

Macquarie

**Sydney Metro Martin Place
integrated station development**

**North Tower, SSD DA Stage 2:
Structural Statement**

CSWSMP-MAC-SMN-ST-REP-999904

Revision 01 | 23 August 2018

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Introduction

This report supports a State Significant Development (SSD) Development Application (DA) (SSD DA) submitted to the Minister for Planning (Minister) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on behalf of Macquarie Corporate Holdings Pty Limited (Macquarie), who is seeking to create a world class transport and employment precinct at Martin Place, Sydney.

The SSD DA seeks approval for the detailed design and construction of the **North Site** Over Station Development (OSD), located above and integrated with Metro Martin Place station (part of the NSW Government's approved Sydney Metro project). The northern entrance to Metro Martin Place station will front Hunter Street, Elizabeth Street and Castlereagh Street, with the North Site OSD situated above.

This application follows the approval granted by the Minister for a Concept Proposal (otherwise known as a Stage 1 SSD DA) for two OSD commercial towers above the northern and southern entrances of Metro Martin Place station (SSD 17_8351). The approved Concept Proposal establishes building envelopes, land uses, Gross Floor Areas (GFA) and Design Guidelines with which the detailed design (otherwise known as a Stage 2 SSD DA) must be consistent. This application does not seek approval for elements of the Metro Martin Place Precinct (the Precinct) which relate to the Sydney Metro City and Southwest project, which is subject to a separate Critical State Significant Infrastructure (CSSI) approval. These include:

- Demolition of buildings on the North Site and South Site;
- Construction of rail infrastructure, including station platforms and concourse areas;
- Ground level public domain works; and
- Station related elements in the podium of the North Tower.

However, this application does seek approval for OSD areas in the approved Metro Martin Place station structure, above and below ground level, which are classified as SSD as they relate principally to the OSD. These components are within the Sydney Metro CSSI approved station building that will contain some OSD elements not already approved by the CSSI Approval. Those elements include the end of trip facilities, office entries, office space and retail areas, along with other office/retail plant and back of house requirements that are associated with the proposed OSD and not the rail infrastructure.

This report outlines the structural and geotechnical philosophy for the project and demonstrates how the Over Station Development (OSD) will integrate structurally with the Sydney Metro Martin Place Station Infrastructure

Context

The New South Wales (NSW) Government is implementing Sydney's Rail Future (Transport for NSW, 2012), a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of customers in the future.

Sydney Metro is a new standalone rail network identified in Sydney's Rail Future. The Sydney Metro network consists of Sydney Metro Northwest (Stage 1) and Sydney Metro City and Southwest (Stage 2).

Stage 2 of Sydney Metro entails the construction and operation of a new metro rail line from Chatswood, under Sydney Harbour through Sydney's CBD to Sydenham and onto Bankstown through the conversion of the existing line to metro standards. The project also involves the delivery of seven (7) new metro stations, including Martin Place.

This step-change piece of public transport infrastructure once complete will have the capacity for 30 trains an hour (one every two minutes) through the CBD in each direction catering for an extra 100,000 customers per hour across the Sydney CBD rail lines.

On 9 January 2017 the Minister approved the Stage 2 (Chatswood to Sydenham) Sydney Metro application lodged by Transport for NSW (TfNSW) as a Critical State Significant Infrastructure (CSSI) project (reference SSI 15_7400). Work is well underway under this approval, including demolition of buildings at Martin Place.

The OSD development is subject to separate applications to be lodged under the relevant provisions of the EP&A Act. One approval is being sought for the North Site – this application – and one for the South Site via a separate application.

Site Description

The Metro Martin Place Precinct relates to the following properties (refer to Figure 1):

- 50 Martin Place, 9 – 19 Elizabeth Street, 8 – 12 Castlereagh Street, 5 Elizabeth Street, 7 Elizabeth Street, and 55 Hunter Street (North Site);
- 39 – 49 Martin Place (South Site); and
- Martin Place (that part bound by Elizabeth Street and Castlereagh Street).

This application relates **only to the North Site**, being the city block bounded by Hunter Street, Castlereagh Street, Elizabeth Street, and Martin Place (refer to Figure 1).

The South Site (39 – 49 Martin Place) is the subject of a separate Stage 2 SSD DA.



Figure 1: Aerial Photo of the North and South Site of the Metro Martin Place Precinct

Background

Sydney Metro Stage 2 Approval (SSI 15_7400)

The Sydney Metro CSSI Approval approves the demolition of existing buildings at Martin Place, excavation and construction of the new station (above and below ground) along with construction of below and above ground structural and other components of the future OSD, although the fit-out and use of such areas are the subject of separate development approval processes.

On 22 March 2018, the Minister approved Modification 3 to the Sydney Metro CSSI Approval. This enabled the inclusion of Macquarie-owned land at 50 Martin Place and 9-19 Elizabeth Street within Metro Martin Place station, and other associated changes (including retention of the opening to the existing MLC pedestrian link).

Concept Proposal (SSD 17_8351)

On 22 March 2018, the Minister approved a Concept Proposal (SSD 17_8351) relating to Metro Martin Place Precinct. The Concept Proposal establishes the planning and development framework through which to assess the detailed Stage 2 SSD DAs.

Specifically, the Concept Proposal encompassed:

- Building envelopes for OSD towers on the North Site and South Site comprising:
 - 40+ storey building on the North Site (see Figure 2)
 - 28+ storey building on the South Site
 - Concept details to integrate the North Site with the existing and retained 50 Martin Place building (the former Government Savings Bank of NSW)
- Predominantly commercial land uses on both sites, comprising office, business and retail premises
- A maximum total GFA of 125,437m² across both sites
- Design Guidelines to guide the built form and design of the future development
- A framework for achieving design excellence
- Strategies for utilities and services provision, managing drainage and flooding, and achieving ecological sustainable development
- Conceptual OSD areas in the approved Metro Martin Place Metro station structure, above and below ground level¹

¹ Refers to those components within the Metro CSSI approved station envelope that will contain some OSD elements not approved in the CSSI consent. Those elements include the end of trip facilities, office entries, office space and retail areas, along with other office/retail plant and back of house requirements that are associated with the proposed OSD and not the rail infrastructure.

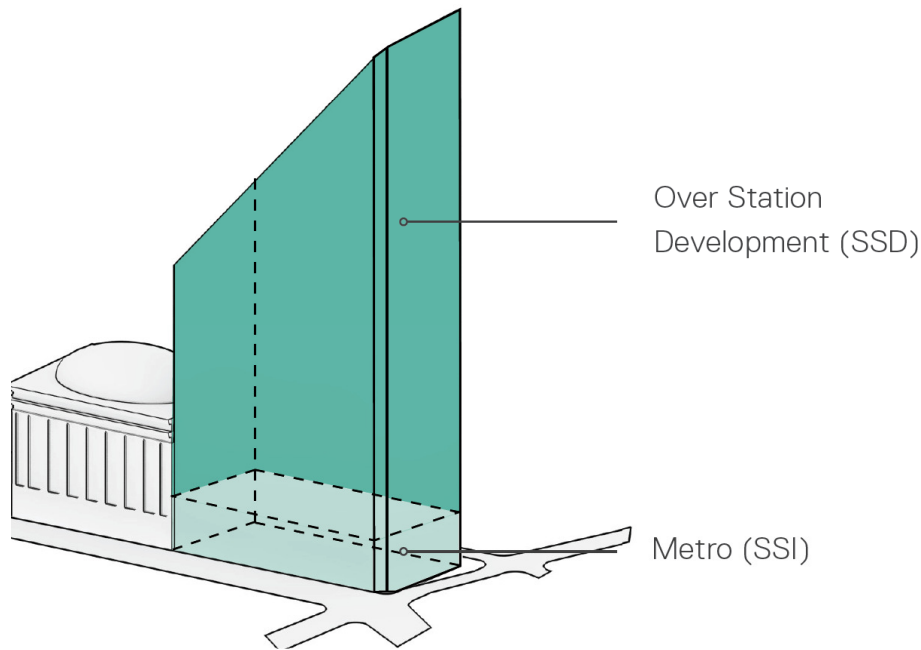


Figure 2: North Site Approved OSD Building Envelope

Planning Proposal (PP_2017_SYDNE_007_00) - Amendment to Sydney LEP 2012

The Planning Proposal (PP_2017_SYDNE_007_00) sought to amend the development standards applying to the Metro Martin Place Precinct through the inclusion of a site-specific provision in the Sydney Local Environmental Plan (LEP) 2012. This site-specific provision reduced the portion of the **South Site** that was subject to a 55 metre height limit from 25 metres from the boundary to Martin Place, to 8 metres, and applies the Hyde Park North Sun Access Plane to the remainder of the South Site, forming the height limit of the tower. It also permits a revised FSR of 22:1 on the South Site and 18.5:1 on the North Site. These amendments were gazetted within Sydney LEP 2012 (Amendment No. 46) on 8 June 2018 and reflect the new planning controls applying to the Precinct.

Overview of the Proposed Development

The subject application seeks approval for the detailed design, construction and operation of the North Tower. The proposal has been designed as a fully integrated station and OSD project that intends to be built and delivered as one development, in-time for the opening of Sydney Metro City and Southwest in 2024. This application seeks consent for the following:

- The design, construction and operation of a new 39 storey commercial OSD tower (plus rooftop plant) within the approved building envelope for the North Site, including office space and retail tenancies.
- Physical connections between the OSD podium and the existing 50 Martin Place building, to enable the use of the North Site as one integrated building.

- Vehicle loading areas within the basement levels.
- Extension and augmentation of physical infrastructure / utilities as required.
- Detailed design and delivery of ‘interface areas’ within both the approved station and Concept Proposal envelope that contain OSD-exclusive elements, such as end of trip facilities, office entries, office space and retail areas not associated with the rail infrastructure.

Planning Approvals Strategy

The *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD) identifies development which is declared to be State Significant. Under Schedule 1 and Clause 19(2) of SEPP SRD, development within a railway corridor or associated with railway infrastructure that has a capital investment value of more than \$30 million and involves commercial premises is declared to be State Significant Development (SSD) for the purposes of the EP&A Act. The proposed development (involving commercial development that is both located within a rail corridor and associated with rail infrastructure) is therefore SSD.

Pursuant to Section 4.22 of the EP&A Act a Concept DA may be made setting out concept proposals for the development of a site (including setting out detailed proposals for the first stage of development), and for which detailed proposals for the site are to be the subject of subsequent DAs. This SSD DA represents a detailed proposal and follows the approval of a Concept Proposal on the site under Section 4.22 of the EP&A Act.

Submitted separately to this SSD DA is a SSD DA for the South Site (Stage 2 South Site SSD DA). A Stage 1 Amending SSD DA to the Concept Proposal (Stage 1 Amending DA) has also been submitted that has the effect of aligning the approved South Site envelope with the new planning controls established for the South Site (achieved through the site specific amendment to the Sydney LEP 2012).

Figure 3 below is a diagrammatic representation of the suite of key planning applications undertaken or proposed by Macquarie and their relationship to the subject application (the subject of this report).

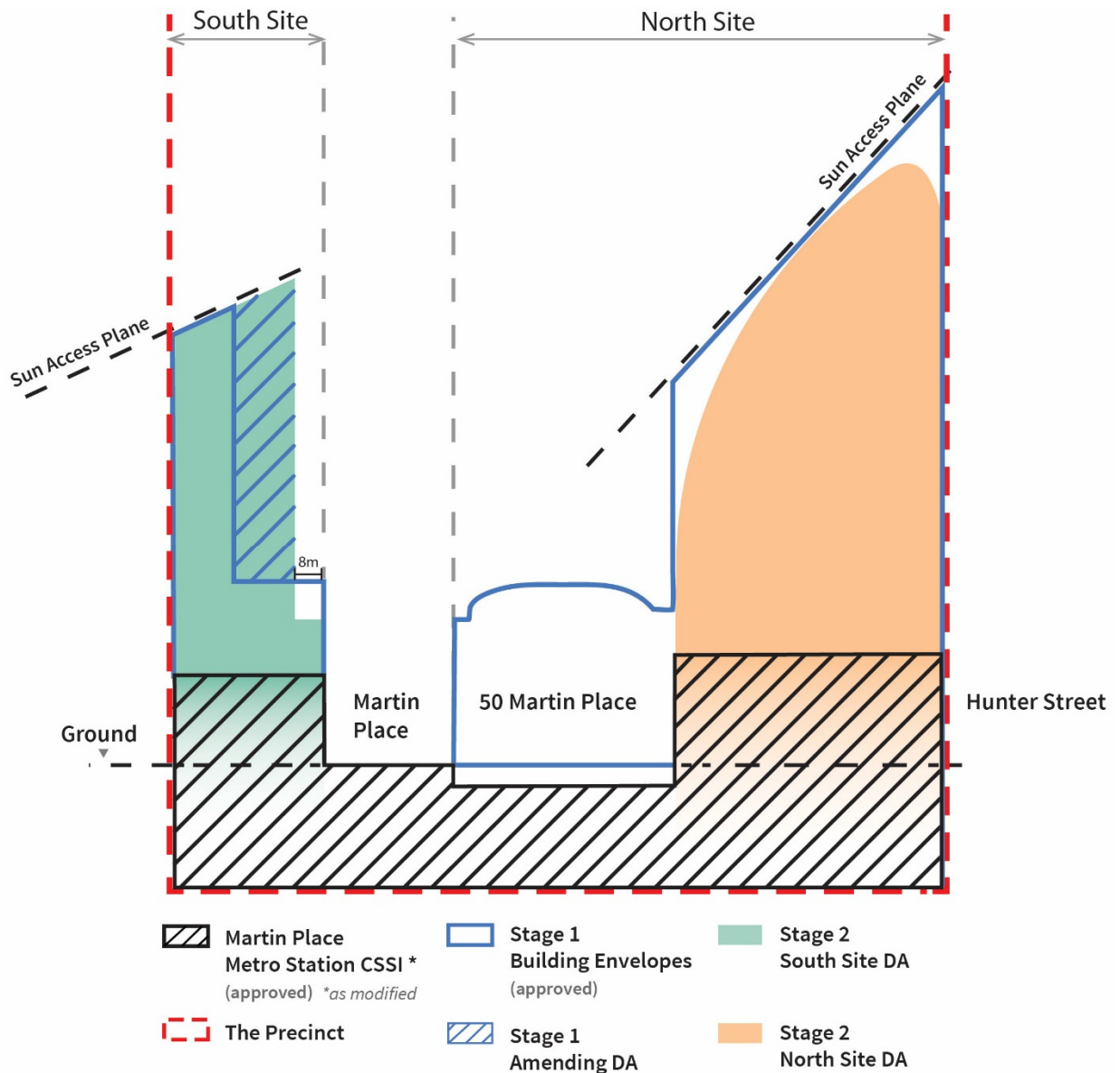


Figure 3: Relationship of key planning applications to the Stage 2 North Site DA (this application)

The Department of Planning and Environment have provided Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as follows:

The EIS shall:

- show how the proposed over station development (OSD) will integrate in design terms and structurally with the Sydney Metro station infrastructure, and identify any specific requirements of the CSSI 7400 approval that has influenced the design of the OSD

The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the EP&A Regulation 2000. Provide these as part of the EIS rather than as separate documents.

In addition, the EIS must include the following:

- Structural statement.

2 Structural Philosophy

The structural philosophy of the project is developed around the requirements of the transport authorities for the station development and the requirements of Macquarie for the retail and commercial office tower components of the buildings. Whilst the development is integrated in terms of architecture and functionality, the definition of the station elements as CSSI as distinct from the OSD elements as SSD will mean differences in a number of aspects of the design and design criteria.

2.1 Excavation

The North Tower shaft and Northern Concourse excavations will be carried out as open cut excavations. The excavation below the upper layers of fill and weathered sandstone are anticipated to be vertical cuts of the Hawkesbury sandstone. Note that excavation work is approved under separate CSSI consent and is not proposed with this SSD DA; however it is included for context.

2.2 North Tower Overview

The North Tower structure is envisioned as an in-situ reinforced building with reinforced concrete columns and reinforced concrete slab and post-tensioned beam system floor structures. Due to the architectural requirement of building geometry and the station requirements there is limited opportunity to utilise the concrete core wall arrangement down through the station levels due to the tapering nature of the of the building. For this reason the lateral stability of the tower in the north-south direction and east-west direction relies primarily on perimeter bracing in either reinforced concrete or in structural steelwork supplemented by the available concrete core structures achieved in the planning.

Below the North Tower is the North Tower shaft, which is linked to the adjacent South Tower shaft by a network of caverns. The North Tower and the North Tower shaft are designed to be constructed as one integrated structure from foundation to rooftop.

The Northern and Southern Concourses, retail and plant spaces below ground are constructed as in-situ concrete basement structures with reinforced concrete columns, walls, and slab and beam floors. The underground station basement structure will typically be bounded within the excavation by perimeter in-situ concrete walls.

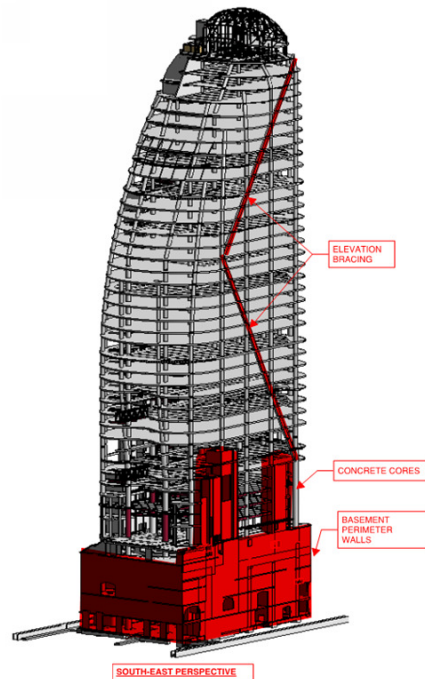


Figure 4: North Tower and Northern Concourse structure perspective describing the integrated design from foundation level to rooftop. The new Sydney Metro tunnels are adjacent to the shaft.

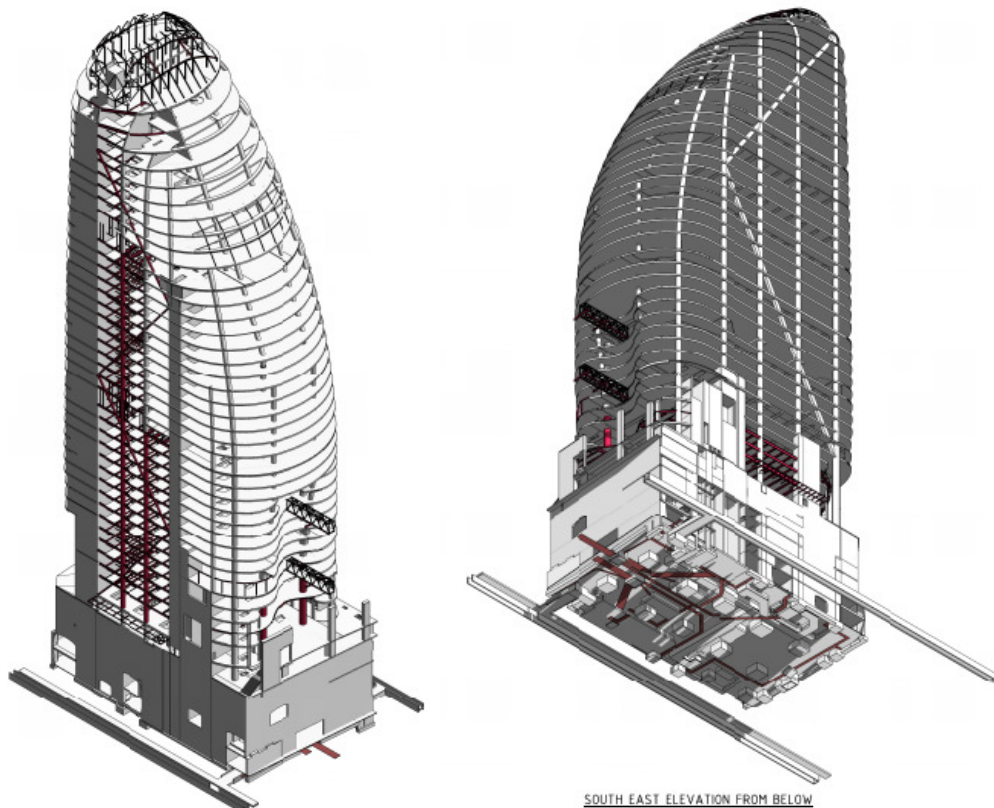


Figure 5: North Tunnel and Northern Concourse perspectives describing an integrated design from foundation level to rooftop. The new tunnels are adjacent to the shaft and the foundation soffits.

2.3 North Tower Stability

As described above, stability of the North Tower is provided by a combination of reinforced concrete core walls supplemented by an arrangement of perimeter elevation bracing elements.

Above ground, the overall building stability needs to be supplemented, due to the tapering of cores up the building, by the use of perimeter elevation mega bracing.

In the north-south direction, stability is provided by the tapering reinforced concrete cores and the mega brace arrangements on the eastern and western elevations of the building. In the glazed lift core on the west the bracing is proposed in structural steel and in the concrete framed arrangement on the east an in-situ concrete brace arrangement is described.

These braces align with the perimeter columns and resist both tension and compression under lateral load reversal.

Stability in the east-west direction is provided by the tapering reinforced concrete cores and the mega brace arrangement on the north elevation of the building. Torsion due to the eccentricity of this north face bracing and the centre of load application for east-west wind loads is resisted by the mega-bracing on the east and western faces. Similarly to the north-south direction, the station shaft perimeter concrete walls transfer the lateral load down to the foundation level.

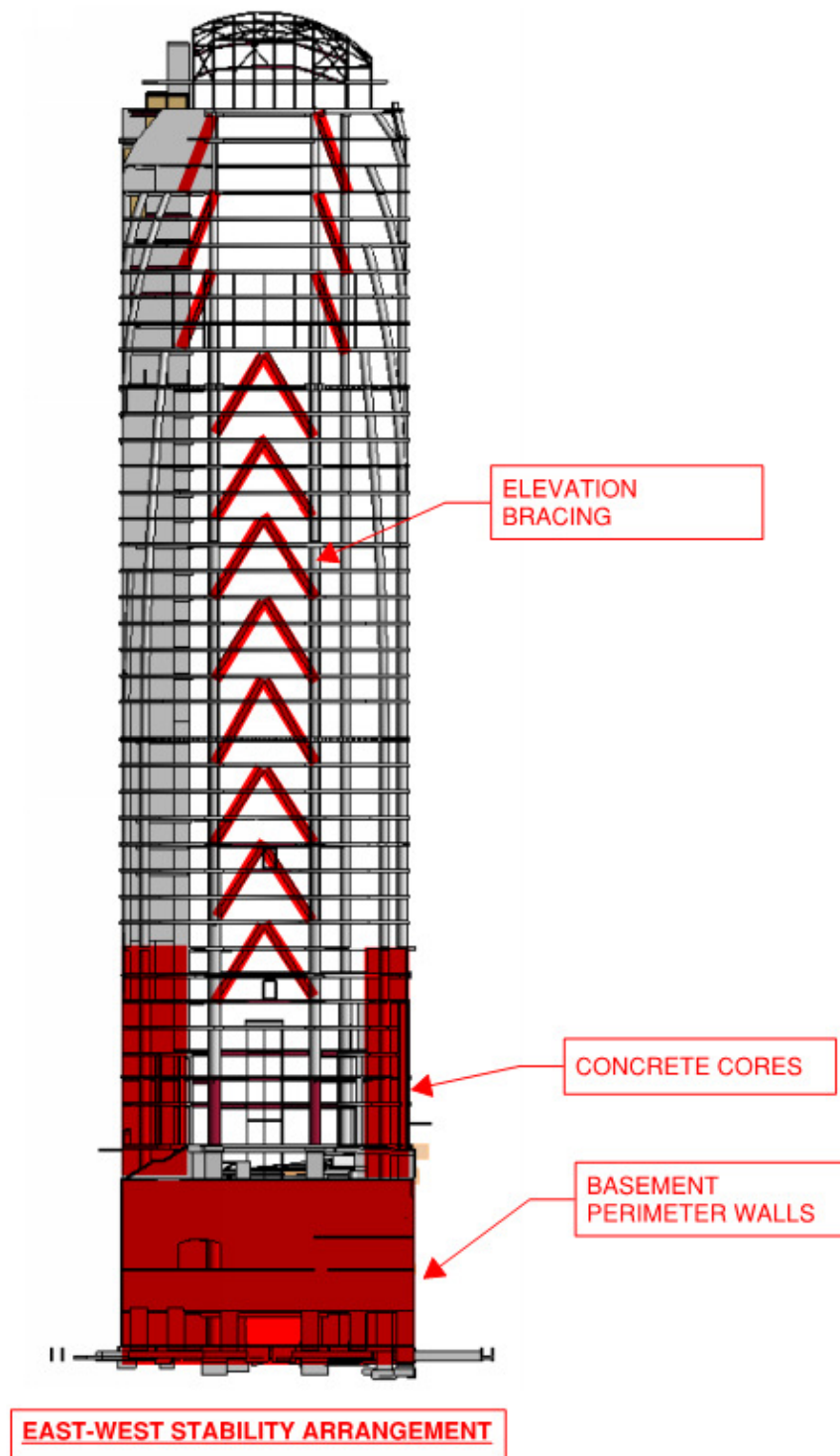


Figure 6: North elevation showing the stability arrangement in the east-west direction.

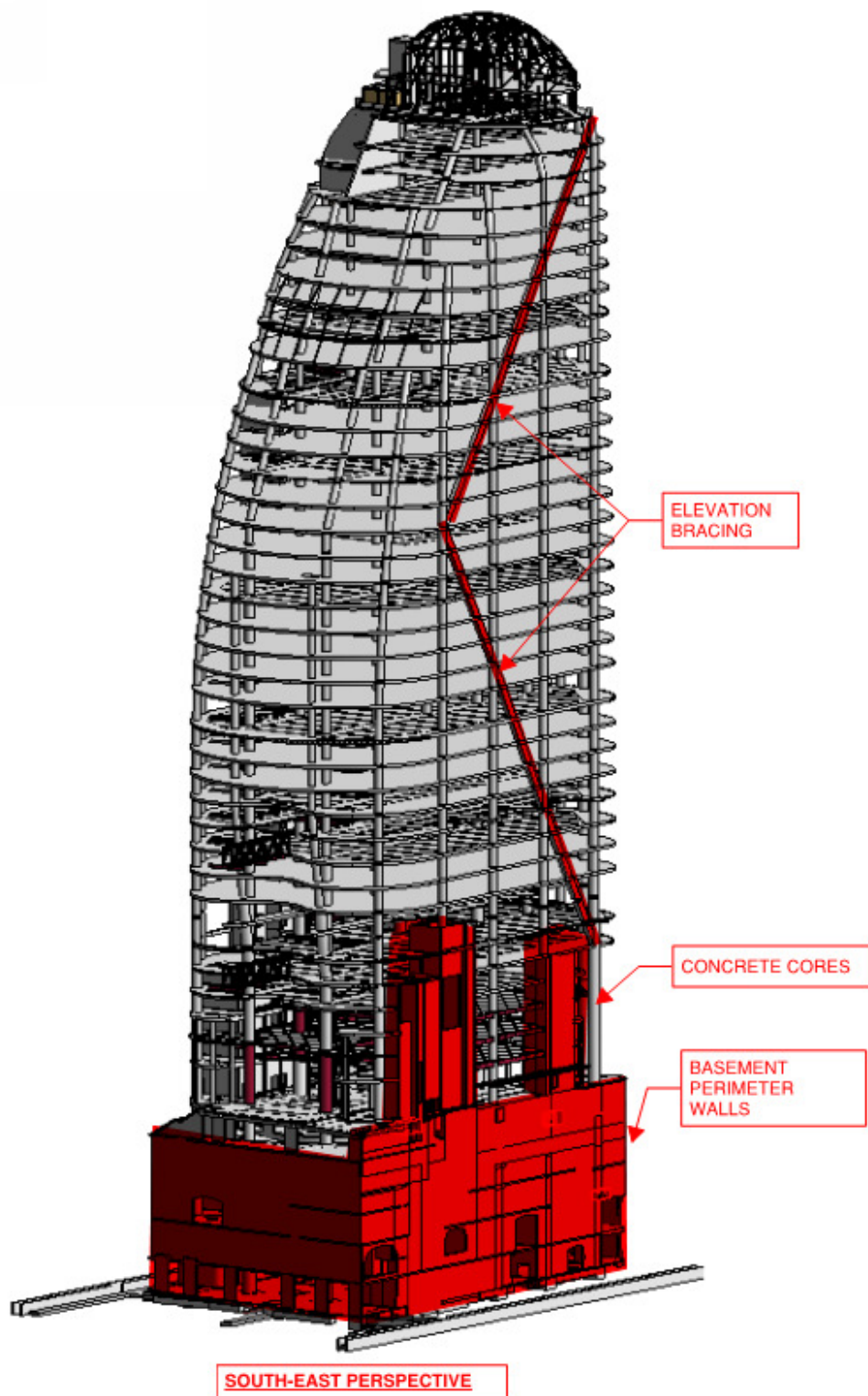


Figure 7: East elevation bracing arrangement.

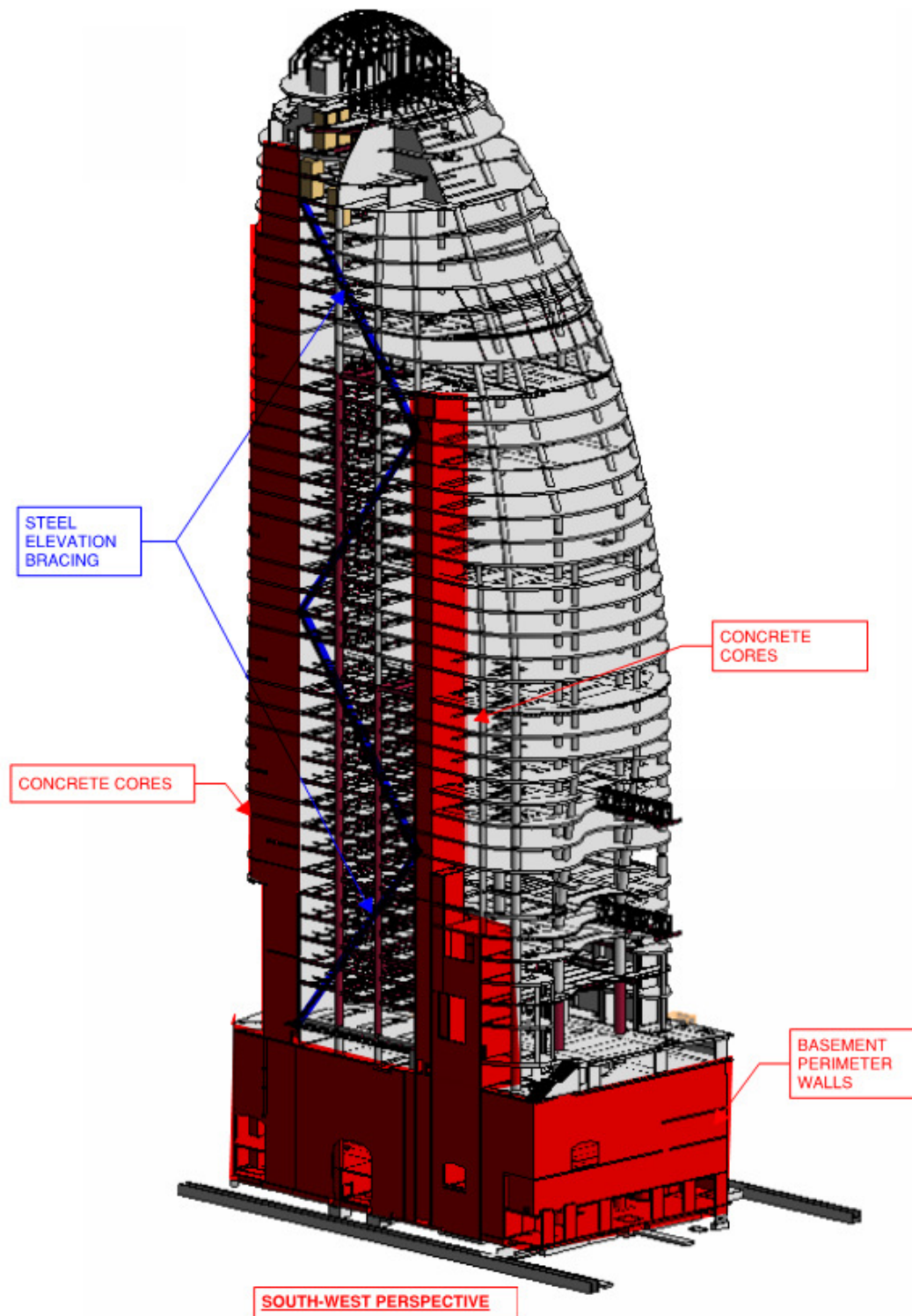


Figure 8: West elevation bracing arrangement.

2.4 Floor Plate Structures

2.4.1 General

The floor plate structure for the OSD typically comprises of one-way spanning reinforced concrete slabs spanning north-south supported on transverse spanning post-tensioned concrete secondary beams. These secondary beams are in turn supported along the column grid on north-south spanning post-tensioned primary beams. The straight and curved perimeter of the building is typically framed by a post-tensioned edge thickening. This provides sufficient stiffness to the building perimeter to support the façade system and provide clearances for building services.

Variations to the depths of this basic configuration are required in plant and storage levels and floors that support significant loads such as the Building Maintenance Units (BMU).

2.4.2 Level 01 to 03 Structural Steel and Concrete Composite Framed Floors

In order to speed up construction of the North Tower floors as well as deal with the inability to construct a formwork system in the central atrium void which extends through the station, a structural steel “jump-deck” is proposed at Level 03.

2.4.3 Curved and Inward Stepped Slabs at Southern Edge

The slab edge to the south of the building is curved in profile and steps back towards the north as the levels progress up the building forming a south-facing atrium space. This stepping southern edge is achieved through a combination of cantilevered primary beams and sloping columns.

2.4.4 Framing Around Main Lift Shafts

The architectural intent is to create a system of glazed lifts on the western face of the building for its full height above Level 01. The intent is to create a system which is as transparent as practicable whilst providing the required vertical and lateral support to the lifts, lift lobbies and façade adjacent to the lifts. To achieve this aspiration the lifts are framed in structural steel. The framing also provides lateral stability to the concrete filled tube (CFT) perimeter columns along the western perimeter. The horizontal steel floor elements restrain the columns at floor level back to the main floor concrete diaphragms.

2.4.5 South Atrium Feature Façade Primary Framing

The south atrium façade incorporates horizontal steel arch elements at each floor level to resist lateral wind loads on the main feature façade. These structural elements provide bold horizontal lines which are also important in carrying all lateral loads on this face back to the east and west floor framing edges where the

forces are resisted by the floor diaphragms tied back to the main building lateral stability system.

These horizontal arches are formed as architecturally expressed structural steel sculpted hollow sections.

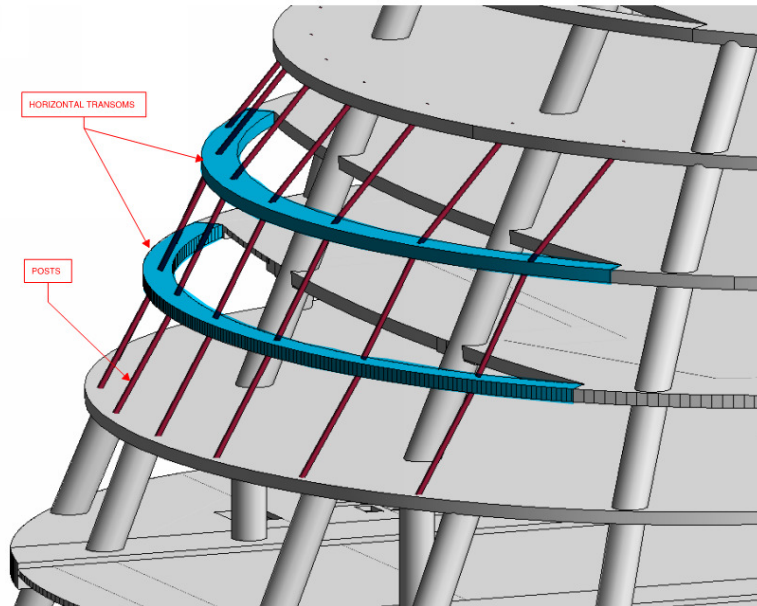


Figure 9: Southern façade primary steelwork framing arrangement.

2.4.6 Roof Structure

A glazed roof is located above the 39th floor of the North Tower. The structure is shown in Figure 10.

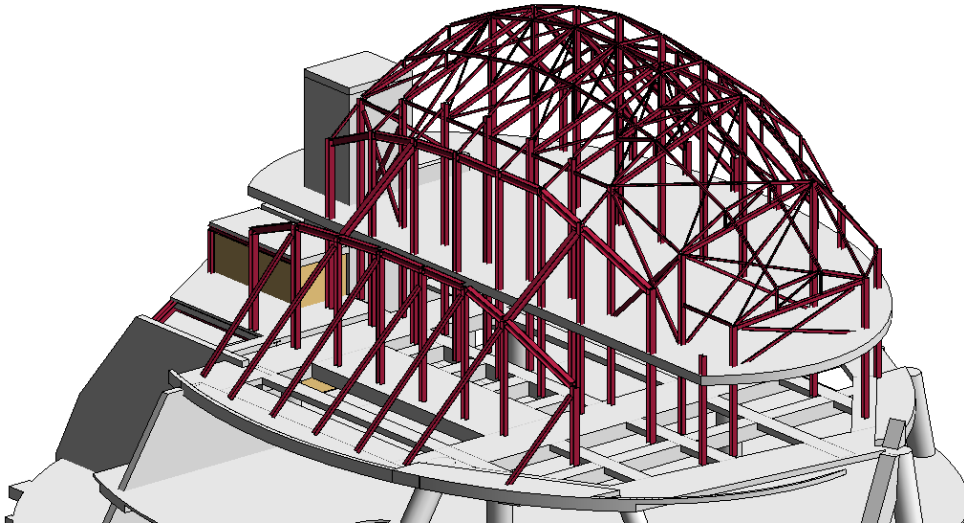


Figure 10: Roof framing arrangement.

2.5 Vertical Structure

Vertical loads have been designed to be supported by a combination of reinforced concrete walls, reinforced concrete columns and CFT.

Concrete walls are typically arranged within the four core structures in the northwest, northeast, southwest and southeast corners of the building.

A system of internal and perimeter columns are provided to support vertical floor loads. In a number of locations where the façade profiles change up the height of the building and the floor slab profile tapers inward, raking columns are required to support these floors. Raking/sloping columns induce in-plane forces where they intersect with the floor slab profile and these forces are resolved back to the building stability systems via the floor diaphragms.

CFT columns are also proposed in the zones in which either structural steel framing is present or for the construction of the Level 03 “jump deck”.

3 Design Criteria

The structures will comply with:

- All current relevant Australian Standards;
- Building Code of Australia;
- Sydney Metro/TfNSW standards and requirements where applicable;
- Metro Martin Place Scope of Works and Technical Criteria;
- Heritage requirements;
- Development Near Rail Tunnels THR C1 12051 ST; and
- Development Near Rail Corridors and Busy Roads Interim Guidelines.

4 Agency Consultations

Consultation has been undertaken on this SSD DA Stage 2 proposal with Sydney Metro and other relevant agencies as detailed in the Stakeholder and Community Engagement Summary Report, prepared by Ethos Urban.

5 Conclusion

The structural design of the North Tower is fully integrated with the design of Metro Martin Place station and has been developed to support the architectural and engineering aspirations of the North Tower.

The design gives full consideration to all relevant design and planning criteria and industry standards, guidelines and legislation.