

Façade Stone (Granite) Performance Specification - North Tower

Martin Place Metro

Macquarie Bank

Prepared for

Lend Lease

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Document prepared by:

Surface Design Pty Ltd

ABN 19 570 343 498

68 York Street, SYDNEY NSW 2000 Australia

T: +61 2 9249 1400

E: info@surfacedesign.com.au

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1. Technical Specification

1.1 Performance Specification

This Specification is a Performance Specification. The Drawings and this Specification indicate the design intent and establish the required geometry of the visible components, and the minimum acceptable standard to which the Stone facade installations must be designed, tested, fabricated and installed.

As performance-based documents, the Drawings and Specification do not provide full details of the proposed systems. It is the responsibility of the Contractor to inform itself of the full extent and detailing of the Works and make all necessary monetary and time allowances.

The Specification is divided into sections for convenience. All parts of the Specification are mandatory, including the Appendices. This document is to be read in conjunction with the following documentations:

- Architectural Specification and Finishes Schedule – JPW
- Architectural Drawings – JPW
- Lend Lease requirements including the GMR's, CIDD's, Alerts and ROADS
- Trade specific scope of works and other relevant documents by The Principal and its Consultants
- Other reports identified in Section 2.3

Notwithstanding any checks and/or reviews by the Consultants, the Contractor is fully responsible for the design, procurement, testing, fabrication, installation, and certification of the facade systems, including all interfacing with the structure and other trades' work.

The Head Contract shall take precedence if conflicts or ambiguity occur between this document and the head contract.

1.2 Green Star Strategy

Refer to Appendix D for the Martin Place Metro OSD Green Star Strategy as provided by the ESD engineers for the project (Lend Lease AI).

1.3 Compliance to Human Rights Requirements

The Stone supplier, quarries and processing plants are to comply with Lendlease requirements including compliance to the 'International Labour Organisations Fundamental Convention' and the 'United Nations Global Compact Principles'.

Human Rights violations (such as Child Labour) is not acceptable for any part of the procurement of these works.

Refer to Lendlease 'Supplier Interview Checklist' for requirements and information required to confirm compliance.

1.4 Description of the Project

The Project includes design and construction of the new Sydney Metro Martin Place Integrated Station Development, integrated with concourse, retail and Martin Place. The two OSD sites, (north 40 storeys and south 29 storeys) are planned for commercial office use which are to be integrated with the ground plane and below ground station to create a single precinct experience.

Project Vision

Macquarie's vision is aligned with the State's objective to create a transportation precinct that offers mixed use space with inter modal travel that seamlessly integrates into the civic centre of Sydney.

The vision will provide the framework for a global leading design for all facets of the built form, one in which high volume transportation systems sit alongside a convergent urban form incorporating commercial office space, modern retail outlets and urban defining civic space. This will reinforce Sydney's credentials as a global city in the 21st century.

A development of this scale, building on a major new transport initiative, comes about only once in a generation. As an integral part of the Martin Place Station precinct, the consolidated Macquarie

proposal for the precinct provides a unique opportunity to restructure and revitalise a city block into the vital fabric of Sydney. It is a unique opportunity to create a world class, sustainable, integrated commercial office and retail experience built around the rich heritage of Martin Place and more specifically 50 Martin Place.



Figure 1 - Image of the Macquarie Proposed development issued in Stage 1 of the USP

The three key components of the precinct include:

North Tower

- Site bound by 50 Martin Place, Castlereagh Street, Elizabeth Street and Hunter Street and incorporate Macquarie owned 50 Martin Place within an integrated precinct
- Property Council of Australia (PCA) 'Premium Grade' commercial tower (refer project brief)
- The tower has a curved form with no set-backs to Elizabeth Street, Castlereagh Street and Hunter Street incorporating approx. 65,000sqm NLA (includes retail)
- The building is a ~40 storey side core reinforced concrete structure with a lift core on Castlereagh Street.
- Targeting 6 Star Green Star Office Design and As Built 2015 V1.1
- Targeting NABERS Energy: 5.5 Star, NABERS Water 3.5 Star:
- Macquarie as anchor tenant for the precinct will consolidate an estimated 8,000+ Sydney staff in a globally significant campus

South Tower

- Situated on the southern side of Martin Place between Castlereagh Street and Elizabeth Street. Site area: ~1,900sqm
- PCA 'Premium' grade commercial tower with 'Premium Grade' services (refer project brief)
- The building is ~29 storey rear core reinforced concrete structure comprising a podium and tower
- The typical podium level floors will offer a ~1,400sqm NLA and the typical tower floors ~1,200sqm NLA. The building is targeted to achieve 35,000sqm of NLA (includes retail)
- Targeting 6 Star Green Star Office Design and As Built 2015 V1.1
- Targeting NABERS Energy: 5.5 Star, NABERS Water: 3.5 Star.

Metro Station and Concourse

A new metro station with 30,000+ passengers at AM peak hour (2026), and station access at Martin Place and Hunter Street (below the South Tower and North Tower respectively), interconnected by public concourses, civic spaces and pedestrian link(s).

The south station entry comprises of a two-level station hall, providing escalator and lift access to the platforms, ticket lines and station amenities. The south shaft incorporates a link to the existing Eastern Suburbs train station (at paid and unpaid locations); a potential future link to the MLC Centre (subject to further stakeholder engagement); retail tenancies and facilities, plant rooms (for Metro and OSD operations) and station offices.

The north station entry comprises of a single-level station hall, providing escalator and lift access to the platforms, ticket lines, station platform rooms, station amenities and an atrium connecting the platform level to the entrance level.

The north shaft incorporates station plant rooms (for Metro and OSD operations), retail tenancies and facilities, and station offices.

A pedestrian tunnel links the north and south station hall at level B3 (unpaid concourse level)

Targeting 6 Star Green Star Design & As Built (Sydney Metro Tool)

1.5 Extent of Work

In general, the scope of works consists of (refer to architectural drawings for all dimensions and finishes):

Type	General Description	Material Requirements (refer to Section 4 for details)
N-FT-24	<p>Red Granite cladding Materials, fixings and finishes to be as per this specification</p> <p>All stone to be a minimum thickness of 30mm and to be designed, engineered, tested and installed in accordance with this specification. Note the rebate details shown in the documentation, providing nominally a 60mm thick stone with a rebate, resulting a minimum thickness at the rebate of 30mm. Also note curved stones and manufacturing of either curved front and back faces or faceted hidden face as deemed necessary by the stone supplier.</p> <p>Colour and appearance to be as required by the architect. To be Polished Granite to match the existing 50 Martin Place (Sydney, Australia) cladding</p> <p>Joint widths to be as shown on the architects' drawings unless agreed otherwise. These joints are to be either grout filled or sealant filled, refer to Section 4 for minimum requirements, colour to be in accordance with architects requirements.</p> <p>Edges to be in accordance with Architectural requirements. Unless noted otherwise, this is to be a 2mm diameter rounded edge (commonly referred to as pencil round).</p> <p>Stone Panel sealant and graffiti protection to be provided to a minimum of 3m above any floor levels adjacent to the stone cladding.</p> <p>Panel sizes to be as per the architectural set out drawings, fixings to be as required with minimum centres of 600mm</p>	<p>Granite: As per this Façade Specification Architectural selection to match 50 Martin Place (Sydney, Australia) 'Red Balmoral' Granite from the Gulf of Finland</p> <p>Fixings and brackets Minimum Stainless Steel grade 316 or aluminium in accordance with Australian Standards</p> <p>Structural steel support framing As per this specification. To comply with AS 4100 or AS 4673 as required.</p> <p>Backpan To be stainless steel, zincalume or aluminium in thickness as required for structural capacity and waterproofing.</p> <p>Miscellaneous Sealants, grout, gaskets, setting blocks, packers See Section 4</p>

1.6 General Scope of Works

The general scope of work for the stone façade systems described above includes the following:

- The scope is to include all engineering, testing, fire rating, samples (including control samples and agreed sampling range) and visual mock ups, , shop drawings, procurement of stone, processing of stone, Quality Assurance and Quality Control of procurement, processing and installation and Digital Engineering (BIM) and monitoring (refer below section titled 'Tracking and Statusing of Building elements')
- Refer to the Architectural drawings and design intent details for the extent and components of each facade type.
- Where required the capping/trims, flashings and terminations to match wall systems in detail and finish.
- Testing of all systems as required.
- Where relevant site water testing of the façade in accordance with AAMA 501.2 to the satisfaction of the client and the consultant team.
- Trade Cleaning of all façade surfaces internally and externally upon completion. The design of all systems and elements is to be coordinated with cleaning, access and maintenance strategy.
- Lightning protection – Where required, Co-ordination for connection of the facade to the building's primary structure.
- Submissions of samples, mock-ups and the like for this project as per the relevant sections of this Specification.
- Undertake design and development of the facade with the consultants and the principle
- Submission of calculations and material datasheets
- Preparation of a Facade Maintenance Manual in accordance with this Specification
- The system design and installation is to be suitably air sealed so as not to cause any acoustic noise such as whistling or other tonal noise.
- Refer to Lend Lease CIDD for specific requirements including requirements for aluminium brackets coatings in concrete, climbing hazards, external cladding, waterproofing, wind effects on buildings.

Tracking and Statusing of Building Elements (provided by Lend Lease)

Lendlease continually looking for ways to improve the delivery of our projects utilising BIM models data and technologies.

The Sydney Martin Place Metro project presents an opportunity for Lendlease to utilise the BIM model for the purpose of tracking, statusing, logistics and progress claims of various building elements (Façade, MEP, etc.).

As such, the subcontractor is required to model elements to allow Lendlease to identify assemblies as one element in the model, geometrically and by a unique code (i.e. Assembly ID), to include status data, either through direct access to an online model (to be provided by Lendlease) and or through Excel spreadsheets.

The Subcontractors needs to be willing to work with Lendlease to develop, test and implement such workflow.

1.7 Secondary Steelwork

Include for all required secondary steelwork, including all sub-framing, stiffening and brackets necessary for the erection of façade and cladding systems. See Appendix B for design intent and anticipated extent (currently under development).

1.8 Interfaces

The façade design and installation are to be coordinated with the following disciplines. The list of coordination items should be considered indicative and non-exhaustive.

Discipline	Coordination Items
Building Structure	<p>Coordinate with structural tolerances for reinforced concrete structural elements, and structural steel.</p> <p>Coordinate locations of cast in brackets and all other façade fixings to be outside the zone of influence of slab reinforcement.</p> <p>Coordinate and agree loads and locations of fixings with the structural engineer for all relevant load cases including but not limited to gravity, wind, seismic and thermal.</p>
Other Façade Contractors	<p>Interface with all adjoining façade and cladding designed and installed by other Façade Contractors including:</p> <ul style="list-style-type: none"> - Curtain wall and glazing contractors - Blind contractor - Other Stone and masonry contractors - Awnings - Canopies - 50 Martin Place, Sydney - Etc.
Mechanical Services	<p>Interface with services ductwork , plant enclosures, louvers, operable façade elements and unit exhausts etc.</p> <p>Coordinate access doors/hatches for maintenance removal and materials handling of plant equipment.</p>
ESD	Coordinate materials and thermal performance with requirements set out in ESD report
Acoustics	Coordinate whole of system acoustic performance with the requirements set out in the Acoustic Report
Hydraulics	<p>Coordinate with hydraulic drawings for locations of any interfaces.</p> <p>Including water capture design requirements.</p>
Internal Finishes	Interface with ceiling, sill, internal linings, partitions, blinds, and floor finishes.
Electrical Services	External lighting (including integrated feature lighting), signage, lightning protection, internal lighting, electrical power and comms to skirting duct and security systems (including interfaces for external door hardware).
Waterproofing Membranes:	Plinths and perimeter hobs including compatibility of sealants with membranes by others.
Fire services	Provision of all requirements set out in fire engineering report, building services report and fire services specification, including façade drenchers (sprinklers) as required)
Building Maintenance	<p>Building access requirements, co-ordination as required.</p> <p>Coordinate all doors and penetrations for monorail/rope access points with Rope access contractor or building maintenance unit contractor. This includes any large scale doors required for BMU at L28 and L38/39/roof</p>
Signage and any other fixtures	Coordinate the location of bracketry for any signage and any other fixtures.

Where the contractor is uncertain they are to raise an RFI and seek approval from The Principle

1.9 Contractor's Responsibilities

It is the Contractor's responsibility to provide samples, mock-ups, prototypes, control samples, Quality Control and Quality Assurance, labour, materials, equipment and related items and to design, engineer, test, fabricate, transport to site, install, commissioning and provide warranty for complete and weather tight systems in accordance with specified parameters, and with the design intent of the contract drawings and this performance Specification.

The Contractor's Works shall include but not necessarily be limited to the following:

- Submission to and compliance with all Authority Requirements.
- Supply of samples and mock-ups. Note that all materials, systems and elements are not to be procured until approval by the client and the consultant team (including façade engineer and architect) is provided
- Prototyping and testing of cladding systems
- Preparation of detailed shop drawings and computations for production of the cladding systems.
- Certification from a suitable qualified engineer (NER registered)
- Submission of documents and samples in accordance with this Specification and the agreed construction programme.
- Design and operation of an agreed quality assurance program and the maintenance of all records.
- Preparation of as-built drawings.
- Preparation of a Facade Maintenance Manual in accordance with this specification.
- Design and installation of assemblies and cladding elements including all required thermal and acoustic insulation, back-pans, weather, air, acoustic and structural silicone seals, smoke flashings, fixings, brackets and accessories.
- Design for building maintenance in accordance with the requirements of the maintenance system and WH&S regulations.
- Provide certification as per this Specification.
- Comply with Lend Lease documentation including GMR's, CIDD's, Alerts and ROADS documentation

1.10 Design and Supply only Items

The following items are to be designed, fabricated and finished by the Contractor and then supplied to the Main Contractor for incorporation into the Works by others.

Cast in fixing elements:

The Contractor is responsible for co-ordinating any cast-in details with the structure, providing detailed set-out drawings (plans), and verifying the position of the fixings once they have been placed them prior to the pouring of concrete.

They are to comply with SA TS 101:2015.

1.11 Warranties

The warranty shall comply with the requirements of that noted in the Head Contract and referred to in the Works Contract and the requirements of this Specification.

In addition to the head contractors warranty requirements the following is to be provided:

- The Contractor shall agree to warrant their works against any defects in the design, workmanship, quality of materials, weather-tightness and performance, and to repair or replace defective design, workmanship or materials of the Contract Works during the warranty period. Defective materials and workmanship includes abnormal deterioration, ageing or weathering of the Works, leakage of water or air ingress exceeding specified limits, structural failure of components resulting from exposure to pressures and forces within reasonably expected limits, failure of parts to function normally, stone breakage and failure of the Works to meet any other specified performance requirements.
- The warranty period is as set out in the Head Contract Works.

2. Standards and Referenced Documents

Standards and Guidelines as a minimum:

2.1 General Notes

All work and labour practices under this Works Contract shall be in strict accordance with all applicable building codes, regulations, bylaws and laws.

- The Standards, Codes and Legislation referenced below and elsewhere in this Specification shall be the current editions.
- No substitutions to these Standards and Codes shall be permitted without the written acceptance of The Consultant. Refer to commentaries for all Standards and Codes where they exist for further information and clarification.
- It is the Contractor's responsibility to ensure that The Principal and its Consultants are satisfied with the Codes adopted by the Contractor for the Works.
- Wherever there are conflicts between different Local Authority Regulations, Codes and/or Standards, the more stringent shall apply and the Contractor shall in such circumstances notify The Principal accordingly.

2.2 Local Legislation

National Construction Code – Building Code of Australia (year per BCA report)

2.3 Project Specific Documentation

Note: Refer to the GMP Documents for a complete list for project specific documentation for current editions and where to acquire them. Including but not limited to the following:

Architectural Specification	JPW
North Tower and North Shaft Structural Report	Arup
Structural Movements and Tolerances Report	Arup
Mechanical Services Specification	Arup
Section J Report	Arup
Acoustic Report	Arup
Reflectivity Report	Arup
Hydraulics Reports	Arup
Wind Pressure Report	CPP
Construction Methodology Report	Lendlease

2.4 Relevant Standards

2.4.1 General

Unless otherwise specified or is specifically supplied by The Principal, the applicable issue of a standard is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

The following abbreviations are used in this Specification:

AS	Australian Standard
AS/NZS	Australian/New Zealand Standard
BS	British Standard
BS/EN	British/European Standard
ASTM	American Society for Testing and Materials
AAMA	American Architectural Manufacturers Association
CCAA	Cement Concrete Aggregates Australia

2.4.2 Design and Structures

AS/NZS 1170.0	Structural design actions – general principles
AS/NZS 1170.1	Structural design actions – permanent, imposed and other actions
AS/NZS 1170.2	Structural design action – wind actions
AS/NZS 1170.4	Structural design action – earthquake design actions
AS 3600 and Supplement	Concrete structures
AS 4100 and Supplement	Steel structures
AS/NZS 4600 and Supplement	Cold-formed steel structures
AS 3700 and Supplement	Masonry structures
AS/NZS 1664 and Commentaries	Aluminium structures – Part 1: Limit state design Part 2: Allowable stress design
AS/NZS 4673	Cold-formed stainless steel structures
AS 1288	Glass in buildings – selection and installation
AS1428.1	Design for access and mobility – general requirements for access – new building work
AS1657	Fixed platforms, walkways, stairways and ladders – design construction and installation

2.4.3 Aluminium

Materials and Products

AS/NZS 1734	Aluminium and aluminium alloys – flat sheet, coiled sheet and plate
AS/NZS 1865	Aluminium and aluminium alloys – drawn wire, rod, bar and strip
AS/NZS 1866	Aluminium and aluminium alloys – extruded rod, bar, solid and hollow shapes
AS/NZS 1867	Aluminium and aluminium alloys – drawn tubes
AS 1874	Aluminium and aluminium alloys – ingot and castings
AS 2848.1	Aluminium and aluminium alloys – compositions and designations – wrought products

Surface Coatings and Finishes

AS 1231	Aluminium and aluminium alloys – anodic oxidation coatings
AS 3715	Metal finishing- thermoset powder coating for architectural application of aluminium and aluminium alloys
AAMA 2605	Superior performing organic coatings on aluminium extrusions and panels

Welding

AS/NZS 1665	Welding of aluminium structures
AS/NZS ISO 18273	Welding consumables – wire electrodes, wires and rods for welding of aluminium and aluminium alloys – classification

2.4.4 Structural Steels and Components

Materials and Products

AS 1163	Structural steel hollow sections
AS/NZS 3679.1	Structural steel – hot-rolled bars and sections
AS/NZS 3679.2	Structural steel – welded sections
AS/NZS 3678	Structural steel – hot-rolled plates, floorplates and slabs
AS/NZS 1594	Hot-rolled steel flat products
AS/NZS 1595	Cold-rolled, unalloyed, steel sheet and strip
AS 1397	Steel sheet and strip – hot-dipped zinc-coated or aluminium/zinc coated
AS 2551	Steel sheet and strip – cold rolled, electrolytic zinc coated

Welding

AS/NZS 1554.1	Structural steel welding – welding of steel structures
AS/NZS 1554.2	Structural steel welding – stud welding (steel studs to steel)
AS/NZS 1554.5	Structural steel welding – welding of steel structures subject to high levels of fatigue loading
AS/NZS 1554.7	Structural steel welding – welding of sheet steel structures
AS/NZS 4855	Welding consumables – covered electrodes for manual metal arc welding of non-alloy and fine grain steels – classification
AS 1858.1	Electrodes and fluxes for submerged arc welding – carbon steels and carbon-manganese steels
AS/NZS 1167.2	Welding and brazing – filler metals – filler metal for welding
AS/NZS 2717.1	Welding – electrodes – gas metal arc – ferritic steel electrodes
AS 4882	Shielding gases for welding
AS 1796	Certification of welders and welding supervisors
AS/NZS 2980	Qualification of welders for fusion welding of steels

Bolts and Fasteners

AS 1110	ISO metric hexagon bolts and screws – product grade a and B – Part 1 – Bolts; Part 2 – Screws
AS 1111	ISO metric hexagon bolts – Product Grade C – Part 1 – Bolts; Part 2 – Screws
AS/NZS 1559	Hot-dip galvanized steel bolts with associated nuts and washers for tower construction
AS 1112	ISO metric hexagon nuts (4 Parts)
AS 3566	Self-drilling screws for the building and construction industries (2 Parts)

Corrosion Protection and Coatings

AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3750	Paints for steel structures (several parts)
AS 1627	Metal finishing – preparation and pre-treatment of surfaces (several parts)
AS 3894	Site testing of protective coatings (several parts)

2.4.5 Stainless Steels and Components

Materials and Products

BS EN 10088-1	Stainless steels. List of stainless steels
BS EN 10088-2	Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
BS EN 10088-3	Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
BS EN 10088-4 (05/30126202 DC)	Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes
BS EN 10088-5 (05/30126205 DC)	Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels
BS EN ISO 3506	Mechanical properties of corrosion-resistance stainless steel fasteners. Part 1: Bolts, screws and studs; Part 2: Nuts; Part 3: Set screws and similar fasteners not under tensile stress; Part 4: Tapping screws

Welding of Stainless Steels

AS/NZS 1554.6	Structural steel welding – welding stainless steels for structural purposes
AS/NZS ISO 14343	Welding consumables – wire electrodes, wires and rods for arc welding of stainless and heat resisting steels – classification

Passivation

ASTM A380	Standard practice for cleaning, descaling and passivation of stainless steel parts, equipment, and systems
ASTM A967	Standard specification for chemical passivation treatments for stainless steel parts
ASTM B912	Standard specification for passivation of stainless steels using electro-polishing

2.4.6 Corrosion Resistant Castings

ASTM A518	Standard specification for corrosion-resistant high silicon iron castings
ASTM A743	Standard specification for castings, iron-chromium, iron-chromium-nickel, corrosion resistant, for general application
ASTM A744	Standard specification for castings, iron-chromium-nickel, corrosion resistant, for severe services
ASTM A890	Standard specification for castings, iron-chromium-nickel-molybdenum corrosion resistant, duplex (austenitic/ferritic) for general application
AS 2074	Cast steels
BS EN 10283	Corrosion resistant steel castings

2.4.7 Stone related codes

In this section, standards relevant to stone are provided.

ASTM

Standard No	Title
ASTM C97	Standard test methods for Absorption and Bulk Specific Gravity of Dimension Stone
ASTM C99	Standard test method for Modulus of Rupture of Dimension Stone

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ASTM C170	Standard test method for Compressive Strength of Dimension Stone
ASTM C1721	Standard Guide for Petrographic Examination of Dimension Stone
ASTM C880	Standard test method for Flexural Strength of Dimension Stone
ASTM C1201	Standard test method for Structural Performance of Exterior Dimension Stone Cladding Systems by Uniform Static Air Pressure
ASTM C1354	Standard test method for Strength of Individual Stone Anchorages in Dimension Stone
ASTM D2203	Standard test method for Staining from Sealants
ASTM C510	Standard test method for Staining and Colour Change of Single- or Multi-component Joint Sealants
ASTM C1242	Standard Guide for Selection, Design and Installation of Dimension Stone Anchoring Systems
ASTM C1528	Standard Guide for Selection of Dimension Stone for Exterior Use
ASTM C119	Standard Terminology relating to Dimension Stone
ASTM C1496	Standard Guide for Assessment and Maintenance of Exterior Dimension Stone Masonry Walls and Facades
ASTM C1515	Standard Guide for Cleaning of Exterior Dimension Stone, Vertical and Horizontal Surfaces, new or Existing
ASTM C616	Standard Specification for Quartz-Based Dimension Stone
ASTM C568	Standard Specification for Limestone Dimension Stone
ASTM C615	Standard Specification for Granite Dimension Stone

British/European standards (BS & BS EN)

Standard No	Title
BS EN 1925	Natural Stone Test Methods - Determination of Water Absorption Coefficient by Capillarity
BS EN 1936	Natural stone test methods — Determination of real density and apparent density, and of total and open porosity
BS EN 12371	Natural stone test methods — Determination of frost resistance
BS EN 12372	Natural stone test methods — Determination of flexural strength under concentrated load
BS EN 12407	Natural Stone Test Methods - Petrographic Examination
BS EN 12440	Natural stone — Denomination criteria
BS EN 12670	Natural Stone - Terminology
BS EN 13161	Natural stone test methods — Determination of flexural strength under constant moment
BS EN 13364	Natural Stone Test Methods - Determination of the Breaking Load at Dowel Hole
BS EN 13373	Natural stone test methods Determination of geometric characteristics on units
BS EN 13755	Natural Stone Test Methods - Determination of Water Absorption at Atmospheric Pressure
BS EN 14066	Natural stone test methods Determination of resistance to ageing by thermal shock

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BS 8221	Code of Practice for Cleaning and Surface Repair of Buildings; Part 1: Cleaning of Natural Stones, Brick, Terracotta and Concrete; Part 2: Surface Repair of Natural Stones, Brick and Terracotta
BS 8298	Code of practice for the design and installation of natural stone cladding and lining; Part 1: General; Part 2: Traditional handset external cladding; Part 3: Stone-faced pre-cast concrete cladding systems; Part 4: Rainscreen and stone on metal frame cladding systems
BS EN 1469	Natural stone products Slabs for cladding Requirements
BS EN 1926	Natural stone test methods Determination of uniaxial compressive strength
BS EN 12059	Natural stone products — Dimensional stone work — Requirements
BS EN 12370	Natural Stone Test Methods - Determination of Resistance to Salt Crystallization
BS EN 13919	Natural stone test methods Determination of resistance to ageing by SO ₂ action in the presence of humidity
BS EN 14146	Natural stone test methods Determination of the dynamic modulus of elasticity (by measuring the fundamental resonance frequency)
BS EN 14147	Natural stone test methods Determination of resistance to ageing by salt mist
BS EN 14157	Natural stones Determination of abrasion resistance
BS EN 14158	Natural stone test methods Determination of rupture energy
BS EN 14205	Natural stone test methods Determination of Knoop hardness
BS EN 14231	Natural stone test methods Determination of the slip resistance by means of the pendulum tester
BS EN 14579	Natural stone test methods Determination of sound speed propagation
BS EN 14580	Natural stone test methods Determination of static elastic modulus
BS EN 14581	Natural stone test methods Determination of linear thermal expansion coefficient
BS EN 16140	Natural stone test methods — Determination of sensitivity to changes in appearance produced by thermal cycles

Australian Standards

Standard No	Title
AS/NZS 4456.10	Masonry units, segmental pavers and flags – Methods of test, Method 10: Determining resistance to salt attack
AS 4459.14	Methods of sampling and testing ceramic tiles, Method 14: Determination of resistance to stains

Nordic Standards

Standard No	Title
NT Build 499	Cladding Panels: Test for Bowing

2.4.8 **Grout to stone joints**

AS ISO
13007.3-2013

Ceramic tiles – Grouts and adhesives – Terms, definitions and specifications for grouts

2.4.9 **Sealant to stone joints**

ISO 11600-
2002

Building construction — Jointing products — Classification and requirements for sealants

2.4.10 **Security**

AS 4145.2 – 2008

Locksets and hardware for doors and windows – Mechanical locksets for doors and windows in buildings.

AS 5039 – 2008

Security screen doors and window grilles

AS 5040 – 2003

Installation of security screen doors and window grilles

AS 5041 – 2003

Methods of test – Security screen doors and window grilles

2.5 **Fire Protection**

AS 1530

Methods for fire tests on building materials

2.6 **Quality Management**

ISO 9000 – 2000

Quality management systems – fundamentals and vocabulary

ISO 9001 – 2000

Quality management systems – requirements

2.7 **Building Maintenance**

OHS Regulations

NSW Work Health and Safety Regulation 2011

NSW Work Health and Safety Act 2011

3. Performance Requirements

Design of the façade systems are to be in accordance with the following performance parameters.

Item	Performance Parameter	Performance Requirement	Notes
1	Design Life	All facade elements are to be designed for: 50 years for structural integrity (Framing, brackets and fixings. excl. structural silicone). 20 years serviceable life (life to first major maintenance)	Unless noted otherwise by the clients' documents such as the Base Building Project Brief.
2	Loads		
	General Requirements	Design to comply with AS1170	
	Dead Loads	Design to AS1170.1	Design all stone fixings and brackets to resist accidental stacking of two panels above during installation.
	Imposed Loads	Design to AS1170.1 Cladding systems are to withstand barrier loads in accordance with AS1170.1 All horizontal and vertical facade projections are to be able to withstand impact loads without dislodgment. Stone systems are to withstand maintenance point load perpendicular to the facade surface of 0.5kN. Expressed elements are to withstand maintenance point load of 1.1kN in any direction. Fall arrest fixings, and cladding elements in contact with rope access lines are to withstand fall arrest loads.	
	Wind Loads	Design to AS1170.2 For serviceability design to 25 year return period For ultimate limit state design to 1000 year return period.	Refer to façade cladding pressures report for design pressures (by CPP)
	Earthquake Loads	Design to AS1170.4	Refer to structural report (by Arup)

Item	Performance Parameter	Performance Requirement	Notes
3	Thermal Movement	<p>System to accommodate:</p> <p>Ambient Temperature Range -10°C to 50°C</p> <p>Surface Temperature Range -10°C to 100°C</p> <p>Elements within cavities may experience high temperatures that are to be determined through prototyping and calculations.</p> <p>Aluminium components shall accommodate expansion/contraction; minimum 1mm per metre of component length depending on the predicted temperature range determine through detailed calculations and testing/prototyping to be completed by the sub-contractor.</p>	
4	Light and Heat Transfer	<p>Refer to Section J report for detailed requirements for compliance.</p> <p>Compliance with this document is required as a minimum.</p>	
5	Condensation	<p>Condensation is not to form on internal surfaces of framing members, solid panels. Any condensation that forms internally within the construction of the panels forming part of the works shall drain to the outside.</p>	
6	Fixing to Structure	<p>Design fixings to resist all loads both individually and in combination.</p>	
7	Displacement of façade elements	<p>Serviceability deflection limits (unless stated otherwise) for elements supporting stone:</p> <p>Aluminium and steel framing – Span/500</p> <p>Cantilevered frame members – Span/300</p> <p>Stone panels – Span/90</p> <p>In-plane member deflections (deflection due to self-weight) – Span/1000 or 2mm, whichever is less, unless agreed otherwise.</p> <p>Maximum displacement be 25mm at any point.</p> <p>For ultimate limit state loads no non-linear (permanent) distortion is acceptable.</p>	

Item	Performance Parameter	Performance Requirement	Notes
8	Tolerances		
	Building structure tolerances	<i>Indicative Tolerances:</i> Refer to structural report by Arup <i>Cast In Inserts:</i> +/- 10mm from slab edge +/- 3mm from concrete surface +/- 25mm off grid position	Builder to confirm
	Support Framing Fabrication tolerances	Framing members – cut to +/-1mm The contractor will be required to submit a detailed list of fabrication tolerances from all of their suppliers including the stone supplier/manufacturer.	
	Installation tolerances	Framing members, overall façade plane +/- 5mm (in/out) from nominal plane position. The contractor will be required to submit a detailed list of installation tolerances from all of their installers.	
	Stone Cladding	Refer to Section 4.3 of this Specification. The contractor will be required to submit a detailed list of fabrication and installation tolerances from all of their suppliers and installer including the stone supplier/manufacturer/processor.	
9	Building structure movements and deflections	The design of the systems is to accommodate the structural movements per the Arup structural report. Identify the magnitude and location of all assumed movements, movement joint dimensions, and opening and closing dimensions of joints at design development stage and submit for approval by the Client and its consultants.	Refer to structural report by Arup
10	Fixings to Structure	Design to resist all loads individually and in most severe load combinations. All fixings are to accommodate the worst combination of structure tolerances, as identified by the builder.	
	Cast-in Inserts	Use only proprietary inserts and design to manufacturer's published data. If non-proprietary inserts are to be used the contractor will be required to provide test data and/or complete adequate site testing on the cast-ins. All inserts are to be compliant to SA TS 101:2015.	If non-proprietary inserts are to be used load testing is required.
	Masonry Anchors	Use only proprietary inserts and design to manufacturer's published data. All anchors are to be compliant to SA TS 101:2015.	If non-proprietary fixings are to be used load testing is required.

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Item	Performance Parameter	Performance Requirement	Notes
11	Air Infiltration	As per AS/NZS 4284.	
12	Weatherproofing	<p>No water shall appear on any interior surface during testing or on the Site for the design life.</p> <p>The systems (including interfaces) shall be fully pressure-equalised and drained, unless agreed otherwise.</p> <p>Minimum drain hole dimension shall be 12mm (diameter). Ensure all drain holes are adequately positioned and sized when applied pressure is zero or negative, all water in internal cavities of the façade system shall drain to outside without detrimental effect to external surfaces.</p> <p>Facade forming the weatherproof line shall be waterproof when tested to AS/NZS 4284.</p>	
13	Maintenance & Replacement Capacity	<p>Identify maintenance requirements in terms of routine (e.g. cleaning) and component repair / replacement.</p> <p>Identify components which must be replaced during the life of the installed systems.</p>	Maintenance and replacement strategy is to be developed
	Stone replacement	Each Stone panel is to be capable of replacement in isolation without damage to adjacent elements, and without removing adjacent panels.	
14	Acoustic Performance	Design of all façade systems is to be in accordance with the performance requirements outlined in the Acoustic Consultants report.	
15	Lightning Protection	<p>Electrical continuity is required between individual sections of facade, in accordance with AS/NZS 1768 and AS 1882.</p> <p>Provide test data to verify electrical continuity of the proposed system.</p>	Electrical Engineer to confirm all details. Note requirements of roof dome and connections of façade elements to structural reinforcing.
16	Structural Silicone	Not allowed for stone fixings.	The Stone Cladding is not to be supported by Structural Silicone.
17	Regulations	Comply with all Government and Statutory Authority Regulations.	
18	Concealed Fixings	All fixings are to be concealed where possible (i.e. designed such that they are not visible externally).	
19	Fixing of beads, trims and features	Ensure that each significant glazing trim or feature is attached to the façade by mechanical means to agreed method and centres, in addition to reliance upon wedge gaskets.	

Item	Performance Parameter	Performance Requirement	Notes
20	Isolation of Materials	Separate different metals with a non-conductive material to eliminate galvanic action. Separation is not required for series 300 stainless steel screws/bolts in aluminium members and zinc (galvanised) and painted aluminium. EPDM (or similar) gaskets.	
21	Fire / Smoke Separation	All floors and walls (as per the fire engineering report) shall be separated in accordance with BCA requirements. This is to comprise a continuous and complete smoke flashing at slab level to separate all adjacent floors, provide fire rated insulation as required to relevant slab edges and vertical interfaces.	Refer to fire engineers report and JPW documentation. All materials used are to be deemed non-combustible under the BCA unless agreed otherwise.
22	Operable elements	Provide stone to doors or operable panels where required.	
23	Materials Compatibility	All materials compatibility testing between adjacent existing and new materials to be completed in accordance with this Specification and the manufacturers requirements.	
24	Signage, services, fixtures, anchors, lighting etc.	Details, locations and interfaces are to be coordinated	
25	Hydraulics and overflows	Details, locations and interfaces are to be coordinated. Note requirement to prevent run off onto adjacent properties (gutters to be provided as per Hydraulic Engineers requirements).	All drainage requirements are to be confirmed and coordinated with the project hydraulic engineer (Arup)

4. Minimum Requirements, Fabrication and Installation

4.1 Materials: General

This section defines the minimum requirements for the project in terms of materials, submissions and workmanship. The Works shall either meet or exceed these requirements.

Where a specific product is nominated, use that product or an approved equivalent. Approval of an equivalent is subject to the discretion of The Client and the consultant team. Provide manufacturer's technical data to verify equivalence.

All materials used shall be new and fit for purpose for which they are to be used.

4.2 Materials: Expected Life

The Subcontractor shall supply documented information outlining the expected service life of all materials used in the Works. This information shall be obtained from product/material manufacturers. This information shall be submitted in accordance with the submission schedule, and be included in the Façade Maintenance Manual.

As a minimum, this information shall include:

- The service life of the product/material on the project (this is not a warranty).
- Requisite maintenance procedures which must be followed in order to achieve the economic life of the product/material.
- An assurance from the manufacturer that the product is suitable and fit for purpose.
- Relevant product data including names of supplier and manufacturer.

4.3 Granite

4.3.1 Summary of process for procurement

The following is a summary of the recommended reviews during the procurement stages:

- Review technical data sheets for proposed supplier's product
- Review proposed shop drawings and calculations.
- Review samples, design team to approve accordingly.
- Testing and Visual Mock ups
- Authority approvals (as required)
- Review of supplier quality management plan
- Quarry and Factory review/audit
- Quality testing review during production of the materials
- Fabrication review including a minimum of
 - Architectural approval for each block, slab and finished panel, and
 - technical tested samples from each block
- Installation reviews (including control bays)

4.3.2 Requirements for colour and visual quality

The red granite is intended to match aesthetically the existing cladding to the lower levels of 50 Martin Place. Refer to Appendix E for example photographs.

The requirements for finish, colour selection, grain size and grain density and colour blending on installation are to be in accordance with the architect's requirements.

As a minimum all stone cladding is to comply with the architectural approved sample colour range, grain size requirements, and grain colour and type density.

All stone blocks are to be approved visually by the architect prior to processing.

All processed stone panels are to be approved by the architect prior to installation.

The architect is to advise on locations and placement of each panel on the façade in order to meet colour blending and general visual quality characteristics required.

4.3.3 Requirements for geometric characteristics

While stricter tolerances may be declared by the manufacturer, the followings are basic requirements on tolerance applicable for stone cladding panels.

Thickness tolerance

Unless indicated otherwise in the relevant drawings, the final processed thickness shall not deviate from the nominal thickness by more than the limits given below:

- 12 mm < nominal thickness ≤ 30 mm ± 10%
- 30 mm < nominal thickness ≤ 80 mm ± 3 mm
- > 80 mm ± 4 mm

Flatness tolerance

The deviation from flatness of the surface (except for natural cleft faces) shall not exceed 0.2% of the slab length (ie. for 600mm long panel this is a maximum of 1.2mm) or 2mm whichever is less.

For natural cleft faces, the tolerance on flatness shall be declared by the manufacturer.

Bow or twist

Maximum deviation of stone face from plane shall not exceed ± 1.5 in 1200 mm for finished surface (as per BS EN 8298).

Squareness

As per BS EN 8298, the length of diagonals shall not vary by more than 0.5% of the nominal stone dimension or 5mm, whichever is less.

Tolerance on length and width

The length and width shall not deviate from nominal size by more than limits given below:

Nominal length or width, mm	< 600	≥ 600
Sawn edge thickness ≤ 50 mm	± 1 mm	± 1.5 mm
Sawn edge thickness > 50 mm	± 2 mm	± 3 mm

Tolerance for angles, rebates and special shapes

Unless stricter tolerances are indicated in the relevant drawings, the permissible tolerance at any points shall be less than 1mm to the nominal dimensions (as per the approved shop drawings).

All curved panels are no be within 1mm of radius throughout the curved surface.

Tolerance for all joints (vertical and horizontal and corners)

The joint width shall not deviate more than 2mm along any point in the joint from the nominated joint width in the drawings. Each joint shall not splay more than 2mm along its length.

Tolerance for dowel holes, kerfs and inserts

Unless indicated otherwise in the relevant drawings, the tolerance for location, depth and diameter of dowel holes, kerfs and inserts shall not be more than the limits given below:

- | | |
|--|------------|
| o Location measured along the length of width of the panel | ± 2 mm |
| o Location measured along thickness (measured from exposed face) | ± 1 mm |
| o Depth | +3/-1 mm |
| o Diameter | +1/-0.5 mm |

For other fixing systems, specific tolerances shall be declared by the manufacturer.

Size of panels for cladding

Commercial sizes of cladding panels shall be based on the area of the smallest possible circumscribed rectangle measured in square meters accurate to two decimal places.

4.3.4 Requirements of joint grout products

The following minimum characteristics for cementitious grout products specified for use in the granite façade are required. The manufacturer/supplier will be required to provide test certificates/test report demonstrating that the grout products meet the minimum characteristics as per AS ISO 13007.3-2013 *Ceramic tiles – Grouts and adhesives – Terms, definitions and specifications for grouts* as well as compatibility certification, and warranties that no staining or cracking or other defects will occur adjacent or within the grout in the life of the project

Property	Requirement	Test Method in ISO 13007-4:2010
Abrasion resistance	$\leq 2\ 000\ \text{mm}^3$	4.4
Flexural strength under standard conditions	$\geq 2,5\ \text{N/mm}^2$	4.1.3
Flexural strength after freeze-thaw cycles	$\geq 2,5\ \text{N/mm}^2$	4.1.5
Compressive strength under standard conditions	$\geq 15\ \text{N/mm}^2$	4.1.4
Compressive strength after freeze-thaw cycles	$\geq 15\ \text{N/mm}^2$	4.1.5
Shrinkage	$\leq 3\ \text{mm/m}$	4.3
Water absorption after 30 min	$\leq 5\ \text{g}$	4.2
Water absorption after 240 min	$\leq 10\ \text{g}$	4.2

Product Selection

Product suppliers to consider are listed below. The manufacturer/supplier will be required to provide test certificates/test report demonstrating the proposed products comply to the minimum requirements.

- Ardex
- Laticrete
- Mapei

4.3.5 Requirements of joint sealant products

The following minimum characteristics for sealant products specified for use in the granite façade are required. The manufacturer/supplier will be required to provide test certificates/test report demonstrating that the grout products meet the minimum characteristics as per *According to ISO 11600-2002 Building construction — Jointing products — Classification and requirements for sealants* as well as compatibility certification, and warranties that no staining will occur due to the sealant in the life of the project

Property	Requirement	Test Method
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Substrate Staining	No Staining	ISO 16938-1:2008 Building construction — Determination of the staining of porous substrates by sealants used in joints
Adhesion/cohesion properties at variable temperatures	No failure	ISO 9047:2001 Building construction — Jointing products — Determination of adhesion/cohesion properties of sealants at variable temperatures
Adhesion/cohesion properties at maintained extension after water immersion	No Failure	ISO 10590:2005 Building construction — Sealants — Determination of tensile properties of sealants at maintained extension after immersion in water
Elastic Recovery	≥ 70% (Class 25LM)	ISO 7389:2002 Building construction — Jointing products — Determination of elastic recovery of sealants
Tensile Properties at Maintained Extension	No Failure	ISO 8340:2005 Building construction — Sealants — Determination of tensile properties at maintained extension
Tensile Properties – Secant Tensile modulus at: + 23°C (N/mm²) And -20°C (N/mm²)	≤ 0,4 and ≤ 0,6	ISO 8339:2005 Building construction — Sealants — Determination of tensile properties (Extension to break)
Loss of volume	≤ 10%	ISO 10563:2017 Buildings and civil engineering works — Sealants — Determination of change in mass and volume
Resistance to flow	≤ 3 mm	ISO 7390:2002 Building construction — Jointing products — Determination of resistance to flow of sealants

Product Selection

Sealant products to consider are listed below. The manufacturer/supplier will be required to provide test certificates/test report demonstrating the proposed products comply to the minimum requirements.

- Dow Corning, 756 SMS Building Sealant
- Parchem, Emer-Seal Construction Silicone
- Sika Group, Sikaflex 11FC
- Tremco, Dymonic 100
- General Electric, GE Silicone 2*+ Concrete Sealant

4.3.6 Requirements for surface finish

General

Surface finishes shall be carried out uniformly to the edges of the cladding panels. In the case where the surface finishing process may involve the use of patching materials, fillers or similar products, these products and the type of treatment shall be declared by the manufacturer of the cladding panels.

Stone sealant and graffiti protection

Provide compatible and durable penetrating sealant and graffiti protection. Application to be bath type, spray or other approved process.

The extent is to be as agreed with Lendlease and the architects.

Re-application procedures and service life to be provided by the manufacturer and documented within the Operations and Maintenance Manuals.

The supplier is to conduct suitable accelerated weathering testing to demonstrate compatibility (including no staining or deterioration of the substrate stone), colour and gloss retention.

Requirements for surfaces after finishing operation

Finished surface shall have the regular appearance typical of the finishing process and shall meet the specified and agreed finish (comparable to reference samples) on all exposed surfaces.

Refer to JPW documentation for nominal descriptions and locations of the various finishes. Notably described as polished for the main body of the stone panels and honed for the vertical face of the rebates. All finishes are to be finalised through sampling and visual mock ups.

The finishing process shall be declared by the manufacturer of the cladding panels. Typical surface finishing processes includes the followings:

Surfaces obtained by grinding:

- Rough ground surface obtained by means of a grinding disk of grain size F 60;
- Medium ground surface obtained by means of a grinding disk of grain size F 120;
- Fine ground surface obtained by means of a grinding disk of grain size F 220;
- Matt ground surface obtained by means of a grinding disk of grain size F 400;
- Highly polished surface obtained by means of a polishing disk or felt.

Surfaces obtained by means of percussion tools:

- Bush hammered surfaces
- Trimmed surfaces obtained with pointed chisel or grooving machine
- Striated surfaces obtained with claw chisel or ruling machine

Surfaces obtained by other operations:

- Flamed finish;
- Sand blasted finish;
- Water jet streamed finish;
- Machine tooled finish (showing tool marks)

- Riven cut (splitting) finish

All edges to be finished in accordance with the architectural requirements. Notably these are described as 2mm diameter rounded corners, and referred to typically as pencil round.

4.3.7 **Specific requirements for stone cladding**

The manufacturer/supplier of stone cladding shall provide the following characteristics of the stone products with reference to the intended use conditions. Declared values are generally acceptable. However, the Architect/Engineer will reserve the right to view test certificates when this is considered necessary.

Denomination

Denomination of the stone including traditional name, petrological family, typical colour and place of origin, shall be declared. Standards such as BS EN 12440, BS EN 12407 or relevant ASTM's such as ASTM C1721 shall be used.

Visual appearance

Visual characteristics and possible variation of the stone shall be declared by the manufacturer. The colour, veining, textures of the stone shall be identified visually by reference samples suitable for providing a general description of visual appearance/characteristics. Adequate number of reference samples shall be supplied to the Architect. The size of the reference sample shall not be less than 300x300mm in face area. The number of the reference samples in project's specified finish shall be sufficient to show the range of appearance regarding colouring, vein pattern, physical structure and surface finish typical of the stone.

The reference samples will be used, when necessary, to evaluate production samples.

The following minimum characteristics of granite are required. The manufacturer/supplier will be required to provide test certificates/test report demonstrating the stone panels in specified finish meeting these minimum characteristics as per ASTM C615.

Petrographic examination	BS EN 12407 or ASTM C1721
Compressive strength (minimum)	131 MPa – ASTM C170
Modulus of rupture (minimum)	10.34 MPa – ASTM C99
Bulk density (minimum)	2560 kg/m ³ - ASTM C97
Absorption by weight (maximum)	0.4% - ASTM C97

Other properties related to engineering properties and properties related to durability and serviceability of the stone may be required to be tested when requested. They include the following:

- Breaking load at dowel hole (for mechanical fixed using dowels on edges) (BS EN 13364)
- Strength of individual stone anchorages (ASTM C1354)
- Water absorption (BS EN 1925 or ASTM C97)
- Apparent porosity and open porosity (BS EN 1936)
- Resistance to salt recrystallisation (BS EN 12370 or AS 4456.10)
- Resistance to aging by salt mist (BS EN 14147)
- Resistance to ageing by SO₂ (BS EN 13919)
- Resistance to ageing by thermal shock (BS EN 14066)
- Changes in appearance produced by thermal cycles (BS EN 16140)
- Stain resistance (AS 4459.14)

4.3.8 Factory production control

A factory production control system (FPCS) shall be established and documented; and submitted to the Design team and Lend Lease for review. The FPCS shall include procedures for internal control of production; sampling plan, testing frequency and test results/records demonstrating that the products conform to the manufacturer's declared values.

Control frequency for factory production control shall not be less than the following:

- o Geometrical characteristics and visual appearances every processed panel
- o Flexural strength/modulus of rupture; compressive strength, water absorption, density for each block used in the project
- o Other properties for each block used in the project

4.3.9 Availability

The manufacturer/supplier shall supply information to Lend Lease demonstrating that enough stone can be produced in the quality and finish required within the project schedule.

4.3.10 Marking and packaging

Each consignment shall carry the following indications as minimum of identification:

- Denomination and source of the stone
- Quantities and dimension of the stone panels for cladding
- Mass of the panels for cladding
- Dimensions and mass of packaging

The panels for cladding shall be cleaned before packaging. Packaging shall be of appropriate mass and size in consideration of transportation and lifting facilities; the top and bottom of the packaging as well as stacking possibility must be indicated. Packaging materials which can cause staining shall not be used. Sensitive polished surface shall be appropriately protected.

4.3.11 Double Sided Tape (for adjacent façade elements)

The stone is not to be fixed with double sided tape. However, any adjacent façade elements, back pans, flashings, etc. that include the use of double-sided tape, the following should be noted for coordination:

- o Unisil Series 2000 double sided glazing tape or similar equivalent.
- o EVA tape, if used, joints shall not be visible from occupied internal spaces
- o Colour to be black

4.3.12 Weatherproofing Sealant (for adjacent back pans etc.)

- o Colour: Weather seals: Black
Air seals: Black
- o Compatible with all substrates
- o Obtain manufacturers written endorsement of all proposed details and submit with shop drawings.

4.3.13 Insulated Spandrel Construction

Thermal Insulation

- Insulation density and type to meet the specified performance of the spandrel. Thermal calculations are to be provided by the Sub-Contractor to verify thickness, type and density of thermal insulation. Thermal performance effects of framing elements to be considered in the calculation of the thermal performance of the facade spandrel panels.

The Sub-Contractor shall confirm the following:

- The proposed insulation material will not emit gases or volatiles when at elevated temperatures (provide technical data sheet which nominates material melting point)
- The proposed insulation material has no detrimental effects when it becomes wet through condensation or humidity;
- The method of securing the insulation will not allow the insulation to sag or slump;
- The Contractor shall guarantee that there will be no reaction between the insulation, adhesives, sealants or other materials inside the spandrel
- All insulation is to be non-combustible in accordance with the fire engineer's requirements.

Spandrel Air seal (Internal lining to spandrel, backing wall to stone cladding)

- Pre-finished Zincalume sheet, or approved equivalent.
- Minimum thickness 1.2mm.
- Calculate back pan thickness and fixing detail to sustain full wind load or alternatively design to serviceability wind load
- Fully seal back pan to system framing.

Cavity (spandrel)

- Ventilation/weep holes at top and bottom of spandrel cavity forming pressure equalised chamber with external pressures.
- Foam baffles fixed to ventilation holes.

4.3.14 Gaskets

- Neoprene, Santoprene, EPDM or silicone.
- Shore A hardness: to suit application.
- The subcontractor shall obtain approval in writing from the sealant manufacturer confirming compatibility of all gaskets touching sealant.
- Gaskets and seals used to achieve the required weather and/or air-tightness shall be selected to accommodate the expected cladding movements, the range of dimension tolerances associated with fabrication and installation of the cladding system.
- Gaskets to maintain dimensional stability for the design life of the cladding.

4.3.15 Setting Blocks

- Dense heat cured silicone rubber, 'silicone compatible rubber' or other rubber type approved in writing by the sealant manufacturer.
- Shore A hardness: 80 – 90 durometer.
- Setting block locations shall be engineered to transfer loads back to the framing system without transferring loads to other panels

4.3.16 Backing Rods

- Closed cell (polyethylene) or open-cell (polyurethane) foam.
- Compatible with sealants and substrate.
- Use only round tools (no sharp edges) to install backing rod. Do not pierce the rod skin of closed-cell rod.

4.4 Aluminium

4.4.1 General

If the Contractor chooses an alloy other than those listed below and not listed in a recognised code (BS8118 or AS1664), then a certificate of properties shall be obtained from the billet maker. The data shall include all mechanical properties required for design, including the yield in compression. This data shall be used in the relevant calculations.

4.4.2 Extruded members

- Alloy 6063-T5 or T6 (typical extrusions) or similar.
- Alloy 6061-T6 (brackets).
- Minimum wall thickness 2.5mm for structural elements.
- Minimum wall thickness 1.2mm for non-structural components, unless agreed otherwise.

4.4.3 Aluminium Finishes:

Refer to Architectural Finishes Schedule for specific finish references.

Typically, the following applies:

- Glazing system framing internal extrusions (mullions and transoms) –coated in accordance with AAMA 2604.
Colour: Refer Architectural Finishes Schedule and design intent drawings for finishes and locations.
- Glazing system framing external extrusions (captive beads) –in accordance with AAMA 2604.
Colour: Refer Architectural Finishes Schedule and design intent drawings for finishes and locations.
- External aluminium panels, cappings and visible flashings (where not accessible) –in accordance with AAMA 2604
Colour: Refer Architectural Finishes Schedule.
- Concealed elements – Powdercoated or anodised any colour.

4.4.4 Composite Aluminium Panels

- Aluminium composite panels shall not be used in this project.

4.4.5 Flashings & Cappings

Visible

- Aluminium sheet: grade 5005 or similar.
- Minimum thickness: 3mm
- Aluminium finish –coat in accordance with AAMA 2604.

Non-visible

- Aluminium or zincalume sheet; minimum thickness 1.6mm.

4.5 Secondary Structural Steel

- Minimum requirement, Grade 250 mild steel.
- Paint colour to any exposed structural steelwork to match selected samples, to be approved by the Architect.
- Prepare material and hot dip galvanise in accordance with AS/NZS4680.

- All elements are to be pre-drilled, cut and welded prior to galvanising.

4.5.1 Secondary Structural Steel – Paint Finish; External

- All external visible structural steel is to be hot dip galvanised and painted.
- All external non – visible structural steel is to be hot dip galvanised.
- Surface treatment suitable for high quality architectural paint coating for visible steelwork. Degrease, wash and dry, then sweep blast galvanised surface with a non-metallic abrasive to impart a suitable surface roughness before priming. Prepare surface in accordance with AS/NZS 4680.
- Where steel is to be painted, surface preparation is to be to abrasive blast class 2.5 to AS1627. Pressure wash and leave overnight to ensure no more than 70 mg/m2 of chlorides.
- Where steel is to be visible, suitably prepare members to remove all surface defects and manufacturing markings, to the satisfaction of the architect.
- Painting system for steel to comply with AS/NZS2312:2002, table 5.2 "*Corrosion protection of batch hot-dip galvanized coatings*". Paint system must be capable of being re-coated in-situ to facilitate future maintenance and to allow touching up of construction damage.
- Paint colour: To match selected samples, to be approved by the Architect.
- Acceptable paint products: International Protective Coating Interthane 990 over Interzinc Epoxy Zinc or similar

4.5.2 Secondary Structural Steel – Paint Finish; Internal

- All internal visible steelwork to be coated with suitable metal primer and powder coat finished; colour to Architect's requirements.
- Alternate paint finishes to be agreed
- Where steel is to be visible, suitably prepare members to remove all surface defects and manufacturing markings, to the satisfaction of the architect.
- Grind all welds and finish to a smooth even surface prior to painting.
- Prepare all steel surfaces in accordance with AS2311 prior to painting.

4.6 Stainless steel

4.6.1 General

- Stainless steel shall conform to the requirements published in the American Iron and Steel Institute Steel Products Manual and shall be designed to AS4673.
- All stainless steel sections, sheets, strips and fasteners shall comply with BS1449 Part 2 and AISI 316.

4.6.2 Visible Elements

- Unless otherwise specified series 316L stainless steel shall be used. Prior approval required by Architect and Façade Consultant for use of alternate grades.
- If the stainless steel is contaminated during fabrication by iron and other non-ferrous metals, clean and ensure the surface has adequate passivity. Test the surface passivity to ensure all free iron has been removed.
- During all fabrication procedures, protect the stainless steel finish with a protective film.
- Comply with AWS for recommended practices for welding. Unless otherwise specified, welds to visible areas of stainless steel to be ground smooth to achieve a seamless surface. Heat tints shall be removed using fine abrasives, pickling paste, wire brushing or similar to achieve continuity with the specified finish. Areas difficult to access shall be manually finished if necessary.
- Do not allow the steel surface to be scratched during fabrication. Scratches which cannot be removed will be cause for rejection.

- See Section 5.2.5 for more information

4.7 Fixings

4.7.1 Cast-In Anchors

- Facade fixings to new structure; use cast-in anchors equal to Halfen or approved fabricated cast-in plate.
- Cast-ins shall be minimum galvanised steel.
- Site welds to facade brackets shall be de-slugged and minimum 2 coat cold galvanised after welding.

4.7.2 Fixings, Screws, Rivets and Washers

- Screws: stainless steel grade 304 or 316 where visible.
- Nuts, bolts & washers: stainless steel grade 304 or 316 where visible.
- Pop rivets (if required): aluminium grade 5052 or stainless steel (300 series) with aluminium or stainless steel mandrels.
- Masonry anchors (expanding or chemical): Stainless steel Grade 316.
- Masonry anchors installed inboard of the airseal may be galvanised or plated steel. Only recognised brands such as Fischer, Hilti, Ramset and Powers may be used.
- Ensure all fixings are concealed. Exposed fixings are unacceptable unless approved in writing by the Architect. Acceptable exposed fixings shall be stainless steel grade 316 pig nose or recessed hex head and finished flush.
- All fixings shall be vibration proof under dead loads, live loads, wind loads and thermal movements.

4.8 Other Materials

4.8.1 Isolation Materials

- Inert material, compatible with materials with which it is in contact
- Non-conductive
- Non-compressible
- Water resistant
- UV resistant
- Compatible with materials with which it is in contact.

5. Fabrication, metal components

5.1 General

Fabricate and assemble the Works in strict accordance with approved Shop Drawings and with the requirements of this section.

Do not modify or adapt the agreed drawings and method statements without written approval. Record all changes on the master set of shop drawings.

5.2 Workmanship

5.2.1 Assembly

- Undertake assembly of components under factory controlled conditions.
- Remove all swarf and burrs from edges of cut and drilled aluminium before assembly of components.
- Where aluminium components are fixed together, ensure meeting aluminium surfaces are fully sealed. Ensure proper cleaning procedures are followed in the preparation of surfaces for sealing.
- Check each panel prior to install. Ensure cladding is free from scratches, shells, edge damage, delamination or other defects, which exceed the specified tolerances, set out in this Specification. Reject any panels that do not comply.
- Ensure all drain holes are clear of sealant and laitance and drain freely.
- Adequately reinforce and accurately cut, fit and seal all junctions to leave only sealed hairline joints.
- Form joints accurately without lipping or offsets in visible surfaces unless designed otherwise. Joints shall be rigidly secured to prevent all but designed movement, unless indicated otherwise.
- Use jigs and computer controlled fabrication tools wherever appropriate to achieve accuracy. Carry out grinding, cutting, shaping and finishing operations using tools and techniques which will prevent contamination or damage of adjacent components with particles or substances which could stain or corrode them.

5.2.2 Aluminium Framing

- Machine-cut all aluminium extrusions
- Factory drill or punch all holes, slots, etc in aluminium extrusions

5.2.3 Structural Steel

- Prepare all visible structural steel to receive a high quality architectural paint finish. Ensure all manufacturing marks and the like are ground back to a smooth finish where exposed to view.
- Ensure all structural steel is prefabricated complete with all holes, welds, vents and the like prior to finishing.

5.2.4 Stainless Steel

- Ensure all fabrication in accordance with ASSDA recommendation.
- Stainless steel sheet for external architectural application shall meet the requirements of type 316L (ASTM A167) or stainless steel grade with pitting resistance equivalent number (PRE = %Cr + 3.3 x % Mo + 16 x %N) of not less than 25. Ferritic stainless steel such as 445M2 grade is considered acceptable for external applications. Stainless steel sheets shall meet all the requirements of relevant current standards (ASTM or BS EN) and additional requirements given in this Specification.

- The external surface of stainless steel sheets shall be mechanically polished with non-directional finish to 2P as per EN10088/2 with surface roughness of not more than 0.5 microns".
- Avoid cross contamination with ferrous metals
- Ensure all oils and chemicals used during the manufacturing process are adequately removed and cleaned prior to being installed in factory fabricated panels and arriving on site.

5.2.5 Vibration-proof fixings

- Ensure all fixings are vibration proof under dead loads, live loads, wind loads and thermal movements, either by use of locking nuts, washers or the application of an approved locking fluid.

5.2.6 Tolerances

- Achieve compliance with maximum allowable fabrication tolerances specified in this specification.

5.2.7 Markings

- Clearly mark fabricated assemblies to identify lifting points, panel types, assembly or installation sequence, location and orientation.
- Mark with removable material, which can be completely removed without affecting appearance of the marked area. Alternatively, mark in areas which will be concealed when the installation is complete.

5.2.8 Protection

- Store fabricated assemblies in a manner that will prevent overload, distress or permanent deformation of the overall assembly or individual components.
- Protect the Works to prevent damage and staining during transportation, storage and erection until Practical Completion under the Head Contract is granted. Ensure temporary protective measures will not affect the appearance of the finishes when the protection is removed.
- The Subcontractor is to submit protective measures for approval prior to transportation and installation. Notify the Principal and discuss protective measures with the design team if open top containers are used to transport materials.
- Package fabricated assemblies so as to prevent finish damage, overload, distress or permanent deformation of overall assembly or individual components either during transportation or hoisting/lifting operations.

5.2.9 Material Deliveries

Check all materials provided by other suppliers for compliance with the project requirements. In particular, check for:

- Source, type, quality, grade, finishes and colour
- Correct accessories and fixings
- Correct sizes
- Correct quantities (to ensure shortages do not delay the works)
- Correct coating thickness
- Shelf life (i.e. that they are not out of date)
- Record all checks, confirming satisfactory supply or corrective actions.

6. Installation

6.1 General

Carry out installation in accordance with approved Shop Drawings by personnel experienced in the handling and site installation of the Works.

Do not cut, drill, modify or otherwise alter any work or the agreed details without obtaining written approval from the client and their consultants (façade engineer and architect). All such alteration work shall be carried out in accordance with the requirements of the Contract Documents and agreed submissions. All changes must be recorded on master documents held by the Subcontractor for inclusion on the 'as-built' drawings.

Employ only competent and experienced installers to carry out the installation. Provide and maintain records to demonstrate their employees' experience and related training.

6.2 -Seal and/or Grout Application

- Follow the sealant manufacturer's instructions for substrate preparation and sealant installation.
- Minimum sealant joint glue-line, to be in accordance with design documentation and manufacturers requirements
- Mask all visible sealant joints with non-staining tape prior to sealant installation to ensure a neat joint and to protect adjacent finishes. Remove the tape immediately after tooling.
- Provide a smooth, slightly concave surface.
- Complete tooling before any signs of skinning. If a seal skins before tooling is complete, remove the seal after curing and re-seal.
- Wet tooling techniques shall not be used.

6.3 Fixings

- Install fixings in accordance with the manufacturer's recommendations and procedures.
- Do not cut reinforcement to concrete/masonry when installing fixings.
- Make good the integrity of the steel corrosion protection system where post drilled or site fixings are used for connections to the external steel work.

6.4 Site Welding

- For site welding of facade fixing brackets or other structural steel, all welding shall be carried out in full accordance with BS EN ISO 15614. Welding shall be supervised by an appropriately qualified tradesperson.
- Protect all finishes from weld spatter, including glass, stone and paint finish. Replace all elements and panels damaged by weld spatter.

6.5 Protection

- Protection of the works will be supplied, installed, maintained and removed by the subcontractor to the requirements of The Client. Protection will remain in place until the commencement of the final clean and will be removed to facilitate trade and final clean.

6.6 Cleaning

- The contractor shall trade clean their works as per The Client scope of work requirements (final clean to be provided).
- Clean all internal and external surfaces of facade, aluminium framing and painted steel etc.
- Undertake a trade clean of the Works, and any surfaces affected by the Works, at a time agreed with The Client. The trade clean shall remove all:

- Protection tapes, films, covers and the like, together with any residual adhesives left by the protection materials.
- Incidental construction dust, laitance, rubble and the like, to a level where the performance and appearance of the installation is not compromised, and any residual material will not etch the surface coatings/finishes and can be easily removed during the final clean.
- Visible installation stickers and temporary product markings and QA markings.
- Conduct a trial trade clean at the commencement of cleaning operations, and seek approval that the level of cleaning is suitable.

6.7 Rejections and Defect Rectification

- Any work determined by the Client and Consultants as being defective (either during the course of the Works or during the Defects Liability Period) shall be rectified by the Subcontractor to the satisfaction of the Client and Consultants. The cost of such rectification shall be borne by the Subcontractor.
- If directed, open up complete work for inspection. The time and cost of the opening up, inspection and closing up will be borne by the contractor.
- Where the inspection identifies that the works have been undertaken in a manner which is different from the approved method statements, then all costs associated with the inspection and subsequent rectification works will be borne by the Subcontractor.

6.7.1 Agreed Methods

- Rectification methods for finished products will be trialled and submitted for approval prior to the commencement of work. Where rectification methods are rejected, replacement of the component and/or assembly will be required.

6.7.2 Allocation of Costs

- Defects, which are clearly due to the actions of the contractor and/or his agents, shall be rectified at the contractors cost.
- Damage, repair/replacement and clean-up costs due to weatherproofing failure of completed work will be at the Subcontractors cost.

6.8 Delivery, Handling and Storage

Co-ordinate the delivery, handling and storage of panels and components so as to ensure they reach their final position in a clean, undamaged condition.

7. Verifications

7.1 Submissions

7.1.1 Schedule

- Make submissions in accordance with the Submission Schedule.
- Confirm schedule of submissions in accordance with the Submission Schedule within two weeks of Contract award.

7.1.2 Contract Samples

- Submit samples of each significant component complete with the proposed colour, texture and finish for acceptance by the Architect, The Client and the consultant team. Ensure that samples incorporate the full variance expected for the project.
- Stone samples proposed for the project shall be submitted in 300 x 300mm size and in 600 x 600mm size. Stone shall be submitted in the finish state to be used on the project;
- Provide samples in nominally 300 x 300mm samples of all typical rebate and recess details, typical corner details, proposed joint details (including sealant and/or grouted details), sealant and/or graffiti protection coatings
- Samples of continuous elements submit 300mm lengths (e.g. extrusions, gaskets, etc.).
- Samples of bolts, fixings and anchors; submit one unit of each type.
- Samples of hardware and ironmongery; submit one unit of each type.
- Approved samples will form the benchmark for the minimum acceptable quality for the project

7.1.3 Shop Drawings

Provide initial system design drawings for review and agreement prior to preparation of shop drawings. The system drawing should include all typical details.

For the shop drawing submission as a minimum provide plans, elevations, detail elevations and full size (1:1) detail drawings for each component, condition and connection. Include allowance for 3D assembly drawings.

As a minimum provide:

- Set-out plans of cast-in anchors or elements to slab edges/edge beams where required.
- Co-ordinated detail of cast in anchors or elements indicating anchor, concrete, prestressing and rebar locations
- Plans, elevations and relevant section details indicating extent of visual mock-up
- Plan indicating façade set-out and extent
- Elevations indicating wall panels, material type, facade type, etc. (including cross referencing of details)
- Part elevations for each facade type
- External wall sections (1:1 details) for all typical and non-typical details.
- Detailed sections through all typical and non-typical details for each facade elements and each detail including stone fixings, secondary steel supports, steel member schedules etc.
- Do not commence fabrication until shop drawings have been reviewed and endorsed by The Client, the Architect and the consultant team.
- Review of shop drawings by The Client and the consultants shall not relieve the Subcontractor of any responsibilities under this Specification.
- Submit print copies of each drawing together with one electronic copy in .pdf format for review in sufficient time to allow for the review / comment / re-submission process to occur prior to fabrication. Allow a minimum of 20 working days for review by all parties from receipt of drawings.

- At the completion of the project, or as directed by The Client, provide the final set of As-Built drawings. These shall be a set of approved details, modified to reflect details changed to suit site conditions, different from those approved originally.

7.1.4 Calculations

- Submit detailed calculations for the facade system.
- Calculations to be prepared by a professional engineer (CPEng) with experience in the design of stone clad wall systems.
- Calculations shall include a summary page indicating key results, assumptions and references.

As a minimum, calculations are to include:

- i) Summary including basis of design; Limit State
- ii) Table of contents
- iii) Determination of Design Wind Pressures including local pressure factors
- iv) Elemental design for strength and stiffness and design of joint for tolerances and movement
- v) All stiffening or bracketing required
- vi) Thermal movement assessment
- vii) Bracket and connection design including cast-in channels and anchors
- viii) All secondary structural steel elements including external steel members, internal steel stiffeners inside aluminium members and their fixings.
- ix) Thermal performance calculations of all elements and provide calculations for average panel thermal properties (for all types of panels) including total panel U-values, spandrel panel U-values and vision panel U-values (to AFRC requirements). The façade thermal performance must be verified and issued to Principal for review and comment prior to commencement of procurement (this includes calculations with Lawrence Berkeley National Laboratory (LBNL) Window software or approved similar).
- Review by The Client and its consultant team of calculations will in no way relieve the Subcontractor of its responsibilities under this Specification.
- Structural engineering certification shall be provided by the Subcontractor's professional engineer (CPEng) confirming the design complies with the Specification and all relevant Standards and Codes, local by-laws etc.
- Submit calculations in conjunction with shop drawings whenever possible. Allow 10 working days from date of receipt of last element for review of calculations by the Consultants.

7.1.5 Maintenance Manuals

- Upon Practical Completion, provide four copies of facade maintenance manuals for the project.
- Maintenance manuals shall include as a minimum:
 - x) Schedule of all materials used including material data, suppliers, and supplier contact details.
 - xi) Cleaning and maintenance requirements (including pre-dated QC sheets to be completed with each maintenance procedure, adequate for 20 years of façade life) for all surfaces / materials.
 - xii) Method for warranties for materials and workmanship including those for components from other manufacturers. Provide original copies of all warranties for materials and workmanship.
 - xiii) A3 size copies of all as-built drawings for the project
 - xiv) CD-Rom copies in AutoCAD DWG and PDF format of all as-built shop drawings for the project
 - xv) Methods for repair / repainting of all painted elements
 - xvi) Suggested inspection regime.

7.2 Visual Prototypes

Mock-Up (Fabrication Stage)

- Visual mock-ups are required for all main facade types, size and extent (Including any other internal fixtures as agreed with Lend Lease) to be agreed by Architect and Client and relevant consultants.
- The Visual Mock shall include (as a minimum) typical rebate and recess details, typical corner details, proposed joint details (including sealant and/or grouted details), sealant and/or graffiti protection coatings
- The mock-up(s) is to be located outside in the contractor's factory or similar prior to placement of the materials order.
- Material orders to be placed only after Architects written approval of the materials in the visual mock-up.
- The mock-up sample should be constructed using specified materials, colours and finishes, but is not required to be fabricated using project extrusions.
- The mock-up shall be used as a visual prototype to assist in the final confirmation of jointing, colours, and materials selection.
- The mock up is to be approved by Lendlease prior to the commencement of fabrication

Control Bays (Installation Stage)

- Control bays are intended to be areas comprising the first panels for each facade type installed on the building. They are intended to become the benchmarks for acceptance of the installation in terms of materials, workmanship and general appearance.
- The location and configuration of the control bays may be modified to suit site programme and access arrangements; staged inspections may be undertaken. These will form part of the Works once accepted by The Principal.
- Control bay locations are to be agreed during shop drawing submission phase.
- A structural bay width x 1 storey height area is envisaged for each of the agreed control bays.

7.2.1 Site Water Testing

- Conduct hose testing on random areas of each facade type, as nominated by The Client, the Architect and the Facade consultant, to demonstrate weather tightness of the installations. Tests shall be conducted, witnessed and reported by an Independent Testing Authority. Allow to conduct a minimum of 10 such tests.
- Water test to AAMA 501.2 field hose test standard.
- Submit test report for each field hose test conducted for the approval of The Client.
- The testing is to be allowed for by the sub-contractor (that is, paid for by the sub-contractor). This includes as a minimum access, water testing equipment (nozzle and hose), testing personnel and test witness to complete the Independent Testing Authority report
- If a test is unsuccessful, the Subcontractor shall allow to investigate the cause(s) of failure, rectify the problem and re-test the failed panel and additional panels until such time as The Client and its consultants are satisfied with the weatherproofing performance of the glazing system. If the cause is found to be a design defect or a defect of installation procedure, all panels with the same defect shall be identified and rectified by the Subcontractor at its cost.

7.2.2 Acoustic performance testing

Acoustic Testing to be as per Arup Acoustic requirements, and as a minimum in compliance with ISO 10140-1 (including the current version and Amendments).

The testing is to confirm acoustic performance of the facade and is required (as a minimum) on all facade systems. The size and layout of each test is to be as per Arup Acoustic Engineers requirements.

The testing is to occur at an accredited and approved test facility.

The Contractor is to propose the test facility as part of tender submission.

7.2.3 Weather seals; Site Installed

- Prior to commencement of regular installation of weather seals on the Site conduct at least three (3) on-site hand-peel tests for each type of seal. Ensure that the sealant manufacturer's representative attends the test and provides a written report of the test and is satisfied with all aspects of the sealant installation and curing.
- Keep QC records of weather seal silicone used on the Site. Ensure that it is stored in accordance with the sealant manufacturer's instructions and that its use-by date is not exceeded.
- Test weather seal sealants regularly on site; skin-over time test.
- Regularly test by hand-pull, cured silicone weather seal joints on the Site. The Subcontractor shall ensure that hand-pull tests shall be carried out with the sealant manufacturer's representative present and obtain the sealant manufacturer's representative's report for all hand-pull tests.
- Make all test reports and QC records available to the Consultants on request. Include a full copy of all QC records in the maintenance manual.

7.2.4 Masonry Anchors

- Verification methods in accordance with SA TS 101:2015.
- Tests of masonry anchors shall be carried out by a tester approved The Client and its Consultants. A representative of the manufacturer of the masonry anchors may carry out the tests, if they regularly carry out this work.
- Nominally load test 1 in every 100 typical masonry anchor. Test at least 1 of each type of non-typical anchor to a minimum of 1% of the type. Provide a graph of load versus deflection for all tests.
- Ensure that the method of load application is representative of the loading in service. The test procedure, including a diagram of the test equipment layout shall be submitted to The Client for approval prior to testing.
- At a test loading value of 1.2 times the design load for the anchor, deflection shall not exceed 1mm, or lesser value agreed with the masonry anchor manufacturer.
- Failures of any of these tests shall be reported immediately to The Client. The Client shall then determine the extent of re-testing required by the Subcontractor, which the Subcontractor shall carry out and bear all associated costs.
- Make all test reports available to The Client and its consultants on request. Include a full copy of all QC records in the maintenance manual.

7.2.5 Finishes

Powdercoat and PVF2 Paint Finishes and Anodising of Aluminium

- Test powdercoating quality and thickness to the requirements of AS 3715.
- Test PVF2 quality and thickness to the requirements of AAMA 2605.
- Test anodised coating and thickness to AS 1231.
- Make all test reports available to The Client and its consultants for review. Include a full copy of all QC records in the maintenance manual.

7.2.6 Weld Testing / Inspection

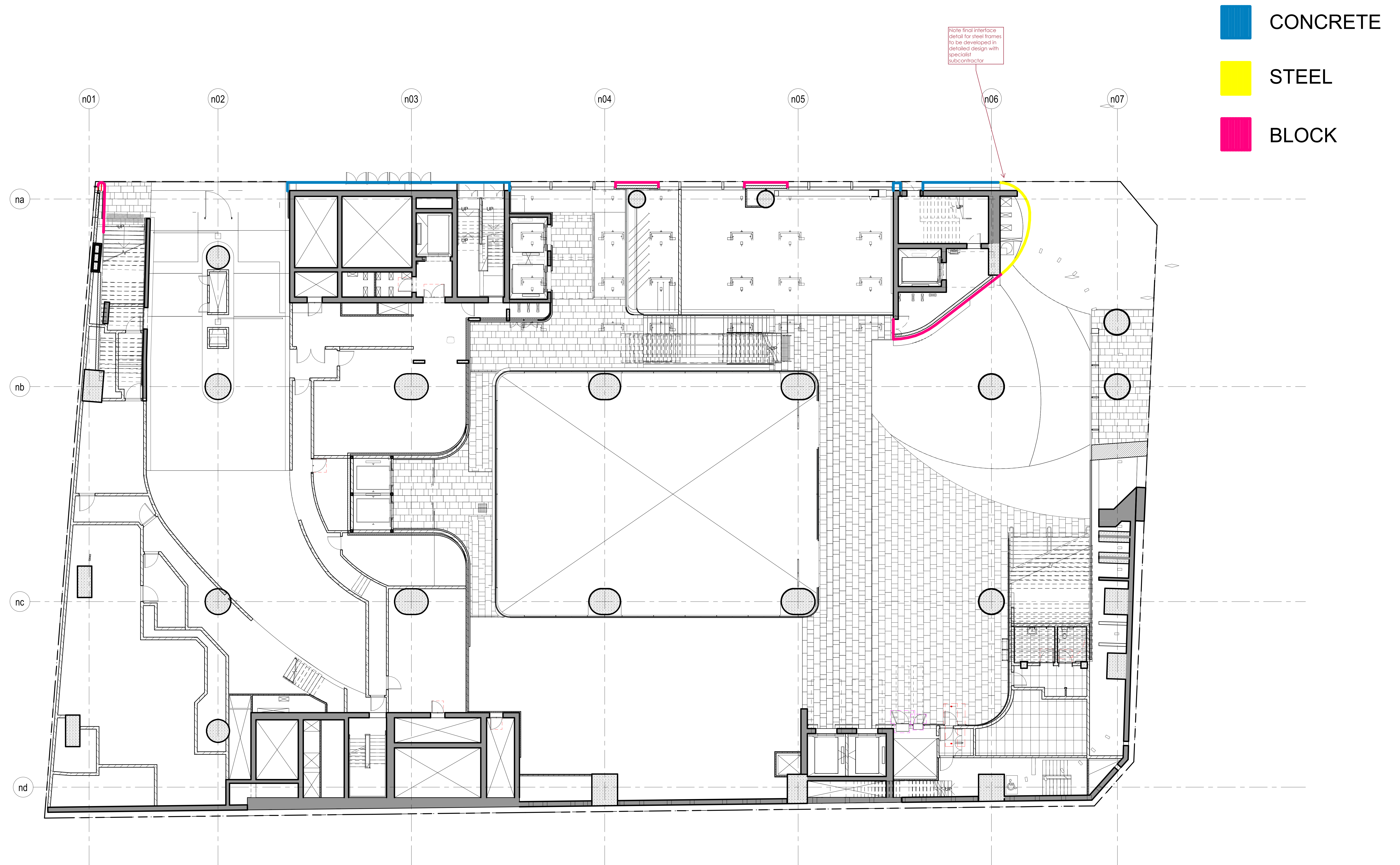
- Inspect and test welding of site and factory fabricated structural steel, including site welding of curtain wall brackets in accordance with BS EN ISO 15614.
- Make all test reports available to The Client and its consultants on request. Include a full copy of all QC records in the maintenance manual.

7.3 Quality Assurance

- Implement a quality assurance system in compliance with AS/NZS ISO 9001.
- Provide a professionally prepared project specific quality plan divided into separate sections for quarry, factory and site works. Present quality plan to The Client for review and comment prior to commencement of the Works.
- Implement a quarry, factory and site inspection / verification procedure which ensures that all elements of the installation are installed in full accordance with the design.
- As a minimum, the QA manual shall include the following:
 - xvii) A method statement for each procedure involved in the implementation of the Works, including responsibilities for each procedure.
 - xviii) A pro-forma for each procedure.
 - xix) Hold points in each procedure when QC checks/tests are carried out.
 - xx) Pass/fail requirements for each check/test cross-referenced to a Specified, Code, Standard or local government requirement.
 - xxi) Non-conformance procedures for each test/check including quarantine and rectification procedures.


Appendix A

Appendix A – Mark up of plans with typical support substrate



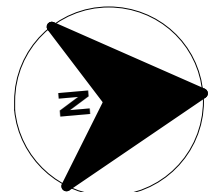
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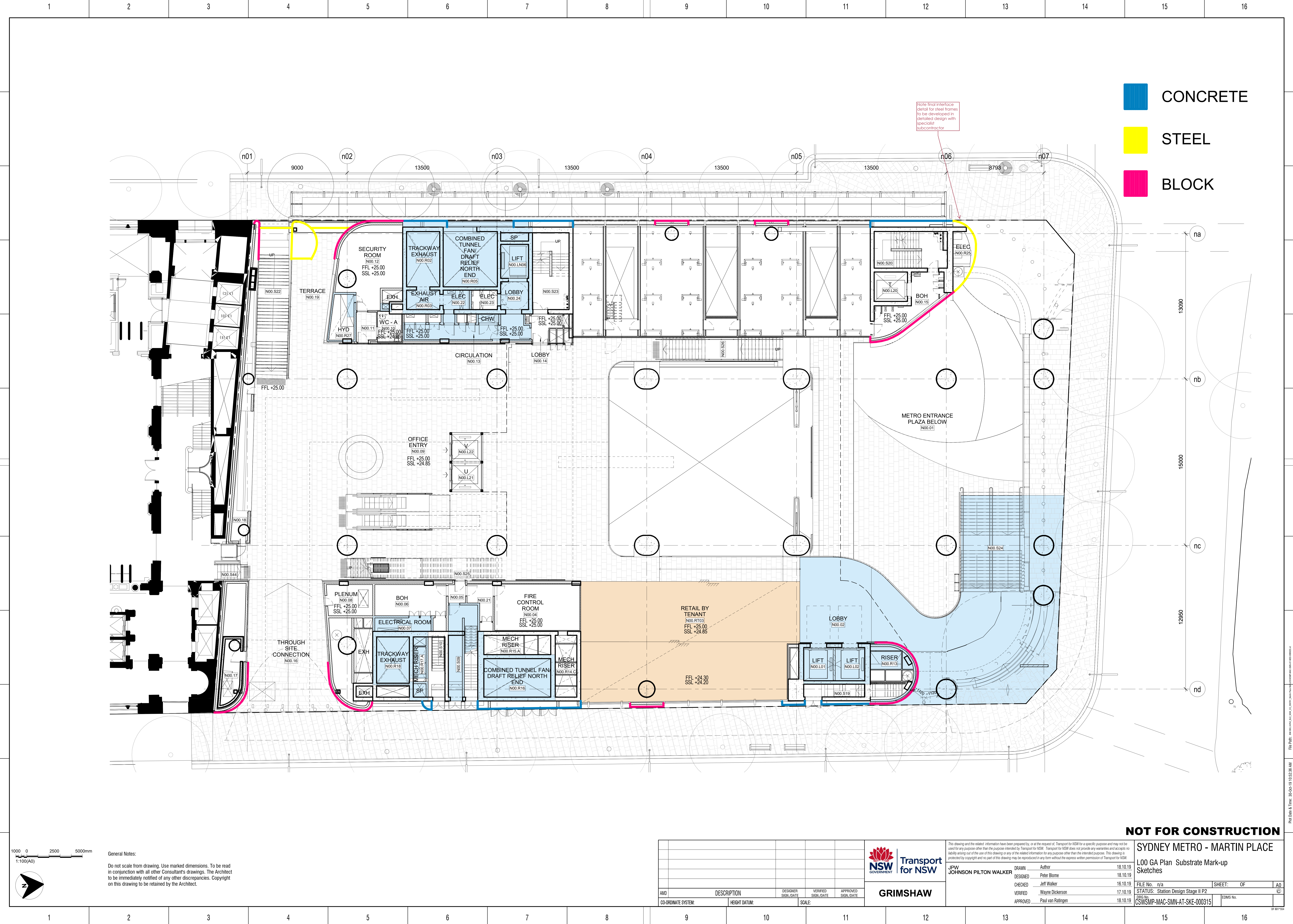
SYDNEY METRO - MARTIN PLACE

				 Transport for NSW	<p>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties or accept any liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</p>	<p>SYDNEY METRO - MARTIN PLACE</p> <p>LG GA Plan Substrate Mark-up Sketches</p>
AND	DESCRIPTION	DESIGNER SIGN./DATE	VERIFIED SIGN./DATE	APPROVED SIGN./DATE		
CO-ORDINATE SYSTEM:		HEIGHT DATUM:	SCALE:			
GRIMSHAW					<p>JPW JOHNSON PILTON WALKER</p> <p>DRAWN <u>Author</u> 18.10.19</p> <p>DESIGNED <u>Peter Blome</u> 18.10.19</p> <p>CHECKED <u>Jeff Walker</u> 18.10.19</p> <p>VERIFIED <u>Wayne Dickerson</u> 17.10.19</p> <p>APPROVED <u>Paul van Ratten</u> 18.10.19</p>	<p>FILE No. n/a</p> <p>STATUS: Station Design Stage II P2</p> <p>PROJECT No. CSMW-MAC-SMN-AT-SKE-000314</p> <p>EDMS No.</p>

General Notes:

Do not scale from drawing. Use marked dimensions. To be read in conjunction with all other Consultant's drawings. The Architect to be immediately notified of any other discrepancies. Copyright on this drawing to be retained by the Architect.





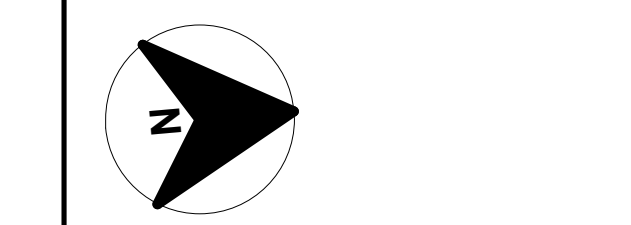
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SYDNEY METRO - MARTIN PLACE

L00 GA Plan Substrate Mark-up Sketches




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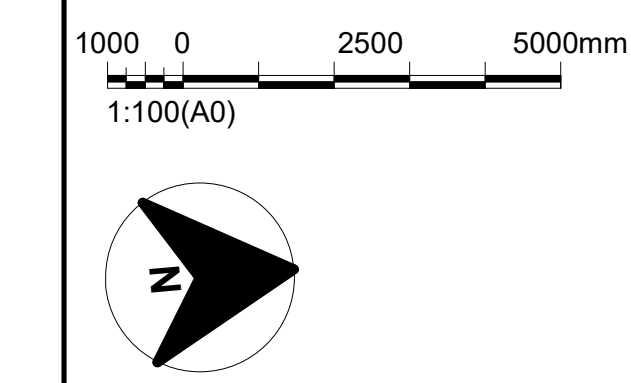
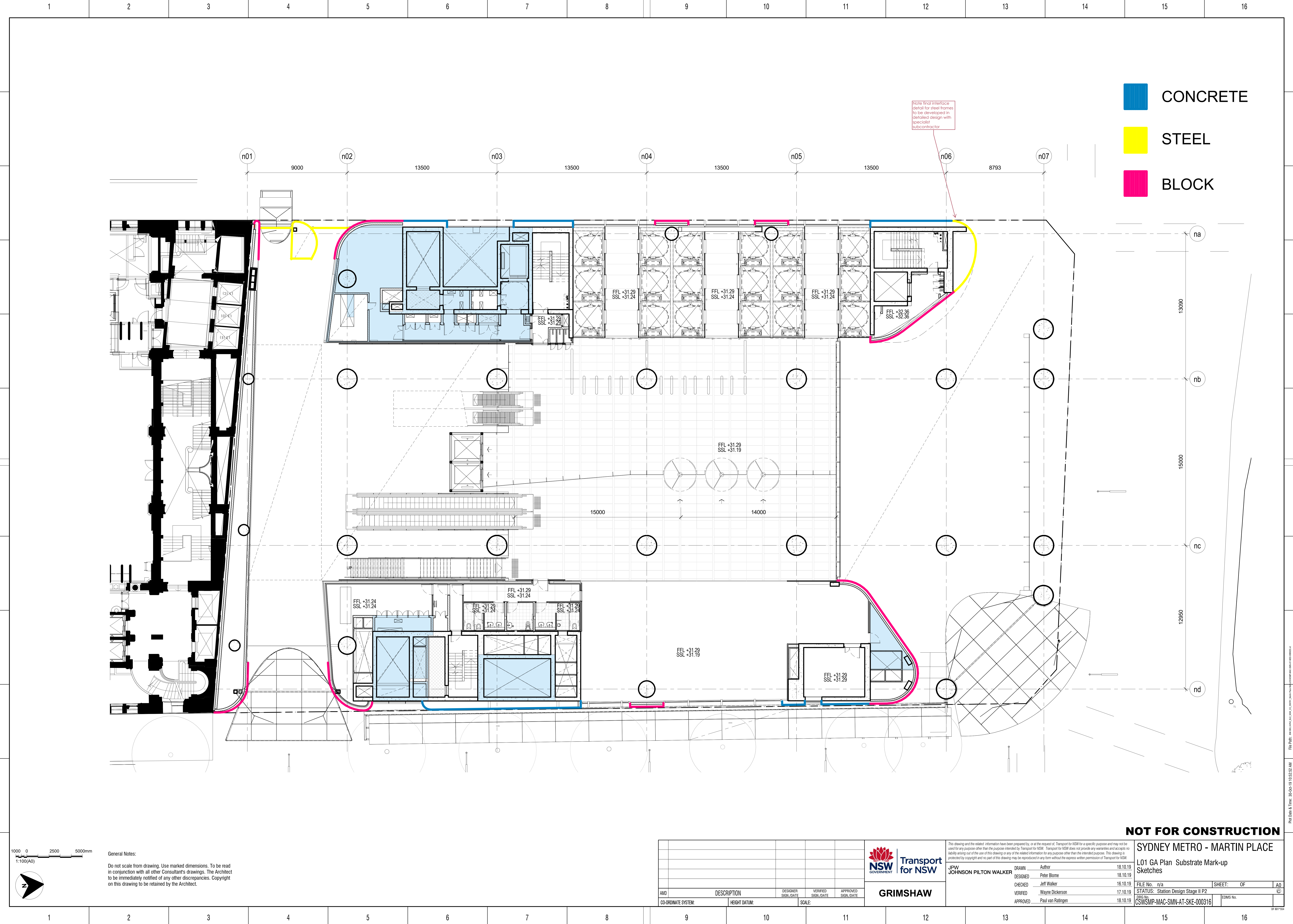
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CO-ORDINATE SYSTEM:	HEIGHT DATUM:	SCALE:		



JPW JOHNSON PILTON WALKER		Author	18.10.19
		DESIGNED	Peter Blome 18.10.19
		CHECKED	Jeff Walker 18.10.19
		VERIFIED	Wayne Dickerson 17.10.19
		APPROVED	Paul van Ratingen 18.10.19

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General Notes:
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AND	DESCRIPTION	DESIGNER SIGN./DATE	VERIFIED SIGN./DATE	APPROVED SIGN./DATE
CO-ORDINATE SYSTEM:	HEIGHT DATUM:	SCALE:		

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JPW
JOHNSON PILTON WALKER

DRAWN	Author	18.10.19
DESIGNED	Peter Blome	18.10.19
CHECKED	Jeff Walker	18.10.19
VERIFIED	Wayne Dickerson	17.10.19
APPROVED	Paul van Ratingen	18.10.19

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SYDNEY METRO - MARTIN PLACE

L01 GA Plan Substrate Mark-up Sketches

FILE No.	n/a	SHEET:	OF	A0
STATUS:	Station Design Stage II P2			
DRG No.	CSWSMP-MAC-SMN-AT-SKE-000316	EDMS No.		

Plot Date & Time: 30-Oct-19 10:52:32 AM
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Plot Scale: 1:100 (A0)

Appendix B

Appendix B – Nominal secondary steel marking elevations and typical details

Refer to the following documentation for nominal supporting steel design and typical façade details by Surface Design related to the stone cladding.

Refer to JPW architectural documentation for further information and coordination.

Nominal positions of floor beams which support lateral forces from the rib beams. Arup to confirm. Nominal maximum lateral force (Ultimate) is nominally 15kN

Connect to core walls, nominal reaction loads ultimate lateral force nominally 10kN each.

Surface Design steel frame for NW bullnose 23/8/19, for further development and discussion.

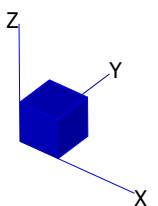
Steel sections:
The blue horizontal 'RIB' beam is a rolled/curved 125x75x5RHS grade 350 (on side) spaced at nominally 2.5m centres vertically. It is supported at either end to the concrete wall of the core, and laterally tied to the core wall through the structure of the floor (by arup)
The red vertical members supporting the vertical load to ground floor slab and the stone panels are 75x5SHS grade 350 spaced at nominally 400mm centres, spanning between the blue rib beams.

Red colour member 75x5SHS grade 350 at 400mm spacing

Blue rib members 125x75x5RHS grade 350 at 2500mm spacing

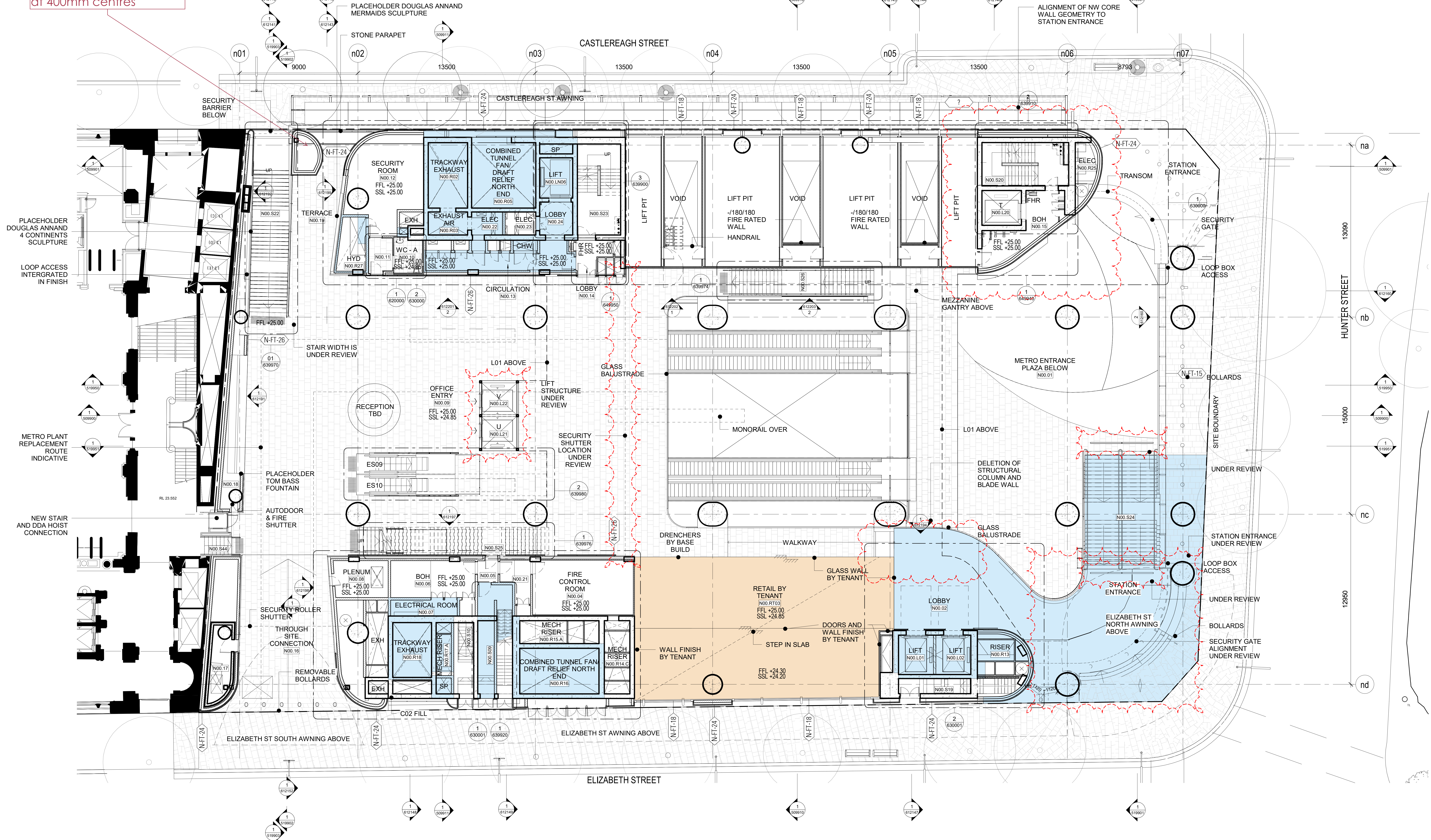
Coordinate with roller shutter door and its structure required.

Support to ground floor slab for all vertical loads (we estimate this as maximum 7kN for each beam subject to vertical loads from floor by Arup.)



526 Nodes	0 Vertices	View	1: self weight
636 Beams	0 Edges	RX: -54.1	1: Freedom Case 1
0 Plates	0 Loops	RY: -0.3	
0 Bricks	0 Faces	RZ: -37.8	
0 Links	0 Surfaces		
0 Paths			

Nominal Fabricated steel frame from 150x50x6RHS at 400mm centres



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SYDNEY METRO - MARTIN PLACE

GROUND PLAN - ELIZABETH STREET

30 General Arrangement

STATUS: STATION DESIGN STAGE II P1

FILE No. n/a SHEET: 1 OF 1

DATE: 18/10/2019 4:00:07 PM

Q

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P	Station Design Stage II P1 Draft	20-09-19	PB/20-09-19	MM/20-09-19
O	Station Design Stage II P1 Draft	13-09-19	PB/13-09-19	MM/13-09-19
N	North Tower Stage 4 WIP 1	30-08-19	PB/30-08-19	MM/30-08-19
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DESIGNED	Peter Blome	18.10.19
CHECKED	Jeff Walker	18.10.19
VERIFIED	Wayne Dickerson	17.10.19
APPROVED	Paul van Ratingen	18.10.19

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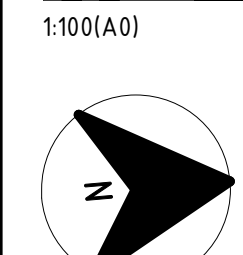
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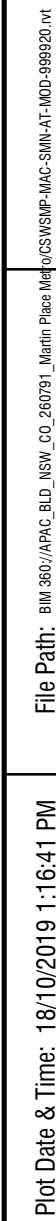
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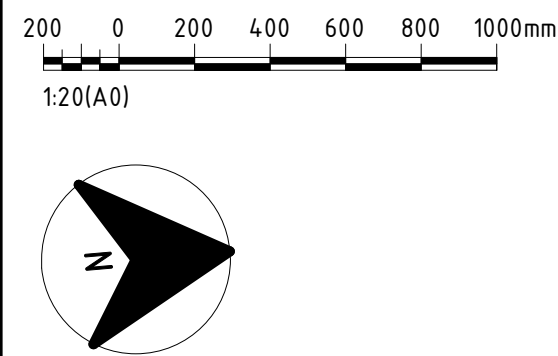
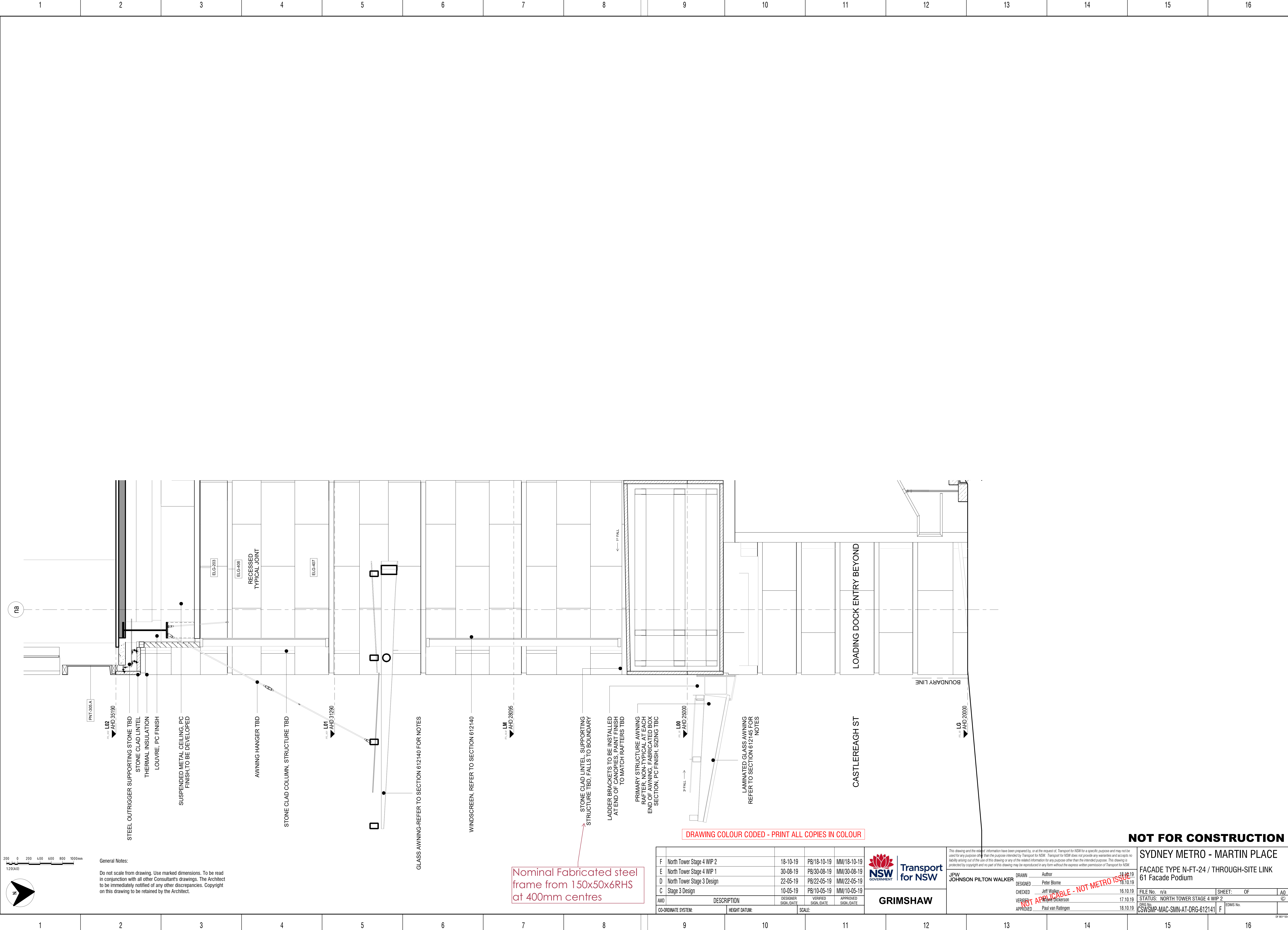
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DP 801154





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Nominal Fabricated steel frame from 150x50x6RHS at 400mm centres

F	North Tower Stage 4 WIP 2	18-10-19	PB/18-10-19	MM/18-10-19
E	North Tower Stage 4 WIP 1	30-08-19	PB/30-08-19	MM/30-08-19
D	North Tower Stage 3 Design	22-05-19	PB/22-05-19	MM/22-05-19
C	Stage 3 Design	10-05-19	PB/10-05-19	MM/10-05-19
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CO-ORDINATE SYSTEM:		HEIGHT DATUM:		SCALE:



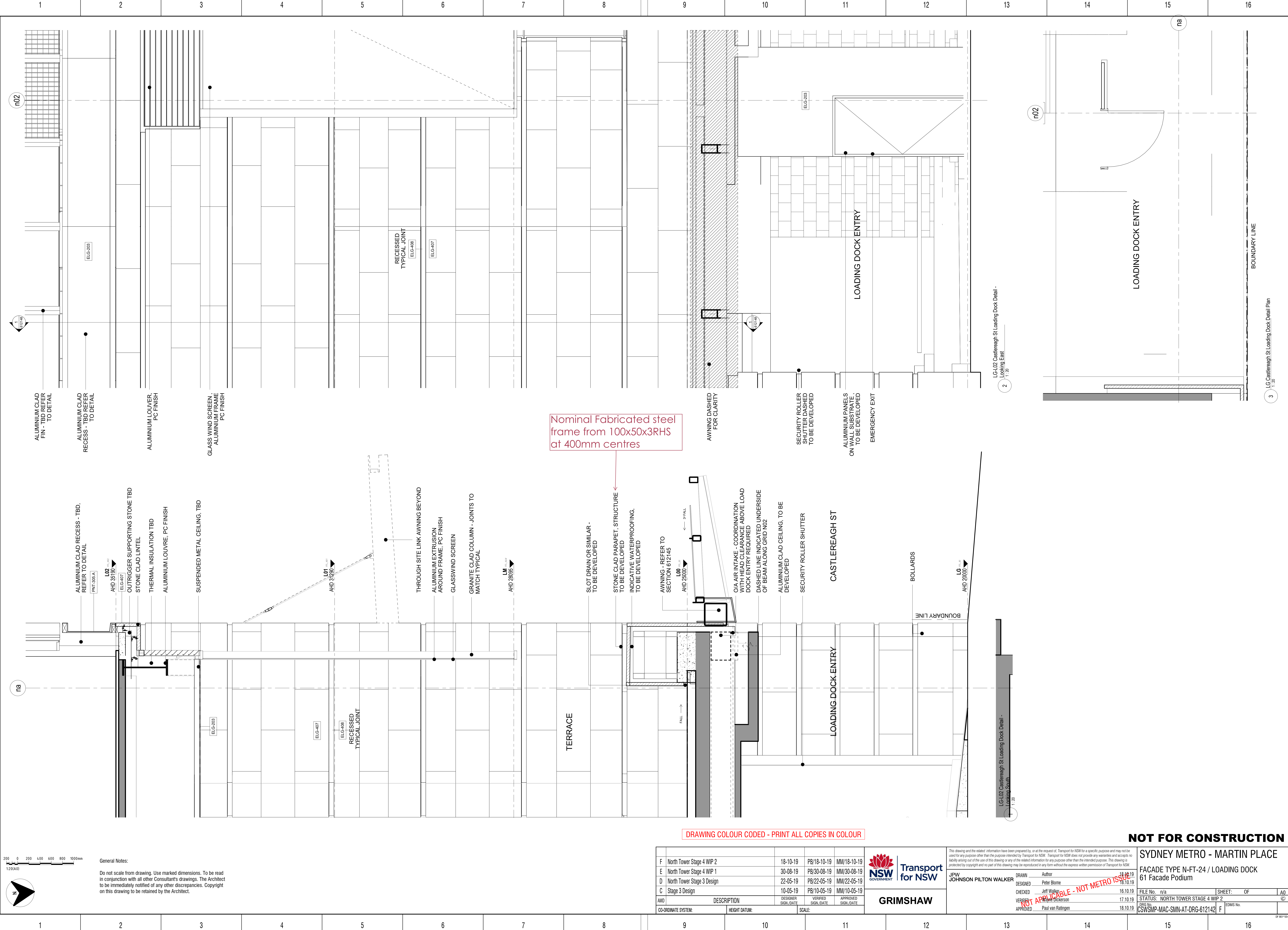
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CHECKED Jeff Walker			
VERIFIED Paul van Ratingen			
APPROVED Paul van Ratingen			

SYDNEY METRO - MARTIN PLACE			
FACADE TYPE N-FT-24 / THROUGH-SITE LINK			
61 Facade Podium			
FILE No.	n/a	SHEET:	OF 1 A0
STATUS: NORTH TOWER STAGE 4 WIP 2			
ORG No.	CSWSMP-MAC-SMN-AT-DRG-612141	EDMS No.	F

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E	North Tower Stage 4 WIP 1	30-08-19	PB/30-08-19	MM/30-08-19
D	North Tower Stage 3 Design	22-05-19	PB/22-05-19	MM/22-05-19
C	Stage 3 Design	10-05-19	PB/10-05-19	MM/10-05-19
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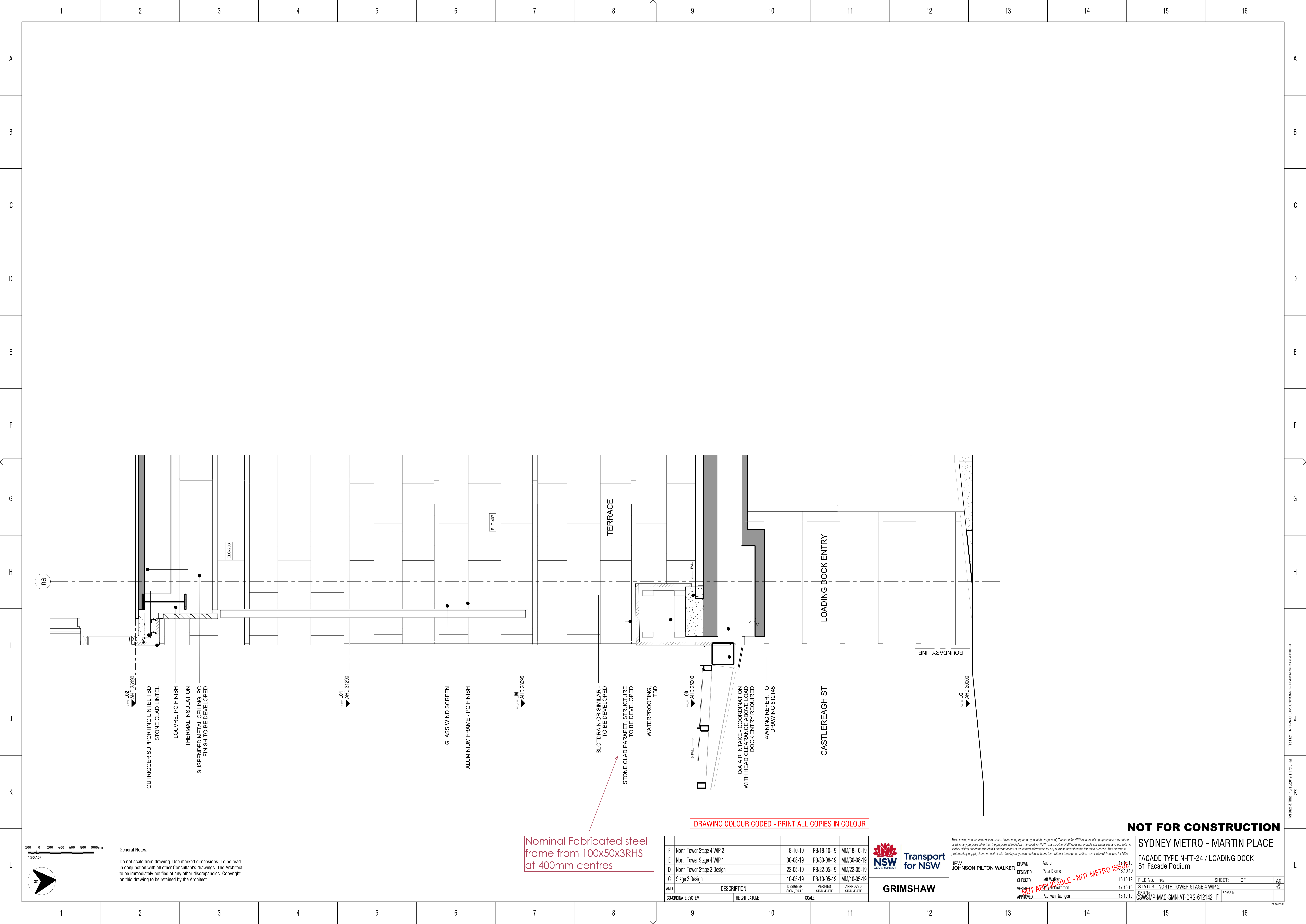


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APPROVED	Paul van Ratingen	18.10.19	

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SYDNEY METRO - MARTIN PLACE			
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61 Facade Podium			
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Nominal Fabricated steel frame from 100x50x3RHS at 400mm centres

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D	North Tower Stage 3 Design	22-05-19	PB/22-05-19	MM/22-05-19
C	Stage 3 Design	10-05-19	PB/10-05-19	MM/10-05-19
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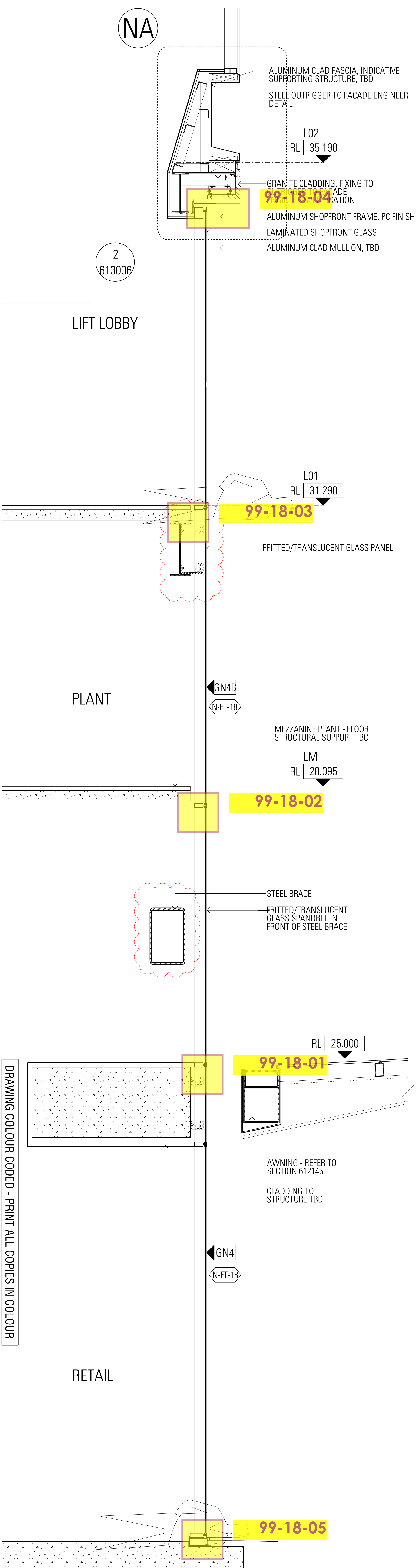
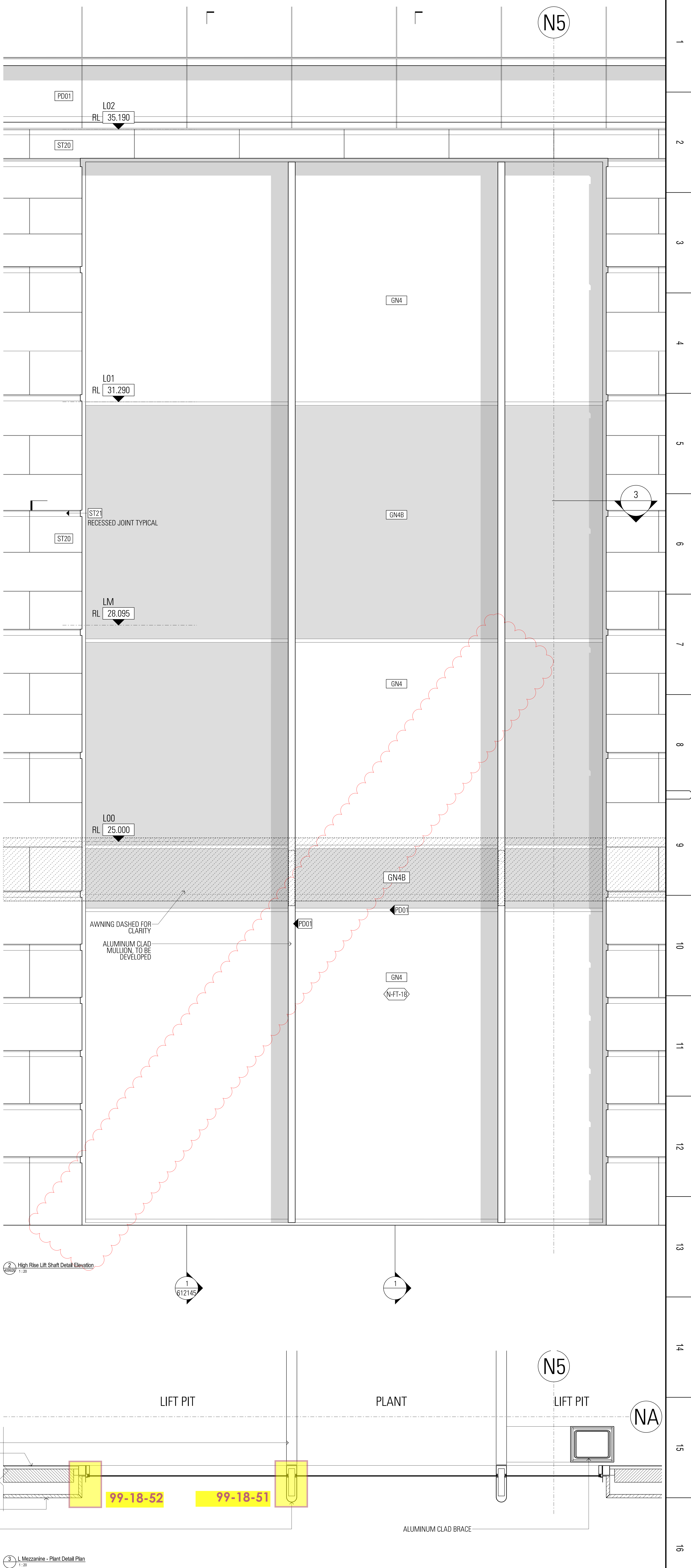
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CHECKED	Jeff Walker	16.10.19	16.10.19
VERIFIED	James Dickerson	17.10.19	17.10.19
APPROVED	Paul van Ratingen	18.10.19	18.10.19

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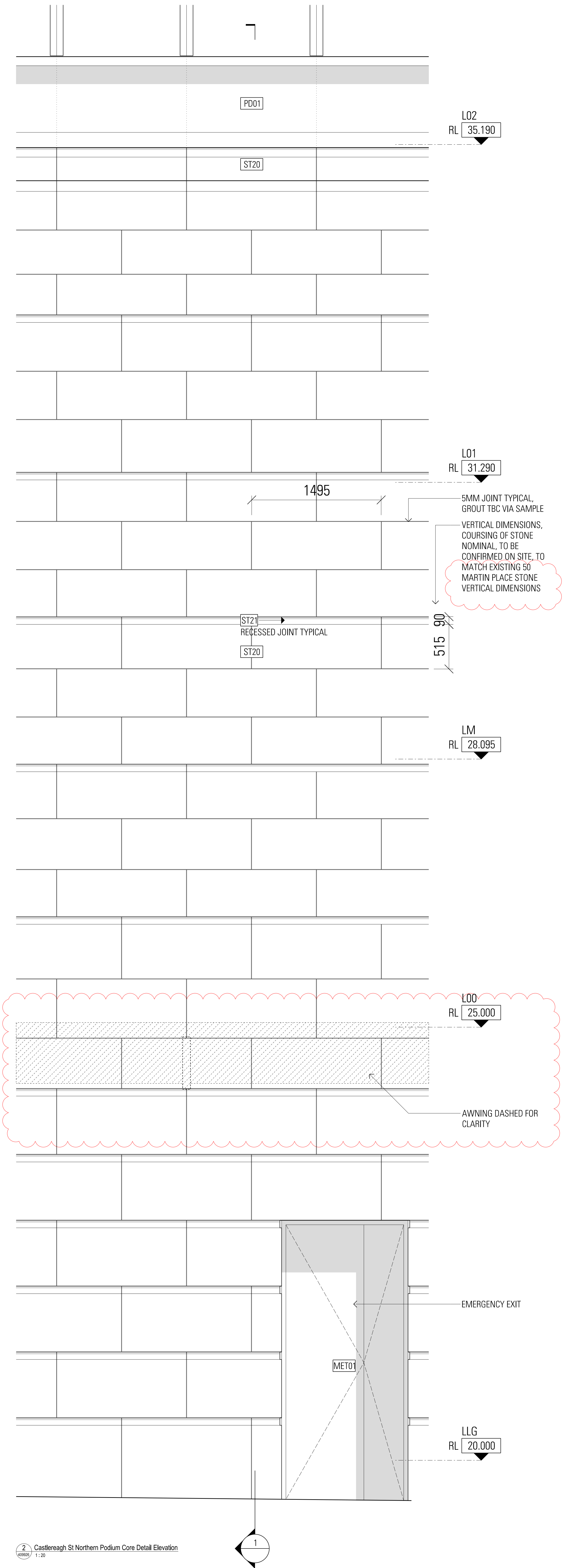
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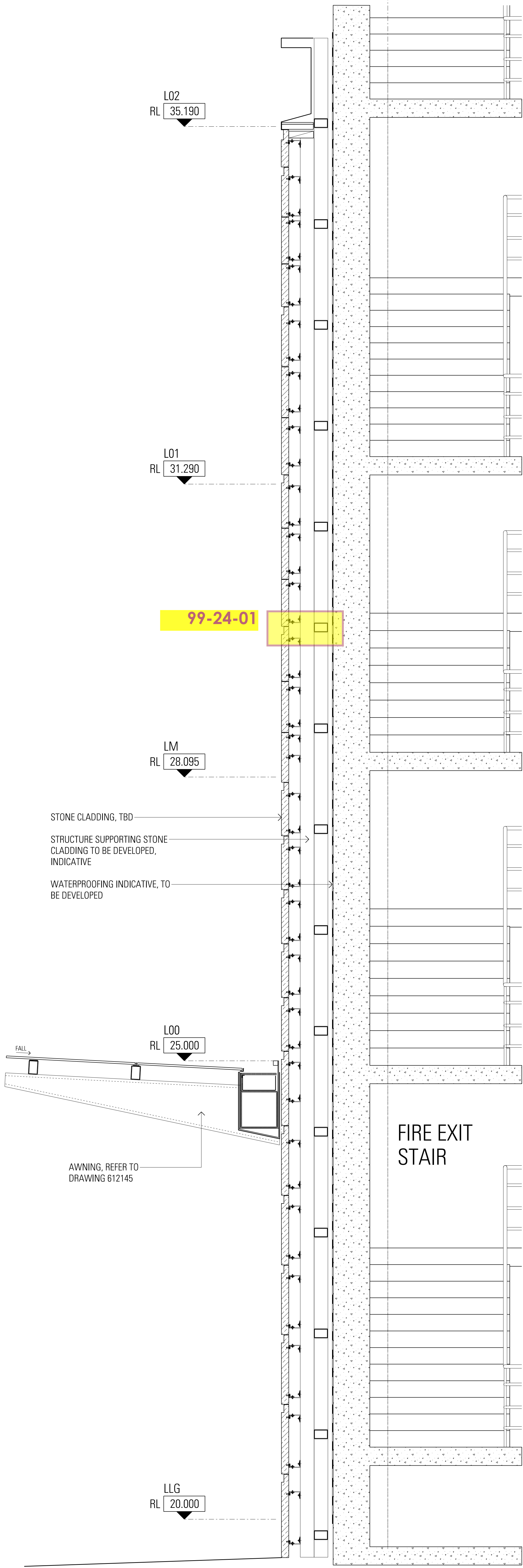
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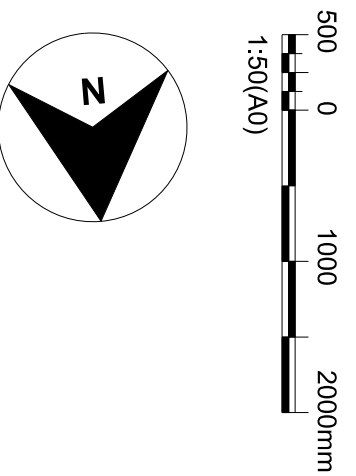
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2 Castlereagh St Northern Podium Core Detail Elevation



1 Castlereagh St Northern Podium Core Detail Section, Looking North



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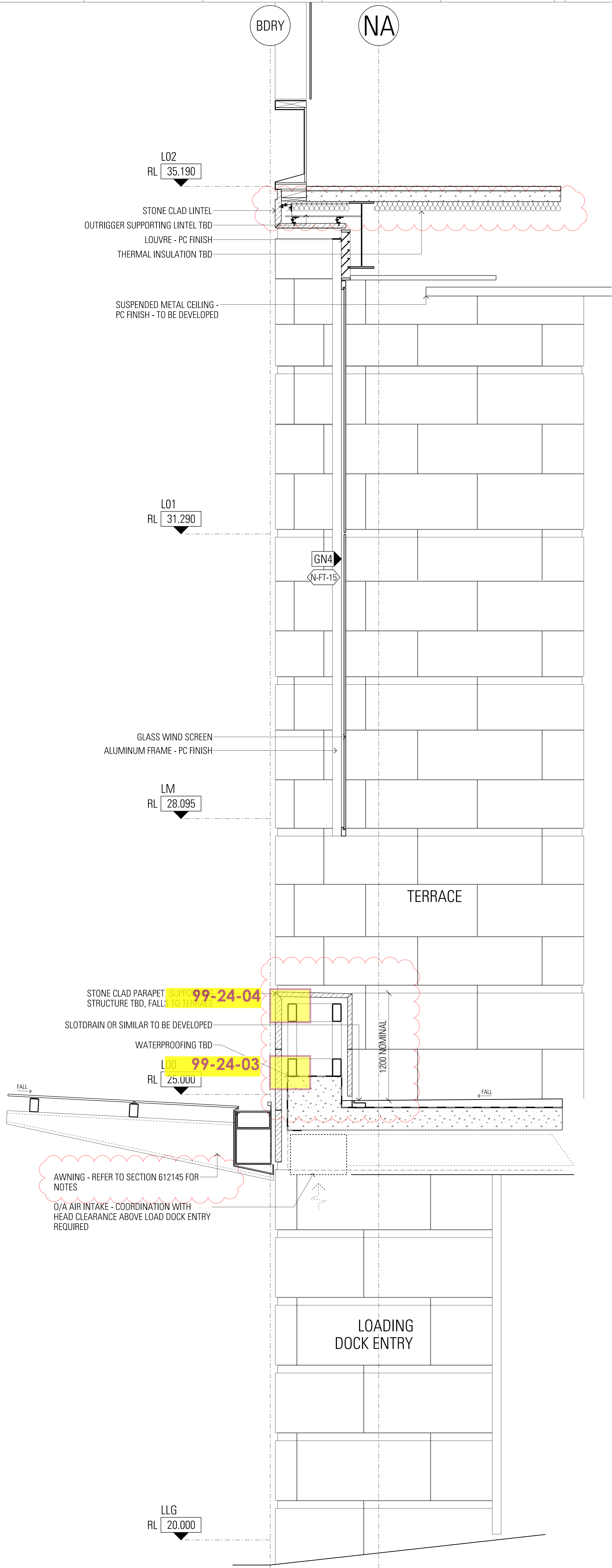
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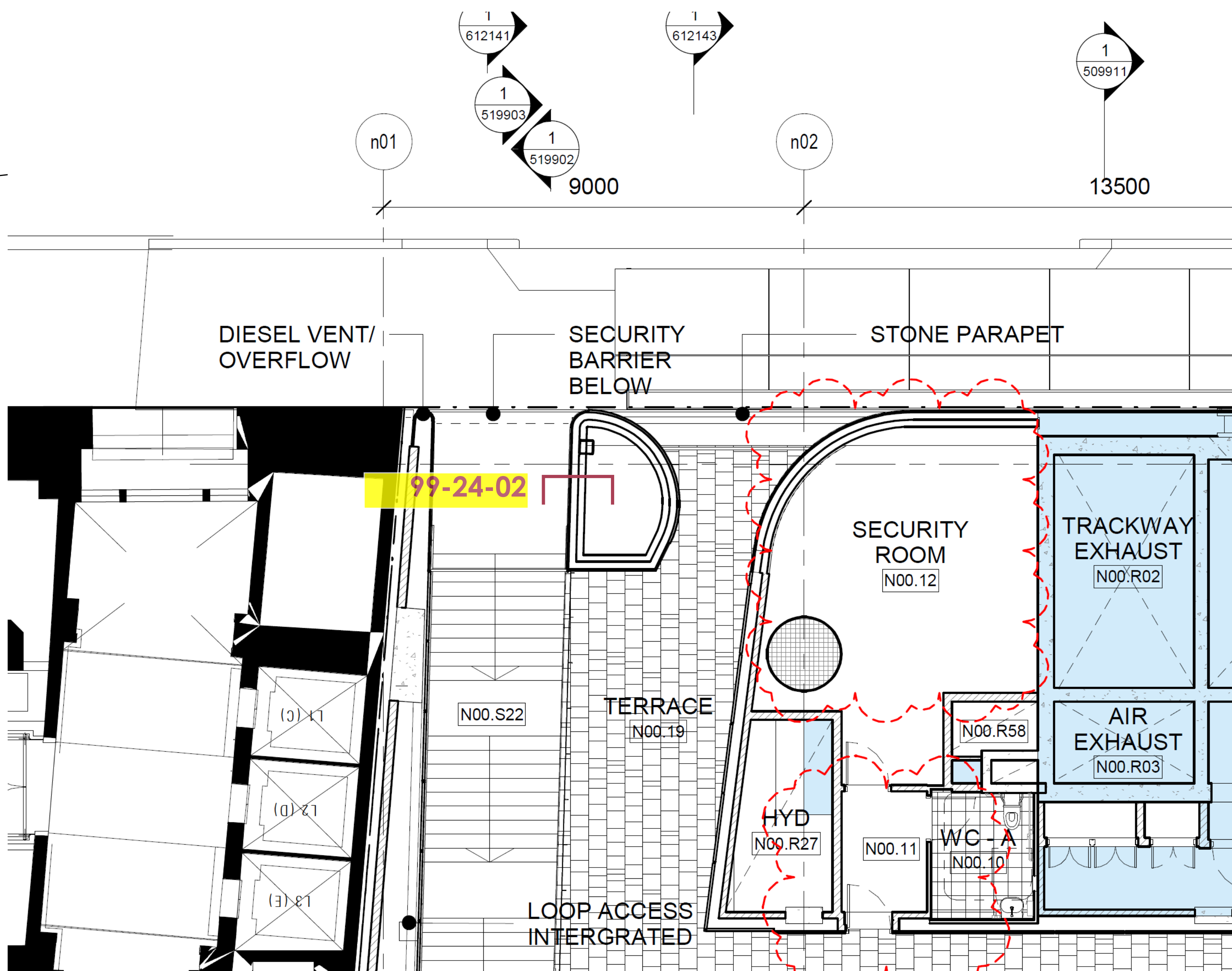
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DWG CHECK	DATE	
APPROVED BY	DATE	

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61 Facade			
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1 Loading Dock Detail Section Looking North
1:20



Refer to Drawing: CSWSMP-MAC-SMN-AT-DRG-300000

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SYDNEY METRO - MARTIN PLACE

LOADING DOCK - NORTH SECTION

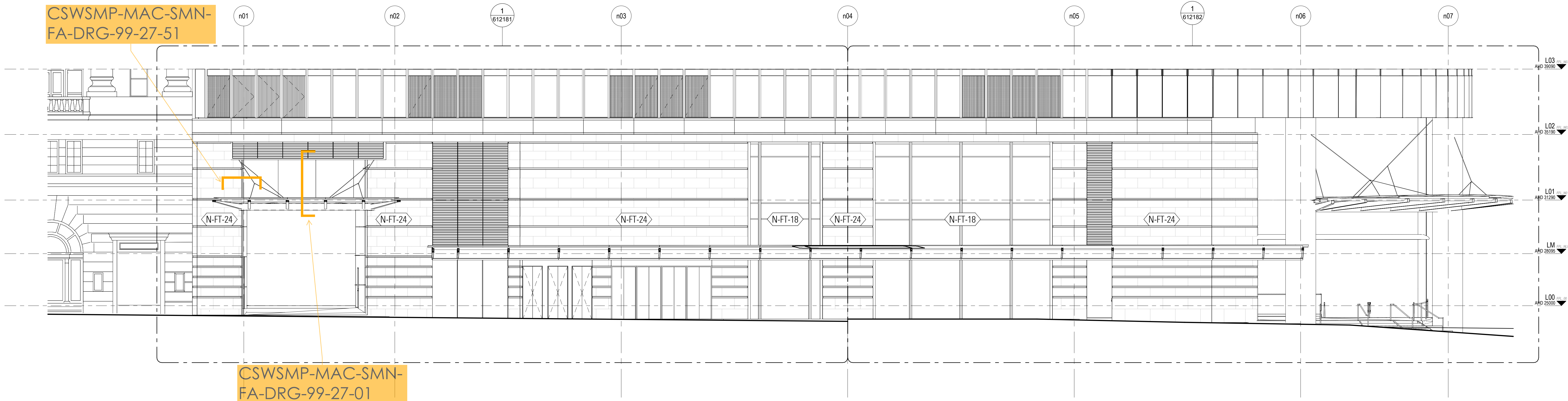
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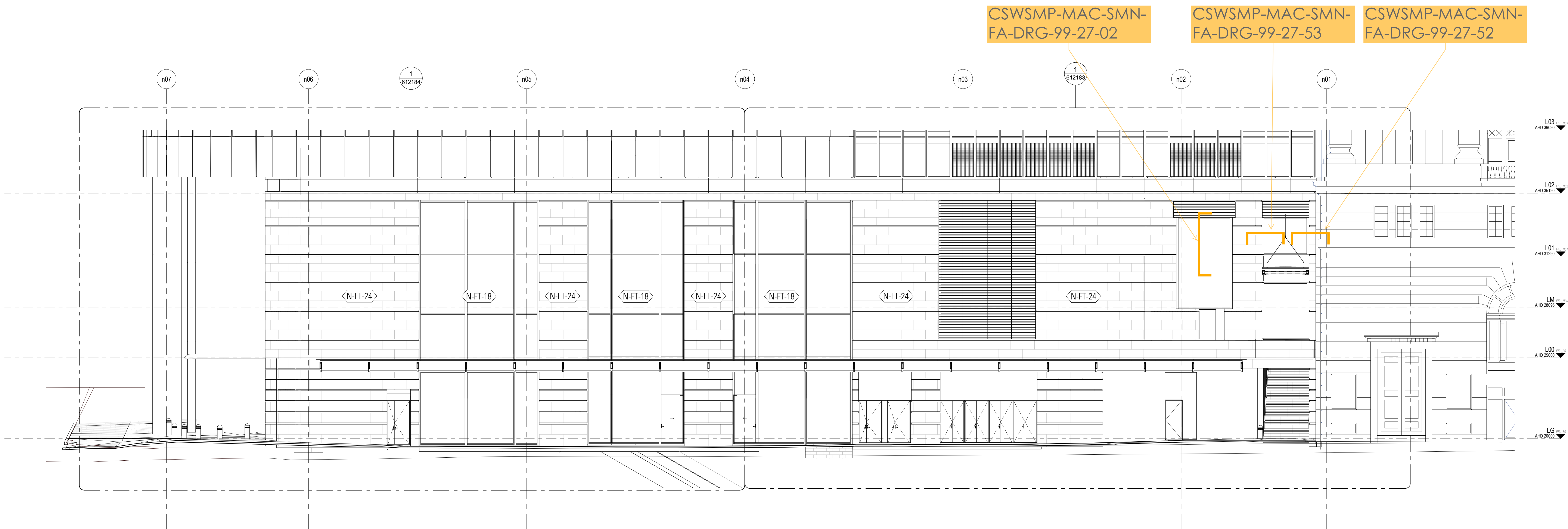
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1 Elizabeth Street Detail Elevation L00 - 03
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2 Castlereagh Street Detail Elevation LG - 03
1:100

REFER TO SURFACE DESIGN DOCUMENTS FOR STONE CLADDING TYPICAL DETAILS:		
N-FT-24 TYPICAL STONE CLADDING	CSWSMP-MAC-SMN-FA-DRG-99-24-01	
N-FT-24 FALSE COLUMN CLADDING	CSWSMP-MAC-SMN-FA-DRG-99-24-02	
N-FT-24 STONE CLAD PARAPET - HOBB DETAIL	CSWSMP-MAC-SMN-FA-DRG-99-24-03	
N-FT-24 STONE CLAD PARAPET - CORNER DETAIL	CSWSMP-MAC-SMN-FA-DRG-99-24-04	
SURFACE DESIGN DOCUMENTS FOR STONE CLADDING TYPICAL DETAILS:		
N-FT-15 - Hunter Street Glazed Screen	CSWSMP-MAC-SMN-FA-DRG-99-15-01 and 02	
N-FT-18 - Retail Exterior Glazing	CSWSMP-MAC-SMN-FA-DRG-99-18-01 to 05	
N-FT-19 - Lobby Glazing	CSWSMP-MAC-SMN-FA-DRG-99-19-01 and 02	
N-FT-23 - Lift Lobby Internal Glazing	CSWSMP-MAC-SMN-FA-DRG-99-23-01 to 04	
N-FT-24 - Granite Stone Cladding	CSWSMP-MAC-SMN-FA-DRG-99-24-01 to 04	
N-FT-25 - Awnings	CSWSMP-MAC-SMN-FA-DRG-99-25-01	

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SYDNEY METRO - MARTIN PLACE

FAÇADE TYPE N-FT-17 / GRANITE CLADDING -

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STATUS: NORTH TOWER STAGE 4 DESIGN

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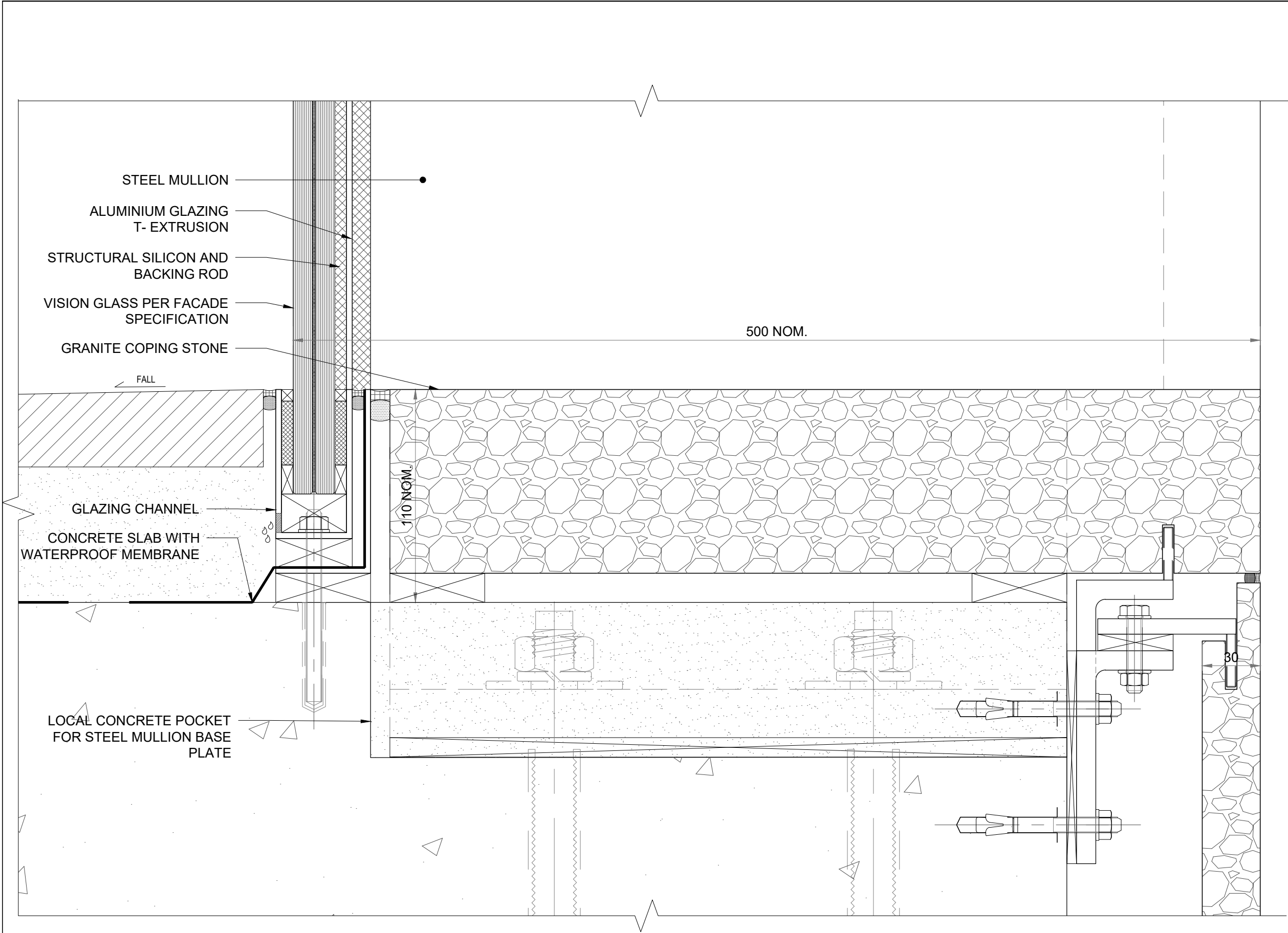
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DESIGNED Author
CHECKED Peter Blome
VERIFIED Wayne Dickson
APPROVED Paul van Ratingen

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1	09/08/2019	FOR DISCUSSION	TZ	RM	
0	07/08/2019	FOR DISCUSSION	TZ	RM	
Rev	Date	Revision Details	Drn	Ver	App

Surface Design

ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 E: Info@surfacedesign.com.au

Architect:
GRIMSHAW
JPW
JOHNSON PILTON WALKER

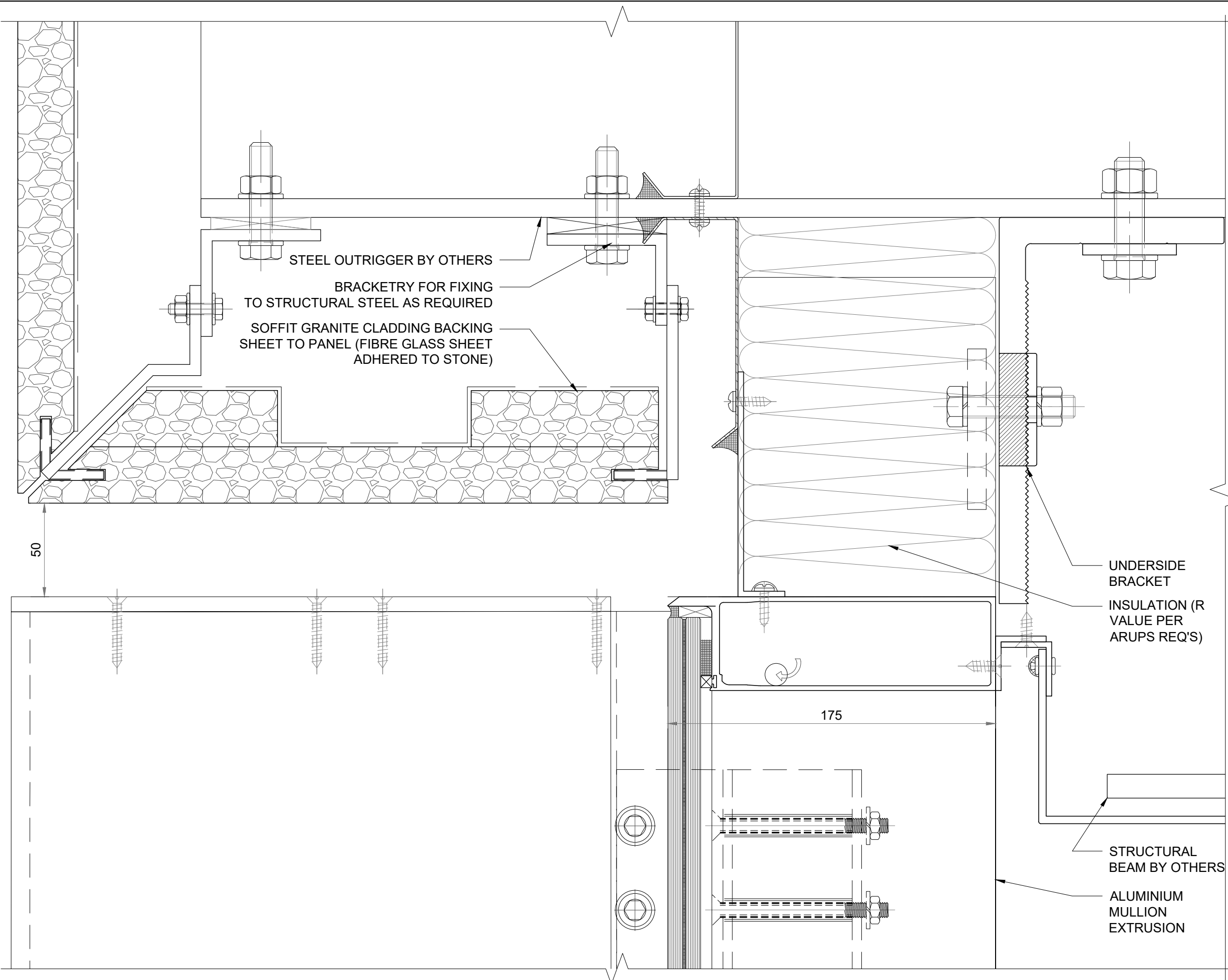


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SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

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01 VERTICAL SECTION
— TYPICAL SILL DETAIL



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Surface Design
ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 E: info@surfacedesign.com.au

Architect:
GRIMSHAW
JPW
JOHNSON PILTON WALKER

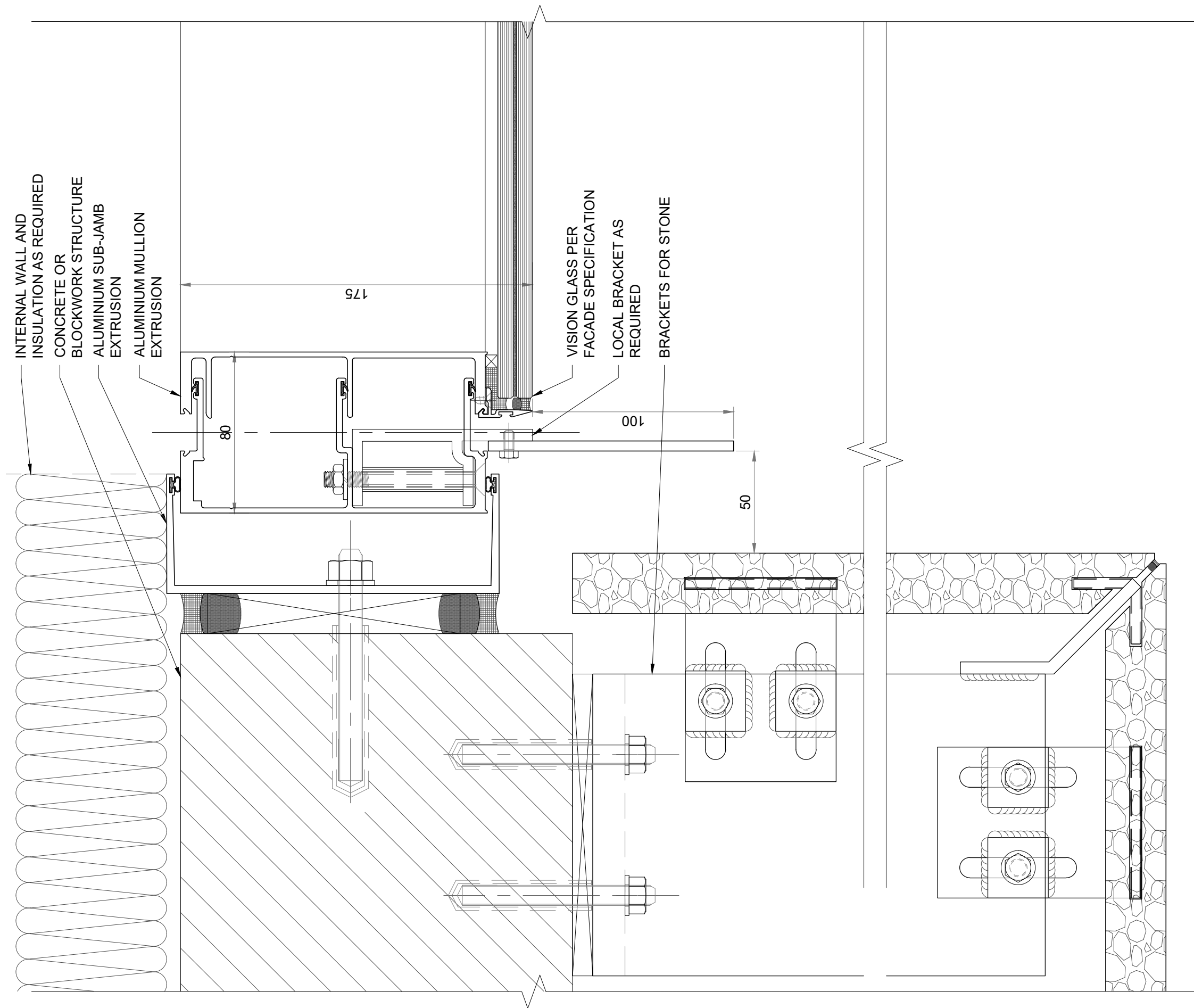


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SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

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01 VERTICAL SECTION
— HEAD DETAIL



01 HORIZONTAL SECTION
— MULLION TO END WALL

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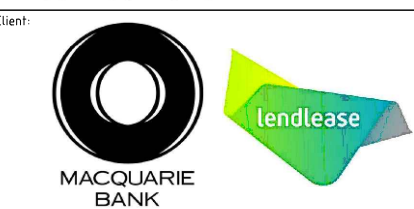
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Surface Design

ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 E: info@surfacedesign.com.au

Architect:
GRIMSHAW
JPW
JOHNSON PILTON WALKER



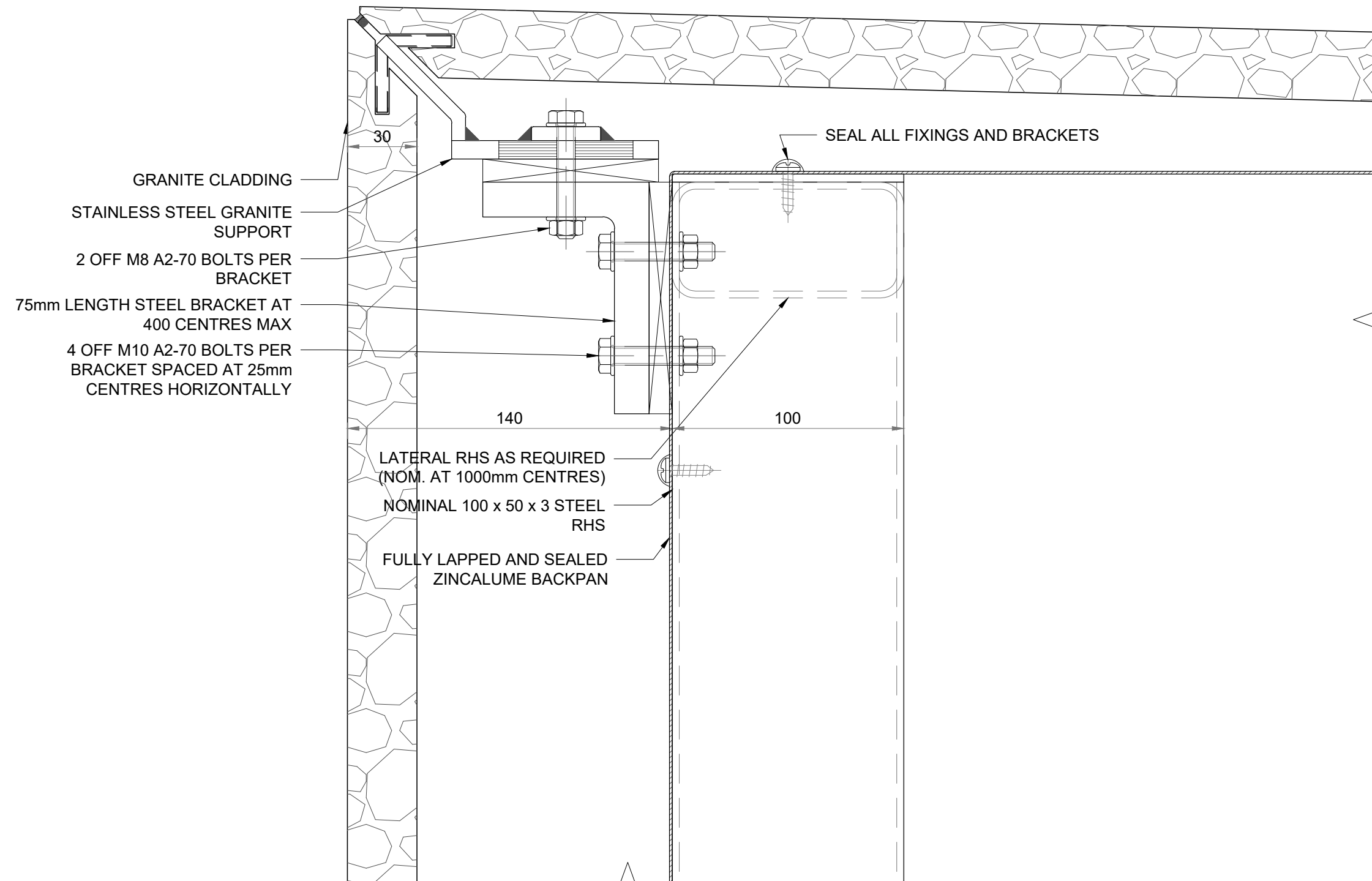
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SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

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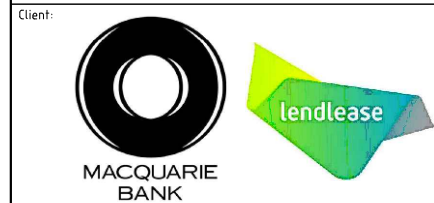
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Surface Design

ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 E: info@surfacedesign.com.au

Architect:
GRIMSHAW
JPW
JOHNSON PILTON WALKER

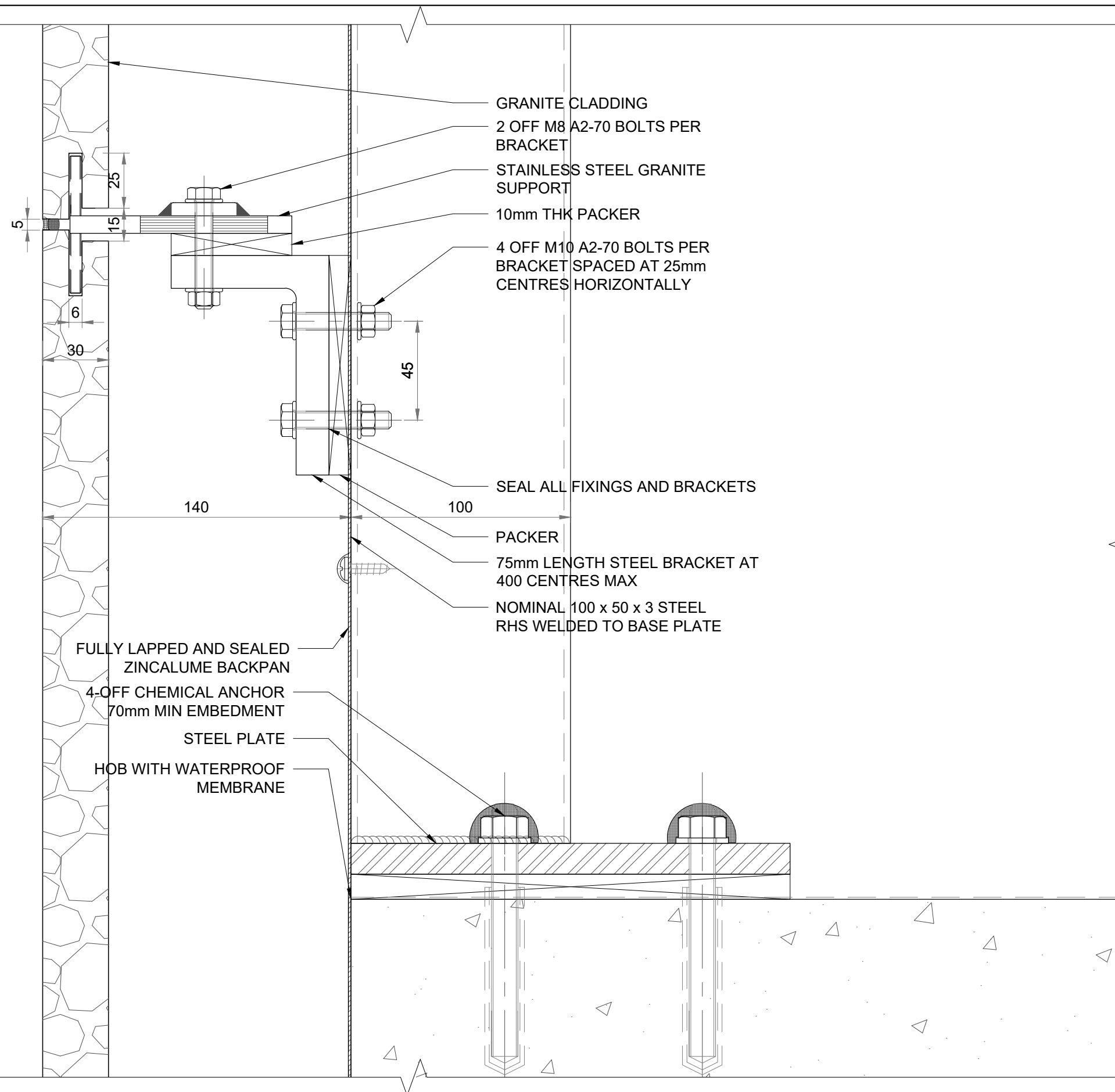


Project:
SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

Drawing Title:
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STONE CLAD PARAPET
CORNER DETAIL

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01 VERTICAL SECTION
— STONE CLAD PARAPET - CORNER DETAIL



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0	15/07/2019	FOR DISCUSSION	TZ	RM	
Rev	Date	Revision Details	Drn	Ver.	App.

Surface Design

ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 **E:** Info@surfacedesign.com.au

Architect:

GRIMSHAW

JPW
JOHNSON PILTON WALKER

Client:



Project:

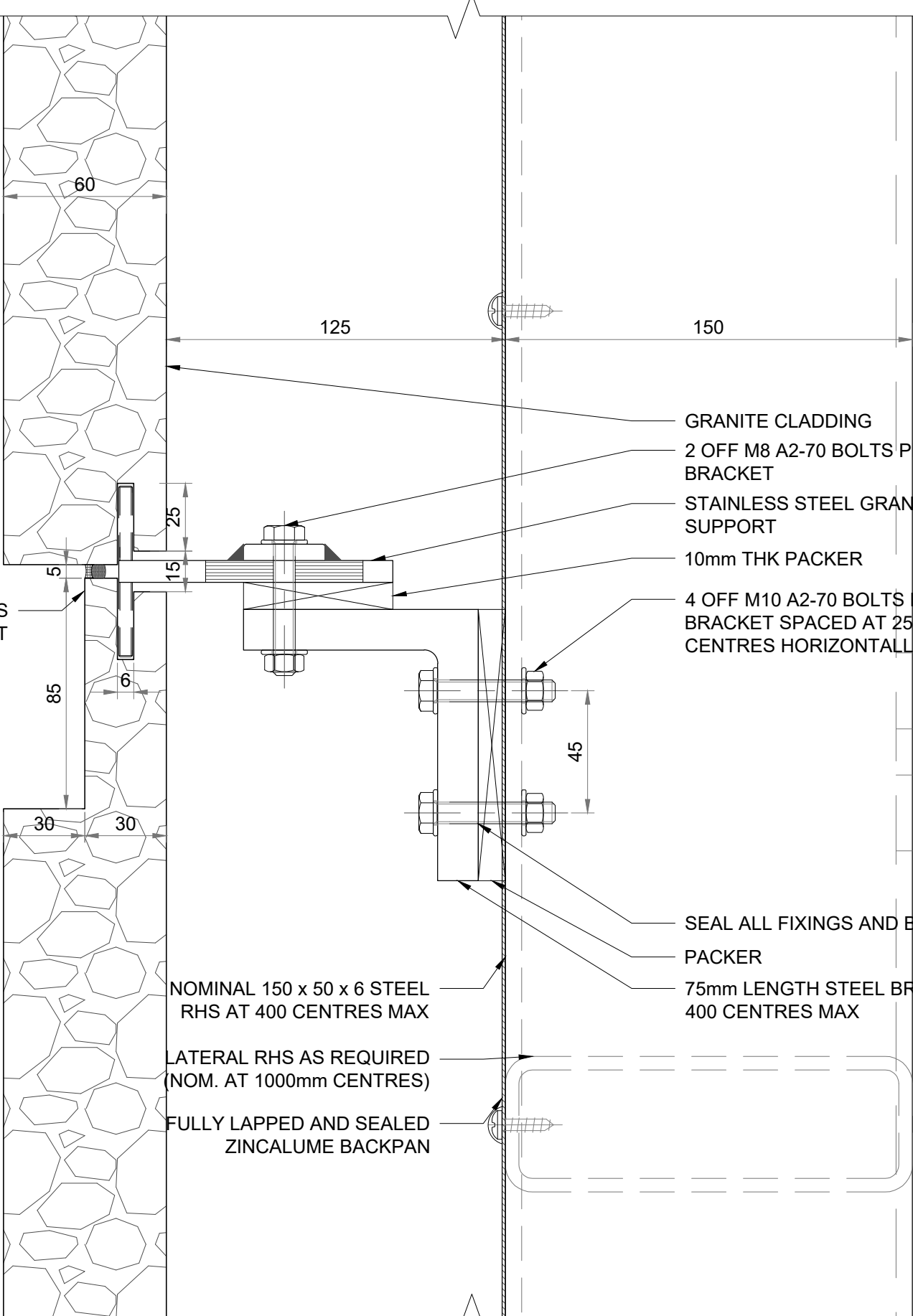
SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

Drawing Title:

N-FT-24
STONE CLAD PARAPET
HOB DETAIL

Drawn TZ	Signed	Date	Verified RM	Signed	Date
Designed RM	Signed	Date	Approved	Signed	Date
Project No.				Scale:	Sheet Size:
17032				1:2	A3
Drawing No.					Rev
CSWSMP-MAC-SMN-FA-DRG-99-24-03					4

JOINT AND REBATE SIZE AS PER JPW'S REQUIREMENT



01 VERTICAL SECTION
— FALSE COLUMN CLADDING

NOTES:
1. REFER TO FACADE
PERFORMANCE SPECIFICATION
FOR ALL TECHNICAL
REQUIREMENTS

FOR
INFORMATION
NOT FOR CONSTRUCTION

4	18/02/2020	STAGE 4 DESIGN SUBMISSION	TZ	RM	
3	03/02/2020	STAGE 4 DESIGN 75% SUBMISSION	TZ	RM	
2	30/08/2019	FOR DISCUSSION	TZ	RM	
1	09/08/2019	FOR DISCUSSION	TZ	RM	
0	15/07/2019	FOR DISCUSSION	TZ	RM	
Rev	Date	Revision Details	Drn	Ver.	App.

Surface Design

ABN 19 570 343 498
68 York Street, Sydney
New South Wales 2000 Australia
T: +61 2 9249 1400 E: info@surfacedesign.com.au

Architect:
GRIMSHAW
JPW
JOHNSON PILTON WALKER



Project:
SYDNEY METRO MARTIN PLACE
OSD
NORTH TOWER

Drawing Title:
N-FT-24
FALSE COLUMN CLADDING

Drawn	Signed	Date	Verified	Signed	Date
TZ			RM		
Designed	Signed	Date	Approved	Signed	Date
RM					
Project No.	17032	Scale:	1:2	Sheet Size:	A3

Drawing No. CSWSMP-MAC-SMN-FA-DRG-99-24-02
Rev. 4

20 10 0 10 20 30 40 50 100mm

Appendix C

Appendix C – Deliverables and Samples Schedule

General Note: The following timings are maximum timeframes. The over-riding control in terms of submissions shall be The Principals approved construction programme.

Sub-Contractor deliverable	Expected delivery
Programme for design, prototyping & procurement	Within 2 weeks of Contract award
Programme for site works	Within 4 weeks of Contract award
Work Method Statements	Within 4 weeks of Contract award
Test programme, including nomination of test laboratory for approval	Within 4 weeks of Contract award Indicative programme for testing. Within 10 weeks of visual prototype approval.
Contractor's drawing schedule	Within 2 weeks of Contract award
Contractor's drawings; Typical Details	Within 2 weeks of Contract award
Contractor's drawings; Concrete Inserts	4 weeks from Contract award date, or as advised by the Head Contractor
Contractor's drawings; full set	Progressively, in sufficient time to allow review / resubmission process
Calculations	Submit with shop drawings
Test reports	Within 2 weeks of successful test completion
Materials certification	Ongoing; 3 weeks prior to use of the material in Production and/or on the Site.
Sealant , grout and graffiti protection compatibility test results	6 weeks prior to installation on the Site
Draft Quality Assurance Manual	Within 4 weeks of Contract award
ITP for manufacturing	Within 4 weeks of Contract award
ITP for installation	6 weeks prior to commencement of installation of the Works
As Built drawings	4 weeks prior to completion of installation of the Works
Maintenance Manual	4 weeks prior to completion of installation of the Works
Deeds of Warranty	4 weeks prior to completion of installation of the Works
Engineering Certification	4 weeks prior to completion of installation of the Works
Samples	Expected delivery
Stone	300 x 300mm samples prior to award of contract.
Aluminium extrusions; 300mm lengths with applied finish	6 weeks prior to commencement of fabrication
Cladding (stone)	6 weeks prior to commencement of fabrication
Material data sheets	8 weeks prior to ordering
Solid aluminium sheet product	8 weeks prior to placement of material order
Material samples (cast ins, fixings, gaskets, sealants, etc)	8 weeks prior to commencement of production
Visual prototypes	Allow sufficient time for inspection and rectification of visual prototype to an agreed standard prior to full scale manufacture and installation.

Appendix D

Appendix D – Green Star Strategy

MARTIN PLACE METRO OVER STATION DEVELOPMENT

GREEN STAR STRATEGY



Document History

Prepared by	Peter Zacharia
Approved by	Daniel Grunbaum
Project Manager	Peter Kazaglis
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Issue	Addendum	Revision	Date
01		Draft for review	15.01.2019
02		Second draft revision	23.01.2019
03		Incorporated Arup feedback	15.02.2019
04		Updated Issue	07.05.2019

Technical Enquiries		General Enquiries	
Name	Eunice Lee	Name	Peter Kazaglis
Position	Environmental Design Consultant	Position	Senior Project Manager
Phone	0444 570 475	Phone	0414 085 559
Email	Eunice.Lee@lendlease.com	Email	Peter.Kazaglis@lendlease.com



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1.0 Introduction

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

This document is intended to:

- Communicate the Green Star risk position to the project teams
- Provide examples of general specification clauses to be included in the contract documentation and the relevant trades.

This document does not:

- Present specific design responses to achieve the targeted credits and rating.
- Contain an exhaustive list of specification clauses specific to each discipline.
- Serve as a contract document to be included in Subcontractor tender packages

While the sustainability consultant is available to provide guidance to the design team, it is the responsible consultants role to ensure design documentation is consistent with the targeted credit requirements. This includes both design intent and contractual requirements to be undertaken by sub-contractors.

2.0 Green Star Strategy

2.1 Rating tool

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

Design & As-Built was released in 2015 and is a single rating tool for all building typologies, replacing building specific legacy tools such as Office, Retail Centre, Multi Unit Residential etc. In general, this tool is less prescriptive than previous tools, putting more onus on the project team to demonstrate how the design delivers the targeted outcome in operation.

2.2 Risk Assessment

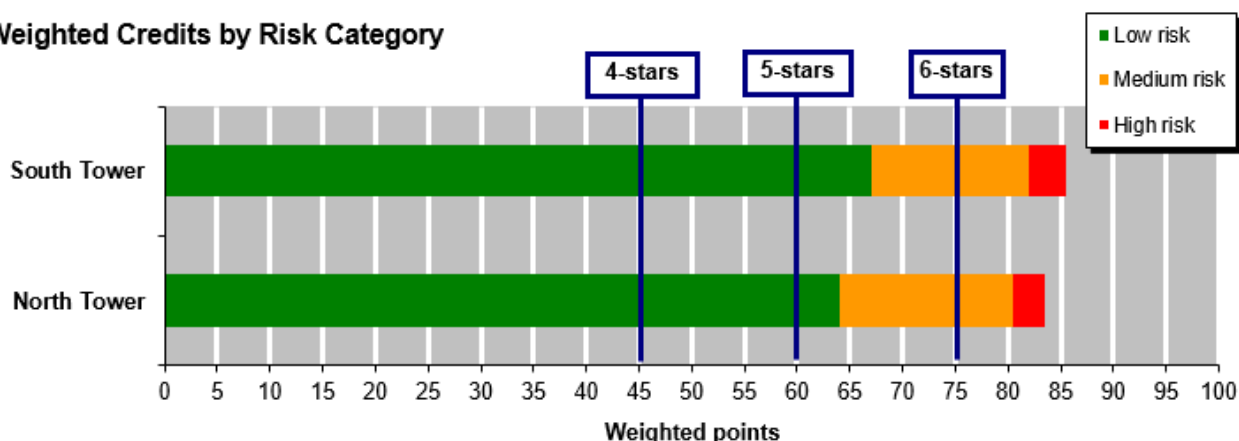
2.2.1 Risk category credit summary

Separate Green Star pathway documents identify targeted Green Star credits for each building. Credits are classified into risk categories as follows:

- **Low Risk:** credits are likely to be achieved as standard practice, or easily incorporated
- **Medium risk:** Credit likely to be achieved, however subject to design development, delivery risk or agreement with Green Building Council
- **High Risk:** Significant delivery risk or may require changes to design intent or delivery methodology

The chart below indicates the total targeted points and the credits by risk category for each building. Risks associated with each credit will change as the project develops so the latest Green Star pathway document should be referred to for each building.

Weighted Credits by Risk Category

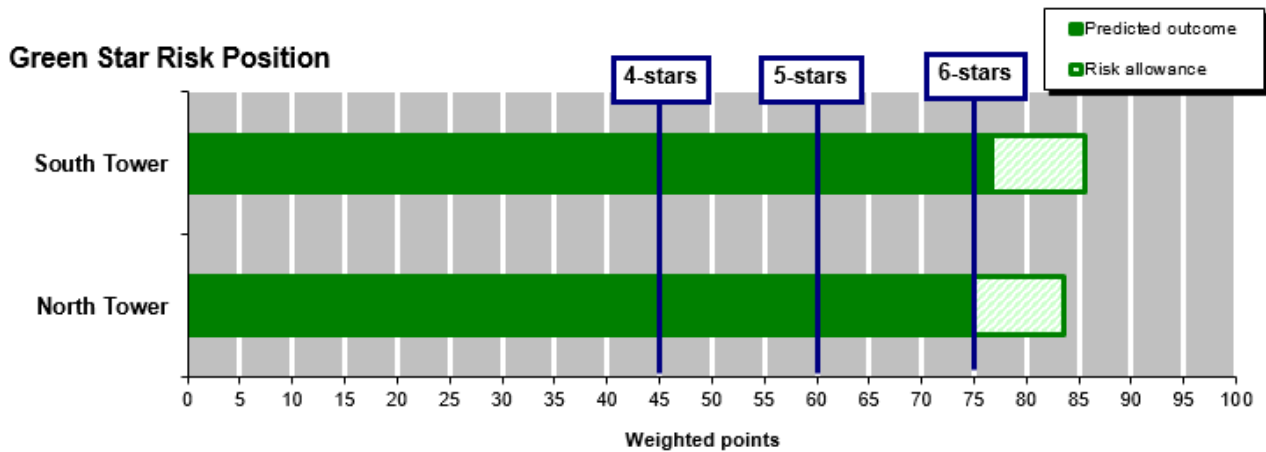


To ensure that an adequate contingency is allowed to enable the rating to be achieved at completion of the project, each of the risk categories presented above carries a risk weighting as follows:

- 95% of Low Risk credits are assumed to be achieved
- 75% of Medium Risk credits are assumed to be achieved
- 50% of High Risk credits are assumed to be achieved



The risk weighted position (i.e. the target points minus the risk allowance) needs to be in excess of the required credits in order to provide confidence that the rating will be achieved. As seen in the following chart, both buildings are in a solid position to commit to a 6 Star rating.



For more information on the points targeted including responsibilities and latest risk please refer to the respective tower's Green Star pathway document.

3.0 Specification Clauses

The section following includes suggested clauses to be incorporated in specifications as per the responsibilities noted in the credit titles. These clauses are for general requirements and do not cover design responses to the Green Star strategy which are discipline specific.

For example; there are no sample clauses relating to lighting design levels or mechanical supply air rates as these are to be determined by the relevant design team and incorporated into the design and contract documentation as appropriate.

Text in red provides comments/advice only and is not to be directly copied into specifications.

Where text appears under the green headings in black text it can be copied into an appropriate section of the specification. Please note that while text can be copied in some instances, responsibility of ensuring design compliance remains with the relevant consultant. For example, the architect selecting material and finishes selections needs to ensure that compliance documentation is available for the scheduled products in accordance with the specification requirements.

3.1 General (All Trades)

Both commercial office towers being delivered as the OSD as part of Martin Place Metro are targeting a 6 Star rating under the Design & As-Built v1.1 rating tool.

The Subcontractor will be an active contributor to the project team's commitment to achieve this rating. In addition to the specific design and delivery requirements noted elsewhere within this document, the Subcontractor is required to:

- Adhere to the requirements of the project Environmental Management Plan Health and Safety plan and ISO14001.
- Adhere to the requirements of the Waste Management Plan, including the re-use and/or recycling of a minimum of 90% of all construction and demolition waste generated on site and thus achieving a minimum 90% reduction of waste to landfill.
- Gain approval from the design team where the Subcontractor alters the design and/or equipment specified. These changes may require additional works by the design team, the cost of which will be incurred by the Subcontractor. Any changes cannot affect the ESD performance criteria for the project and must meet all ESD requirements.
- Submit all documentation, information, data and drawings necessary to support the Green Star submission.

3.2 Commissioning & Tuning

2.1 Services and Maintainability Review (Mech, BMCS, Elec, Hydr, Fire, VT)

The project team must demonstrate that a comprehensive services and maintainability review has been conducted with the results summarised in a 'Service and Maintainability Report'. While this is led by the Independent Commissioning Agent (ICA) with support and input from the design team, subcontractors will be required to review and provide input as necessary and requested by the ICA. The scope of the review must address the following aspects of the building systems:

- Commissionability
- Controllability
- Maintainability
- Operability
- Safety

The 'Service and Maintainability Report' must be agreed and signed off by all involved parties including sub-contractors.

2.2 Building Commissioning (Mech, BMCS, Elec, Hydr, Fire, VT)

The specification must list the commissioning requirements for each system. It is not sufficient to state that the systems must be commissioned to the relevant standard; instead the documentation must:

- List the design parameters for each system;
- List the required commissioning activities;
- Define how each system is intended to operate; and
- List the acceptable tolerances during commissioning

The specification must clearly indicate divisions of responsibilities, pre-commissioning procedures, commissioning requirements, witnessing requirements, phased completion requirements (if needed), post occupancy checks, and any training requirements for the operator. Where these are documented within a separate project commissioning plan, the specification should detail how the Subcontractor must comply with the plan.

2.3 Building Systems Tuning (Mech, BMCS, Elec, Hydr)

The subcontractor is required to participate in building tuning, which includes quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties.

The building tuning process will require the analysis of data from the monitoring systems and assessment of feedback from occupants on building conditions.

Building tuning generally involves:

- Verification that nominated systems are performing to their design potential at full and part load conditions;
- Reviews of environmental performance against the targets;
- Collection of user feedback to match the system performance with the occupant's needs;
- Adjustments of all the systems to account for all deficiencies discovered; and
- Management, communication, and assignment of responsibilities for the tuning process within the team

3.3 Building Information

4.1 Building Operations and Maintenance Information (Mech, BMCS, Elec, Hydr, Fire, VT~~All Services, Facade~~)

The project team must demonstrate that comprehensive building operation and maintenance information is available to the facilities management team in accordance with the following requirements.

Operations and Maintenance manuals are provided for all nominated building systems and include the following sections:

- A summary sheet of relevant building service contacts;
- System-level information for nominated building systems;
- Introduction and scope, including physical and functional descriptions;

- Operating parameters and procedures;
- Preventive maintenance requirements, including procedures and schedules;
- Corrective maintenance requirements, including repair requirements;
- Service contacts, and any warranties and certificates;
- As-built drawings for all nominated services ~~(Mech~~ incorporating at least:
 - Mechanical, electrical and hydraulic drawings and schematics covering all associated nominated building systems;
 - Architectural, façade/building envelope drawings; and
 - Architectural layout of base building.

All Operations and Maintenance manuals will be structured at a minimum to include the sections outlined above, and delivered as a single document including bookmarks and/or hyperlinks to allow for easy navigation of the manual, or should the manual and associated drawings be excessive large, be delivered within a succinct folder structure, bookmarked and hyperlinked to allow of easy navigation.

3.4 Indoor Pollutants

13.1.1 Paints, Adhesives & Sealants (Arch, Mech, Elec, Hydr, Fire, VT, Façade, Struct)

Total Volatile Organic Compounds (TVOCs) are to be in conformance with the limits set out in the table below. TVOC values must reflect the final ready to use product (in the case of paints, inclusive of tints) and made in grams of VOC per litre (g/L) of ready to use product.

Product Category	Max TVOC content in grams per litre (g/L) of ready to use product
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

The following test methods are relevant to paints:

- ISO Method 17895 (2005), for a material with a presumed VOC content <1%
- ISO Method 11890-2 (2006), for a material with a presumed VOC content <15%
- ISO Method 11890-1 (2007), for a material with a presumed VOC content >15%
- ASTM D3960, which is comprised of four individual testing procedures that measures TVOC (D2369) as well as density (D1475) and water content (D4017). Exempt compounds (D4457) must not be subtracted in the calculation of VOC contents.

The testing method for adhesives and sealants is the ASTM D3960 as detailed for paints.

The Subcontractor is required to provide a TVOC datasheet for all paints, adhesives and sealants to be applied internally on site for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports confirming the quantities and volume of each product used.

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities of each product type used.

13.1.2 Carpets (Arch)

There are two methods for demonstrating that a carpet complies. A combination of methods can be used to demonstrate compliance.

A. Product certification

The product is certified under a recognized Product Certification Scheme (listed on the GBCA website) or other recognised standards.

The certificate must be current at the time of product registration or submission and list the relevant product name and model.

Please refer to <http://www.gbca.org.au/green-star/technical-support/materials-category/product-certification-schemes/2933.htm> for a list of recognised schemes.

B. Laboratory Testing

The product complies with the TVOC limits specified in the table below.

Test Protocol	Limit
ASTM D5116 – Total VOC limit	0.5 mg/m ² per hour
ASTM D5116 – 4-PC (4-Phenylcyclohexene)	0.05 mg/m ² per hour
ISO 16000 / EN 13419 – TVOC at three days	0.5 mg/m ² per hour
ISO 10580 / ISO/TC 219 (Document N238) – TVOC at 24 hours	0.5 mg/m ² per hour

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities of each product type used and providing evidence of compliance.

13.2 Engineered Wood Products (Arch, Mech, Elec, Hydr, VT)

Engineered wood products include particleboard, plywood, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels. Timber veneers are excluded. The following applications of engineered wood products are excluded from this credit:

- Temporary uses of composite timbers (i.e. formwork)
- Composite timbers not used in indoor applications (i.e. car parks)
- Non-engineered wood products such as milled timber

All engineered wood products used in the building must meet the relevant limits specified in the table below, as per the specified test protocol, or have product specific evidence that it contains no formaldehyde.

Test Protocol	Emission limit
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤ 1 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	≤ 1 mg/L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) – LVL	≤ 1 mg/L
JIS A 5908:2003 – Particle Board and Plywood, with use of testing procedure JIS A 1460	≤ 1 mg/L
JIS A 5905:2003 – MDF, with use of testing procedure JIS A 1460	≤ 1 mg/L
JIS A 1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminated)	≤ 0.1 mg/m ² hr
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤ 0.1 mg/m ² hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤ 0.1 mg/m ² hr (at 3 days)
ASTM D6007 *	≤ 0.12 mg/m ³
ASTM E1333 **	≤ 0.12 mg/m ³
EN 717-1 (also known as DIN EN 717-1)	≤ 0.12 mg/m ³
EN 717-2 (also known as DIN EN 717-2)	≤ 3.5 mg/m ² hr
<p>* The test report must confirm that the conditions of Table 3 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.</p> <p>** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.</p>	

The Subcontractor is required to provide an emissions limit datasheet for engineered timber products to be applied internally on site for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports confirming the quantities and volume of each product used.

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and compliant products have been used, and generate a report summarising the quantities of each product type used.

3.5 Water

18A Potable Water (Hydr, Arch)

Martin Place Metro OSD has committed to the potable water consumption reduction performance pathway. The Compliance Requirements and guidance for the Performance Pathway are detailed in the Green Star Potable Water Calculator Guide. Required points are achieved through specified fixture and fitting efficiencies, as detailed below:

- Hand Basin Taps – 6 Star WELS
- Toilet – Dual Flush 4 Star WELS
- Urinals – Waterless or 6 Star WELS
- Showers – 3 Star WELS (6 L/min)

Other initiatives that are to contribute to low potable water consumption includes:

- Fire system test water is to be captured and re-used on site
- Rainwater capture and re-use on site
- Condensate capture and reuse on site
- No water or non-potable water used for irrigation
- Native plants used for any landscaping

3.6 Responsible Building Materials

20.1 Structural and Reinforcing Steel (Struct)

All structural and reinforcing steel used in the buildings structure must be sourced from a responsible steel maker. The steel manufacturer or maker must demonstrate compliance with the following initiatives:

- The steel making facilities where the steel for the project is being sourced must have a currently valid ISO 14001 Environmental Management System (EMS) in place. The Subcontractor is to provide valid ISO 14001 EMS certificates from the steel making facilities where the structural and/or reinforcing steels in the project were produced.
- The steel maker supplying the steel is a member of the World Steel Association's (WSA) Climate Action Program (CAP). A current CAP certificate from the WSA confirming membership must be provided. Certificates are valid for a period of 2 years and must be current at the time that the Green Star documentation is submitted.

At least 60% (by mass) of all reinforcing bar and mesh shall be produced using energy-reducing processes in its manufacture (measured by average mass by steel maker annually). Energy reduction arising from energy-reducing processes must equate to at least 40 MJ/tonne, measured as a percentage of annual mass of reinforcing steel produced by the steel maker. Reinforcing steel products sourced from a steel maker using Polymer Injection Technology (PIT) in manufacturing their reinforcing products is an acceptable method of compliance.

The Subcontractor is required to provide the following documentation prior to commencement of works:

1. Steel manufacturer ISO 14001 certificate.
2. Evidence of membership to WSA's Climate Action Programme from the Steel Making facilities where the structural or reinforcing steel was produced.
3. Confirmation from the Supplier stating, where relevant based on the credit criteria claimed:
 - a. That they are a responsible steel maker, and listing their compliance documentation.

- b. The total quantities (by mass) of reinforcing steel supplied to the building.
 - c. That the steel meets or exceeds 500MPa strength grade.
4. Energy-Reducing Processes report from every reinforcing steel maker, explaining the energy reducing processes used in their steel making process and confirming that it is used in the production of at least 60% of the reinforcement products they produce on an annual basis. The report must contain a summary of the life cycle assessment result for this technology in accordance with the Protocol for Demonstrating Equivalency in Energy Reduction
 5. Confirmation and evidence of the chain of custody (location of supply, transport route and transport mode) associated with the sourcing, manufacture and fabrication of structural and reinforcing steel.

20.2 Timber Products (Mech, Elec, Hyd, VT, Arch, Façade, Struct)

Timber requirements apply to all applications within the project including, but not limited to:

- Formwork and other temporary installations (i.e. hoardings)
- Structural and non-structural timber including internal walls, floors and roof structures
- External and internal cladding
- Flooring, wall and ceiling finishes
- Internal and external joinery, windows, doors and other specialist uses of timber, such as installed furnishings or balustrades
- Furniture items made from timber or including timber components
- Engineered timber and composite wood products

All timber used on the project is to be sourced from a combination of the following:

- Sourced from forests that have been certified by forest certification schemes that meet the GBCA's 'Essential' criteria for forest certification. Currently this includes the FSC International and PEFC schemes. Please see <http://www.gbca.org.au/green-star/revised-timber-credit/2693.htm> for further information.
- Re-used timber

Where certified timber is used, it must be supplied in accordance with the Chain of Custody (CoC) rules of the respective certification scheme. Relevant CoC certificates and invoices including a relevant CoC code and/or serial number must be provided.

Where re-used timber is used a description must be provided demonstrating how this requirement is met and providing calculations (i.e. a breakdown of all components by area, length and mass). Where the actual cost of the item is known then the cost must be reported. Where the actual cost of reused items is not known, then the cost may be estimated on the basis of replacement cost (i.e. the cost of an equivalent new item).

If timber products are produced from 100% post-consumer recycled timber without any virgin timber content, then this can be deemed 're-used' timber. Third party verification, in the form of a signed statement, is required to confirm the percentage of post-consumer recycled content in such product(s) in order for them to be recognised as 'reused timber'. The third-party verification statement must be provided by an auditor registered by the Registrar Accreditation Board Quality Society of Australasia (RABQSA), or other equivalent national or international auditor accreditation system.

The subcontractor is required to provide evidence of compliance for all timber products used on the project for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports on all timber products used with the following details:

- Description of timber use/product

- Whether it is re-used, certified or uncertified timber
 - Where certified, provide name of certification scheme and CoC code or serial number
- Quantity of timber by area (m²), lineal metre (m), or number of items (no.)
- Cost of each timber item

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

20.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables (Arch, Mech, Elec, Hydr, BMCS, Fire, VT, Landscape)

All permanent formwork, pipes, flooring, blinds and cables must either:

- Contain no PVC and have an Environmental Product Disclosure (EPD), or
- Meet Best Practice Guidelines for PVC

Where a product contains no PVC, the subcontractor is to provide a product datasheet or equivalent that describes the composition of the product and an EPD for the product.

Where a product contains PVC, the subcontractor is to provide evidence that the manufacturer has been independently verified to meet the *Best Practice Guidelines for PVC in the Built Environment*.

The subcontractor is required to provide evidence of compliance for all permanent formwork, pipes, flooring, blinds and cables used on the project for review by the Lendlease prior to use of the product. During construction, the subcontractor is required to provide monthly reports on all of the above products used with the following details:

- Product name and use
- Whether it is Best Practice PVC or non-PVC
- Cost of each item

At completion of works, the Subcontractor shall undertake a final audit to sure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

3.7 Sustainable Products (Refer to - Appendix A – Sustainable Products Strategy)

21 Product Transparency and Sustainability

The following specification clause should only be inserted into specifications which include products or materials highlighted within Appendix A – Sustainable Products Strategy on page 1645. The blue text within the following clause needs to be amended to be made product specific, therefore referencing the product or material in question.

This project is targeting an overall proportion of materials (measured by cost) which meet the transparency and sustainability requirements demonstrated by the following recognised initiatives. Subcontractors are required to limit product selections for ****Insert applicable Product e.g. Plasterboard**** to those with certification in line with the table below, with preference given to those with certification aligned with the items highlighted **Pink**, subcontractors are required to submit compliant certification to justify a selection prior to procurement.

At completion of works, the Subcontractor shall undertake a final audit to ensure the correct and complaint products have been used, and generate a report summarising the quantities and costs of each product type used.

Transparency and Sustainability initiative	Sustainability Factor (SF)
Reused Product	1.00
Recycled Content Product	1.00*
Environmental Product Declarations - product-specific	0.75
Environmental Product Declarations – industry-wide	0.50
Product has Level A Third Party Certification	1.00
Product has Level B Third Party Certification	0.75
Product has Level C Third Party Certification	0.50
Stewardship Program	0.50

* Only the percentage cost of the recycled content in a product cost is considered

The different initiatives are summarised below along with compliance documentation required:

- **Reused Products**
 - Reused products are items that have been previously used and are incorporated in the project without significant changes to the structure or function of the item. Cleaning, making good, repairs, recovering and resurfacing are allowed.
 - A statement from the manufacturer confirming that the products are recycled, the recycled content and the cost is required to demonstrate compliance.
- **Recycled Content products**
 - Recycled content items are items produced with recovered materials. The percentage of recycled content is counted towards the compliant product cost.
 - A statement from the manufacturer confirming that the products are recycled, the recycled content and the cost is required to demonstrate compliance.

- **Environmental Product Declarations (EPDs)**
 - There are a number of EPD schemes available globally, however only those with a minimum cradle-to-gate scope which are independently verified are recognised by Green Star. The two EPD formats recognised include:
 - Products with a product-specific third party verified EPD which are issued in conformance with ISO 14025 or EN15804, independently audited and based on cradle-to-gate scope as a minimum
 - Products with an industry-wide, third party verified EPD which are issued in conformance with ISO 14025 or EN15804, independently audited and based on cradle-to-gate scope as a minimum and where the product manufacturer is a recognised participant in the EPD
- **Third Party Certification**
 - Third Party Certification levels are defined in the GBCA's Framework for Product Certification Scheme. Further details are available on the GBCA's website <http://www.gbca.org.au/green-star/technical-support/materials-category/product-certification-schemes/2933.htm>
- **Stewardship Programs**
 - Product stewardship programs encourage projects and suppliers to share responsibility for the effective reduction, reuse, recycling or recovery of products. Product stewardship is demonstrated via product stewardship contracts for both leased and purchased items, provided:
 - The contract is between a supplier and the building owner or tenant
 - The supplier agrees to collect the item at lease end for re-lease, re-use or recycling without any exemptions for timing, quality or quantity that is accepted for collection

4.0 Appendix A – Sustainable Products Strategy

The following products / materials have been nominated for inclusion within the Sustainable Products Strategy due to the extent of compliant products available on the market. In order to achieve the targeted points within the Green Star pathway, the following products need to be specified as having compliant certification, with preference given to product specific Environmental Product Declarations (EPD) or a Level A Third party certification.

Specifications with products / materials highlighted below shall include the specification clause detailed within section 3.7 – Sustainable Products [on page 14](#)~~on page 13~~.

Product / Material	Compliant Manufacturer Example*
Lifts	Schindler
Concrete	Boral
Reinforcement	OneSteel
Access Flooring	ASP
Carpet	Interface
Plasterboard (Wall)	Knauf
Cladding	Alucobond
Tiles	IKF
Reinforcing Steel - Reo	OneSteel
Plasterboard (Ceiling)	Knauf
Metal ceiling tiles	Armstrong
Insulation	Knauf
Structural Steel - Columns	OneSteel
Structural Steel - Suspended Slabs	OneSteel
Structural Steel - Columns	OneSteel
Structural Steel - Roof Structure	OneSteel

*Example suppliers / manufacturers for reference only, other suppliers / manufacturers can be specified once they demonstrate compliance with the relevant certification.

Appendix E

Appendix E – 50 Martin Place reference photographs

