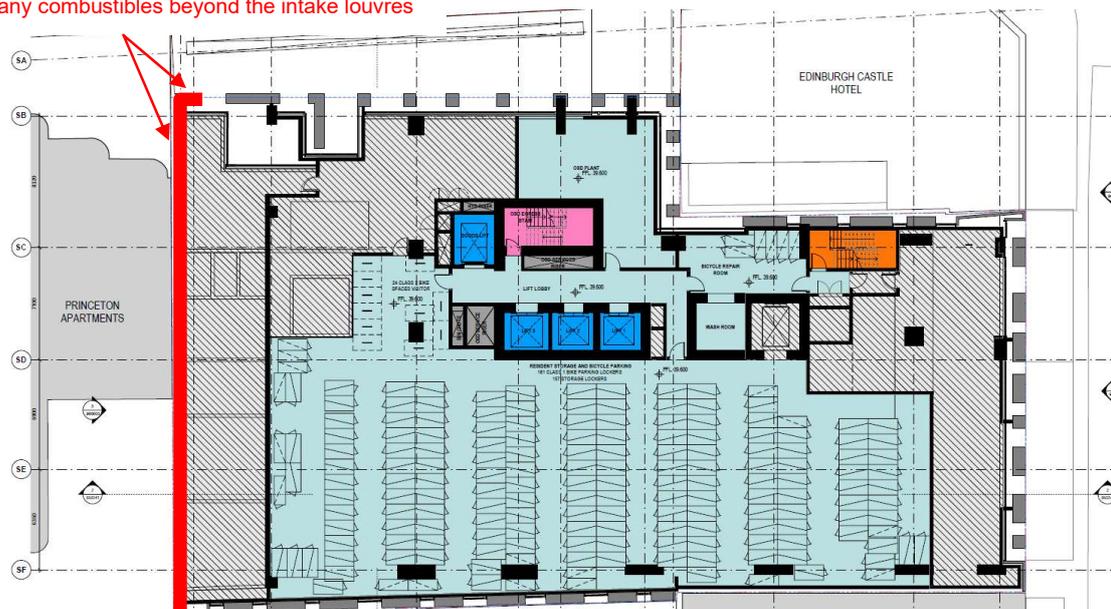


Figure 8 Protection of openings level 3

### 4.3 Access and egress

13. The provision for escape within the building is to be with access to not less than two fire-isolated exits on each storey with the exception of:
  - a. level 05 plant areas
  - b. level 37-38 plant areas.
14. Level 2 restaurant areas must have access to not less than three exits with an aggregate exit width of not less than 3.2m.
15. All exits and paths of travel to exits must be not less than 1m in clear width in accordance with clause D1.6 of the NCC with the exception of the main entry/exit from the Level 2 restaurant which must be as follows:
  - a. 1.25m in the stair and landings between wall and handrail where only one side has a handrail
  - b. 1.2m in the stair and landings between handrails where both sides have handrails
  - c. 1.1m clear opening in any doorways.
16. The following maximum travel distances apply on the residential levels of the building:
  - a. up to 13m to the nearest exit or point of choice instead of 6m on levels 7-34 and 36
  - b. up to 25m to the nearest exit or point of choice instead of 20m on level 35 from the communal area.
17. The following travel distances apply from the common areas on level 2:
  - a. up to 50m to the closest of two or more alternative exits instead of 40m
  - b. up to 70m between alternative exits when measuring back through the point of choice instead of 60m
  - c. not less than 6m between alternative exits instead of 9m.

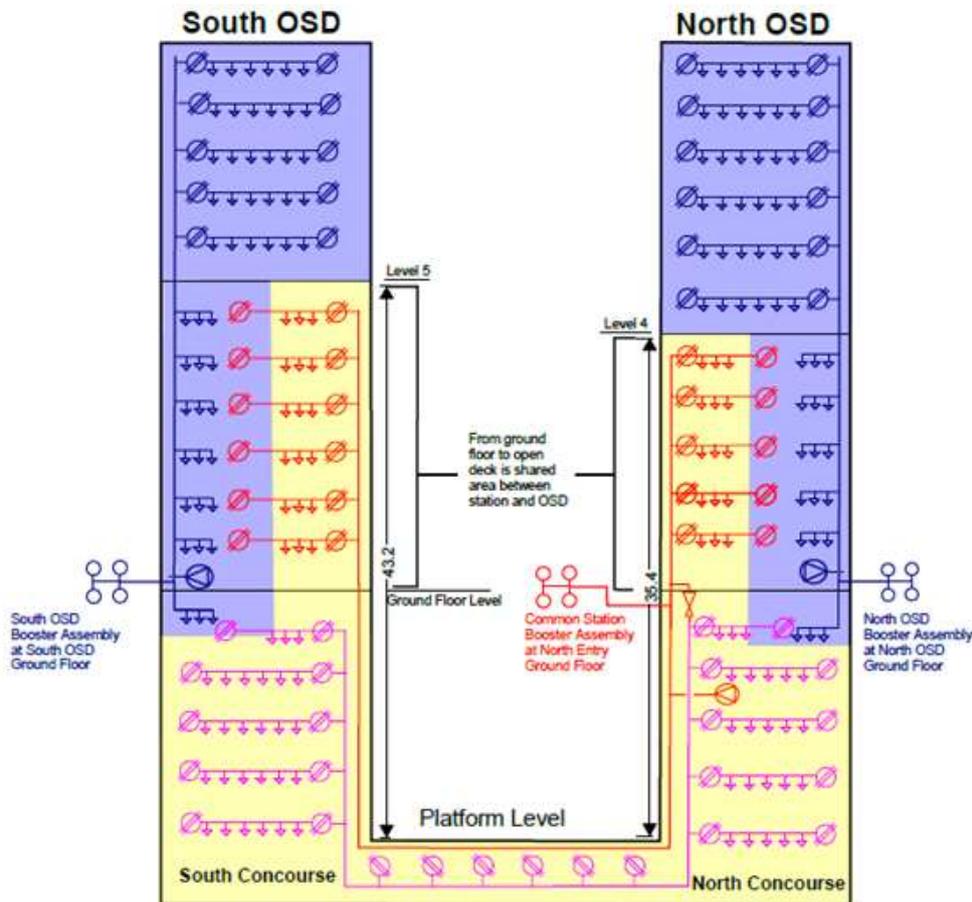
18. The following maximum travel distances apply from the common areas and plant areas of the building on levels 3-4, 6 and 37-38:
  - a. 30m to a single exit or point of choice instead of 20m
  - b. 40m to the closest of two or more alternative exits.

## 4.4 Services and equipment

### 4.4.1 Firefighting systems

19. The wet fire services serving the OSD must be separated from the station systems as shown in Figure 9.

**Note:** The sprinkler systems for the station and OSD areas are fed from the respective fire systems water supply and boosters, whilst the hydrant system serving the OSD enabling levels B1-L5 is fed from the station fire systems water supply and booster.



**Proposed Wet System Demarcation:**

Fire Hydrants on podium levels at North and South to be boosted by station boosters. Sprinklers to be fed of OSD ring main and Station ring main independently.

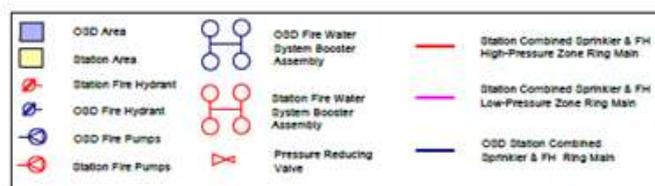


Figure 9 Wet fire services delineation

20. A fire hydrant system must be installed throughout the building in accordance with clause E1.3 of the NCC except that AS 2419.1:2017 may be used.
- The fire hydrant system is proposed to be combined with the sprinkler system for the building in accordance with AS 2118.6-2012.
  - The hydrant system must be provided with a ring main.
  - The fire pump room is proposed to be located on basement level B1 mezzanine.
- Note:** A performance solution for the access to the fire pump room is considered reasonable based on access via a fire stair and a fire separated lobby a level B1 mezzanine.
21. A fire hose reel system must be installed throughout the building in accordance with clause E1.4 of the NCC and AS 2441:2005. Residential levels will have portable extinguishers in accordance with NCC.
22. A sprinkler system must be installed throughout the building in accordance with specification E1.5 of the NCC and AS 2118.1:2017 and AS 2118.6-2012 with the exception of:
- station system is designed to AS 2118.1-1999
  - station plant areas provided with gas suppression are not provided with sprinklers
  - tunnel ventilation plenums are not provided with sprinklers as these are used for smoke exhaust.
23. Portable fire extinguishers must be provided as listed in table E1.6 of the NCC and must be selected, located and distributed in accordance with sections 1, 2, 3 and 4 of AS 2444:2001. In particular, the portable fire extinguishers provided in the residential parts must be:
- an ABE type fire extinguisher
  - a minimum size of 2.5kg
  - distributed outside a sole-occupancy unit –
    - to serve only the storey at which they are located
    - so that the travel distance from the entrance doorway of any sole-occupancy unit to the nearest fire extinguisher is not more than 10m.
24. A fire control room dedicated to the OSD South tower must be provided in accordance with specification E1.8 of the NCC with the exception that the room may have a single access door directly from outside.
25. Emergency lifts must be provided in accordance with clause E3.4 of the NCC for a building with an effective height of more than 25m.

#### 4.4.2 Smoke hazard management

26. The dry fire services serving the OSD must be separate from the station systems, however a mimic panel for the station fire system must be provided within the OSD FCR.
27. A smoke detection and alarm system in accordance with specification E2.2a of the NCC must be provided on the OSD enabling levels and throughout the residential levels. Smoke detection in the residential corridors shall form part of the AS1670.1-2018 smoke detection system.
28. All air-handling systems capable of recycling air between the fire/smoke compartments – including between class 2 and 3 sole-occupancy units – must be provided with fire/smoke dampers where the air-handling ducts penetrate any elements separating the fire/smoke compartments served in accordance with clause E2.2 of the NCC. The system must be arranged such that the air-handling system is automatically shut down and the fire/smoke dampers close by smoke detectors complying with clause 7.5 of AS 1670.1:2018.

29. All fire-isolated stairs, passages and lobbies must be provided with a stair pressurisation system where required by table E2.2a of the NCC and in accordance with AS/NZS 1668.1:2015 except for the stair flight serving basement mezzanine level 01 which connects to the OSD Tower stair at ground level.
30. Corridors and lobbies on ground to level 05 in front of lifts connecting up to the residential levels are proposed to be fire separated from high fire load areas where zone smoke control is proposed to be omitted on the OSD enabling levels. Refer to Figure 10 - Figure 15.

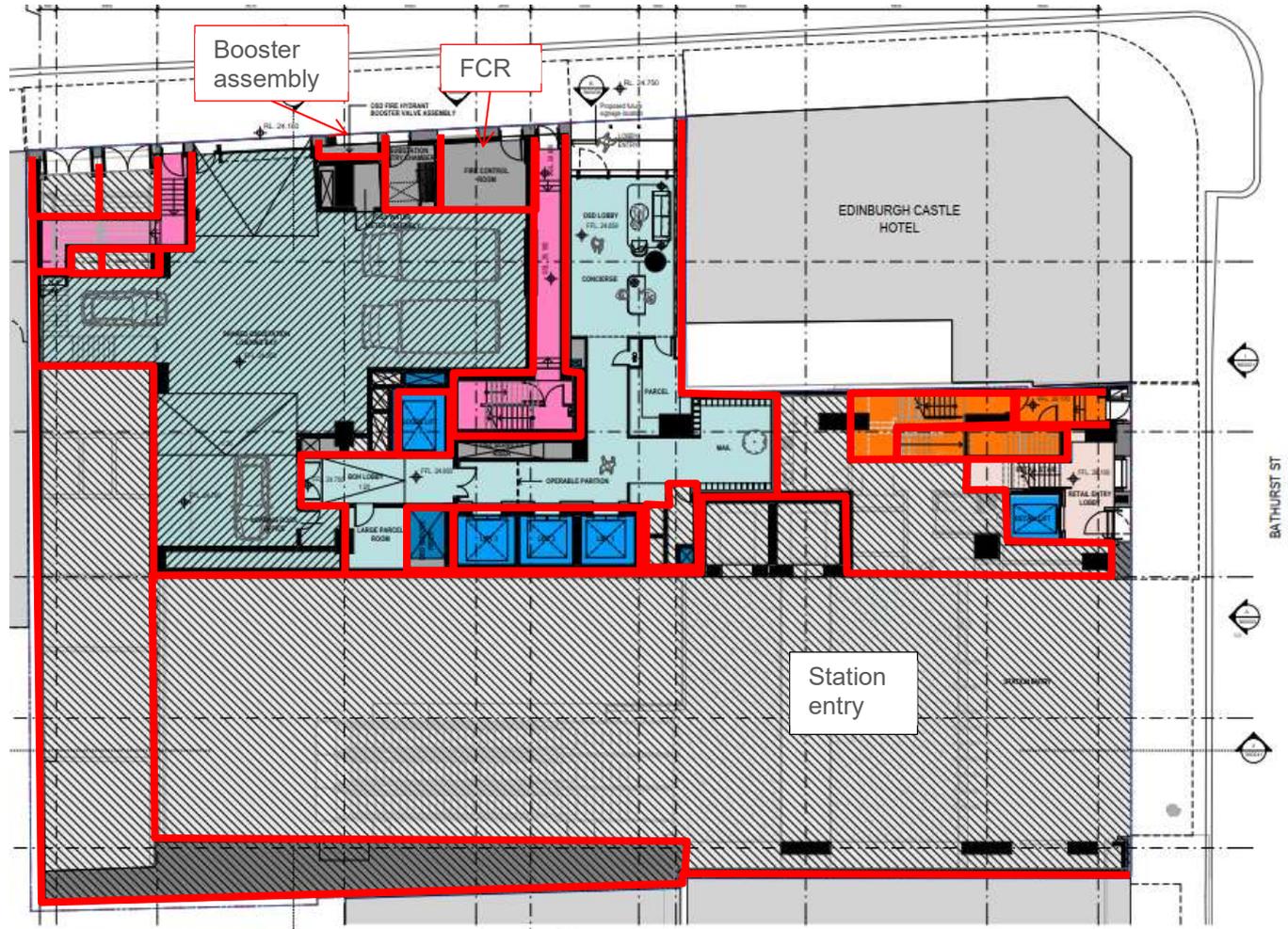


Figure 10 Indicative fire separation (Ground floor)

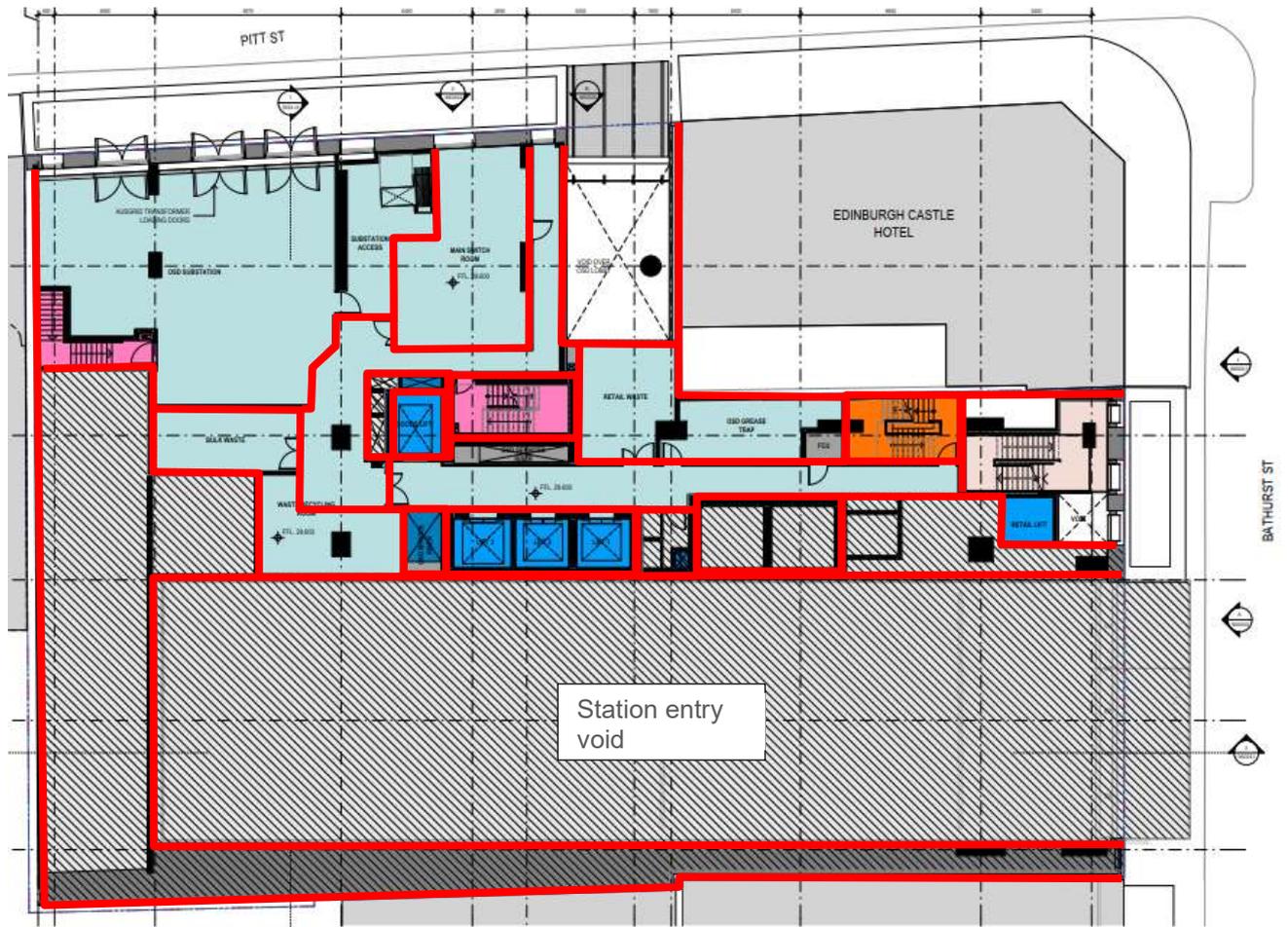


Figure 11 Indicative fire separation (level 1)

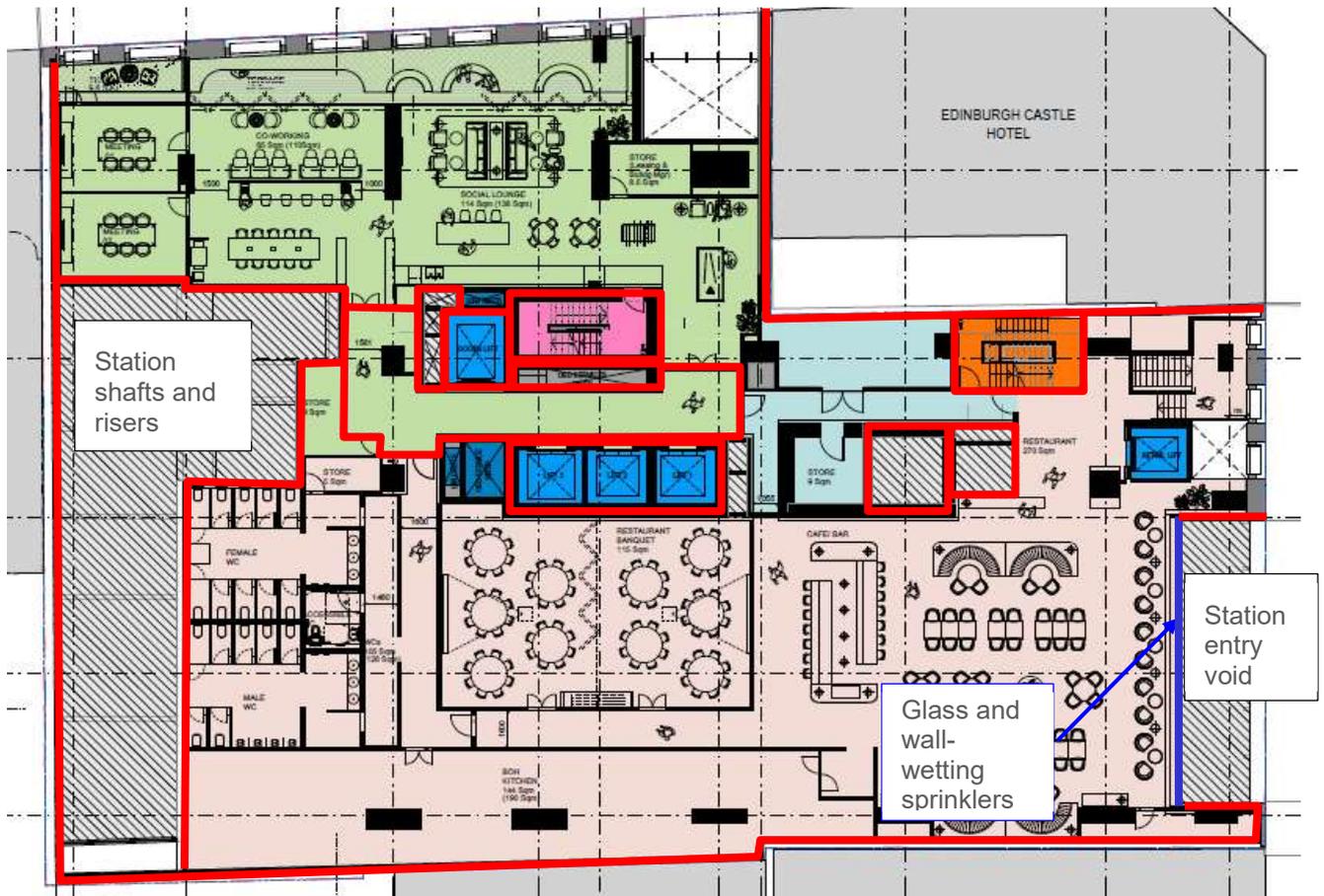


Figure 12 Indicative fire separation (level 2)

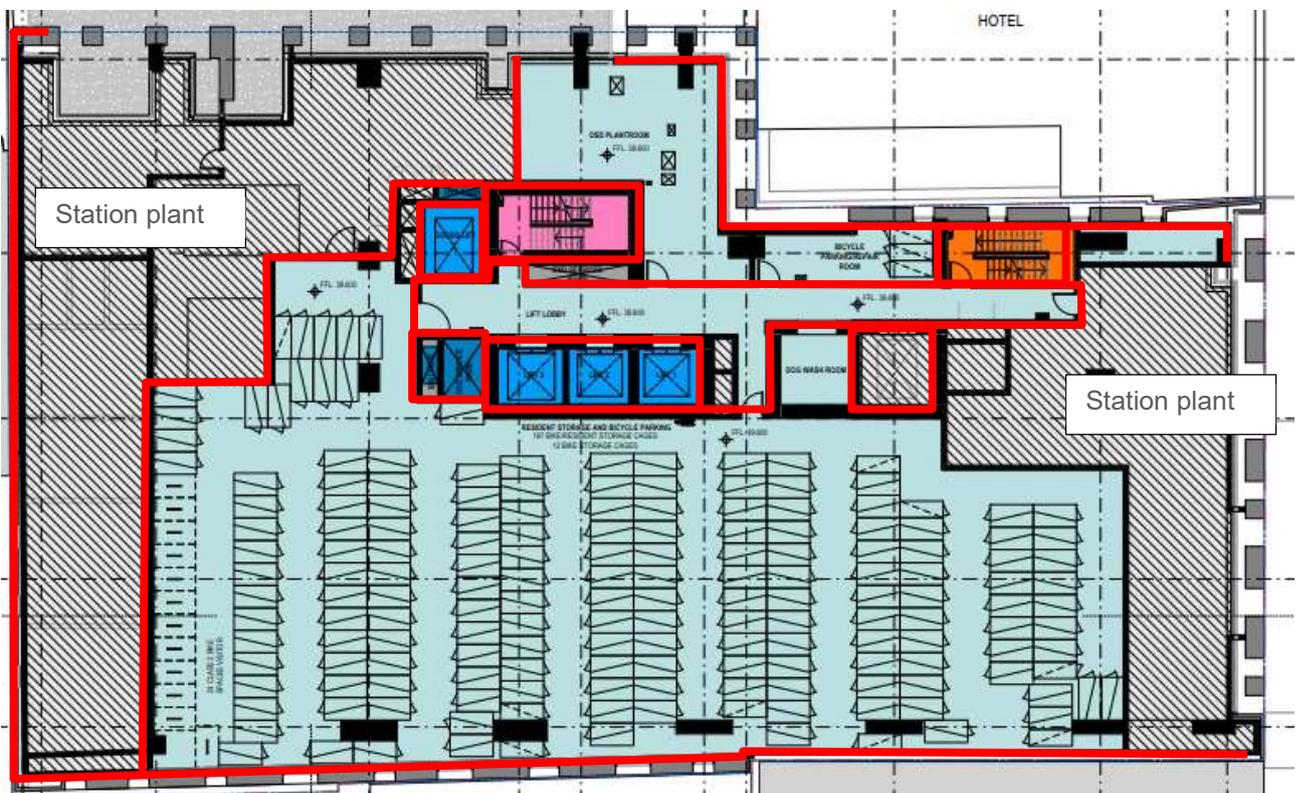


Figure 13 Indicative fire separation (level 3)

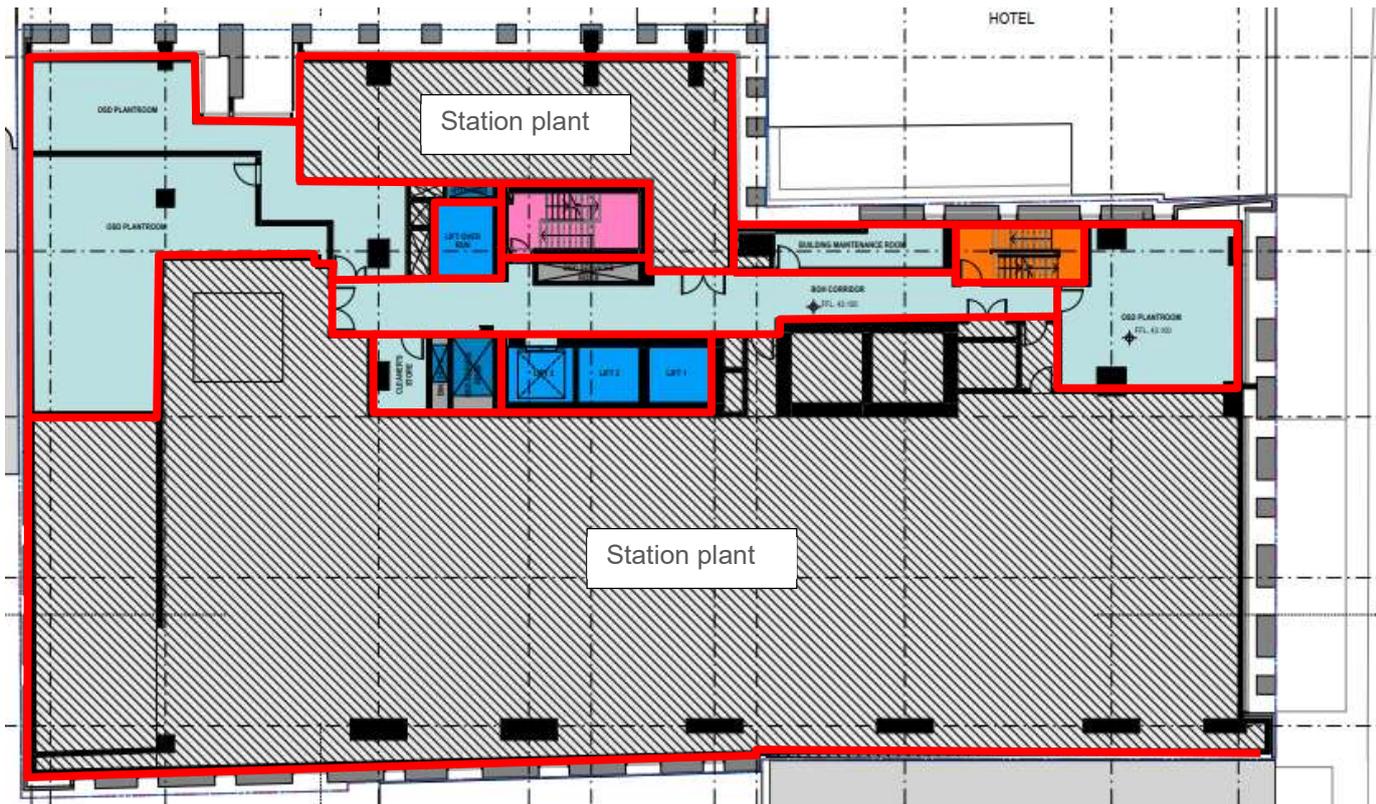


Figure 14 Indicative fire separation (level 4)

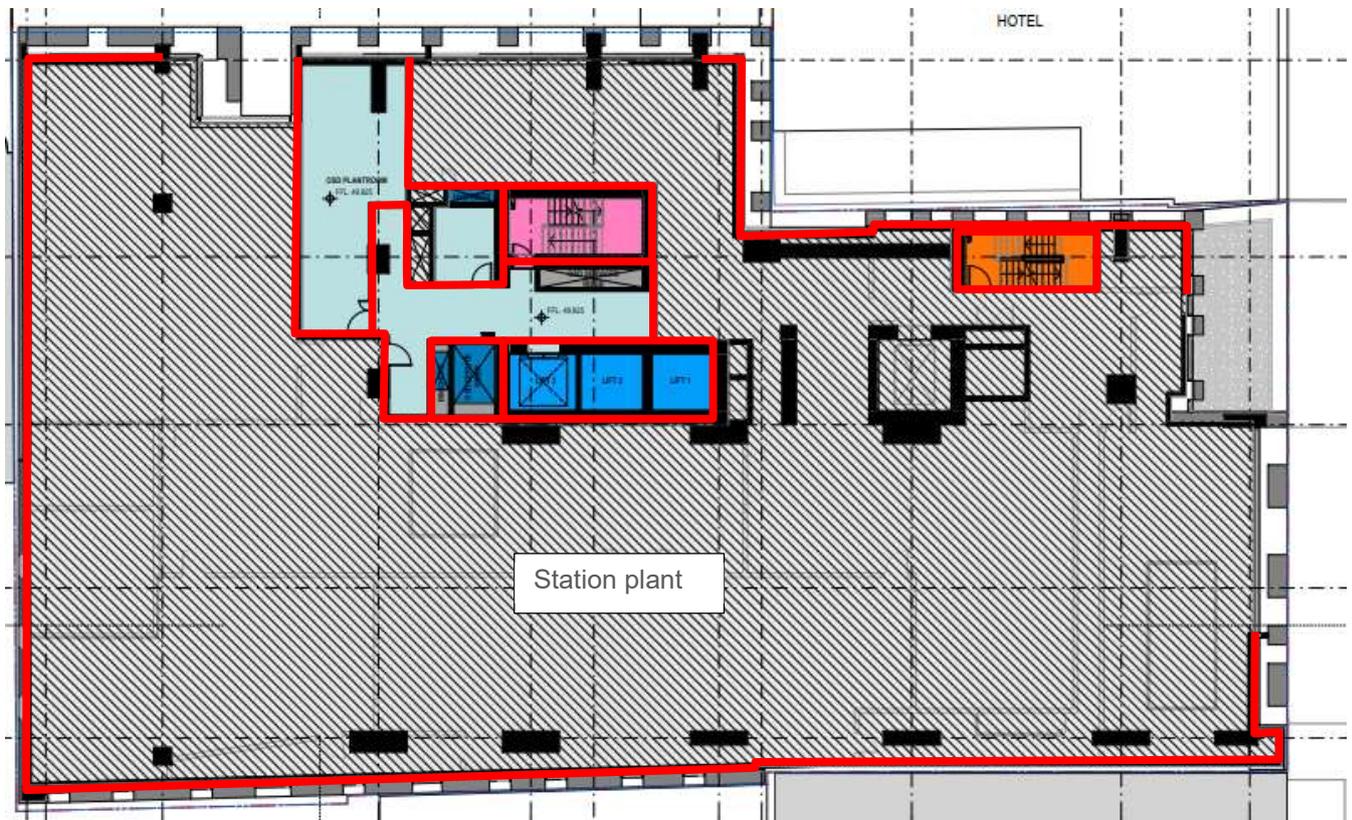


Figure 15 Indicative fire separation (level 5)

### 4.4.3 Emergency lighting, exit signs and warning systems

31. An emergency lighting system must be installed throughout the building in accordance with clauses E4.2 and E4.4 of the NCC and AS 2293.1:2018.
32. Exit signs and directional signs must be installed throughout the building in accordance with clauses E4.5, E4.6 and E4.8 of the NCC and AS 2293.1:2018. Clause E4.7(a) which allows the omission of illuminated exit signage in class 2 buildings is not to be used as a requirement of this performance solution. All exit signage must be illuminated due to the increased travel distances.
33. An emergency warning and intercom system (EWIS) complying with clause E4.9 of the NCC and AS 1670.4-2018 must be installed throughout the building.
  - a. The emergency warning system must be audible through all occupied areas of the building including external areas where evacuation back into the building is required.
  - b. Additional visual signals must be provided to augment the audible emergency evacuation signal if the background noise exceeds the limit under the standard – eg in plant rooms.

**Note:** The zoning and cascading of the station and OSD tower EWIS systems will be developed in consultation with Sydney Metro to mitigate adverse impact on the train operations in the event of a fire alarm in the OSD tower.

### 4.5 Fire safety during construction

34. During construction after the building has reached an effective height of 12m, the required fire hydrants and fire hose reels must be operational in at least every storey that is covered by the roof or the floor structure above except the two uppermost storeys, and any required booster connections must be installed – in accordance with clause E1.9 of the NCC.

### 4.6 Commissioning of fire safety strategy

35. The building work and fire safety measures relating to the performance solution report must be inspected by an appropriately qualified fire safety engineer prior to occupation to confirm that the holistic performance is consistent with these requirements. Detailed inspections and commissioning tests for the building fire safety systems will need to be undertaken separately by the relevant consultants and/or installers.

## 5. Review of conditions of consent

### 5.1 Separation of fire systems

The OSD tower and Pitt Street station are to be treated as separate buildings and will not share the same facilities and plant rooms. Fire services to the OSD tower and Pitt Street station will generally be separated including:

- a. Water storage tanks
- b. Fire pump rooms
- c. Fire hydrant booster assemblies
- d. Fire control rooms
- e. Fire detection and occupant warning systems – common occupant warning throughout the floors will utilise both systems.
- f. Sprinkler suppression systems
- g. Fire hydrant systems – OSD enabling levels up to and including level 05 in the south tower are proposed to form part of the station fire hydrant system and boosted from the northern station entry.

**Note:** The separation of the fire services was discussed with FRNSW on 10/12/2019 and is currently under development and subject to further consultation as requested by FRNSW.

### 5.2 Pedestrian connection interfaces

The OSD tower has no direct connection with the station and will be fire separated from the station to mitigate the impact of fire in either building.

Egress stairs serving the public areas of the station will be separate from the OSD tower stairs. Station areas which share egress stairs with the OSD tower are limited to back-of-house plant areas which have low fire risk and low occupant load to ensure minimal impact on the OSD tower evacuation capacity.

Smoke hazard management systems are generally separate between the station and OSD tower with the shared stairs served by the OSD stair pressurisation systems.

### 5.3 Fire and life safety systems

As detailed in section 4, a concept fire and life safety (FLS) strategy has been developed for the station OSD enabling levels and the OSD tower to confirm the adequacy of the fire and life safety systems within the Pitt Street Metro site in relation to the fire hazards of the Sydney Metro.

### 5.4 FRNSW consultation

Consultation has been undertaken with FRNSW in relation to the interface between the Pitt Street Station and the OSD North and South on the 10<sup>th</sup> December 2019 and 5<sup>th</sup> February 2020.

Additional consultation with FRNSW is ongoing and will be incorporated as part of the construction issue documentation. This includes finalisation of the separation of fire services between the station and OSD tower.

## 6. Conclusion

As detailed in this report, the development of the OSD tower concept design has considered the specific nature and fire hazards associated with the Sydney Metro integrated development site and it is possible to develop performance solutions for the issues identified to demonstrate compliance with the relevant performance requirements of the NCC without major changes to the proposed OSD tower design.

The details of the proposed performance solutions are subject to the outcome of the fire engineering brief and analysis which will be carried out generally in accordance with the International Fire Engineering Guidelines (IFEG).

The performance solutions for the building will be developed as part of the ongoing design and development process and documented in a format suitable for submission to the relevant approval authorities. It is noted that additional performance solutions may be identified during the ongoing design development process in consultation with the design team.

## Appendix A Drawings and information

Drawing title	Dwg no	Date	Drawn
Site plan	SMCSWSPS-BAT-OSS-AT-DWG-910041 rev C	31/03/2020	Bates Smart
L00 Ground Level – L01 General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-930041 to 930141 rev C	31/03/2020	
L02 – General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-930241 rev D	20/03/2020	
L03 – L06 Mezzanine General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-930341 to 930642 rev C	31/03/2020	
L07 – L08 General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-930741 to 930841 rev D	31/03/2020	
L09-13 – Typical Low-rise General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-930941 rev C	31/03/2020	
L14-34 Typical Highrise General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-931441 rev C	31/03/2020	
L35 – L39 Roof General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-933541 to 933941 rev C	31/03/2020	
B01 Mezzanine - General Arrangement Plan	SMCSWSPS-BAT-OSS-AT-DWG-939542 rev C	31/03/2020	

Report title	Report reference	Date	Prepared by
Building Code of Australia 2019 report for SSD DA submission – Pitt Street south metro over station development (OSD)	SMCSWSPS-PCH-OSS-PL-REP-000001 (19-213762 R03)	17/2/2020	Philip Chun Building Code Consulting

## Appendix B FRNSW consultation

### B.1 Stage 1 – 20/9/2017

The following meeting minutes have been extracted from the Design stage 1 FEB report prepared by Metron<sup>3</sup> and are provided for background information.

#### 6.2 Summary of Consultation Undertaken and any Agreements Achieved

##### 6.2.1 Stations and Services - Meeting Minutes for Fire Brigade Consultation

###### Strategy

The strategy for fire brigade consultation involves consultations performed by METRON, TSOM, the unsolicited proposal organisation and CSM (Central). Joint consultations will facilitate a streamlined and cohesive consultation process and will achieve effective fire brigade response and engagement. Separate consultations have been also performed by each organisation.

The appended minutes are in reference to the meeting with FRNSW to present the METRON FLS strategy.

###### Date

The meeting was held at Fire Rescue NSW headquarters on Wednesday 20<sup>th</sup> September 2017.

###### Attendance:

---

<sup>3</sup> Metron, Fire Engineering Brief – Stage 1 design Underground Stations Design & Technical Services, NWRLSRT-MET-SRT-FL-REP-000003 rev P10 dated 20 July 2018

- Mark Castelli – FRNSW
- Matthew Rowley – FRNSW
- Andy Tam – MTR
- David Sweetman – METRON
- Elliott Vercoe – METRON
- Roger Blackwell – TfNSW
- Shaohua Xia – FRNSW
- Patrick NG – MTR
- Will Marshall – METRON
- Geoff Pearce – METRON

**Minutes:**

1. TfNSW explained intent of meeting was to introduce METRON and the basis of fire safety design of their stations and service buildings.
2. TfNSW presented 4 copies of the tunnel alignment drawings, from Chatswood to Sydenham for reference throughout the project briefings and discussions.
3. METRON explained the limitation of areas associated with their works and interface needed to both linewise, as well as Martin Place and Central stations
4. METRON identified –
  - a. Each station to have Fire Control Room, generally at surface
  - b. Sprinkler booster, station hydrant booster and tunnel hydrant booster at each station
  - c. all travel distances and egress times will be demonstrated by Fire Engineering, with ASET/RSET calcs and modelling.
  - d. All escalators will be on essential supplies with those running in direction of egress to be maintained, those travelling towards the incident will slow to stop.
  - e. All lifts are stretcher lifts and also on essential supplies, with UPS for homing.
  - f. All plant rooms are fire separated.
  - g. Over Station Development will be designed by Others, but all OSD areas will be fully fire separated. All OSD areas will be fitted-out separately as a part of that development. No services will be shared, separate fire water supplies and boosters, separate FCR, egress and other provisions.
5. METRON presented stations as being of 2 types, –
  - a. Cut and Cover – Crows Nest; Barangaroo; Waterloo - all with Island platforms and having an enclosed, pressurised scissor stair at each end
  - b. Cavern – Victoria Cross; Pitt Street (also includes Martin Place, but that station is designed by Others.) – all with separate caverns per platform and interconnecting adits to centralised egress routes having escalators and an enclosed, pressurised scissor stair at each end.
6. Barangaroo Station was discussed –
  - a. Unusual escape stair arrangements in Pods at street level, with ground level egress facilities still under development.
  - b. Underground connection to future shopping centre – to be separated by a fire shutter.
7. Victoria Cross Station was discussed –

- a. Deep station, with lifts and stairs at one end, escalators lifts and stairs at other.
  - b. Ground level to form a breezeway, allow natural smoke venting – FRNSW noted the detailed design at Chatswood demonstrated the need for smoke modelling to be undertaken with wind analysis.
8. Pitt Street Station was discussed –
- a. Cavern station with 2 separate OSD towers, ground level wraps around Edingburgh Castle Hotel.
  - b. Separate FCR and FIP for towers and station, with interlink for information
  - c. Shared egress stairs from above ground areas shared, i.e. car park and service rooms. FRNSW queried the clarity of direction and separation between areas especially if their access opposes direction of general population’s egress.
9. METRON presented an outline of their FEB, which included Over Station Development Transfer levels, but excludes the OSD as such. METRON confirmed:
- a. clarified that Metro boosters would comprise separate Tunnel and Station systems, with the Tunnel boosters to be separate for tunnels each side of the station. OSD boosters are to be completely separated from Metro boosters.
  - b. clarified that the NFPA standards and ASA standards are considered reference documents only and are not mandated.
  - c. identified that platform/train evacuation scenarios were based on a single missed headway to both up and down track for both design and high challenge events, using AW4 loadings, SFAIRP principles will be adopted for Extreme cases.
  - d. confirmed 10MW train fires are assessed for structural integrity, but smoke control and egress assessments are limited to 3MW as fire growth beyond this would be after evacuation completed.
  - e. Concourse smoke exhaust is generally provided with a dedicated exhaust system (with the exception of Pitt Street). Station entrances are provided with natural ventilation.
  - f. Egress provisions are generally based around 2 x 2m wide fire separated paths at each end of the platforms, with a total of 8 wheelchair refuges within the stairwell.
  - g. Pedestrian modelling has been performed to demonstrate maximum of 8 minutes queue time, with ASET/RSET calcs to support this
10. FRNSW queried the assessments performed for bomb threat evacuation. It was discussed that this is currently not included, but given the increased terrorist threat, could be included within the next design phase if instructed by TfNSW.
11. FRNSW queried the inclusion of fare gate opening and Opal card instructions during evacuation, as recent example at Wynyard station demonstrated delays as passengers attempted to “tap-off” despite the Opal system being shut down during the evacuation. TfNSW to review arrangements and potential for messages with the Operator – currently represented by MTR.
12. FRNSW queried Stabling areas and how doors would be opened during an incident at the stabling. TfNSW to review arrangements and potential for messages with the Operator – currently represented by MTR.
13. FRNSW advised that from the broad overview of the preliminary station designs presented there didn’t appear to be any issues of major concern at this stage of the design phase. Notwithstanding, FRNSW advised that further assessment of the submitted drawings may identify issues that may be of concern and need resolution.

14. Post meeting comment: FRNSW advised that once the station designs progress to the final detailed stages and further consultations are undertaken, there is potential for design issues to arise that may be of concern to FRNSW with regard to fire and life safety or detrimentally impact FRNSW firefighting operations. As per previous infrastructure stakeholder engagement and protocol, FRNSW will welcome engagement with the project's design team to work through any issues of concern to achieve safe and satisfactory resolutions.

### 6.2.2 RCD - Meeting Minutes for Fire Brigade Consultation

#### Strategy

The strategy for fire brigade consultation involves presenting FRNSW with the concept of the RCD and outlining the preliminary FLS strategy, and key considerations involving the development.

The appended minutes are in reference to the meeting with FRNSW to present the METRON FLS strategy.

#### Date

The meeting was held at Fire Rescue NSW headquarters on Tuesday 9<sup>th</sup> January, 2018.

#### Attendance:

- Mark Castelli – FRNSW
- Ben Hamilton - FRNSW
- Elliott Vercoe – METRON
- Roger Blackwell – TfNSW
- Will Marshall – METRON

#### Minutes:

1. WM Introduced the concept of the RCD, and outlined the FLS scope in relation to the undercover deck.
2. MC queried whether vehicle access would be provided above the deck. RB explained that above the deck is still concept design and is to undergo development.
3. RB mentioned that a precinct wide water storage system will introduce delineation concerns due to sharing of services between an infrastructure project and private development. BH mentioned that maintenance will require coordination. RB confirmed this strategy has not yet been resolved but will need to be considered in future development.
4. WM outlined the fire safety strategy as shown in the attached presentation.
5. MC queried the exclusion of sprinklers to the trackways beneath the deck. WM and RB mentioned the occupants were at risk of electrocution, the height of the space, and the train body providing protection from sprinkler suppression.
6. RB noted the difficulty of implementing egress paths. The egress cannot be like Tallawong Road Stabling Facility, as there are no drop down egress paths running beneath the tracks.
7. Upon conclusion of the presentation, MC was asked if there were any immediately concerning items. MC responded that the main thing to comment on would be the exclusion of sprinklers. MC also noted the potential for sharing the water tanks with the above RCD

development will be problematic; RB and WM noted this will need to be considered as part of the over deck works

8. BH asked about the water pump arrangement. WM explained that we have a combined system, and showed the location of the pumps and water tanks.
9. MC asked whether a concrete is readily available which achieves the FLS requirements for the linewide tunnels. WM confirmed it is being used on Westconnex, and that it is available.
10. MC mentioned he is more concerned regarding vehicle access for the oversite development, however understands this has not yet been developed.
11. Re: fire rated slab. RB mentioned that there is not significant support to reduce the 240/240/240 fire curve. WM explained we have currently allowed for a 240 minute fire rating against the RABT fire curve, but are considering a reduction to 240 minutes against the 'standard' cellulosic fire curve as the RCD space isn't of such an enclosed nature for the RABT fire curve to be considered realistic. RB mentioned this could be explored.
12. MC asked regarding the hydrant 60 m hose spacing with 1 m into the train. WM confirmed these will be available as in the regular stabling yard. RB confirmed stabling hydrants are above ground twin-outlet hydrants.

## B.2 Stage 2 – 5/2/2020



Warringtonfire Suite 802 Lvl 8, 383 Kent St  
ABN: 81 050 241 524 Sydney NSW  
P: 02 9211 4333 2000 Australia

<b>Time</b>	8am – 9.30am	<b>Date</b>	05/02/2020
<b>Job no</b>	SY180170	<b>Issued</b>	07/02/2020
<b>Project</b>	Pitt Street Station		

### Meeting minutes

Attendees	Role	Organisation
Michael Gleeson	Fire authority	FRNSW
David Absalom	Fire authority	FRNSW
Yael Bornstein	Proponent	TfNSW / Sydney Metro
Emily Ball	Proponent	TfNSW / Sydney Metro
Andrew Addinsell	SMCSW FLS SME	TfNSW / Sydney Metro
Carlo Laba	OSD developer representative	TSA Management
John Mills	D&C contractor	CPB
Boris Petrovic	Services engineer	Aurecon
Lieselot Baert	Architect	Foster + Partners
Tony Tang	Architect	Cox Architecture
Peter Murphy	Certifying authority / BCA consultant	Philip Chun
Micael Lundqvist (ML)	Fire safety engineer	Warringtonfire
Genevieve Stanistreet	Fire safety engineer	Warringtonfire

Table 1 Stakeholders present at meeting

### Purpose

The purpose of the meeting was to discuss the work documented in the fire engineering brief report, specifically the following:

- Fire engineering process / deliverables
- Trial concept design
- Preliminary station ASET / RSET analysis
- Proposed performance solutions

### Key points discussed

1. Scope / fire engineering process & deliverables
  - ML provided an overview of the project and fire engineering deliverables. It was noted that comments on the FEB will be addressed in the FER.
  - CPB confirmed that the FEB will be issued to FRNSW and TfNSW / Sydney Metro on Friday 7<sup>th</sup> February 2020.

20200207-SY180170 FEB workshop 2 meeting minutes.docx



## 2. Trial concept design

- ML provided an overview of the trial concept design – refer to presentation slides attached.
- Fire rating for OTE structure – ML noted that current strategy is to protect OTE structure from a train fire for 2 hours with ISO fire exposure from below and smoke temperature exposure from within duct. FRNSW queried whether trackside temperature modelling would be undertaken. ML confirmed that the fire and smoke modelling include this. Note: This modelling is for trackside below the OTE duct, not inside the OTE duct.
- FRNSW noted that a summary of the OTE fire safety requirements across the different Metro stations would be beneficial to identify differences between stations. ML noted that this would need to be requested from TfNSW / Sydney Metro.
- ML also noted that platform side there are unprotected steel elements designed to withstand 450°C to mitigate risk of failure when occupants / FRNSW may be located in that area. FRNSW queried what would happen if this temperature was exceeded. ML clarified that structural design is such that potential failure is to be localised. ML also noted failure is not expected to have a big impact on the smoke exhaust as a locally enlarged opening to the OTE is expected to increase the volume exhaust in that area as the OTE is a plenum.
- South OSD level 2 restaurant fire separation – ML detailed the proposed -60/- fire rated glazing. It was noted that this is not documented in the FEB Rev A as this is a recent design development.
- Escalators for evacuation from the station – FRNSW queried whether a possible preference by occupants to use escalators over fire-isolated stairs is accounted for in the occupant evacuation modelling undertaken. ML confirmed that in the Pathfinder occupant evacuation modelling undertaken, a significant portion of the occupants evacuate via the escalators. FRNSW queried whether a scenario has been assessed where all escalators stop. ML confirmed that this scenario has not been assessed, but can be if required.
- Operator intervention for misaligned train scenario to reduce air pressure on EEDs and EWDs – ML noted that operator intervention will be required to reduce air pressure on EEDs and EWDs in the unlikely event of a misaligned train fire scenario. The alternative option would be to reduce the station exhaust, however it is considered more appropriate to run the station exhaust at full capacity and rely on operator intervention in the unlikely case of a train misaligned to the platform and the auto-sliding doors (ASDs).
- North OSD level 2 retail egress – ML detailed the proposed egress strategy incorporating the use of a station fire stair instead of reliance on escalators for evacuation. Note: TfNSW / Sydney Metro recommended confirming this with TSOM.
- Station manual fire suppression – FRNSW support the provision of fire extinguishers in FOH areas and no fire hose reels in FOH areas. CPB confirmed allowance has been made for fire extinguishers in FOH areas in locked cabinets as per SWTC requirements. Note: CPB to send an RFI to TfNSW / Sydney Metro to seek advice on consistency with other Metro stations.
- North B5 plant level – ML noted that it is understood there is currently a provision for sprinklers and smoke detection on this level. As the area is a restricted access area for cable reticulation, this may cause issues in the event of a detector going off and the operator needing to access the areas to check the cause of alarm. FRNSW noted they will not access HV areas until power has been verified as isolated and requested confirmation of what systems would be affected in the event of such a shutdown. Note: Strategy to be resolved with design team and TSOM and documented in FER.

## warringtonfire

- FIP provisions – ML noted that SMCSW FLS SME requested for station and OSD towers to have FIP + 2 x mimics in all FCR in previous meeting. In OSD FCR it is proposed to provide relevant OSD FIP + station mimic only, ie no mimic for other OSD due to required cable route through station and no clear operational benefit in providing this additional mimic. FRNSW agreed that a mimic for the other OSD would not be that beneficial. FRNSW noted that in the event of an alarm, typically two fire trucks would respond. Note: CPB to send an RFI to TfNSW / Sydney Metro to seek formal advice from FRNSW and Sydney Metro in relation to this requirement.
  - EWIS matrix – ML detailed the proposed EWIS strategy, noting that it is a work in progress. In the event of a fire in the station, FRNSW noted that their preference is for the EWIS to start to cascade into the OSD tower. TfNSW / Sydney Metro noted that this strategy may be different to other Metro stations, eg Martin Place. Note: Further TWG workshop to be held with Metro, TSOM and OSD developer to confirm requirements.
  - Water supply – FRNSW queried the station hydrant water supply. Aurecon confirmed that the feed hydrant as part of the booster will draw from the main, whilst on site pumps draw from tanks.
  - Wet systems split – ML presented the proposed wet systems split. Fire hydrants on podium levels at north and south are to be boosted by station boosters at north site. Sprinklers are to be fed off OSD ring mains and station ring main independently. No objection to the proposed system split was raised in the meeting.
3. Preliminary station ASET / RSET analysis
- ASET / RSET analysis – ML presented the preliminary ASET / RSET modelling results – refer to presentation slides attached. It was noted that a 10MW extreme event fire scenario has been modelled to inform the SFAIRP review of station smoke hazard management provisions.
  - FRNSW queried where the 10MW fire size originated. ML explained that the 10MW fire size is based on the estimated peak HRR for one train carriage. This was calculated by the train provider Alstom as part of the SMNW project. Sydney Metro confirm this Alstom report has been provided to FRNSW previously.  
  
Post meeting note: Section 6.3 of the FEB details that part of the rolling stock specification requires a maximum fire heat release rate per car of 10MW as defined by the Duggan method.
4. Proposed performance solutions
- ML provided a brief overview of the key proposed performance solutions. Due to time restrictions all performance solutions were not discussed – refer to presentation slides attached.
  - Egress from South OSD enabling levels 4 / 5 was discussed. FRNSW noted that they would like two exits to be provided from TVS/TES plenums and fan rooms.

## Appendix C Draft EWIS cascading strategy

	OSD Tower South (residential)				OSD Tower North (commercial)			
	OSD Tower				OSD Tower			
	OSD Tower				OSD Tower			
L06- Crash deck	OSD plant	Station BOH			OSD Tower			L05-
L04	OSD plant	Station BOH			Station BOH			L04 Crash deck
L03	OSD plant/storage	Station BOH			OSD sky lobby		Carstacker	L03
L02	OSD communal areas / restaurant				OSD sky lobby		Carstacker	L02
L01	OSD plant	Station BOH	Station FOH		OSD sky lobby	Station BOH	EOTF etc	L01
Ground L00	Lobby / Dock	Station BOH	Station FOH		Station FOH	Station BOH	Lobby / Dock etc	Ground L00
B1 / B1 Mezz	OSD plant	Station BOH (voids)	Station FOH		Station FOH	Station BOH	OSD plant	B1 / B1 Mezz
B2	Station BOH		Station FOH		Station FOH	Station BOH		B2
B3	Station BOH		Station FOH		Station FOH	Station BOH		B3
B4	Station BOH		Station FOH		Station FOH	Station BOH		B4
B5	Sumps, pits and cable trenches			Station FOH - Platform / Adits	Station FOH	Station BOH		B5

**Notes:**

- No cascade of EWIS from 'red, orange, yellow' into 'blue, green'.
- No cascade of EWIS from Station 'blue, green' into OSD North.
- Station FOH split into three zones - South, Platform and North. Single EWIS zone but different cascade matrix.
- MTS have confirmed station BOH and FOH are to be split into aseparate zones.
- Allow zoning for split of all levels and uses for future flexibility.
- PSS B01-L01 and PSN B01-L03 merged to simplify cascade matrix.
- PSS L03-L05 merged to ensure first cascade from station FOH includes these levels as they contain station smoke exhaust serving FOH.
- 2 up / 1 down means all zones on those levels, eg PSN L04 cascades to L05-06 and EOTF, Carstacker etc + Sky lobby.

**Matrix examples:**

- 1. Fire in Station FOH North (green)**
  - ALERT in station FOH incl platform and South entry (green)
  - EVAC in station FOH after up to 10min or 2nd alarm (MTS to confirm delay)
  - ALERT in station BOH
  - EVAC in station BOH
- 2. Fire in Station BOH South (blue)**
  - ALERT in station BOH (blue)
  - EVAC in station BOH after up to 10min or 2nd alarm (MTS to confirm delay)
  - ALERT in station FOH and adjacent OSD South (3 up / 1 down = green, orange, red and yellow) - Note proposed 3 up cascade.
  - EVAC in station FOH and adjacent OSD South (3 up / 1 down) after another 10min
  - ALERT in next OSD South (2 up / 1 down = OSD Tower)
  - Normal cascade in OSD South Tower beyond crash deck at same intervals (ECO to confirm cascade 10min & 2 up / 1 down)
- 3. Fire in above ground OSD or station BOH plant (eg yellow)**
  - ALERT in fire affected compartment (minimum that storey)
  - EVAC in fire affected compartment after up to 10min or 2nd alarm (MTS/ECO to confirm delay)
  - ALERT in adjacent OSD (2 up / 1 down = red and OSD Tower)
  - EVAC in adjacent OSD after another 10min
  - ALERT in next OSD enabling (2 up / 1 down = orange and OSD Tower)
  - Normal cascade in OSD Tower beyond crash deck at same intervals (ECO to confirm cascade 10min & 2 up / 1 down)
  - No cascade into station FOH/BOH (green and blue) and no cascade to non-fire affected OSD Tower.
- 4. Fire in OSD Sky lobby / residential communal areas or restaurant (red)**
  - ALERT in fire affected compartment (red) + carstacker (due to egress via Sky lobby)
  - EVAC in fire affected compartment after up to 10min or 2nd alarm (ECO to confirm delay)
  - ALERT in adjacent OSD and station BOH (2 up / 1 down = orange, yellow and OSD Tower)
  - EVAC in adjacent OSD (2 up / 1 down) after another 10min
  - Normal cascade in OSD Tower beyond crash deck at same intervals (ECO to confirm cascade 10min & 2 up / 1 down)
  - No cascade into station FOH/BOH (green and blue) and no cascade to non-fire affected OSD Tower.
- 5. Fire in first OSD Tower level (white)**
  - ALERT in fire affected compartment (minimum that storey)
  - EVAC in fire affected compartment after up to 10min or 2nd alarm (ECO to confirm delay)
  - ALERT in adjacent OSD and station BOH (2 up / 1 down = yellow and OSD Tower)
  - EVAC in adjacent OSD and station BOH after another 10min
  - ALERT in next OSD and station BOH (2 up / 1 down = red, orange and OSD Tower)
  - Normal cascade in OSD Tower beyond crash deck at same intervals (ECO to confirm cascade 10min & 2 up / 1 down)
  - No cascade into station FOH/BOH (green and blue) and no cascade to non-fire affected OSD Tower.



