Eckersley
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Mandarin Centre
Concept Facade Engineering

Issue 03

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Document History

This **Concept Facade Engineering Report** has been prepared by Eckersley O'Callaghan to accompany a concurrent Rezoning Request and State Significant Development Application (SSDA) for a mixed-use development at 61A-65 Albert Avenue, Chatswood. The site is legally described as Lot 2 DP1035379. This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARS) issued for the project (SSD-85024458).

This document has been prepared for the sole benefit, use and information of Eckersley O'Callaghan's contracted client, for the purposes set out above. It is not intended for, and should not be relied upon by, any third party and no responsibility is undertaken to any third party.

Date	Is. No	Reason for issue	Prepared By	Checked By
25.11.2025	01	For information - DRAFT SSDA Report	MR/TF	TD
08.12.2025	02	Concept Facade Engineering Report - SSDA	MR/TF	TD
15.12.2025	03	Concept Facade Engineering Report - SSDA	MR/TF	TD

Contents

1. Introduction

The project Involves rezoning of the site, demolition of the existing building and construction of a 32-storey mixed use tower designed by Skidmore, Owings & Merrill(SOM).

The proposal is for a 32-storey mixed-use development. The commercial uses within the building comprise five floors of retail and wellness between Ground Level and Level 3. The residential component offers 325 Units, located on Levels 4 to 32, including terraced upper floors from level 25 and 32. EOC has been appointed to provide facade engineering from concept design to construction.

This report provides a summary of the design drivers behind the engineering of the facade systems carried out during the Concept Design Stage. It focuses on the development of the principal facade types, in relation to Concept design, preliminary considerations have been made regarding air and water tightness, acoustics, fire performance and cost efficiency of technical solutions, developed in collaboration with the other consultants forming part of the project team.

The design of the principal facade systems has been developed in coordination with Skidmore, Owings & Merrill(SOM) and the other consultants involved in the project. This report is prepared for the purposes of demonstrating options for the facade and summarises the analysis undertaken to date. In the following pages, marked-up elevations, technical descriptions and design drivers summary are to be read alongside the architectural package and is the subject of DA. The construction implications have been analysed and described to illustrate the proposed design development and to discuss issues that will influence the design process at next stages.

It should be noted that the information delivered in this document is aspirational and will be targeted in Design development phase. Therefore, any cost plans based on this information should contain suitable contingencies to allow for future design development and coordination plus any unknowns and risks associated with the project. Facade calculations in this report are subject to benchmarking and quality expectations targeted for the project.

The report has been provided for the exclusive benefit of the Client and their professional advisers/consultants and should not be used by any third parties without the permission of EOC. This report should be read in conjunction with the other materials and reports produced by the design team and should therefore not be relied on exclusively for decision making purposes in isolation.

1.1 Project Background and History

The site has a long planning history, beginning in 2013 with a Planning Proposal to Willoughby Council to amend the WLEP for mixed-use development, including 70% shop top housing. Despite initial support, the Council rejected the proposal in 2015, leading to a new Planning Proposal in 2016, which was also refused. The Sydney North Planning Panel recognised the proposal's merits in 2019, and the Department of Planning granted Gateway Approval in 2020. The Chatswood CBD Strategy, finalised in 2020, recommended a prohibition on residential uses in the Commercial Core zone, despite market feasibility analyses indicating low demand for new commercial office development.

The proposal was amended to reduce residential floor space to 30%, which was approved but remains commercially unfeasible. Market conditions have worsened, with high office vacancy rates and low demand for new commercial office space in Chatswood CBD. The current proposal seeks a mixed-use development with a predominant residential emphasis, aligning with the original 2014 vision.

1.2 The Site

The site is 61A-65 Albert Avenue, Chatswood and is located within the Willoughby local government area (LGA). The site is legally described as Lot 2 in Deposited Plan (DP) 1035379. It is regularly shaped and falls approximately 3m from West to East. The site is within the Chatswood central business district (CBD).
The urban context surrounding the site is characterised by a mix of commercial, retail and residential developments. The surrounding locality is described as:

• Directly north of the site is the Sebel Hotel which is a 28-storey tower. Further north is a variety of commercial, and retail uses which form the Chatswood Westfield Shopping Centre.
• The east of the site is bounded by Victor Street. Development consists of predominately retail continuing the Chatswood Westfield Shopping Centre.
• To the south of the site is a multi-storey car park for the Chatswood Westfield Shopping Centre and high-density residential development. Chatswood Baptist Church adjoins the site on the southern side of Albert Avenue and Chatswood Park is located towards the south-west.
• To the west of the site is the Chatswood interchange which includes Train and Metro services to the Sydney CBD and Sydney's Northern suburbs. These key transport links are located within 160m of the site.

The site currently accommodates the Mandarin Shopping Centre featuring five levels of retail space and three levels of car parking. Retail tenants include Hoyts Cinemas and Strike Bowling

Figure 1.1 Locality Plan. Source:Urbis, 2025

Figure 1.2 Aerial Photograph. Source:Urbis, 2025

2. Relevant Codes and Standards

All engineering aspects on the project will be in accordance the key standards relating to the facade design listed below.

DESIGN LOADING
- 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 actions – Wind actions
- AS 1170.4 Structural design actions – Earthquake actions in Australia
- AS 4488 Industrial rope access systems

STEEL
- AS 1562.1 Design and installation of sheet roof and wall cladding – Part 1: Metal
- AS 2312 Guide to the protection of iron and steel against exterior atmospheric corrosion
- AS 2728 Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements
- AS 3566.1 Self-drilling screws for the building and construction industries – Genera requirements and mechanical properties
- AS 3566.2 Self-drilling screws for the building and construction industries – Corrosion resistance requirements
- AS 4100 Steel structures
- AS 4600 Cold formed steel structures
- AS 4673 Cold formed stainless steel structures

ALUMINIUM
- AS 1231 Aluminium and aluminium alloys – Anodized coatings for architectural applications
- AS/NZS 1664.1 Aluminium structures – Limit state design (and other materials and welding Standards referenced therein)
- AS/NZS 1664.2 Aluminium structures – Allowable Stress Design
- AS 1734 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate

ANCHORS
- AS 5216 Design of post-installed and cast-in place fastenings in concrete

GLASS AND GLAZING
- AS 1288 Glass in buildings – Selection and installation
- AS 2047 Windows in buildings – Selection and installation
- AS/NZS 2208 Safety glazing materials in buildings
- AS 4145.3 Locksets – Part 3: Mechanical locksets for windows in buildings
- AS 4285 Skylights
- AS 4666 Insulating glass units
- AS/NZS 4667 Quality requirements for cut-to-size and processed glass
- BS 6262 Code of practice for glazing for buildings
- BS EN 1096-1-3 Glass in building – Coated glass
- BS EN 14179-1 Glass in building – Heat soaked thermally toughened soda lime silicate safety glass
- ISO 12543-6 Glass in building – Laminated glass and laminated safety glass
- ASTM C 509 Standard specification for elastomeric cellular preformed gasket and sealing material
- ASTM C 864 Standard Specification for Dense Elastometric Compression Seal Gaskets,Setting Blocks, and Spacers
- ASTM C 1036 Specification for flat glass
- ASTM C 1048 Specification for heat treated flat glass
- ASTM C 1172 Specification for laminated architectural flat glass
- ASTM C 1376 Standard specification for pyrolytic and vacuum deposition coatings on flat glass
- ASTM C 1651 Standard test method for measurement of roll wave optical distortion in Heattreatedflat glass

SEALANTS AND JOINT FILLERS
- AS 1527 Two-part polysulphide-based sealing compounds for the building industry
- ASTM C 509 Standard specification for elastomeric cellular preformed gasket and sealing material
- ASTM C 510 Test method for staining and colour change of single and multi-component joint sealants
- ASTM C 719 Test method for adhesion and cohesion of elastomeric joint sealants under cyclic movement
- ASTM C 793 Test method for effects of accelerated weathering on elastomeric joint sealants
- ASTM C 794 Standard test method for adhesion-in-peel of elastomeric joint sealants
- ASTM C 864 Standard specification for dense elastomeric compression seal gaskets, setting blocks and spacers
- ASTM C 920 Specification for elastomeric joint sealants
- ASTM C 1184 Specification for structural silicone sealants
- ASTM C 1193 Guide for use of joint sealants
- ASTM C 1248 Test method for staining of porous substrates by joint sealants
- ASTM C 1281 Standard specification for preformed tape sealants for glazing applications
- ASTM C 1401 Specification for structural sealant glazing
- ASTM D 2203 Test method for staining from sealants

PROTECTION
- AS 1530 Methods for fire tests on building materials
- AS 1768 Lightning Protection
- AS 5113 Classification of external walls of buildings based on reaction-to-fire performance

PROTECTIVE COATINGS
- AS 1231 Aluminium and aluminium alloys – Anodic oxidation coatings
- AS 1397 Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc-coated
- AS 1627 Metal finishing – preparation and pretreatment of surfaces
- AS 1650 Hot-dipped galvanised coatings on ferrous articles
- AS 1789 Electroplated coatings – Zinc on iron and steel
- AS 1790 Electroplated coatings – Cadmium on iron and steel
- AS 2311 Guide to the painting of buildings
- AS 2312 Guide to the protection of iron and steel against exterior atmospheric corrosion
- AS 2331 Methods of test for metallic and related coatings
- AS 2837 Wrought alloy steels – Stainless steel bars
- AS 3715 Metal finishing thermoset powder coatings for architectural applications
- AS 3750 Paints for steel structures
- AS 3754 Safe application of powder coatings by electrostatic spraying
- AS 4680 Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
- AAMA 2603 Voluntary specification, Performance requirements and Test procedures for pigmented organic coatings on aluminium extrusions and panels
- AAMA 2604 Voluntary specification, Performance requirements and Test procedures for high performance organic coatings on aluminium extrusions and panels
- AAMA 2605 Voluntary specification, Performance requirements and Test procedures for superior performing organic coatings on aluminium extrusions and panels

PERFORMANCE TESTING
- AS 1530.4 Methods for fire tests on building materials, components and structures- Fireresistance test of elements of construction
- AS 1683 Methods of test for elastomers
- AS 2047 Windows in buildings – Selection and installation
- AS 4284 Testing of building facades
- AS 4420 Windows – Methods of test
- AS 5113 Classification of external walls of buildings based on reaction-to-fire performance
- BS 6375-2 Performance of windows – Part 2: Specification for operation and strength characteristics
- ASTM C 794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
- AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
- AAMA 501.4 Recommended Static Test Methods For Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts
- AAMA 501.6 Recommended Dynamic Test Methods For Determining The Seismic Drift Causing Glass Fallout From A Wall System
- AAMA 502 Voluntary specification for field testing of newly installed fenestration products
- AAMA 503 Voluntary specification for field testing of newly installed storefronts, curtain walls and sloped glazing systems
- AAMA 508 Voluntary Test Methods and Specification for Pressure Equalized Rain
- Screen Wall Cladding Systems
- AAMA 509 Voluntary Test Methods and Classification Methods for Drained and Back Ventilated Rain Screen Wall Cladding Systems
- AAMA 2603 Voluntary specification, Performance requirements and Test procedures for pigmented organic coatings on aluminium extrusions and panels
- AAMA 2604 Voluntary specification, Performance requirements and Test procedures for high performance organic coatings on aluminium extrusions and panels
- AAMA 2605 Voluntary specification, Performance requirements and Test procedures for superior performing organic coatings on aluminium extrusions and panels

QUALITY MANAGEMENT
- AS/NZS ISO 9000 Quality management systems – Fundamentals and vocabulary
- AS/NZS ISO 9001 Quality management systems – Requirements
- AS/NZS ISO 9004 Quality management systems – Guidelines for performance improvements ISO 14001 Environmental management

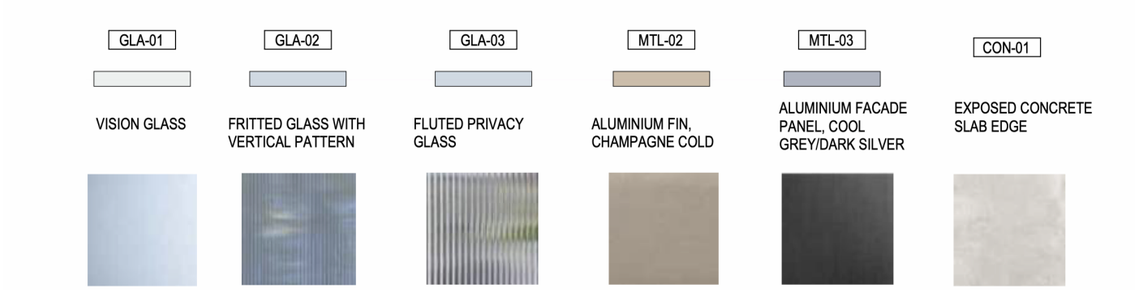
BUILDING MAINTENANCE
- OHS Regulations NSW Work Health and Safety Regulation

3. Facade System Summary

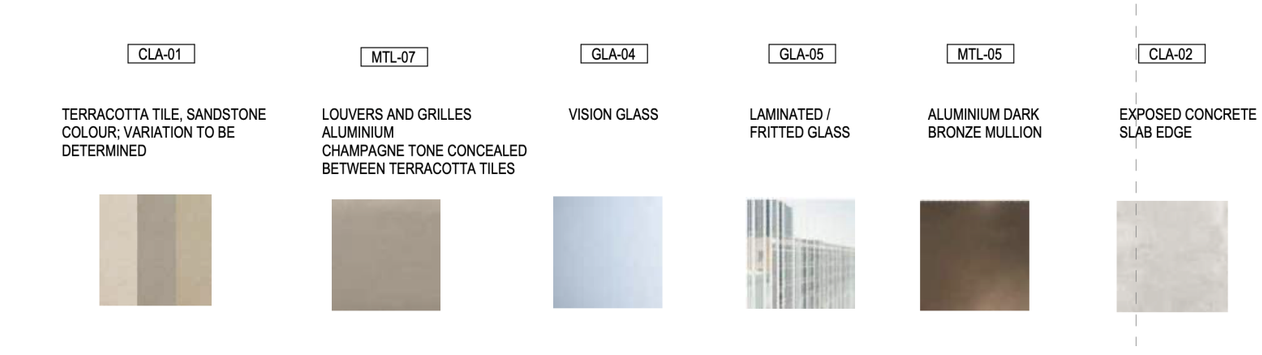
Code	Name	Location	Description	Reference Architectural Finishes
EWS-101	Principal Tower Facade	L04-L32	Aluminium framed window wall system with combination of Double glazed and opaque infill panels.	GLA -01, GLA-02, GLA-03, MTL-02, MTL-03
EWS-102	Podium Glazing System	L00(Residence), L01-L03	Aluminium framed Stick curtain wall system with Single Glazed Infill panels.	GLA -05, GLA-04, MTL-05,
EWS-201	Ground Level Retail Glazing System	Level 00(Ground Level)	Stainless Steel Framed Stick curtain wall system Incorporating Entrance Opening systems.	GLA 04
EWS-301	Podium Opaque Facade	L00-L03	Light weight Opaque Wall system incorporating vertical format terracotta rainscreen and support system	CLA-01
EWS-302	Residence Opaque Facade	L00-L03 East Podium	Light weight Opaque Wall system incorporating vertical format terracotta rainscreen with metal cap detail and support system	CLA-01, MTL-07
RFS-101	Retail Canopy	Level 00	Light-weight Metal Clad Roof system.	

Reference Architectural External Finishes Schedule

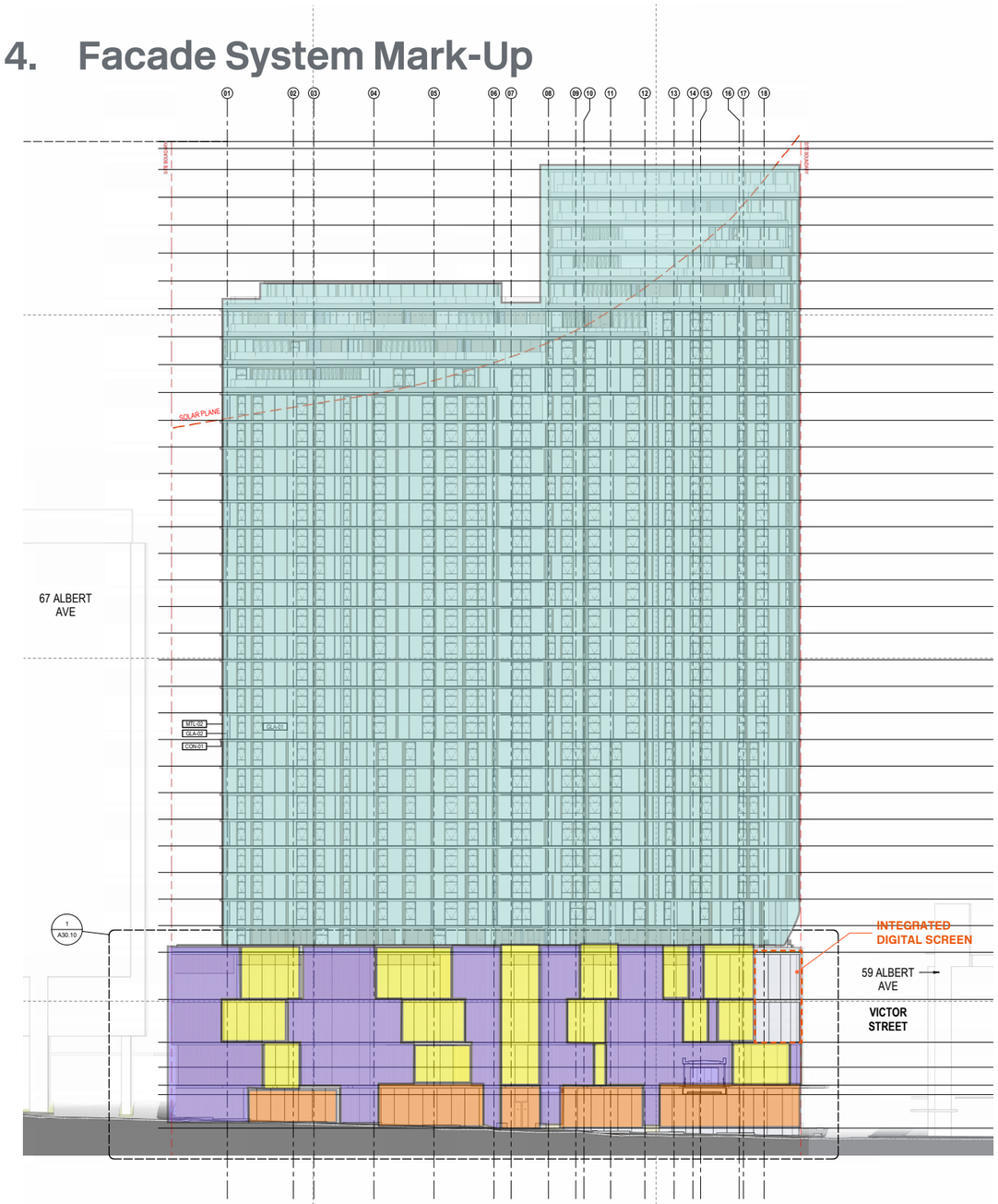
Tower



Podium



4. Facade System Mark-Up



1 BUILDING ELEVATION - SOUTH
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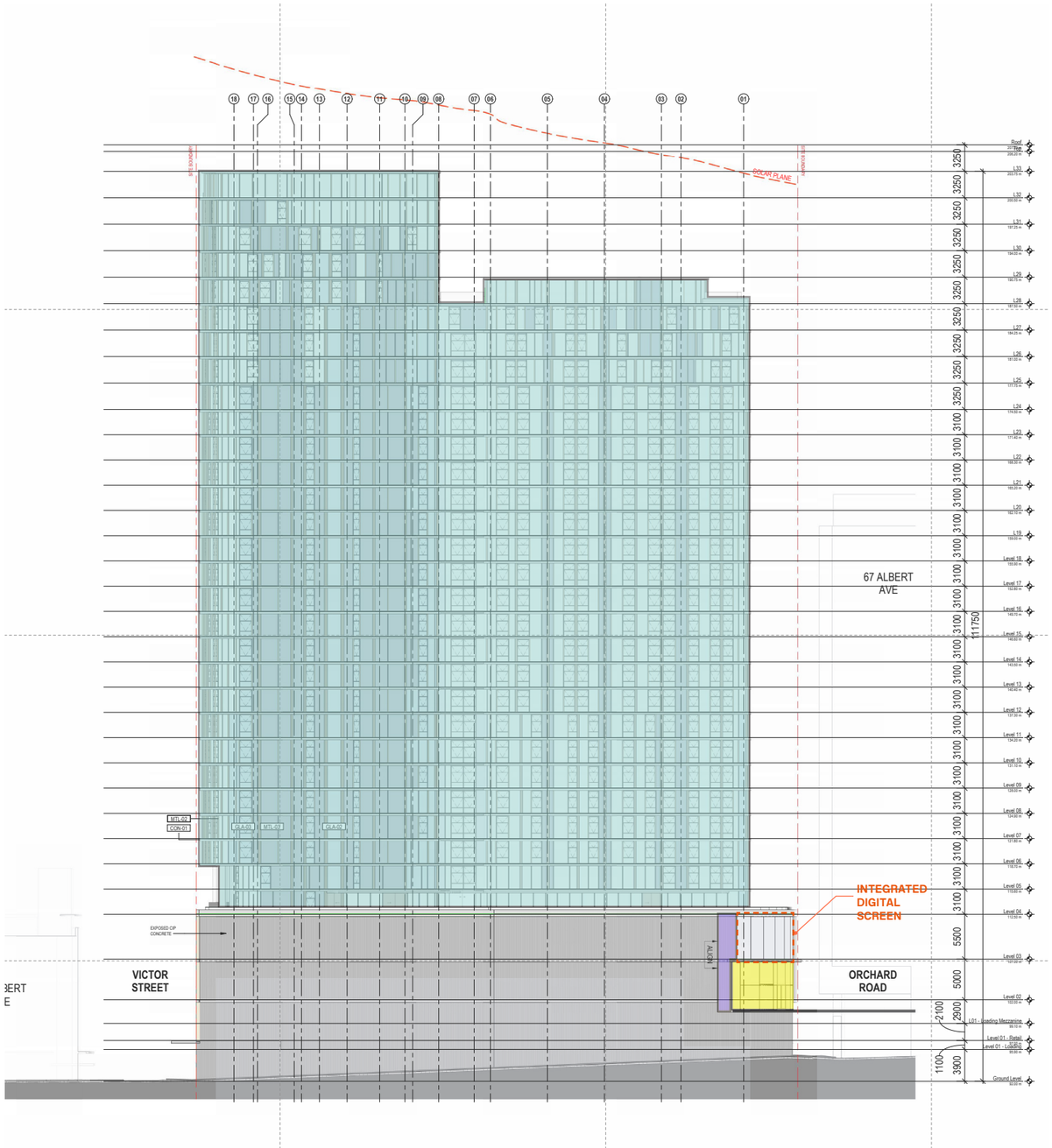

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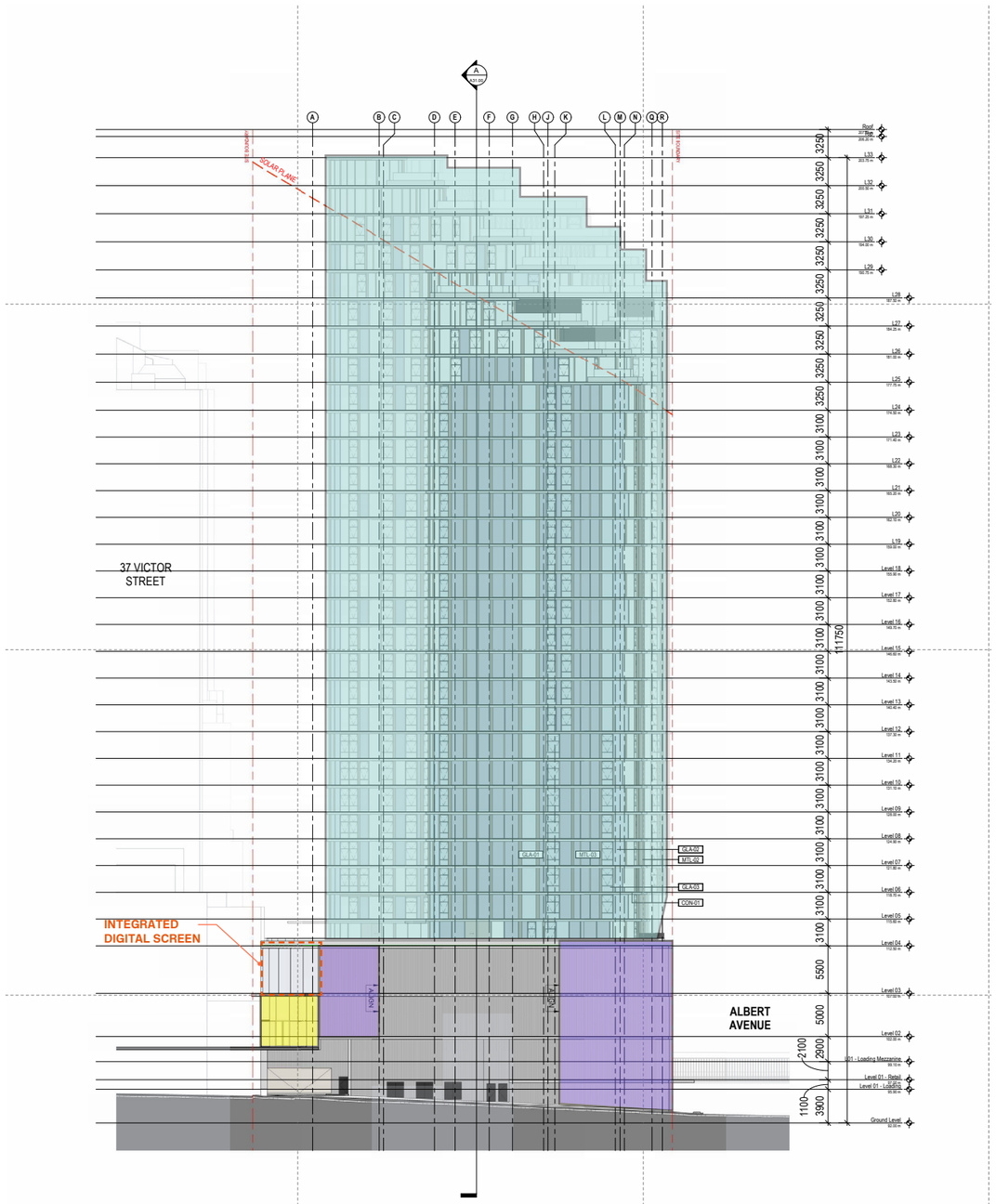

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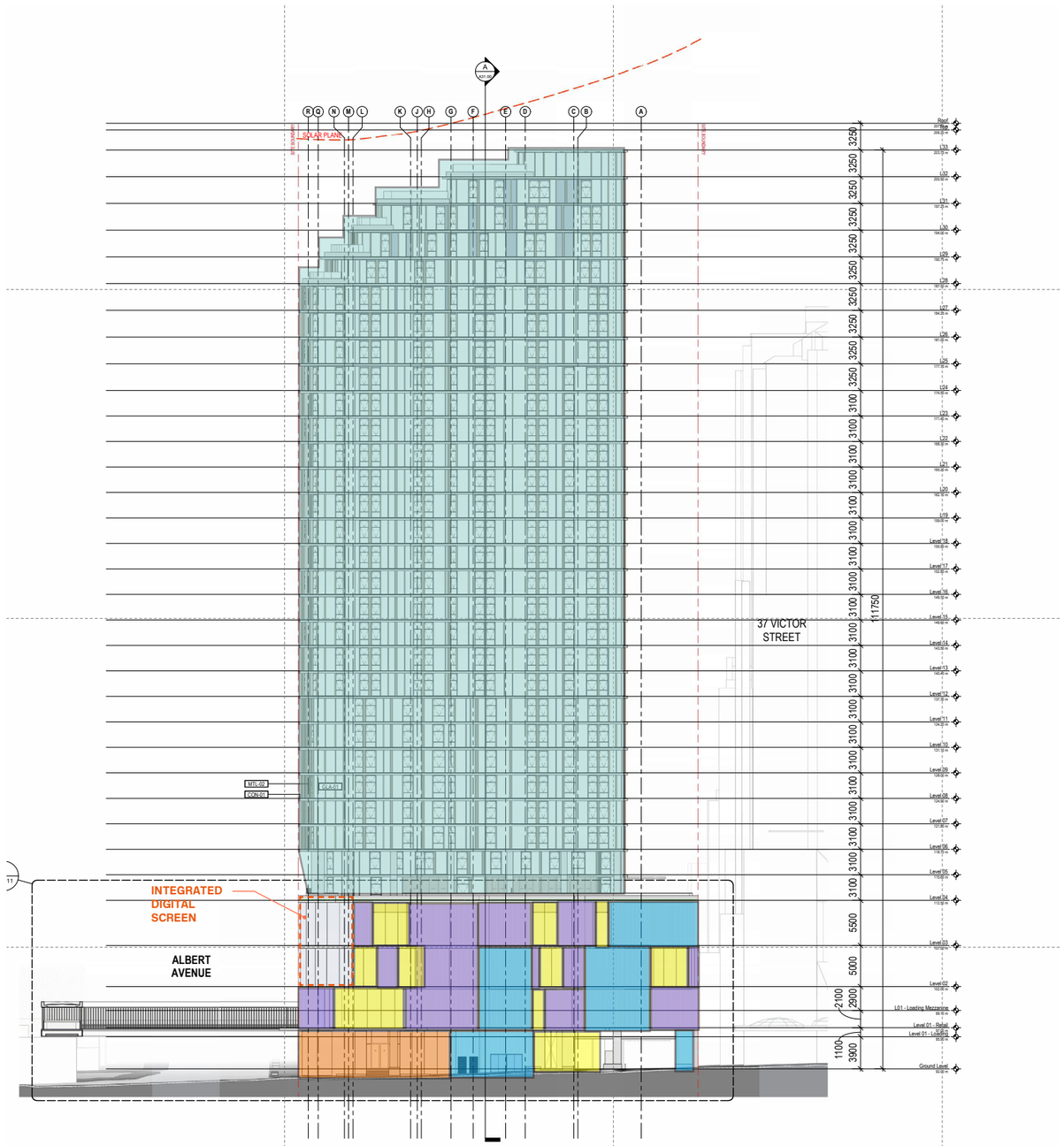


1 BUILDING ELEVATION - EAST
1 : 200

5. Basis of Design

5.1 Design Life and Circularity

According to the project brief, the facility shall be designed for minimum 50 years design life and designed and constructed to be protected or treated from structural deterioration to ensure a maintenance free service life of minimum 50 years.

However, it is important to note that the facade comprises components with heterogeneous life expectancies. Due to the difficult disassembly of facade systems, the lack of material data at end-of-life as well as end of warranty, the facade is often replaced entirely, with durability levelled down. It is generally reasonable to assume that with proper care and maintenance, the facade construction should have an expected service life of 25 years. This can be further improved through detailing and material specification with the aim to facilitate disassembly and replacement of the least durable components in the facade.

The table below identifies the different facade components in the facade along with their expected service life.

System Components	Expected Service Life	Component category [CWCT Standard for systemised envelopes]	Comments
Aluminium extrusions	50 years	Primary	
PPC finish	50 years	Secondary	Finishes can be touched up. Higher specification of finish can ensure more durable finish.
Anodized finish	50 years	Secondary	More durable but hard to touch up. Finishes assumed to need to meet services life of associated component
Aluminium unitised fixings, spigots and brackets	50 years	Primary	Periodic inspections still required for signs of wear from abrasion.
Thermal breaks	50 years	Primary	Permanent loading of the thermal break is avoided through careful design to minimise long term creep of the plastic.
Sealants and membranes	50 years	Primary	Periodic inspection and cleaning is required. However, seals are concealed by rainscreen cladding so inspection and replacement strategy is made more difficult.
Gaskets	25 years	Primary	Periodic inspection and cleaning is required. However, gasketry is concealed by rainscreen cladding so inspection and replacement strategy is made more difficult.
Thermal insulation and aluminium panels	50 years	Primary	Not accessible
Firestops	50 years	Primary	Not accessible
Cavity barriers (including intumescent strip)	50 years	Secondary	Periodic inspection and potential replacement is required. However, the cavity barriers are concealed by rainscreen cladding so inspection and replacement strategy is made more difficult.
GRC and rainscreen cladding.	25 years	Secondary	Rainscreen elements on the unitised system should be easily removable to allow for inspections of the components concealed within the cavity (cavity barriers, subframe, seals, gaskets, etc.).
Rainscreen subframe	50 years	Primary	Periodic inspections still required for signs of wear from abrasion.
Ironmongery	5 years	Secondary	These items will be accessible to facilitate replacement.
Glazing	25 years	Secondary	External caps will be favoured to facilitate replacement of glazing.
Architectural precast concrete	50 years	Primary	

5.2 Structural design

5.2.1 Key facade loading

Wind loads
The preliminary wind load considered for this design stage has been estimated following AS 1170.2:2021:
T1 at 116m above Ground RL
— ULS: 3.0 kPa, -4.3kPA
— SLS: 2.0 kPa, -2.8kPa

T2 at 102.8m above ground RL
— ULS: 2.9 kPa, -4.3kPA
— SLS: 1.9 kPa, -2.8kPa

Podium at 25.3m above ground RL
— ULS: 2.0 kPa, -4.3kPA
— SLS: 1.3 kPa, -2.8kPa

Wind loads to be cross-referenced with wind tunnel test report for additional resolution.

Maintenance loads
For this design stage, point loads of 0.5 kN for vertical surface and 1.1 kN for horizontal surface are considered in the design.

The above considerations are preliminary. The loads imposed on the facade by the Access and Maintenance strategy to be coordinated in the next stages.

Barrier loads
Barrier loads for the project should be in line with AS1170 and AS1288.

Type of occupancy and location	Loading
C3 Areas without obstacles for moving people and not susceptible to over-crowding.	Line load of 0.75 kN/m acting a height of 1.1m above finished floor level Uniformly distributed load of 1.0 kN/m² Point load of 0.6 kN acting on any part up to and including 1.1m above floor level
C5 Areas susceptible to over-crowding	Line load of 3.0 kN/m acting a height of 1,1m above finished floor level Uniformly distributed load of 1.5 kN/m² Point load of 1.5 kN acting on any part up to and including 1.1m above floor level

Impact loads
Impact loads on the facade for the project should be in line with CWCT TN 75.

CWCT TN75 Performance	Safety performance	Serviceability performance	Exposure Category
External glass pane on curtain wall within 1.5m of ground level (Ground floors)	Negligible Risk	Class 2	Category B
External glass pane on curtain wall(Podium)/ window wall(Tower) above 1.5m of ground level (All other levels)	Negligible Risk	Class 2	Category E
Plant room cladding panels	Low Risk	Class 2	Category E
Aluminium louvers - external shading systems	Low Risk	Class 2	Category E
Terracotta Rainscreen	Moderate Risk*	Class 3	Category B

* Moderate risk due to maximum mass (50g<X<500g) of terracotta rainscreen panels/battens as per CWCT TN75.

5.2.2 Facade weight
A preliminary weight calculation has been carried out for the Main facade system for coordination with the structural engineer. Weights have been calculated in kN/m². The load should be distributed on the primary structure as per the designated supporting strategy.

Reference Facade Code	Proposed System	Load (kN/m²)	Notes
EWS-101	Aluminium Window wall with sunshade fins	0.6	Facade is supported on the slab, Load to be distributed on each slab.
EWS -102	Aluminium Stick Curtainwall system	0.5	Facade is supported on the slab, Load to be distributed on each slab.
EWS- 301	Light Weight opaque wall system with terracotta cladding	0.6-0.9	Facade is supported on the slab, Load to be distributed on each slab.

5.2.3 Movement accommodation

Façades will need to accommodate all movements and dimensional changes that may occur in the building due to thermal changes, deflections, settlement and creep as specified by the Structural Engineer.

It is essential that the facade can accommodate the expected structural movements to maintain weather tightness performance and mitigate the risk of structural damage to the facade.

The primary structure deflection limits should be coordinated during the design stage and the key considerations and results on the accommodation of the movement by the main facade system will be investigated.

5.2.4 Thermal performance

The following table summarises the minimum target performance as tested to meet BASIX thermal Comfort Load limits by the ESD Consultant.

Facade Performance targets for BASIX Compliance			
Location		U Value (Glass and frame)	SHGC (system)
Tower (L04 -L24)	Fixed Glazing	3.2	0.46
	Fixed Glazing - Fritted	3.2	0.28
	Awning Windows	3.3	0.42
	Awning Windows - Fritted	3.3	0.26
	Balcony Sliding Doors	3.2	0.5
	Balcony Sliding Door TB	2.7	0.5
	Balcony Bifold Systems	4.0	0.5
	Balcony Bifold Systems TB	2.6	0.5
	Opaque (insulation only)	R2.5	
Upper Levels (L25-L32)	Fixed Glazing	2.2	0.23
	Sliding Doors	3.2	0.5
	Sliding Doors TB	2.7	0.5
	Bifold Doors	4.0	0.5
	Balcony Bifold Systems TB	2.6	0.5
	Opaque (insulation only)	R2.5	

These values are illustrated as a driver for Facade Design and System nomination in the current stage, Final Compliance targets should be coordinated with Sustainability Engineer and the BASIX Consultant.

5.3 Condensation and mould growth (psychometric conditions)

The following tables summarises the internal conditions expected for the destination of use of the building.

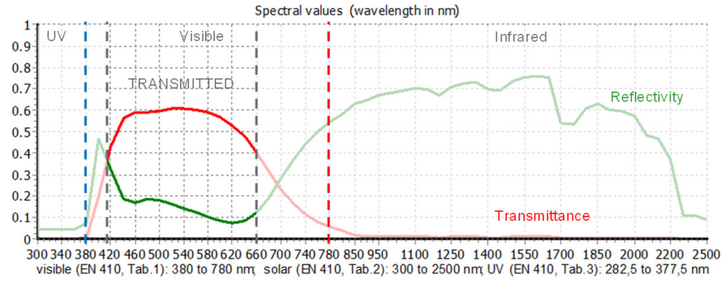
Internal conditions		
Location	Temperature	Relative humidity
Retail	22.5 °C ± 1.5 °C	40~70 %
Residential	21.1 ~23.9 °C ± 1.5 °C	40~70%

The values above are preliminary and will be coordinated with the MEP engineer in the following stage.

5.4 Glass photometric

The solar gain and light transmittance targets have been coordinated with the Architect and the sustainability engineer. Please refer to the Glass Studies section for Preliminary Glazing Performance Studies.

The use of natural daylighting is a key factor for the design of the window and door systems on this project. The balance of views, daylight and the control of solar heat is usually critical in the design of the glazing systems.
For the Tower Glass a double glazing with Low E coating is proposed. For the upper levels, to achieve both the insulating and solar gain requirement, high performance selective coatings are implemented in the double-glazed units.



These coatings cut out infra-reds and ultra-violets. The more stringent the solar gain requirement (SHGC), the more wavelengths within the visible spectrum are cut out and therefore the darker and more reflective the glass becomes.

5.5 Airtightness

The table below shows the air permeability target that is expected to be achieved for the building considering the facade systems proposed. The value will need to be confirmed by the MEP engineer during the following stage.

Performance Target	Target
Whole building air-permeability	5.0 m3/m2/h @50Pa

The design of the facade systems will ensure that sufficient airtightness is achieved when the systems are in their closed position. The facade system, including all joints between it and other works will be designed to prevent uncontrolled air flow through the joints and interfaces of the cladding systems, in the interests of:

— Occupier comfort.
— Limitation of heat loss
— Acoustic performance and reduction of wind noise
— Minimising dust ingress

This is to allow an efficient overall environmental strategy, aligned with the MEP design assumptions and along with best practice for low-energy design. The intent of assigning the air tightness levels also serves the purpose of sufficiently defining, controlling and commissioning the environmental zones.

5.6 Water tightness

The facade system will be designed to be appropriately water-tight, either through direct sealing of the walls or through controlled drainage of the walls or systems. The waterproofing strategy relies on the chosen facade option and its procurement so will be developed in the next stage. However, the chosen systems will be designed to be robust and compatible with adjacent systems. Compromise might be required at later stage for incorporating doors at entrances depending on threshold requirements.

5.6.1 Termination Height

The vertical upward termination of height (or “termination height”) for waterproofing membrane on external wet area has been calculated based on the AS 4654.2. Based on the preliminary wind speed from AS 1170.2 wind load assessment the recommended termination heights are :

Level /Location	Minimum Termination Height
Terraces (L25-L33)	100mm
Podium (L04)	70mm

The Winter gardens within the tower zone are not deemed as a weather line as confirmed by design team. Hence there is no slab setdown/termination height requirement for the Tower zone.
Wind tunnel assessment is recommended to obtain the more realistic design wind speed for the project.

5.6.2 Water Penetration Test

The facade systems will be subject to satisfactory result of water penetration test following AS 4284, undertaken by accredited NATA laboratory or equivalent. The preliminary test pressure is as below:

— Static pressure:
  Tower : 600Pa
  Podium : 400Pa
— Cyclic Pressure: Tower:
  Stage 1: 300~600 Pa
  Stage 2: 400~800 Pa
  Stage 3: 600~1200 Pa

  Cyclic Pressure: Podium:
  Stage 1: 200~400 Pa
  Stage 2: 267~534 Pa
  Stage 3: 400~800 Pa

AS 2047 test reports may be considered on a case-by-case basis.

5.7 Fire

5.7.1 External spread of flame

The external wall systems will be designed in accordance with the Australian codes and current fire safety guidance. The building's specific fire strategy is established by the Fire Engineering Consultants.

All the facade primary materials and components shall be incombustible, with exceptions as acceptable in guidance to meet other regulatory requirements (e.g. weather tightness).

Fire-stopping shall be provided at all junctions between the facade and internal compartmentalization as identified in the fire strategy report. All cavities within the external wall construction shall have cavity barriers to locations recommended in current guidance.

Where a specific fire resistance is required to external wall elements to limit the risk of fire spread to adjacent property, these shall be provided through a combination of fire safety protection measures, e.g. fire-resisting external wall construction, active suppression or fire curtains.

The facade specification will demand certification documenting the required fire performance for all relevant materials and components, and site QA procedures will be established for all fitted fire-stopping and cavity barriers.

5.7.2 Facade fire rating

We understand that there is no fire rating requirement on the facade. Further coordination with the fire engineer will be carried out during the following stage.

5.8 Acoustic

The facade performance specification will depend on factors including:

— The characteristics of the noise source including the noise level incident on the building and the frequency characteristics. For intermittent noise sources the frequency of and time of occurrence is also significant.
— The sensitivity of the internal use to external noise.
— The area of building element exposed to noise.

Acoustic requirements and performance targets to be coordinated with the design team in next stages. Proposed build-ups will be provided in the EOC facade specifications, however a full set of laboratory tests for all the elevations need to be provided by the specialist contractor once appointed. Proposed build-ups will be provided in the EOC facade specifications in-line with the acoustic specifications during next stages.

5.9 Security

No security information has been reviewed in detail. This will be further investigated during next Stage design.

EOC anticipate that door and window systems that are deemed accessible will have a PAS-24 requirement and potentially a more stringent Secure by Design requirement due to the communal nature of the entrances.

5.10 Environmental impact

For an overview of the typical environmental impacts of the facade, please refer to Chapter 9 and 10. In the context of the ongoing Climate Emergency, there is a focus on reducing the emissions of greenhouses and when considering a building, this is in the form of either Embodied Carbon or Operational Carbon. Embodied carbon is the term capturing the emissions during the non-operational phase of the building life including during the material extraction, component manufacture, transportation, assembly, replacement, deconstruction, and disposal. In contrast, operational carbon is the term that represents the emissions occurring during the use of a building, through artificial lighting, heating, and cooling for example. It is essential to consider the impact of design choices on both embodied and operational carbon to base decision making on a holistic total carbon emissions perspective.

The embodied carbon assessment has been carried out to present a preliminary estimation of embodied carbon content for different facade options from cradle to gate completion (A1-A3). These stages do represent the most significant part and are those for which the most data is available.

6. Tower Facade Systems

6.1 EWS-101

Principal Tower Facade
Aluminium framed Window wall system incorporating fixed double glazing (Clear and Fritted glazing options) , Awning window, vertical spandrel and opaque panel configurations.

Location	L04-L32
Floor-Floor Height	3250mm 3100mm
Facade Zone	200mm

6.1.1 Design drivers

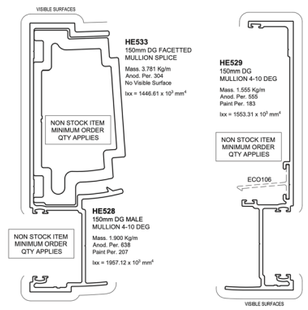
The main design drivers for this facade have been identified as:
— Structural efficiency of framing members while maintaining architectural panelisation.
— Movement accommodation allowance.
— Allowance for multiple facet angles.
— Support strategy for shading fins.
— Cost efficiency and ease of installation

6.1.2 Thermal Performance

Facade Performance targets for BASIX Compliance			
Location		U Value (Glass and Frame)	SHGC (system)
Tower (L04 -L24)	Fixed Glazing	3.2	0.46
	Fixed Glazing - Fritted	3.2	0.28
Upper Levels (L25-L32)	Fixed Glazing	2.2	0.23

6.1.3 System description

For the Principal Tower facade, a pre-assembled window wall system with sub-framing is proposed. The Panels are designed to span from slab to slab, being bottom supported on the slab below. Slab thickness and Nosing detail are subject to Architect and structural engineers detail. A minimum set down at the facade zone and an external drain slope are recommended. Aluminium Vertical and Horizontal fins are designed to be supported by the mullion with lateral support brackets to future resolution. The extrusion fins are as per architectural intent and will require further coordination with the design team in next stages.
Example Systems : Alspec Hunter-evo 150.



Some key considerations that lead the selection of this facade system are reported below:
— Fast installation that can be done fully from the inside. It does not require external access via scaffolding or mast climbers;
— Increased quality of panels due to manufacturing in a factory under controlled conditions;
— High resistance to air and water tightness due to prefabrication;
— Suitable for high-rise buildings and facades with large repetition;
— Reduced installation complexity due to minimum workmanship on-site & increased safety;
— Larger movement accommodation and flexibility compared with a stick system;

6.1.4 Support Strategy

The typical load path is transferred from the infill panels and to the mullions of the window wall system. The Window Wall is spanning from slab to slab, the panels are gravity supported at the base with a sub framing member and restrained at the top with a sub head.

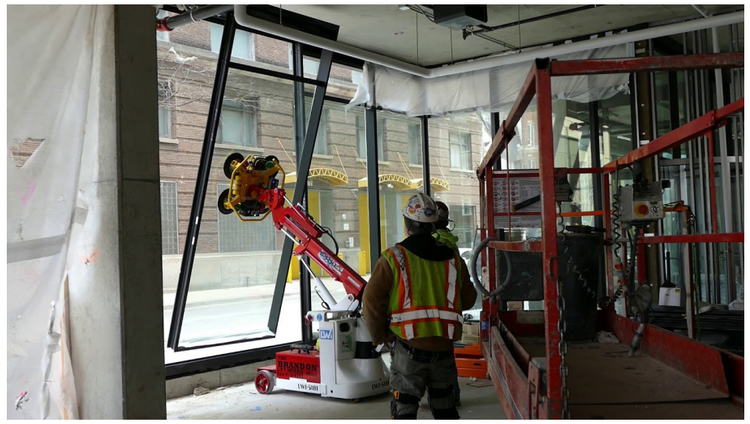
The subframes are faceted along the Facade set out radii, to the widths of the infill panel as per the design intent .

6.1.5 Construction method

The typical installation method for the proposed window wall is achieved with a glazing robot/industrial manipulator which lifts the panels into place from the internal floor space.

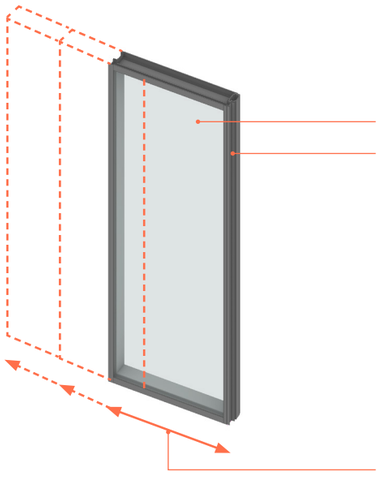
The installation sequence is here described:

— The primary structure is surveyed, and the subframes are installed onto the slab prior to delivery of facade units.
— Facade units are delivered on site and lifted to the installation level using the tower crane or hoist for storage and preparation prior to installation.
— The facade panels and then lifted by the glazing robot and placed within the subframes.
— The alignment and rotation of the panel is adjusted to ensure the unit is level relative to the adjacent units.



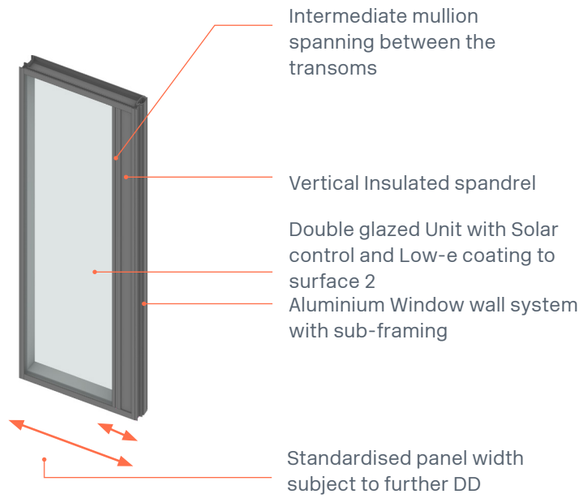
NOTE: *DIAGRAMS ARE INDICATIVE AND SUBJECT TO FURTHER DD

6.1.6 Panel Configurations



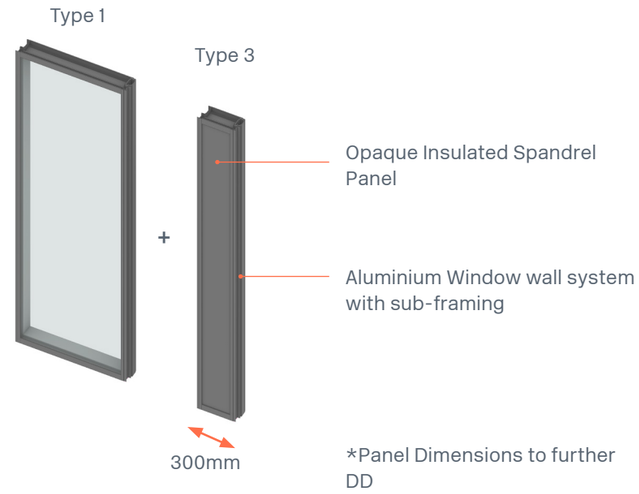
PANEL TYPE 1 - FIXED GLAZING

- Type 2 panel has additional mullion for internal wall interface with spandrel.
- The proposed design includes a fixed glazing panel and vertical spandrel.
- * Dimensions subject to future coordination.

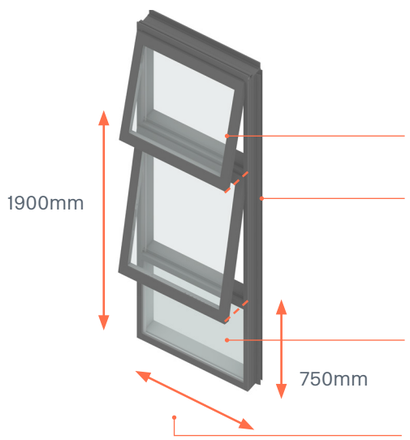


PANEL TYPE 2 - GLAZING PANEL WITH VERTICAL SPANDREL

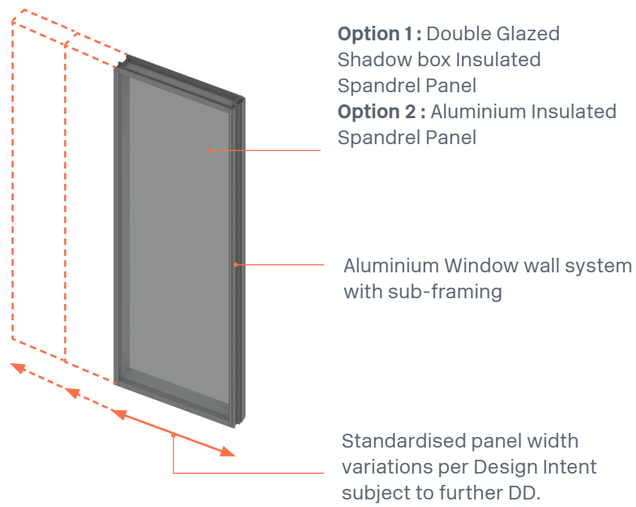
- The opaque panels can help soften the facets with the opportunity to use additional mullion to assist angle change if needed.
- Applied at but not limited to Structural Wall interface with facade.



PANEL TYPE 3 - OPAQUE SPANDREL PANEL



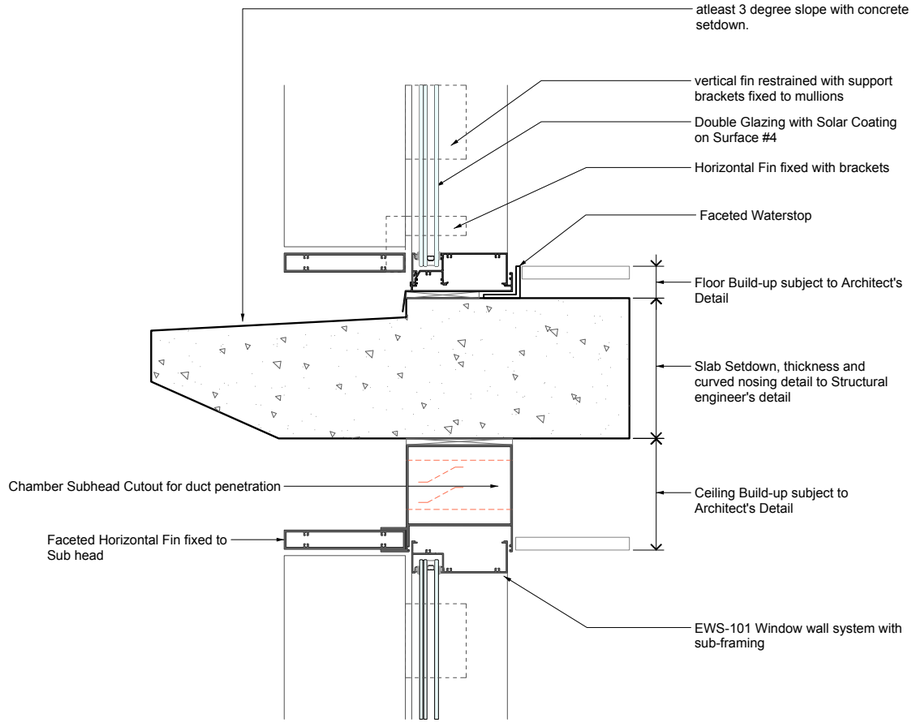
PANEL TYPE 1a - FIXED GLAZING



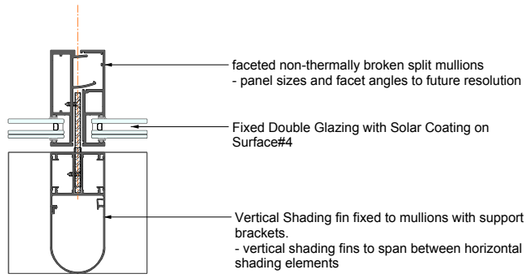
PANEL TYPE 4- OPAQUE PANEL (North and West facade)

NOTE: *SKETCH DETAILS FOR ILLUSTRATION OF FUTURE COORDINATION

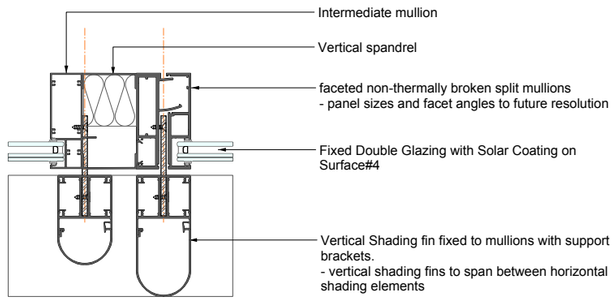
6.1.7 EWS 101 System Sketches



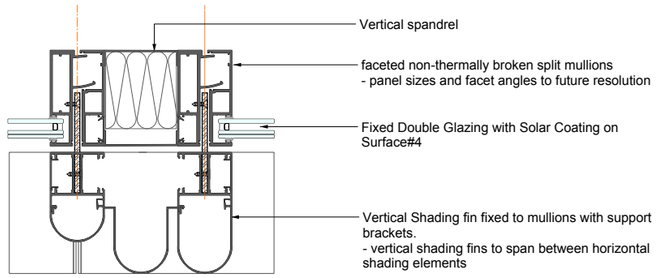
Sketch Detail : Typical Vertical Section at Slab edge



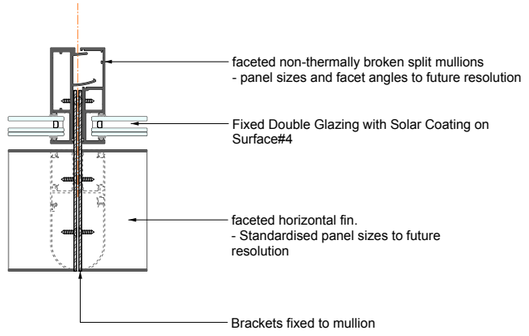
Sketch Detail : Typical Mullion Panel Type 1



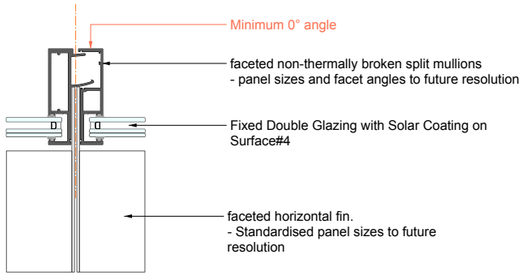
Sketch Detail : Typical Mullion Panel Type 2



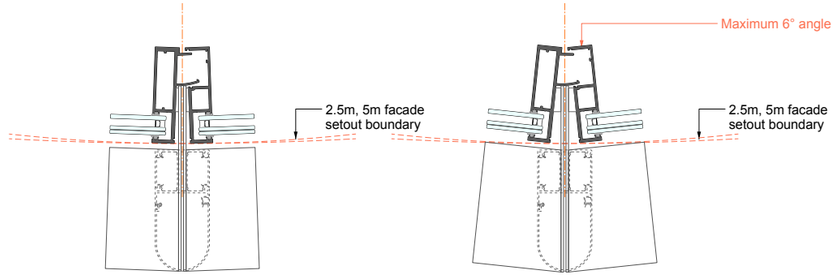
Sketch Detail : Typical Mullion Panel Type 3



Sketch Detail : Typical Mullion - Plan through Horizontal Fin



Sketch Detail : Typical Mullion with Horizontal Fin



Sketch Detail : Angled Mullions

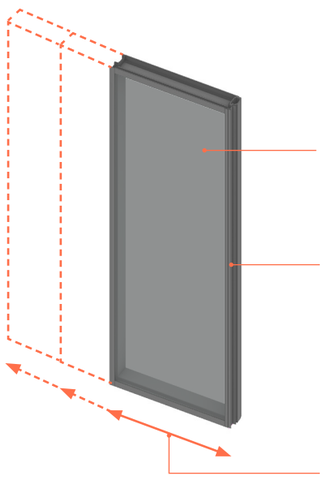
(Profile adaptations for each slab edge radius may be required - subject to further DD)

NOTE: *SKETCH DETAILS FOR ILLUSTRATION OF FUTURE COORDINATION

6.1.8 Opaque Panel Configuration - North Tower

Location	North and West Tower Facade - L05 - L32
Floor-Floor Height	3250mm 3100mm
Facade Zone	200mm
Operable System Types	Awning Windows

A Vertical insulated spandrel facade with incorporated Vertical and Horizontal Fin elements is proposed for the Opaque configurations of the Northern Tower. Spandrel Options an aluminium facing panel and a glazed shadowbox are explored at this stage. Internal Ling and Plaster boards shall be fixed to an internal Light weight backing wall with thickness and insulation as per thermal requirements. A Linear arrangement of panels is recommended for this zone as opposed to the faceted window wall glazing proposed for the remaining tower zones. Panel widths and Opening Configurations to be coordinated with the Architect in next stages.

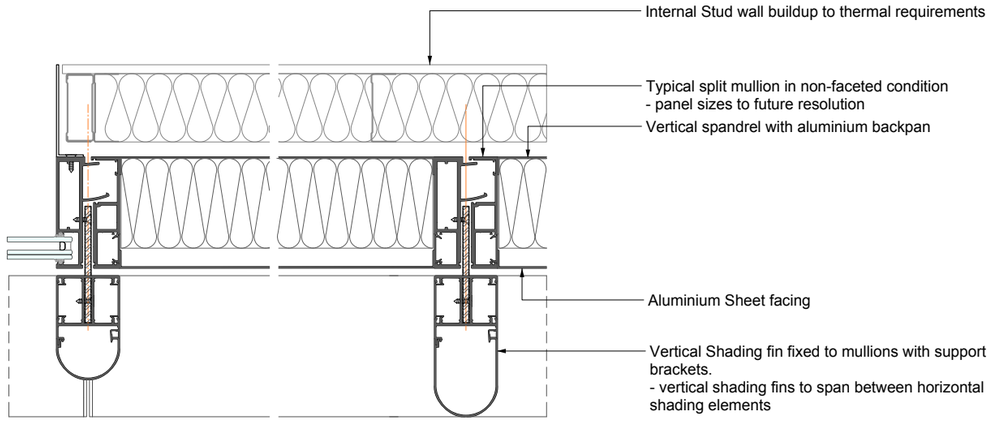


Option 1 : Double Glazed Shadow box Insulated Spandrel Panel
Option 2 : Aluminium Insulated Spandrel Panel

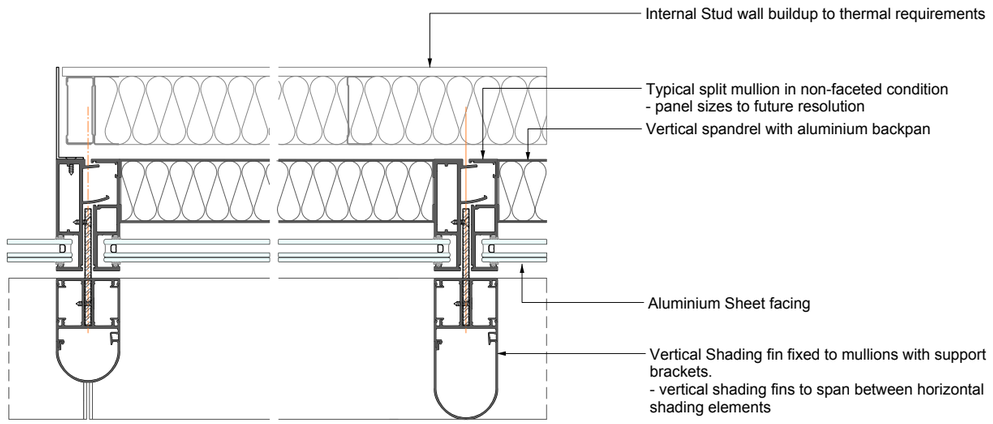
Non thermally broken Aluminium Window wall system with sub-framing

Standardised panel width variations per Design Intent subject to further DD.

PANEL TYPE 4- OPAQUE PANEL (North and West facade)



Sketch Detail : Typical Plan of Opaque Panel Configuration Option 1



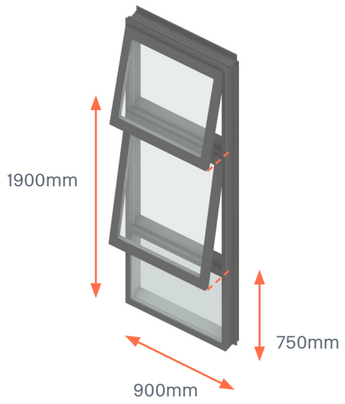
Sketch Detail : Typical Plan of Opaque Panel Configuration Option 2

NOTE: *SKETCH DETAILS FOR ILLUSTRATION OF FUTURE COORDINATION

6.2 Operable Systems

Outer Facade

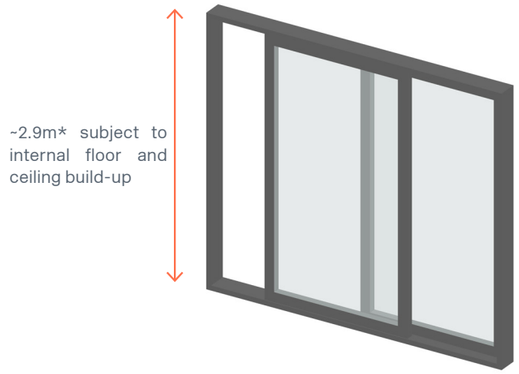
Awning Windows



Material	Aluminium	
Height	~2.9	
Width	~0.9m	
Operability	Manual	
Whole System U-Value (BASIX target)	3.3	
Glazing SHGC (BASIX Target)	0.42 (Clear)	0.26 (Fritted)
Facade Zone	200mm	
Glazing	Low E IGU	
Exemplar systems	Alspec ProTilt® High Performance Awning Reynaers Masterline 10 Capral AGS Commercial 50 Awning Sash	
Notes	The system is not a part of the weatherline at winter garden conditions	

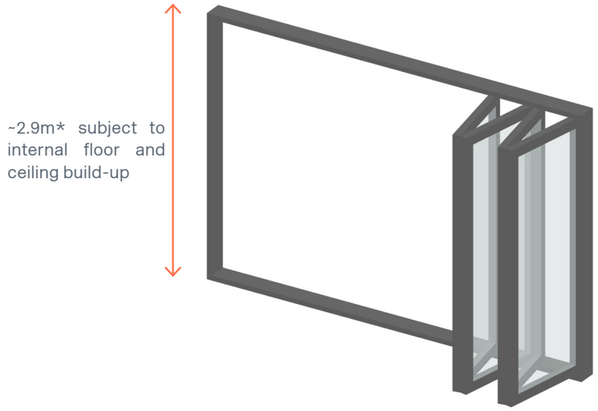
Winter Garden Bay

Sliding doors



Material	Aluminium
Height	~2.9m
Width	2m - 2.9m
Operability	Manual
Whole System U-Value (BASIX target)	2.7~3.2 (Some units may require thermally broken system)
Glazing SHGC (BASIX Target)	0.5
Facade Zone	200mm
Glazing	Low E IGU
Exemplar systems	Alspec Proglide High performance Reynaers Masterline 10 Capral Artisanal Architectural 934 Panoramic
Notes	The system is not a part of the weatherline at winter garden conditions

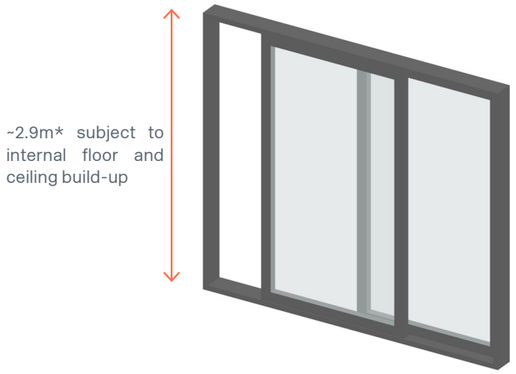
Bifold doors

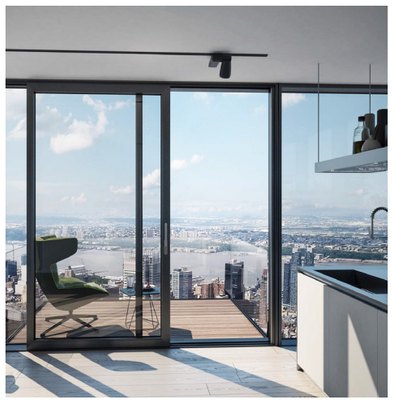


Material	Aluminium
Height	~2.9m
Width	3.5m-4m
Operability	Manual
Whole System U-Value (BASIX target)	2.6~4.0 (Some units may require thermally broken system)
Glazing SHGC (BASIX Target)	0.5
Facade Zone	200mm
Glazing	Low E IGU
Exemplar systems	Alspec Hawkesbury® Commercial Multi-Fold Door Reynaers Concept Patio 68 Capral Artisan 996 Quik Folding Door
Notes	The system is not a part of the weatherline at winter garden conditions

Upper Level Terraces

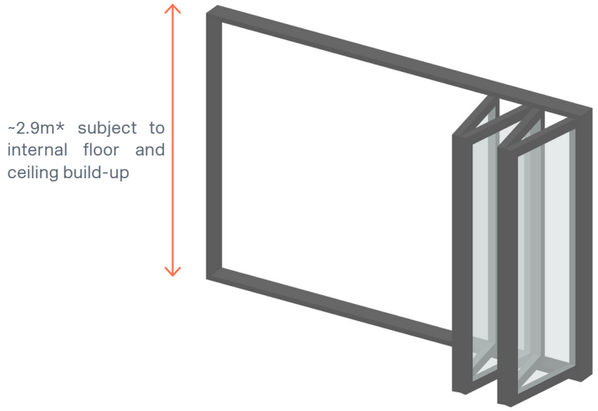
Sliding doors





Material	Aluminium
Height	~2.9m
Width	2m - 2.9m
Operability	Manual
Whole System U-Value (BASIX target)	2.7~3.2 (Some units may require thermally broken system)
Glazing SHGC (BASIX Target)	0.5
Facade Zone	200mm
Glazing	Double Lam IGU with Low-e
Exemplar systems	Alspec ProGlide Minimalist™ Sliding Door Reynaers Hifinity Vitrocsa Sliding (Premium)
Notes	The system forms a part of weatherline. Acoustic, Wind and thermal requirements to be investigated in the next stages.

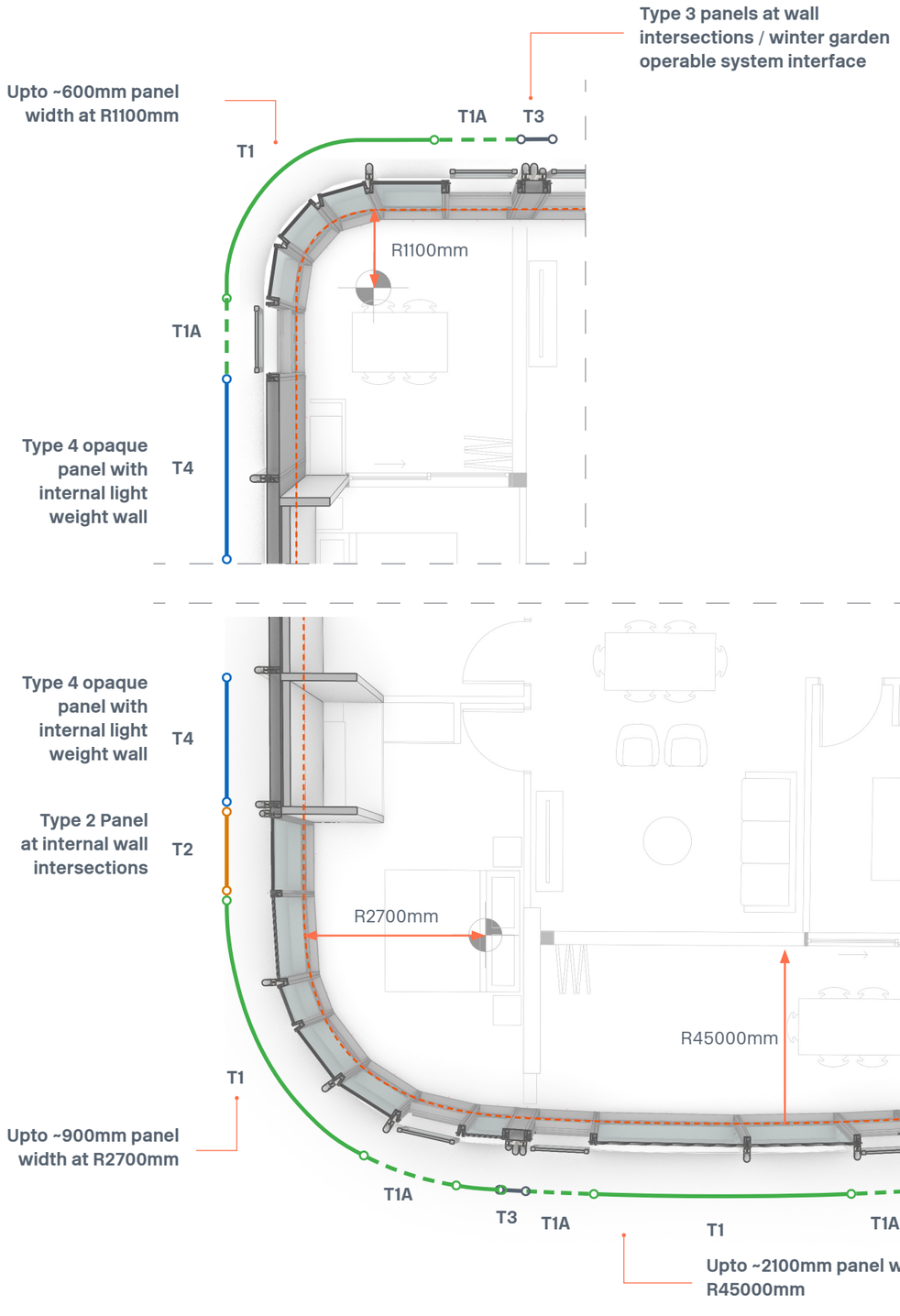
Bifold doors

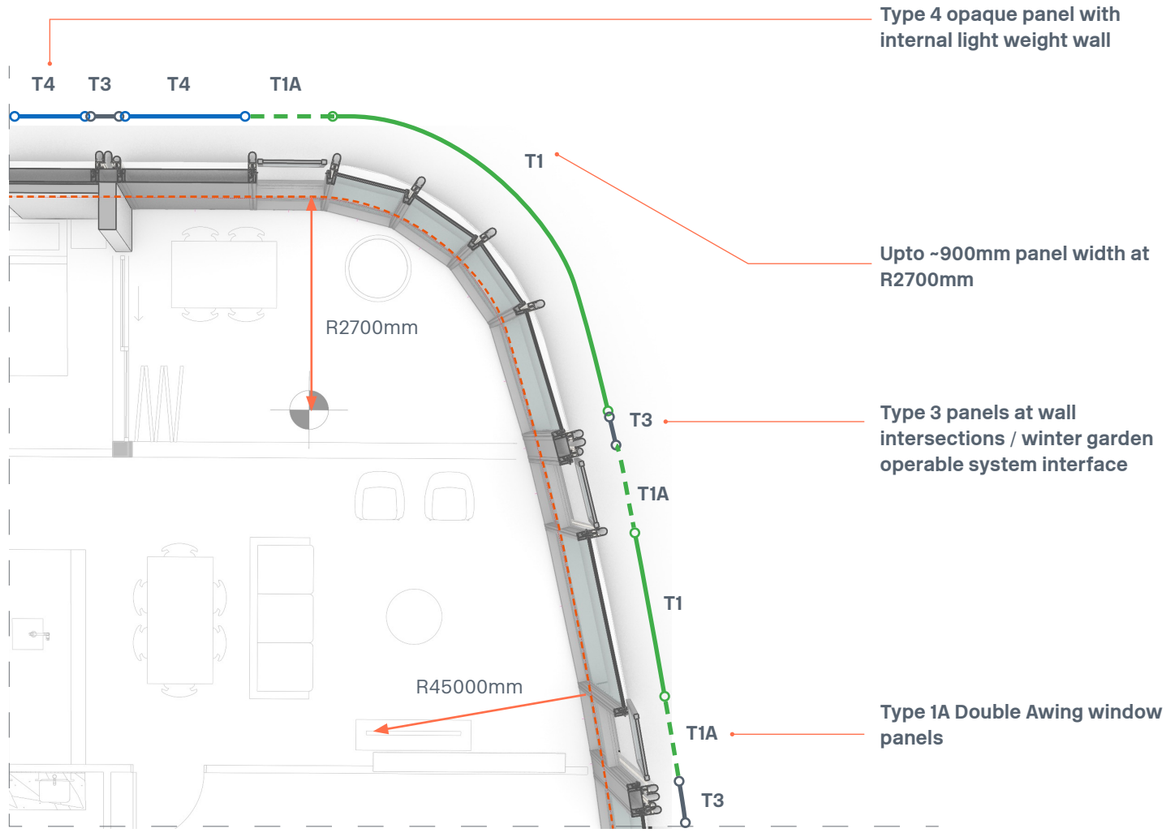


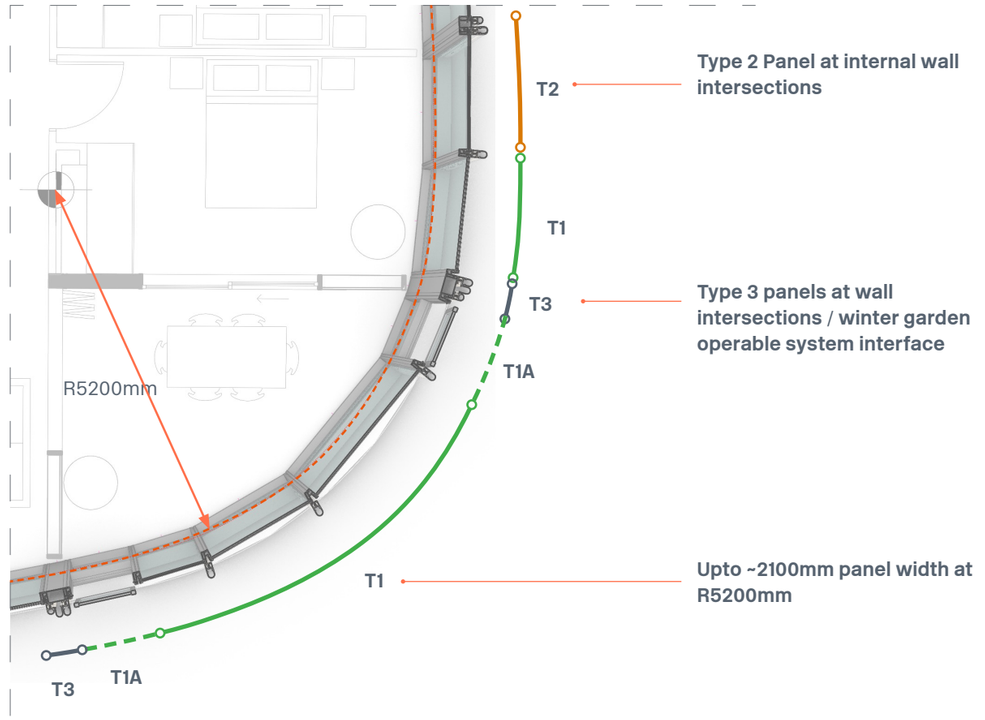
Material	Aluminium
Height	~2.9m
Width	3.5m-4.5m
Operability	Manual
Whole System U-Value (BASIX target)	2.6~4.0 (Some units may require thermally broken system)
Glazing SHGC (BASIX Target)	0.5
Facade Zone	200mm
Glazing	Double Lam IGU with Low-e
Exemplar systems	Alspec Hawkesbury® Commercial Multi-Fold Door Reynaers Concept Patio 68 Capral Artisan 996 Quik Folding Door
Notes	The system forms a part of weatherline. Acoustic, Wind and thermal requirements to be investigated in the next stages.

6.3 Panelisation Rationalisation Studies

The Following diagram illustrates the panelisation tests and corner curvature setout constraints in a typical Tower floor. This sets the rules for the four radii in consideration -1100mm, 2700mm, 5200mm, 45000mm which get repeated in the plan(not shown). Final panelisation and setout to be developed with the architect in the next stages.







NOTE: *THE DIAGRAM ILLUSTRATES THE INTENT FOR PANELISATION AND THE CONSIDERATIONS FOR PANEL TYPES. STANDARDISATION OF PANEL WIDTHS SUBJECT TO FURTHER DD

6.4 Glass Selection

6.4.1 Glazing Balance

In this section, considerations regarding glass design are reported, considering energy, thermal and structural aspects. The balance of views from outside, daylight, thermal insulation and solar gains control through the transparent envelope is an important aspect in highly glazed buildings.

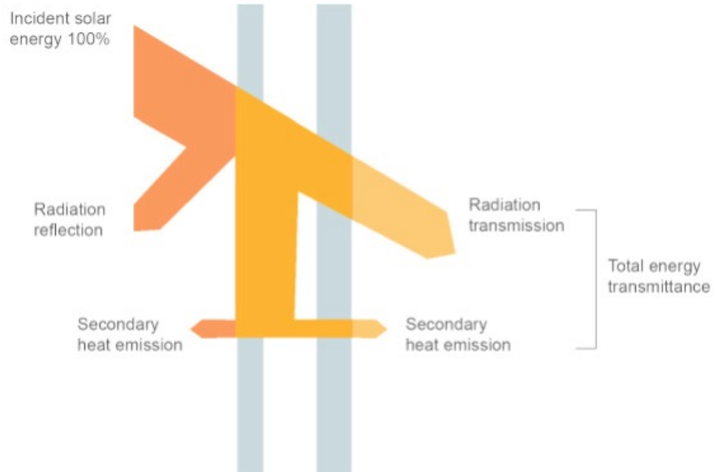
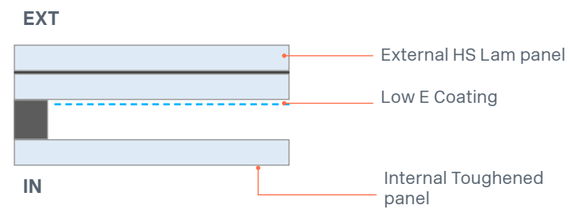
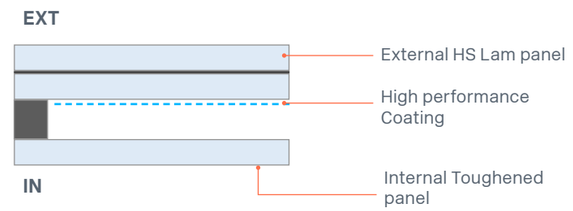
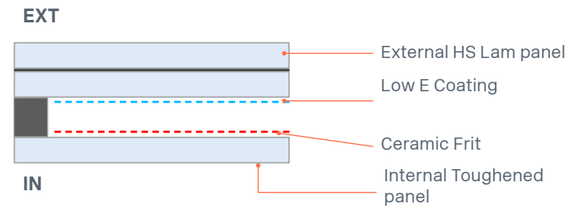
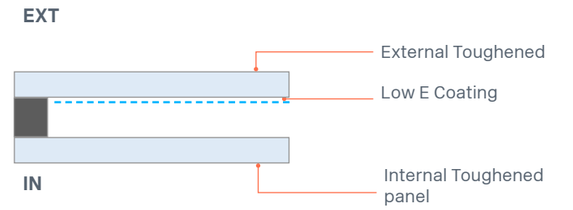
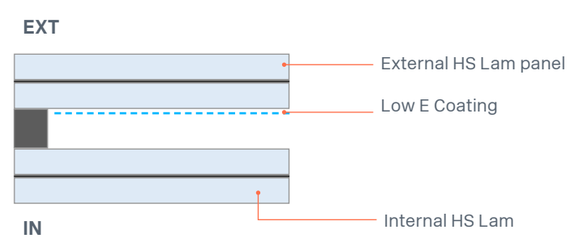


Figure 58: Solar radiation, reflection, transmission emission scheme in an IGU

6.4.2 Performance Targets

System Ref	Location	Glass U Value (BASIX target)*	Glass SHGC (BASIX target)*	External Reflectance	Reflective Colour	Buildup Sketch
EWS 101	Typical Tower Fixed Glazing + Integrated Awning Windows (Option for coating on inner pane)	~1.9	0.5	<15%	Neutral	
	Upper levels 25-32 Fixed Glazing + Integrated Awning Windows	~1.3	0.25	<15%	Neutral	
	Typical Tower North Facade Fixed Glazing + Integrated Awning Windows (Fritted)	~1.9	0.3	<15%	Neutral	
	Winter Garden Operable Systems	~1.9	0.55	<15%	Neutral	
	Upper levels 25-32 Operable Systems	~1.9	0.55	<15%	Neutral	

*** Target values based on a 10% frame ratio applied to Basix System targets as referenced in Section 5.2.4**

6.4.3 Energy performance and coating selection - Tower Glazing

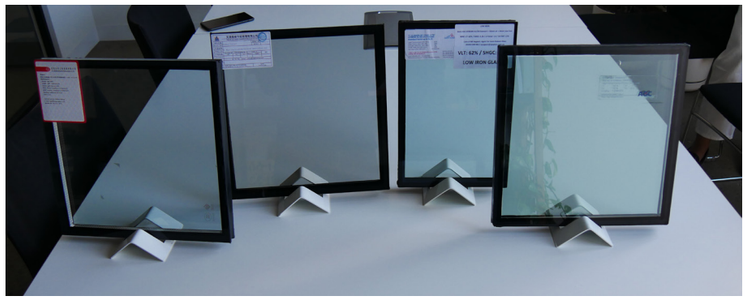
The key parameters influencing the envelope's energy performance are U-value, SHGC value and light transmission. The following list is not exhaustive but illustrative of coating availability close to our target values.

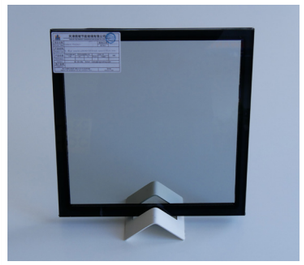
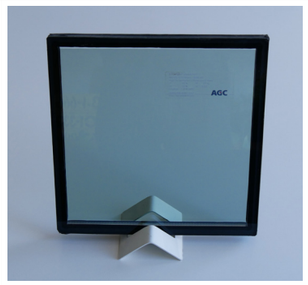
For The Typical Tower Glazing, with reference to the Basix modelling targets, the SHGC is set to 0.5. With the aim of giving the glass a high degree of transparency, and consequently, a high percentage of light transmission, possible coating options are shown in the table. The list aims to illustrate availability of products. Selection of Glass type subject to further coordination.

Coating	Supplier	SHGC	U Value	Light trasmittance %	Visible light reflectance		Reflective Colour
					ρv % out	ρv % in	
Insulglass LowE Plus - Clear Laminate	AGG	0.55	1.4	78%	12	13	Neutral
Double Silver Low-e (SJ12-79D on outer surface of internal pane)	CSG	0.5	1.65	70%	11	12	Neutral
Planitherm HN	Saint - Gobain	0.55	1.85	69%	13	12	Neutral
Optitherm	Glass Works	0.54	1.6	77%	14	14	Clear

6.4.4 Energy performance and coating selection - Upper Levels 25-32

For the upper levels Glazing, with reference to the Basix modelling targets, the SHGC is set to 0.25. With the aim of giving the glass a high degree of transparency, and consequently, a high percentage of light transmission, possible coating options are shown below. The list aims to illustrate availability of products. Selection of Glass type subject to further coordination.



Coating	Supplier	SHGC	U Value	Light trasmittance %	Visible light reflectance		Reflective Colour	Image
					ρv % out	ρv % in		
PTE6-A05	TG Taicang	0.26	1.61	54%	12	15	Blue Grey	
Triple Silver Low-e (SJ52S)	CSG	0.25	1.6	50%	13	13	Neutral	
CLIMAPLUS COOL-LITE XTREME 61/29(II) Diamant	Saint - Gobain	0.26	1.6	62%	11	14	Blue Grey	
STOPRAY VISION 52T	AGC	0.25	1.6	50%	16	12	Blue Grey	

7. Podium Facade Systems

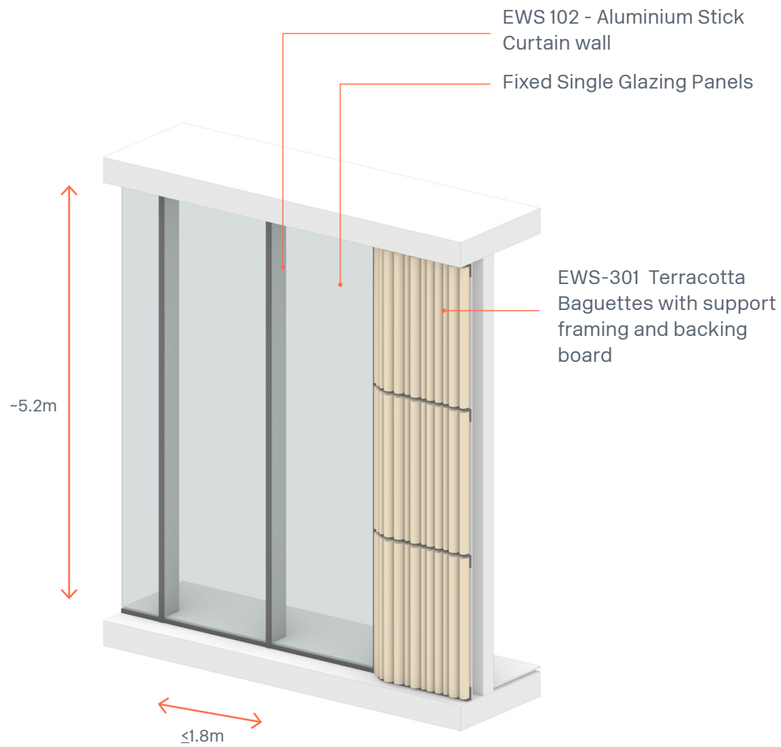
7.1 EWS-102, EWS-301

EWS-102 : Podium Glazing System
Vertical format Aluminium framed Stick curtain wall system incorporating fixed single glazed panels.

EWS-301 : Podium Opaque Facade
Light weight double stud or stud wall with cavity insulation incorporating vertical format terracotta baguettes as a rainscreen system with support framing.

Recommended use of colour matched terracotta substrate in the event of chipping due to hard body impact in trafficable areas.

Location	L00(residence), L01 - L03
Floor-Floor Height	5.5m, 5m
Glazing U-Value (ESD Target)	4.0
Opaque R-Value (ESD Target)	2.7
Facade Zone	300mm
Door Types	Sliding Doors



NOTE: *DIAGRAMS ARE INDICATIVE AND SUBJECT TO FURTHER DD

7.1.1 Design drivers

The main design drivers for this facade have been identified as:
— Structural efficiency of framing members while maintaining architectural panelisation.
— Movement accommodation allowance.
— Incorporating Door systems

7.1.2 System description

For the Podium Glazing, an aluminium capped Stick System is proposed with incorporated door systems. The stick system is a curtain wall facade typically comprised of a framework and infill panels. Framework components (mullions & transoms) arrive on-site as individual pieces or pre-assembled frames. Infill panels (vision glass, operable elements) are then incorporated in the grid. Weatherproof joints can vary between pressure cap systems, toggles, or structural sealants. Typically, all weather protection at interfaces is done via EPDMs and by site-applied silicone.

7.1.3 Support Strategy

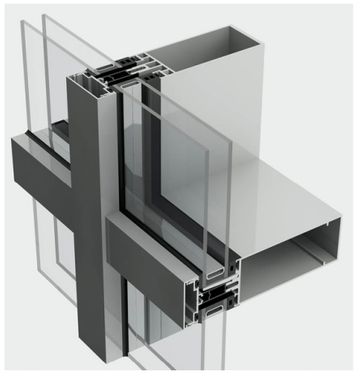


Figure 1.3 Aluminium Stick curtain walling with pressure plate and cap

The typical load path is transferred from the infill panels and to the mullions of the stick curtain wall system. The Curtain Wall is spanning from slab to slab, the mullions are either gravity supported at the base, while the other end of the mullion is then restrained out-of-plane via pre-positioned brackets. Brackets are required at every mullion.

The glazing is vertically supported on two blocks typically located 150mm from the transom. The load is then taken through the transom to the mullions. Additional support angles are sometimes introduced for heavier glazing build-ups. The glass is restrained out-of-plane with aluminium pressure caps.

7.1.4 Construction method

External access is required to install the stick system curtain wall.

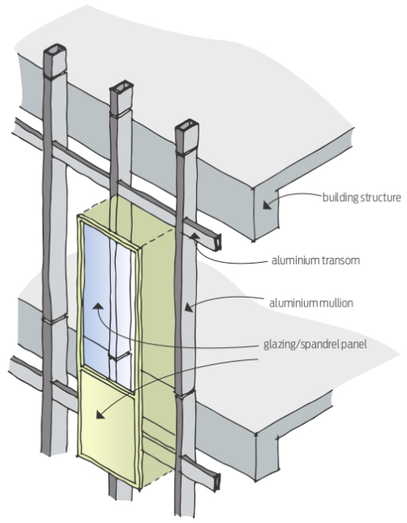


Figure 1.4 Regular stick curtain wall system elements

The sequence might be as follows depending on how the trades are split:

1. Curtain wall bracketry and framing
2. Infill glazing and spandrel panels + EPDM
3. Firestops + Insulation
4. Metallic flashings

Figure 1.5 Typical Construction of Stick System

7.1.5 Terracotta System

The main design drivers for this facade have been identified as:
— Structural efficiency of framing members while maintaining architectural panelisation and design Intent.
— Movement accommodation allowance.
— Accomodation for Ventilated zones

7.1.6 System description

For the Podium Opaque facade Terracotta Baguette rainscreen system is proposed. Terracotta panels can be extruded or cast. For economy of material and in cases of high repetition, extruded terracotta profiles are generally preferred and can achieve a wide range of profiles, as shown in the image below.

Exemplar Suppliers: NBK Terrart Baguettes , DCA Tempio Baguettes

7.1.7 Support Strategy

Vertical Terracotta Baguettes can be supported using
- Side fixing strategy
- Back Fixing Strategy

Both systems accommodate the current design intent and are subject to supplier preference and future resolution with the design team.

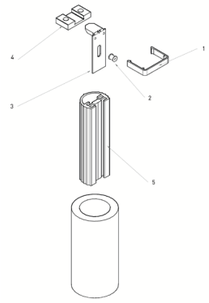


Figure 1.6Top Fixing support system with inserts and support clips

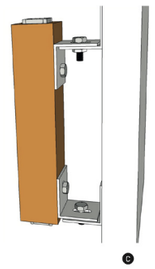
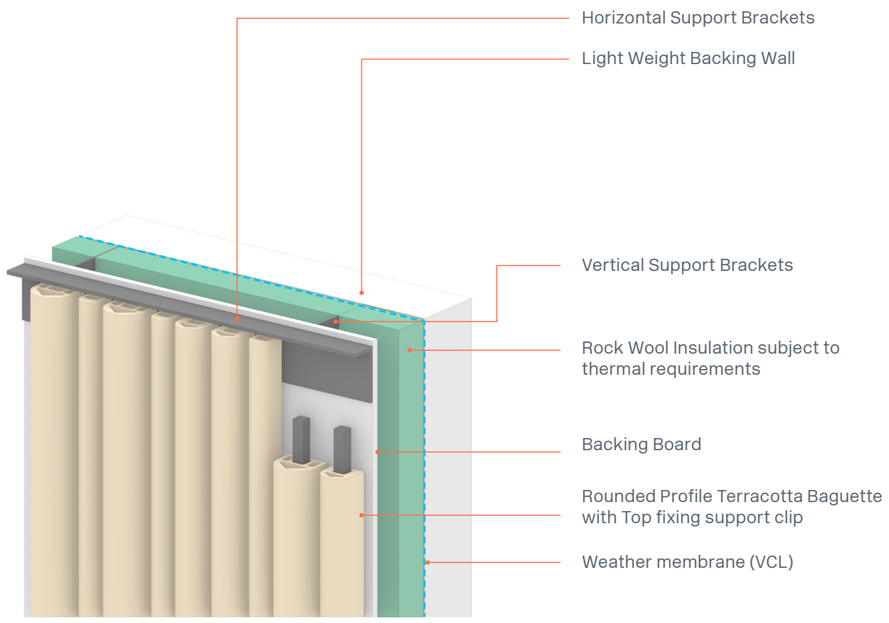
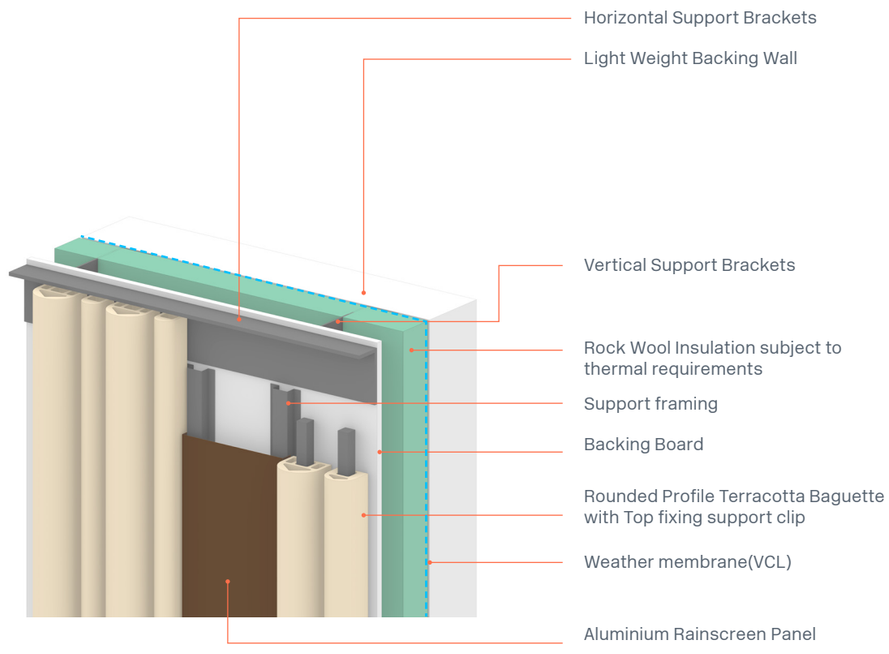


Figure 1.7 Side Fixing Brackets

7.1.8 System Sketch - Typical Podium Opaque Facade - EWS 301



7.1.9 System Sketch - Podium Opaque Facade - Residential Entrance - EWS 302



7.2 EWS-201

Ground Level Retail Glazing System
Vertical format Stainless steel framed Stick curtain wall system incorporating fixed single glazed panels and Entrance door configurations to future coordination

Location	Retail Facade - L00
Floor-Floor Height System Height	<5.8m
Whole System U-Value	NA
Glazing SHGC	NA
Facade Zone	300mm
Entrance Door Types	Sliding Doors

7.2.1 Design drivers

The main design drivers for this facade have been identified as:
— Minimal facade framing
— Structural efficiency of framing members while maintaining architectural panelisation.
— Movement accommodation allowance.
— Incorporating Door systems

Figure 1.8 Steel T-profile Stick curtain walling with Aluminium pressure plate and cap

Figure 1.9 Steel RHS/SHS Stick curtain walling with aluminium pressure plate and cap

7.2.2 System description

For the Entrance Glazing, a Steel Stick System is proposed with incorporated door systems. Stick systems comprise individual vertical (mullions) and horizontal (transoms) spanning members, infilled with panels that are either opaque or glazed.

The framework components arrive on-site as individual pieces or pre-assembled for ease of installation or quality control reasons. Infill panels (vision glass or opaque elements) are then incorporated in to the grid. All weather protection is by site-applied.

The restrain method of the infill panels can vary between pressure cap systems, toggles, or structural sealants. Each of these restraint methods has advantages and disadvantages and the drivers for the preferred options are typically the architectural design intent, structural movements, maintenance/glass replacement, and cost.

The use of a steel system admits the possibility of using composite steel systems. These systems typically use an RHS/SHS or T-shaped steel profile for the strength and then use a small aluminium extrusion attached to the front of the section to create the interface for the infill panels and waterproofing.

7.2.3 Support Strategy

The typical load path is transferred from the infill panels and to the mullions of the stick curtain wall system. The Curtain Wall is spanning from slab to slab, the mullions are either gravity supported at the base, while the other end of the mullion is then restrained out-of-plane via pre-positioned brackets. Brackets are required at every mullion.

The glazing is vertically supported on two blocks typically located 150mm from the transom. The load is then taken through the transom to the mullions.

The support strategy from truss primary structure and system framing for the large format panels in level 01 will be developed in next stages

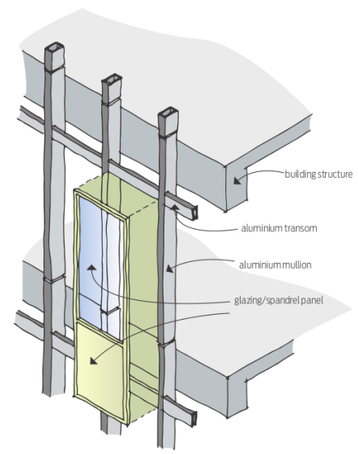


Figure 1.10 Regular stick curtain wall system elements

7.2.4 Construction method

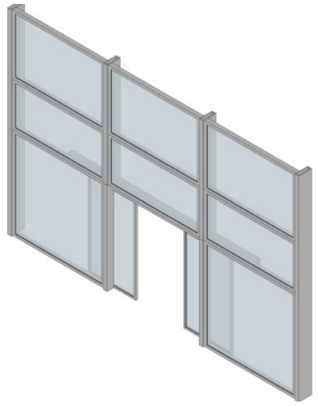
External access is required to install the stick system curtain wall.
The sequence might be as follows depending on how the trades are split:

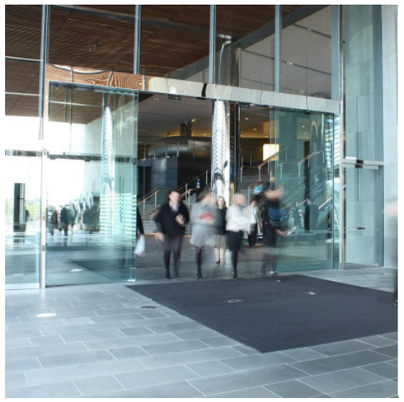
1. Curtain wall bracketry and framing
2. Infill glazing and spandrel panels + EPDM
3. Firestops + Insulation
4. Metallic flashings

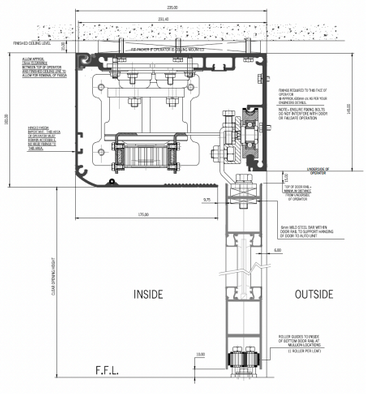
Figure 1.11 Typical Construction of Stick System

7.3 Operable Systems

Retail Sliding Door Systems



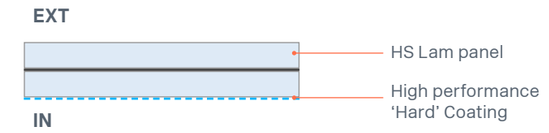




Material	Aluminium
Height	~2.9m (TBC by Architect)
Width	4m - 4.5m
Operability	Motorised
Whole System U-Value (BASIX target)	NA
Glazing SHGC (BASIX Target)	NA
Facade Zone	300mm + Motorisation Mechanism
Glazing	Laminated single glazing
Exemplar systems	Dormakaba 401 or similar
Notes	

7.4 Glass Technologies

Performance Requirements

System Ref	Location	System U Value ESG Target	SHGC ESG Target	VLT	External Reflectance	Reflective Colour	Buildup Sketch
EWS 102	Podium Facade	4.0	0.29	>30%	<15%	Neutral	
EWS 201	Retail Facade	4.0	0.7	>85%	<15%	Neutral