

# Sydney Metro City & Southwest Pitt Street

## PITT STREET SOUTH OVERSTATION DEVELOPMENT

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**State Significant Development**

**Development Application (SSD DA)**

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Prepared for Pitt Street Developer South Pty Ltd

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**TTW** Structural  
Civil  
Traffic  
Façade

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## 1.0 Executive Summary

The Pitt Street Integrated Station Development (PSISD) scope involves the construction of a new Metro station in the CBD with two major entrances; one to the North along Park Street and the other to the South on the corner of Bathurst and Pitt Street. The construction includes two new Metro platforms and adits that provides pedestrian links between the platforms and the North and South station boxes.

The above ground structure in the podium levels, approximately 7 floors above natural ground, will consist of a mix of:

- Station facilities,
- Retail facilities,
- Residents amenities
- OSD back of house, and
- shared loading dock

The Over Station Development (OSD) for the South station is proposed to be a 39 storey apartment tower, which will house Sydney's first Build-to-Rent (BTR) scheme. As the Structural engineers on the Pitt Street Metro Station (South), TTW have also been engaged to provide structural advice for the proposed OSD.

### 1.1 Purpose of this Report

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) Dated 28 October 2019. Specifically, this report has been prepared to respond to the SEARs requirements nominated in Table 1.

*Table 1 SEARs 4 Requirements*

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SEARs 4.
b) Demonstrates how the State Significant Development (SSD) will integrate with the Critical State Significant Infrastructure (CSSI) infrastructure such as structural design

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## 2.0 Introduction

This report has been prepared to accompany a detailed 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 requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 28 October 2019.

The detailed SSD DA seeks development consent for:

- Construction of a new residential tower with a maximum building height of RL171.6
- Integration with the approved CSSI proposal including though not limited to:
  - Structures, mechanical and electronic systems, and services; and
  - Vertical transfers;
- Use of spaces within the CSSI 'metro box' building envelope for the purposes of:
  - Retail tenancies;
  - Residential lobby and residential amenities;
  - Loading and services access.
- Utilities and services provision.
- Stratum subdivision (Station / OSD).

The site is located within the Sydney CBD, on the corner of Bathurst Street and Pitt Street. It has two separate street frontages, Pitt Street to the west and Bathurst Street to the north. The area surrounding the site consists of predominantly residential high-density buildings and some commercial buildings, with finer grain and heritage buildings dispersed throughout.

- Lot 10 and DP 1255507

[illegible]



## **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.



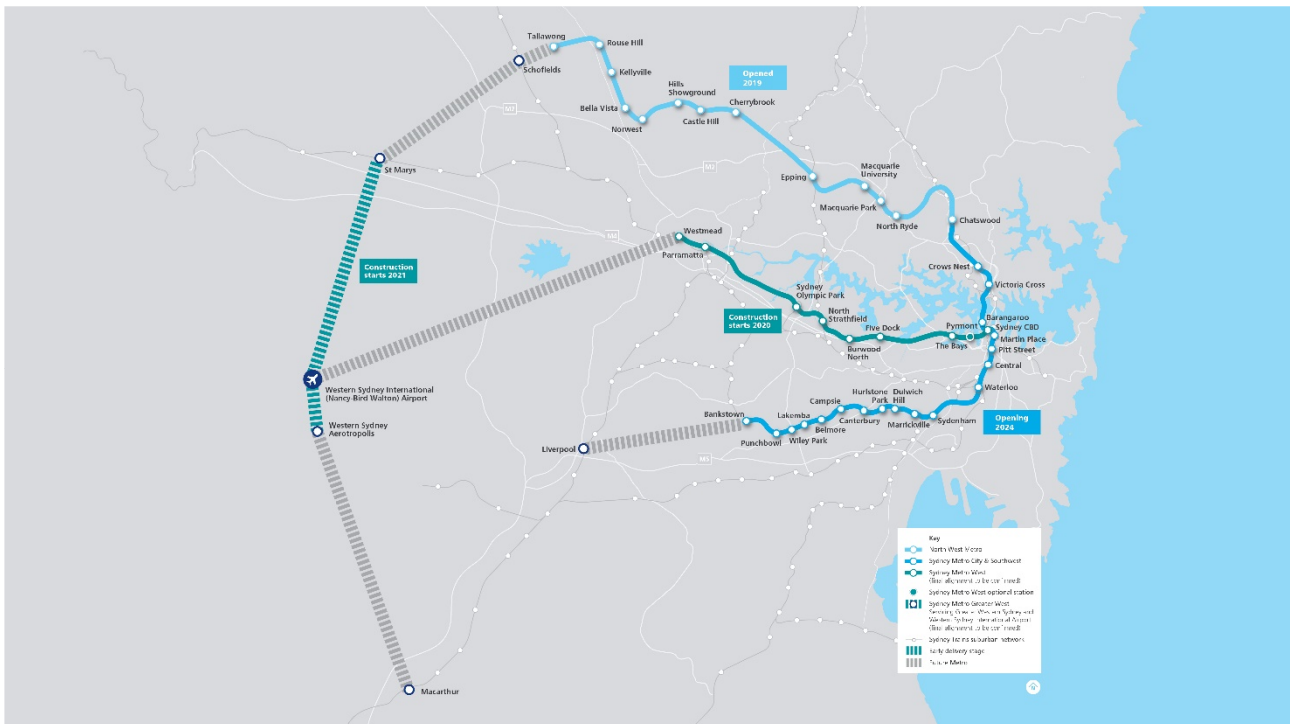


Figure 2 – Sydney Metro Alignment Map - Source: Sydney Metro

The Sydney Metro Project is illustrated in the figure above.

On 9 January 2017, the Minister for Planning approved the Sydney Metro City & Southwest - Chatswood to Sydenham project as a Critical State Significant Infrastructure project (reference SSI 15\_7400) (CSSI Approval). The terms of the CSSI Approval includes all works required to construct the Sydney Metro Pitt Street Station, including the demolition of existing buildings and structures on both sites (north and south). The CSSI Approval also includes construction of below and above ground works within the metro station structure for appropriate integration with over station developments.

## 2.3 Station and OSD Interface

The CSSI Approval included Indicative Interface Drawings for the below and above ground works at Pitt Street South Metro Station site. The delineation between the approved Sydney Metro works, generally described as within the “metro box”, and the Over Station Development (OSD) elements are illustrated below. The delineation line between the CSSI Approved works and the OSD envelope is generally described below or above the transfer slab level respectively.

Figure 3 – Pitt Street Station (North-South Section)

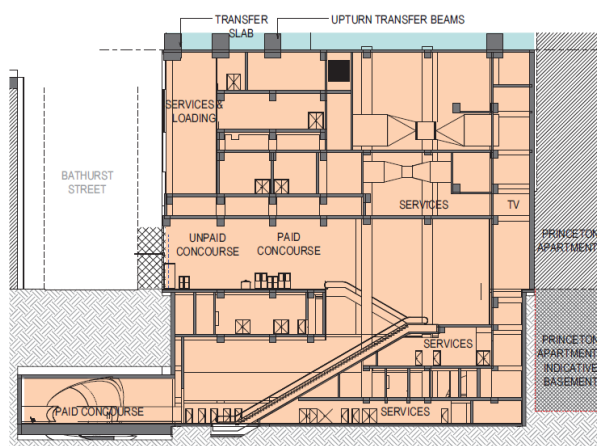
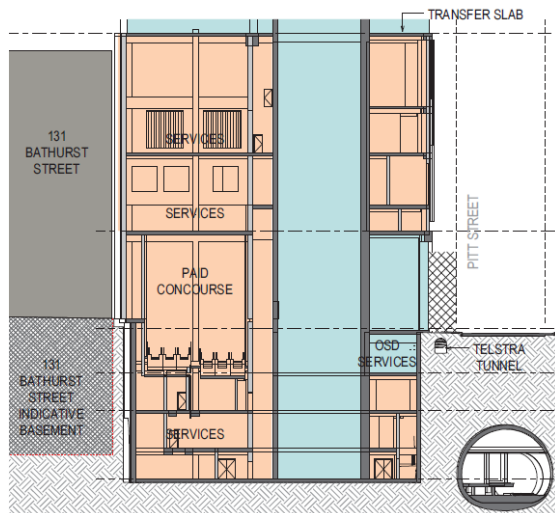


Figure 4– Pitt Street Station (East-West Section)



### 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 in the following section.

## 2.4 Pitt Street South Over Station Development (OSD)

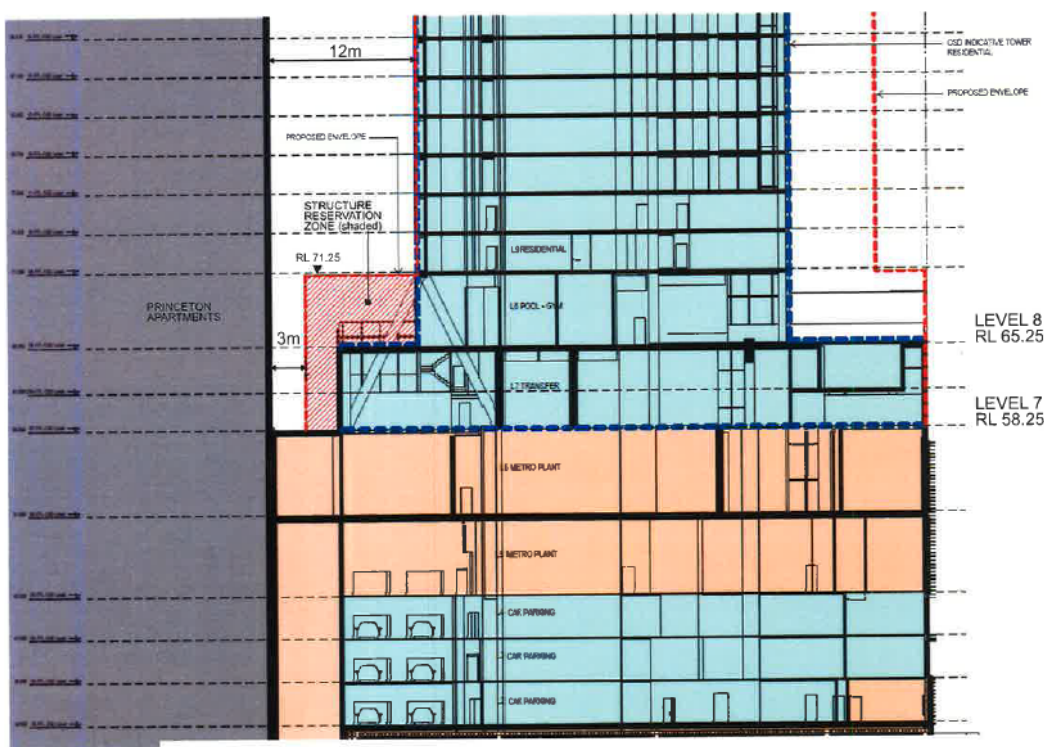
Development consent was granted on 25 June 2019 for the Concept Development Application (SSD 8876) for Pitt Street South OSD including:

- A maximum building envelope, including street wall and setbacks for the over station development.
- A maximum building height of RL171.6.
- Podium level car parking for a maximum of 34 parking spaces.
- Conceptual land use for either one of a residential or commercial scheme (not both). NO maximum Gross Floor Area was approved as part of SSD 8876.

The building envelope approved within the Concept SSD DA provides a numeric delineation between the CSSI Approval “metro box” envelope and the OSD building envelope. As illustrated in the figures below, the delineation line between the two projects is defined at RL 58.25 (Level 7).

For the purposes of the Detailed (Stage 2) SSD DA, it is noted that while there are two separate planning applications that apply to the site (CCSI and SSD DA), this report addresses the full development across the site to provide contextual assessment.

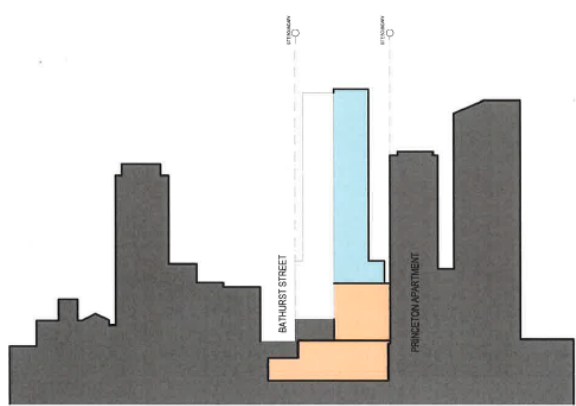
Figure 5– Pitt Street South Concept SSD DA – Building Section



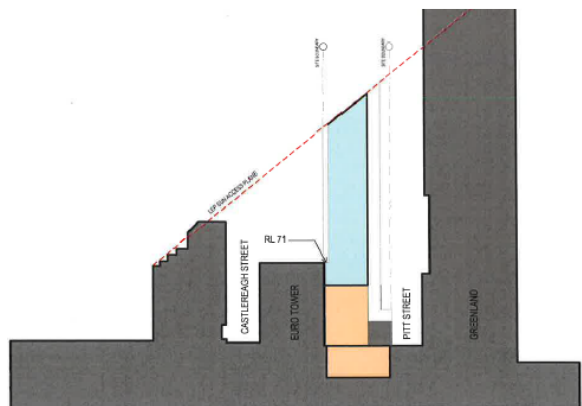
Source: SSD 8876 Concept Stamped Plans

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

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



Source: SSD 8876 Concept Stamped Plans



Source: SSD 8876 Concept Stamped Plans

### 3.0 Design Loadings

In general, all loads and load combinations shall comply with AS/NZS 1170 Parts 0 to 4, Structural Design Actions. Live load reductions will be applied as permitted by AS/NZS 1170.1. Refer to sections 3.1 – 3.6 for relevant design loads.

The 2019 National Construction Code regulations are applicable for this project.

#### 3.1 Design Life and Importance Level of the Structure

The Design Life and Importance Level of the structure is given as per the NCC for a typical apartment building. As per building classification 2, the following is inferred:

Design Life:	50 years
Importance Level:	3, as per BCA requirements

**Note:** For the protection of the Metro, the lateral stability elements for the tower have been designed for Importance Level 4 for ultimate seismic and wind actions as per the critical design criteria of the station.

#### 3.2 Permanent Actions – Dead Loads

Dead load shall be considered as the self-weight of the structure plus an allowance for services, toppings, walls and ceilings which vary throughout the site.

The additional dead loads should not be less than the following:

Element	UDL (kPa)
Balconies with finishes – with falls for drainage	1.7kPa (maximum 70mm concrete)
Apartments (allowances for partitions and ceilings)	1.5kPa
Lightweight roof Structures	0.25kPa
Glazed Roof Areas	0.5kPa
Suspended services	0.25kPa
Landscaped areas (planter beds)	20 kN/m <sup>3</sup> (saturated soil)

##### 3.2.1 Façade Loading and Internal Walls

No façade of masonry wall loading is included in the loads noted in the above table.

In collaboration with INHABIT, our designs have been based on a curtain wall façade option (0.5kPa); which equates to approximately 1.5kN/m line loading based on a typical floor to floor height of 3m. This line load has allowance for the light weight GRC vertical blades intermittently around the building perimeter, which is understood to be spanning floor to floor.

It is assumed that all internal partitions will be of lightweight infill stud construction and specific allowance will be made for masonry partitions if required. In particular, masonry walls will most likely be required around services rises in addition to thickened slabs.

##### 3.2.2 Landscaping Loads

Landscaping loads have been allowed for based on preliminary advice received from the Landscape Architect, Sue Barnsley. These areas will be further developed and co-ordinated during Design Development.

### 3.3 Imposed Actions - Live Loads

Design floor live loadings are to generally satisfy the minimum provisions of AS1170.1 and in particular the following:

Element	UDL (kPa)	Concentrated Load (kN)
Stairs	5.0	4.5
Plant (TBC)	5.0 or higher as advised by services engineer	4.5
OSD Transfer Level	20	
Apartments	1.5	2.5
Balcony	2.0	2.5
Corridor	4.0	4.5

No live load reductions are to be applied to any floor system elements. Pattern loading will be considered when determining worst case scenarios for strength and serviceability where required by AS1170. Live load reductions will be considered for columns and walls in accordance with AS1170.1.

Loads in plant areas are to be confirmed by services engineers once layouts are known. Higher loading will be required for large pieces of plant or tanks.

### 3.4 Wind Loads

Base wind loading parameters for the apartment, as taken from AS1170.2, are shown in the table below.

Parameter	
Importance Level	3
Design Life	50 years
Region	A2
Annual probability of exceedance	1/1000
V <sub>1000</sub>	46m/s
Terrain Category	TC3

For the protection of the Metro, the stability elements for the OSD tower has been designed for the ultimate wind conditions associated to the higher design criteria of the Station under (Importance Level 4). A specialist wind consultant (CPP) has been engaged to provide a wind study of the building to refine static loads. Refer to wind reports issued by CPP for further information.

### 3.5 Earthquake Loads

Earthquake loadings are in accordance with AS1170.4 – 2007 (Earthquake Actions in Australia) and AS/NZS 1170.0 – 2002 unless noted otherwise.

Parameter	
Hazard Factor (z)	0.08
Site Sub-Soil Class	Be (Buildings founded on rock)
Importance Level	3
Annual probability of exceedance	1/1000
Earthquake Design Category	III
Minimum kpZ Value	0.10

### 3.6 Protective Design Requirements

Karagozian & Case (K&C) have been engaged by Pitt Street Developer South Pty Ltd to provide specialist protective design consultancy services to ensure the Pitt Street Station are compliant with the blast hardening requirements of Appendix B12 of the SWTCs. TTW have worked alongside K&C to integrate any blast requirements into the Stage 2 structural design. Further co-ordination between the consultants is ongoing as the project enters detailing stages.

Please refer to the following documents prepared by Karagozian & Case (K&C) for further information regarding the protective design requirements:

- Blast Vulnerability Assessment – 19A\_081-TR-001

### 3.7 Level 6 Construction Loads – Crash Deck

The station (and six levels of podium) are designed to have a 100 year design life. The OSD residential tower, starting at level seven, is designed to have a 50 year design life. Raised floor plates within the podium levels relating to OSD usage (i.e level two retail) will be designed for a design life of 50 years.

The level six slab has been designed to have a 20kPa construction live load to allow for future alterations to the tower over.

For clarity, this construction load is on the base level slab, and does not include the allowance of a raised slab and pool structure at level 6 amenities floor. These amenities are for the OSD, therefore it is assumed that these will be removed and demolished before the tower over.

### 3.8 Barriers

Barriers including parapets, balustrades and railings are to be designed in accordance with Table 3.3 of AS/NZS 1170.1.



### 3.9 Design Standards

AS	Edition	Title
AS/NZS 1170.0	2002	Structural Design Actions Part 0: General Principles
AS/NZS 1170.1	2002	Structural Design Actions Part 1: Permanent, imposed and other actions
AS/NZS 1170.2	2011	Structural Design Actions Part 2: Wind Actions
AS 1170.4	2007	Structural Design Actions Part 4: Earthquake loads
AS2327.1	2003	Composite Structures
AS3600	2018	Concrete Structures
AS3700	2018	Masonry Structures
AS4100	1998	Steel Structures

## 4.0 Serviceability

### 4.1 Deflection Limits

All suspended concrete are designed in accordance with the following parameters in addition to the following Australian Standards:

- AS1170.0 Table C1
- AS3600-2018

Maximum Floor Deflection Limit				
	Dead	Incremental	Live	DL+LL
Floors supporting non masonry partitions	Span/360 (25mm max)	Span/1000 <sup>1</sup>	Span/500	Span/300 (30mm max)

<sup>1</sup> Areas supporting normal weight masonry partitions

<sup>2</sup> Incremental deflection after compactus installed

### 4.2 Vibration

Recommended peak acceleration for human comfort due to vibrations vary pending on the usage of the floor plate. Common consensus on acceptable frequencies vary between 4 to 10Hz based on designated residential or gym spaces respectively. RAM Concept will be utilised to determine the design acceptable limits for vibration of the typical floor plate based on the 'footfall' theory.

The proposed OSD pool at level 6 amenities floor will be designed and detailed to be fully isolated from the main building structure. The independent pool shell will sit on bearing pads which will absorb the movement induced from people swimming and diving into the pool. This detailing is critical such that the dynamic loads from the pool do not adversely affect the serviceability of the structure. This will be further developed during Design Development.

### 4.3 Durability

For concrete elements, durability will be achieved by specifying all elements in accordance with Section 4 of AS3600. This section of the code sets out requirements for plain, reinforced and post tensioned concrete structure and members with a design life of 50 years. Exposure classifications as follows:

Exposure Classification	Elements
A1	Internal
B1	In Ground and External

Protective coatings to structural steel elements shall comply with AS/NZS 2312 and ISO 2063 for the long-term protection category.

### 4.4 Fire Resistance Levels

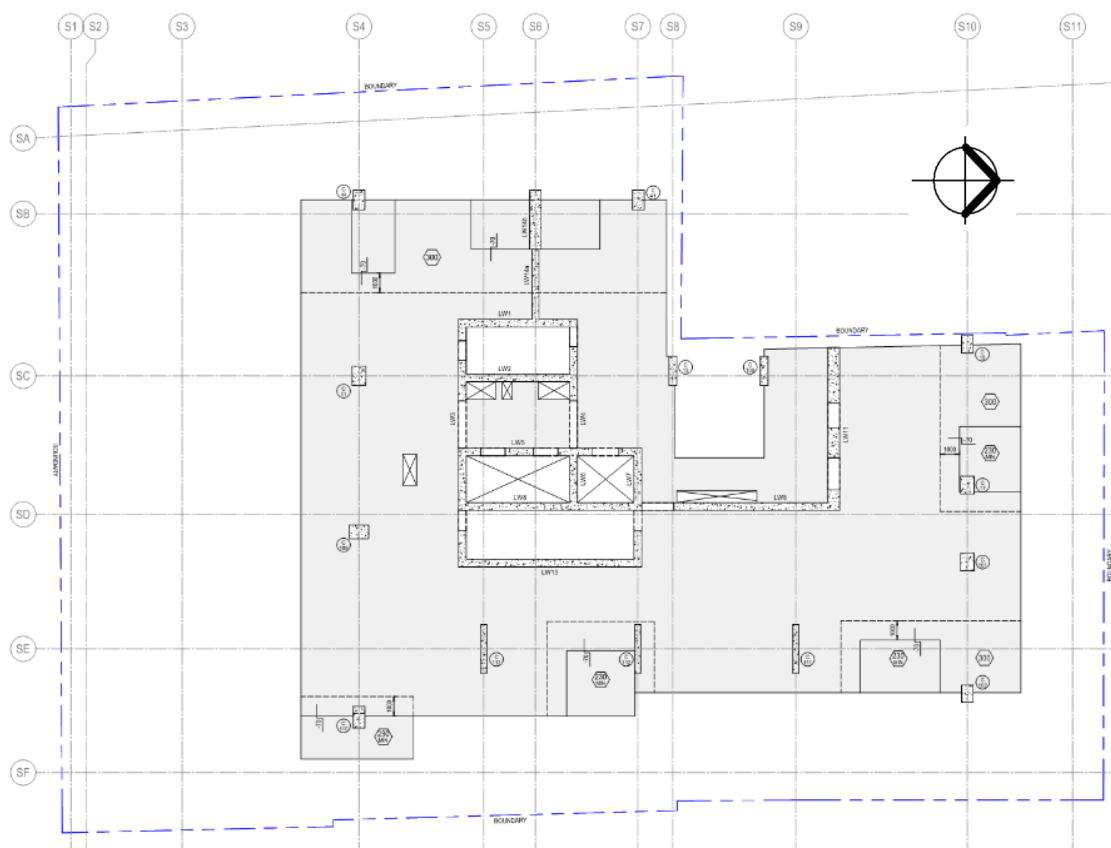
The NCC type of construction required for this building will be Type A. Fire Resistance Levels (FRL) for the structural elements will need to be in accordance with Specification C1.1 of the NCC. Typically the FRL (minutes) for concrete structural elements is 90/90/90. Structural design has considered this in the design thicknesses of vertical and horizontal concrete elements. Further co-ordination with Warrington Fire will occur through Design Development to ensure any other FRLs requirements are addressed with structural design.

## 5.0 Structural Design

### 5.1 Lateral Stability

The lateral stability system has been designed to accommodate the site wind, earthquake and robustness loading for both strength and serviceability requirements. The main OSD lift shaft core walls extend through the entire tower. In addition to this, the station stair core (west of the main shaft) is also carried up through the tower. Due to high drift under wind load cases, two east/west shear walls are required to restrict the lateral movement at the upper levels to be within compliant limits. A typical tower floor plate is shown in a Figure below. The OSD structure is modelled as part of the overall station lateral stability model in ETABS. Due to the more stringent requirements on the station below (importance level 4, 100 year design life), similar seismic and wind actions have been adopted to the tower for strength (as per station design requirements).

Figure 8: Typical Tower Floor Plate



### 5.2 Structural Floor Plates

The proposed Pitt Street South OSD is a 39-storey build to rent apartment tower. The floor plates are generally consistent in their arrangement, with the upper four levels decreasing in size to accommodate an upper level terrace and plantroom areas. The main transfer of the apartment layout columns is predominately over a double storey transfer, in the level 6 amenities floor and level 7 apartment layout. Refer to Section 5.4 for more details. Additional transfers occur at lower levels in the podium due to spatial requirements.

The proposed OSD structure has been co-ordinated such that the main lift core and station stair at station continues up through the spine of the tower. Additional blade walls in the east-west direction have been included to, not only support the gravity floor loads, but also restrict the lateral movements of the tower at the upper levels.

There are a number of apartment level mixes in the proposed build-to-rent apartment scheme. The apartment layouts however, have been worked to suit a consistent column set-out in the apartment tower.

The design of the typical apartment floor plates is a 230 thick two-way PT flat plate slab. A 30mm setdown for wet areas can be accommodated in the current slab spans. At balcony locations, a 300mm slab fold to accommodate the 90mm step is required. Upper level terrace floors are thicker to accommodate the increased dead and live load requirements.

### 5.3 Penetrations

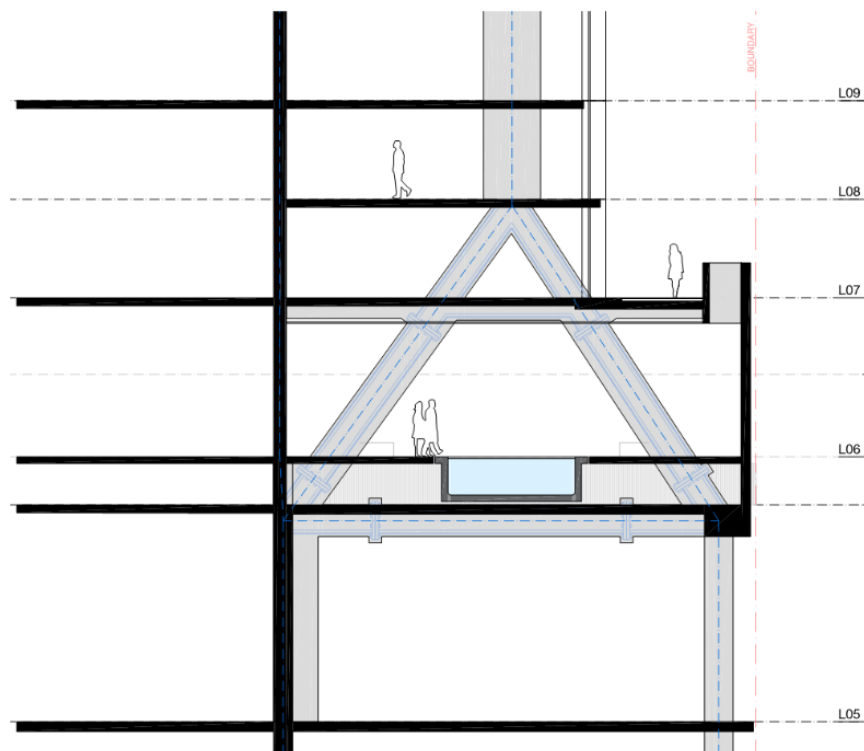
Services risers are required through the apartment tower. The location and size have been co-ordinated amongst all consultants to have optimum design for structure, services and architectural layout.

### 5.4 OSD Transfer

One of the main changes made from the Stage 1 Concept was the elimination of the large columns between the escalators at the station level (ground to level B4). This large open span to the eastern side of the building at podium level and below created some large transfers at level 6.

To optimise the structure and architectural layout at level 6 amenities floor, the 5 main transfers were carried out over two floors (level 6 and level 7). The angle of the raking columns allowed more useable space under the transfer structure, which was vital around the intended pool space. An indication of the transfer is provided below in Figure 5.

*Figure 9: Typical Section of Main Tower Transfer*



In addition to the transfers nominated above, other column transfers are required to suit the column alignment from the OSD apartment levels to the station levels below. These transfers are typically located in the podium levels (between level 1 and 5), and do not have the large offset as shown in the example above. The minor transfers are typically dealt with 'flag columns' or transfer walls. Any eccentricities are taken out in either the floor plate diaphragm or column bending.

## 6.0 Sustainability

The Pitt Street Over Station Development (OSD) South is a proposed new build-to-rent (BTR) residential tower to be constructed above the Pitt Street Metro Station. Ecologically Sustainable Design (ESD) principles are being applied in the design, delivery and operation of the project, and third-party verification will be provided through Green Star Design & As-Built v1.3 certification.

The following commitments have been made for the residential component of the development:

- Achieve a 5-Star rating using the Green Star Design & As-Built v1.3 rating tool.
- Exceed BASIX minimum compliance requirements for energy and water including:
  - BASIX Energy score: 30% reduction in Greenhouse Gas (GHG) emissions
  - BASIX Water score: Greater than 40% saving in potable water consumption
  - BASIX Thermal Comfort: Achieve better than 6 -Star average HERS star rating across the project. The intent of a sustainable design is to reduce greenhouse gas emissions and resource use associated with the use of concrete.

As part of the Green Star Strategy for the project, the following credits are being reviewed:

- Reduced life cycle impacts (Credit 19A) - including reduced impacts of concrete.
- Responsible steel (Credit 20.1) - only relevant if structural and reinforcing steel are >1% by cost of the project contract value.
- Responsible timber (Credit 20.2) including formwork.

For further information on the targeted credits, refer to the ESD report provided by Cundalls.

## 7.0 Conclusion

The design of the OSD Tower integrated with the construction of the future Pitt Street South Station and Sydney Metro City and Southwest rail corridor has been developed in line with the architectural intent of the OSD Tower and Station.

The structural design is considered to be compliant to relevant design and planning criteria. Preliminary co-ordination with other key engineering services has been undertaken. Further design development is required for the documentation to be ready for a Construction Certificate.

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Director

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