University of Newcastle | Central Coast Campus
Lyons + EJE
Façade Design Report

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Revision History

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1.0 Introduction

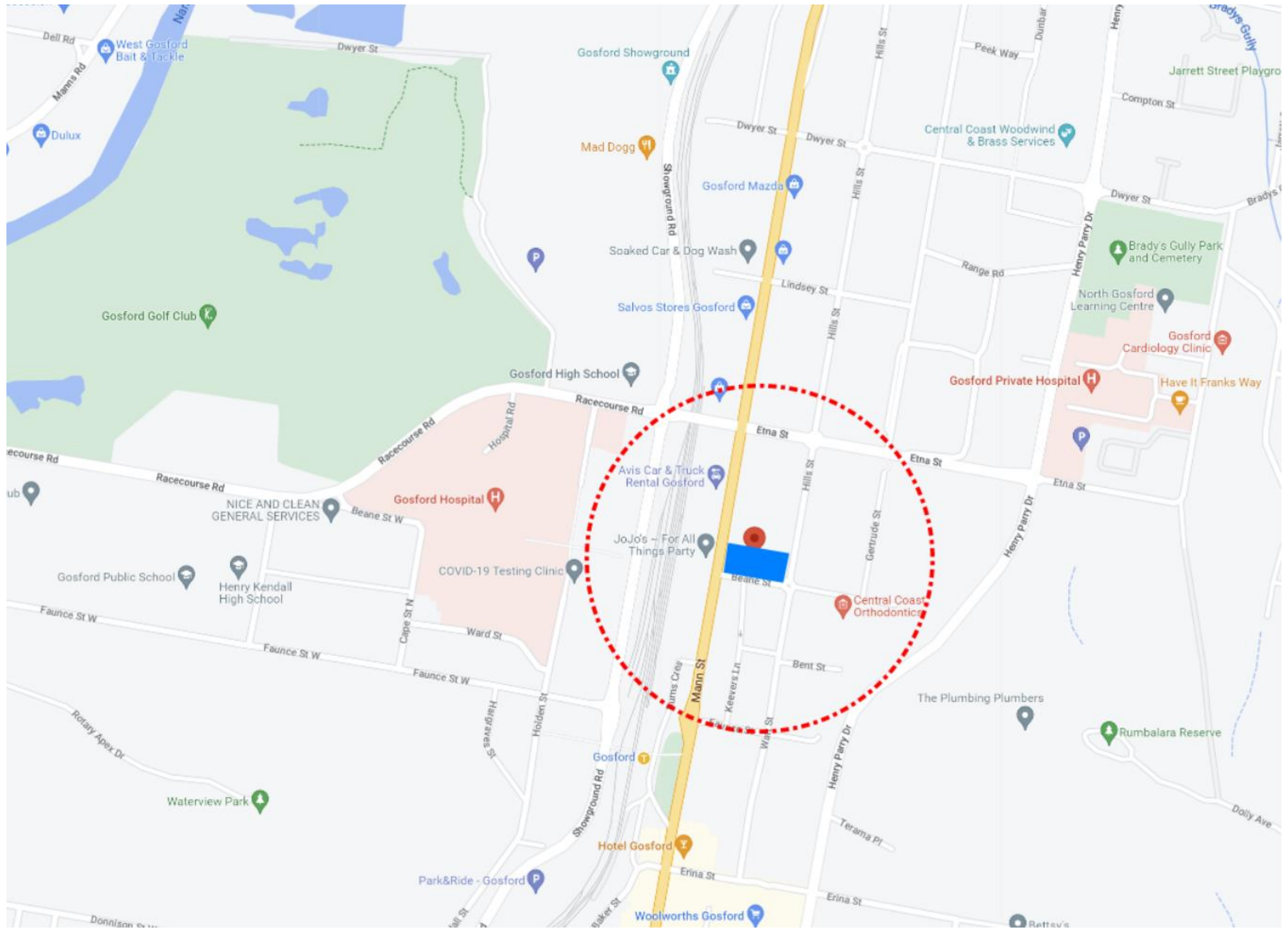
This report has been prepared for Design Development stage of the University of Newcastle Central Coast Campus located at 305 Mann Street, Gosford. The project involved the design and construction of a new 3 level education building at the campus. A concept render of the project is below (Figure 1).

Figure 1 | Project aerial concept render

The project consists of the following key façade systems:

- FA-CW01a –Curtain-wall with double glazing, aluminium spandrels and vertical fin features
- FA-CW01B – Curtain-wall with double glazing and aluminium spandrels
- FA-CW02 – Curved curtain-wall with double glazing and custom ceramic frit pattern
- FA-WW01 – Steel framed, zig-zag window-wall system with double glazing
- FA-WW02 – Unitised aluminium strip window system (above FA-WW01)
- FA-RS01 – Equitone rainscreen cladding fixed to lightweight stud wall
- FA-RS02- Equitone rainscreen cladding fixed to concrete base structure
- FA-AL01 – Aluminium rainscreen cladding fixed to lightweight stud wall
- FA-AL02 – Aluminium rainscreen cladding fixed to concrete base structure
- FA-WN01 – Café Serve-Thru Window
- FA-WN50 – Operable glazed louvres

This report provides an overview of the key design considerations, criteria and assumptions for the design of façade systems for the project.



2.0 Project Data

2.1 Project Team

The following key parties are involved in the project:

Client	Mater Misericordiae Ltd
Architect	Lyons + EJE
Building Certifier	Blackett Maguire Goldsmith
Structural Engineer	Northrop
Civil Engineer	Northrop
Cost Consultant	Wilde & Wollard
Mechanical Engineer	ADP Consulting
Electrical Engineer	ADP Consulting
Hydraulic Engineer	ADP Consulting
Façade Consultant	Inhabit Group
ESD Consultant	WSP
Building Physics Consultant	WSP
Acoustic Consultant	RAPT Consulting
Fire Engineer	Holmes
Wind Consultant	Wind to AS1170
Landscape Architect	McGregor Coxall
FP1.4, NCC Weatherproofing Consultant	Inhabit Group

2.2 Scope of Works

The following façade types are proposed for the project. Façade system plan mark-up are included in following section.

System	Code	System Description	Vision Code	Non-vision Code	Attachments
Curtain-wall	FA-CW-01a	Unitised, aluminium framed curtain-wall system with low-e double glazing, aluminium spandrels and extruded aluminium, vertical and horizontal feature fins	GL01	AL01	
	FA-CW01b	Unitised, aluminium framed curtain-wall system with low-e double glazing, aluminium spandrels and extruded aluminium	GL02	-	
	FA-CW02	Unitised, curved, aluminium framed curtain-wall system with low-e double glazing w/ custom dot ceramic frit.	GL03	-	
Window Wall	FA-WW-01	Steel framed, zig-zag, window-wall system with low-e double glazing, and proprietary doors and operable windows.	GL04	AL01	FA-WN01 FA-WN50
	FA-WW02	Unitised, aluminium framed strip-window system (at high level, above FA-WW01)	GL-02	-	FA-WN50
Rainscreen Systems	FA-RS01	Equitone cladding in rainscreen configuration, fixed to lightweight stud wall system with rigid air barrier and thermal insulation.			
	FA-RS02	Equitone cladding in rainscreen configuration, fixed to concrete base structure.			
	FA-AL01	Solid aluminium cladding in rainscreen configuration, fixed to lightweight stud wall system with rigid air barrier and thermal insulation.			
	FA-AL02	Solid Aluminium cladding in rainscreen configuration, fixed to concrete base structure.			

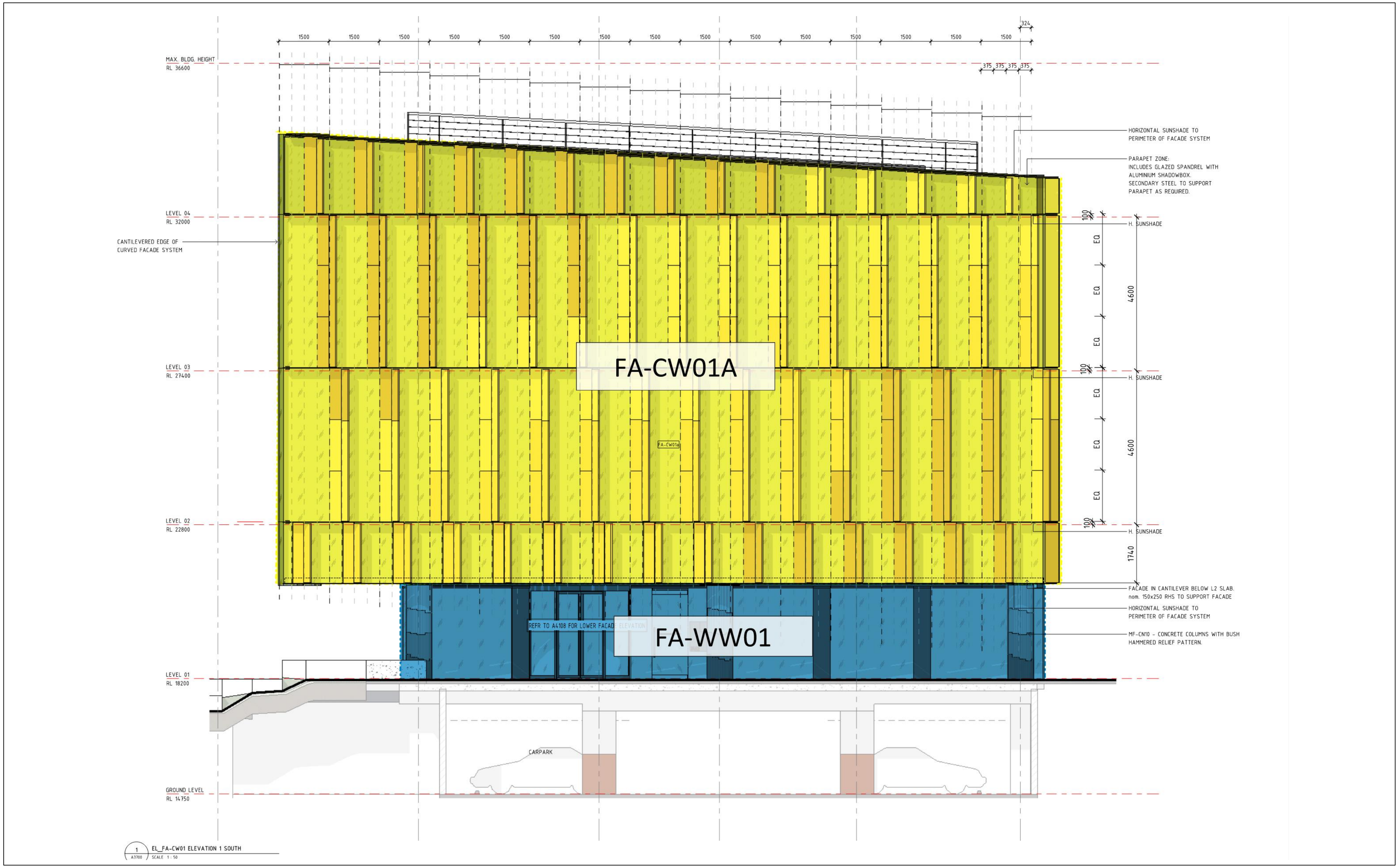
The following vision glass types are proposed for the project.

Code	Description	Additions/modifications
GL01	Clear double glazed unit with high performance low-e coating on surface #2	Benchmark glazing product: Xinyi Glass 6C(XT71121-Z)#2 + 12A + 6C
GL02	Clear double glazed unit with high performance low-e coating on surface #2	Benchmark glazing product: Xinyi Glass 6C(XT71121-Z)#2 + 12A + 6C
GL03	As per GL01 with ceramic frit pattern surface #2, low-e coating to surface #2 or #3 depending on curvature of glazing.	
GL04	Clear double glazed unit with high performance low-e coating on surface #2	Inner lite laminated for safety. Laminated inner and outer lite where a door or can be mistaken for a door

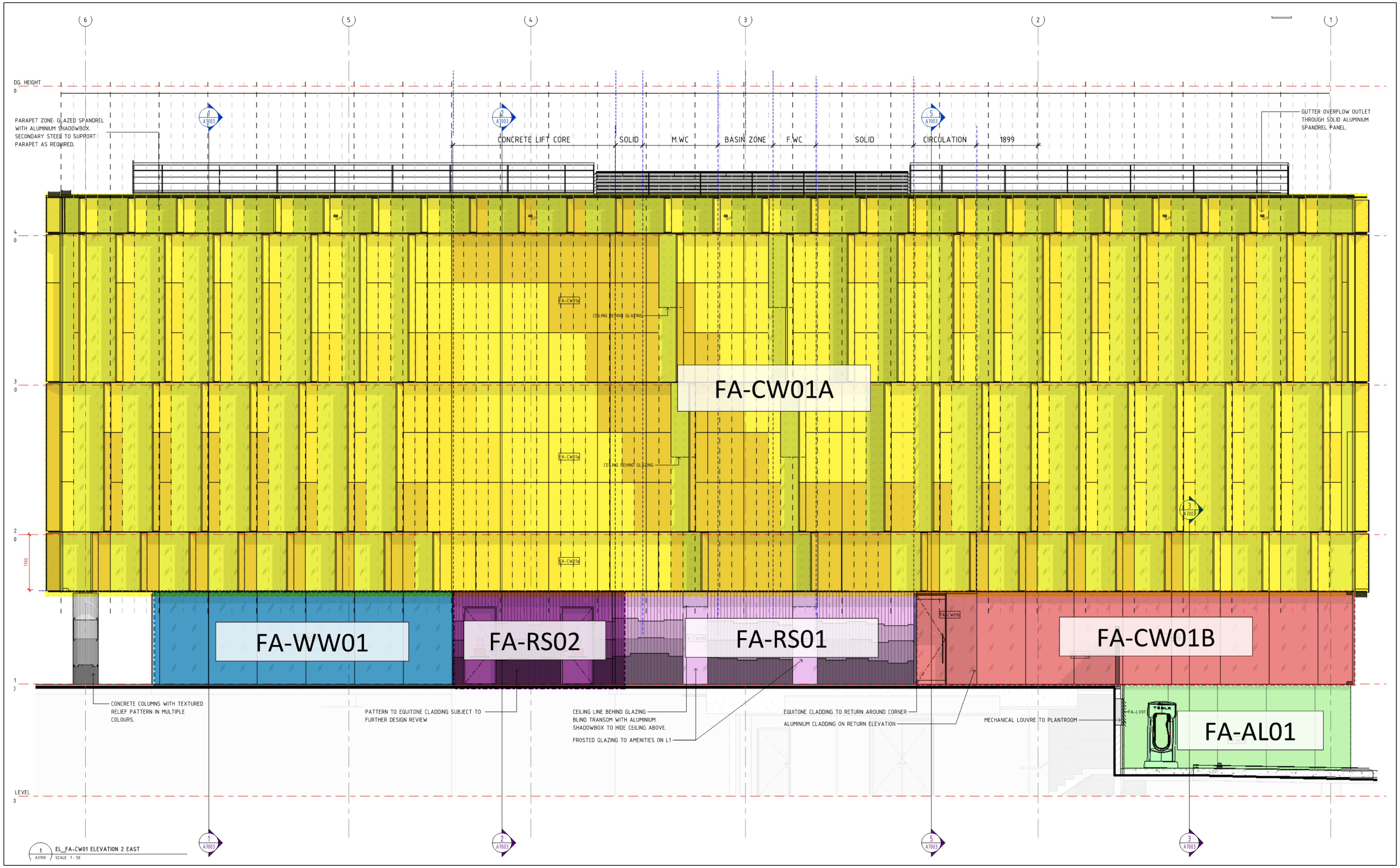
The following non-vision, non-glass types are proposed for the project.

Code	Description	Additions/modifications
AL01	Solid aluminium sheet, powder coated to AAMA2604	
EQ01	Equitone cladding, 'Lines'	

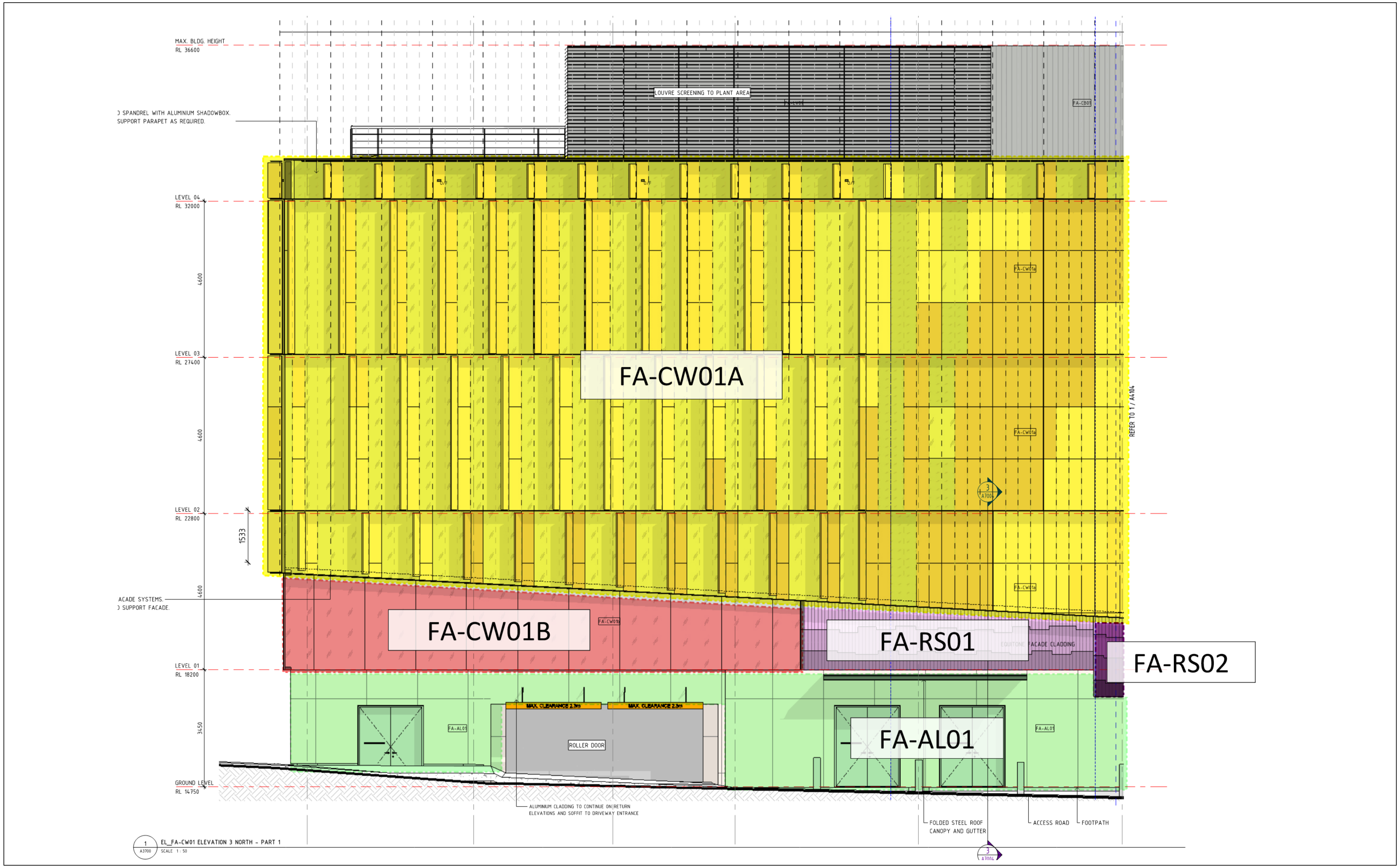
South Elevation



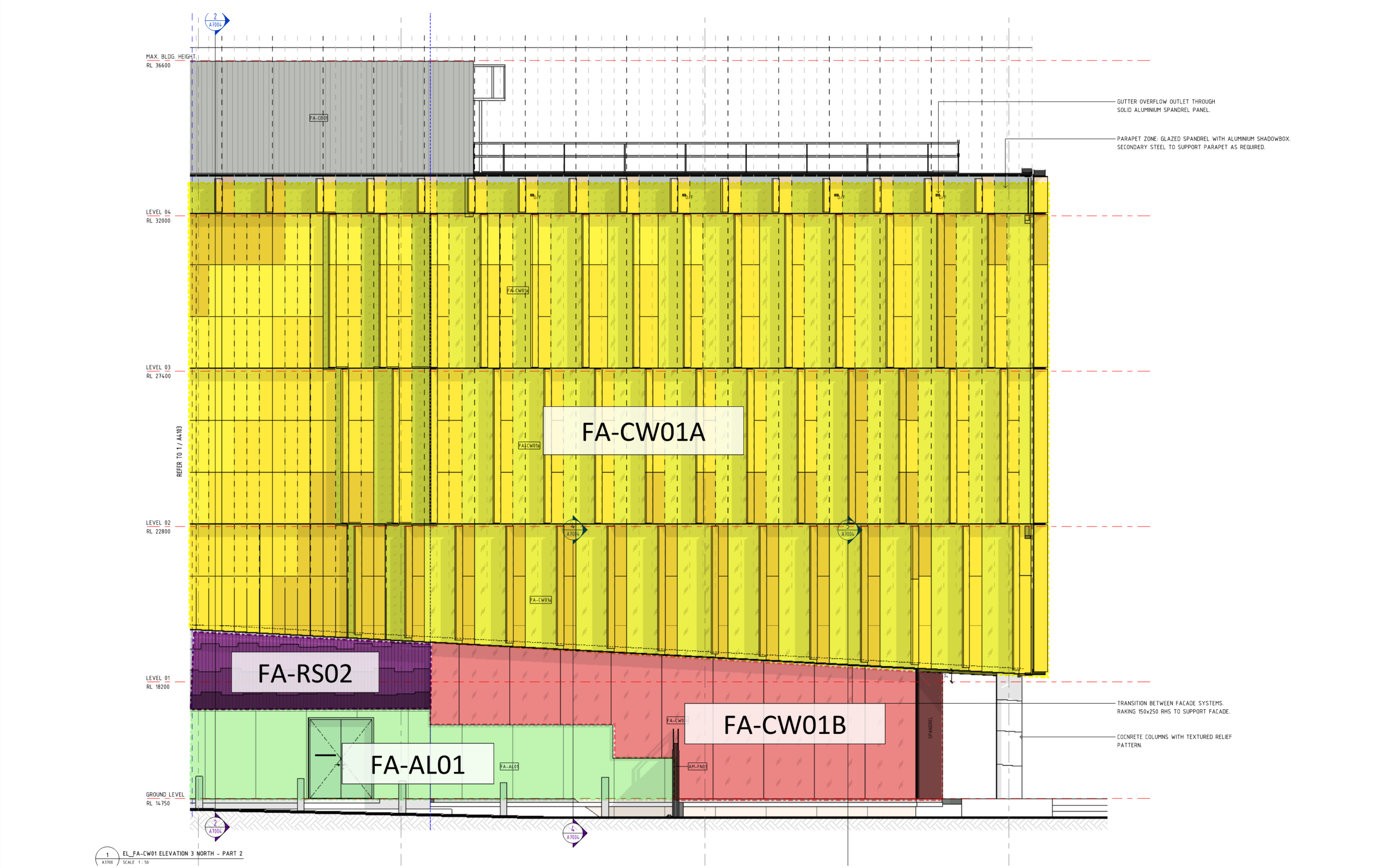
East Elevation



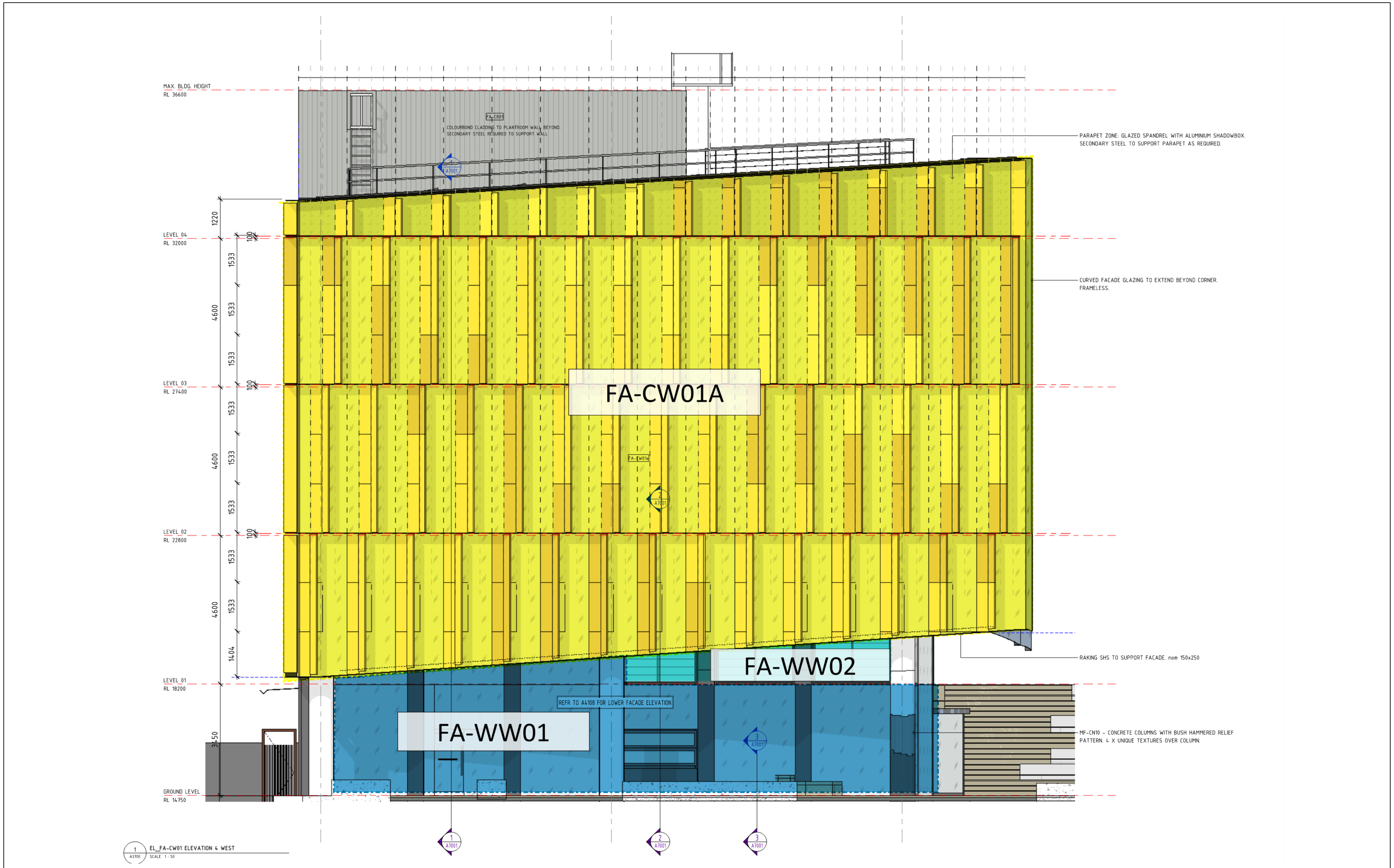
North Elevation – Part 1



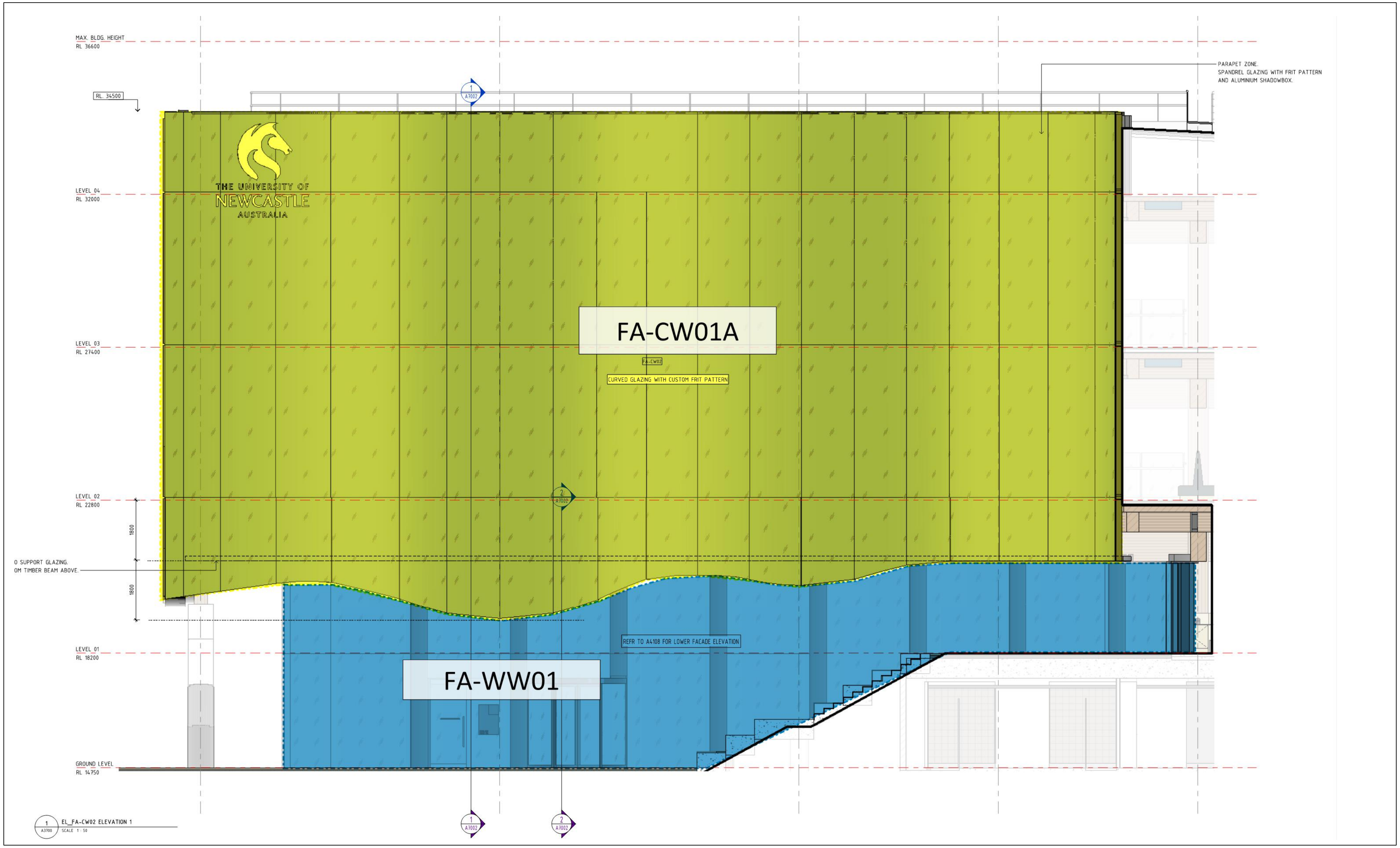
North Elevation – Part 2



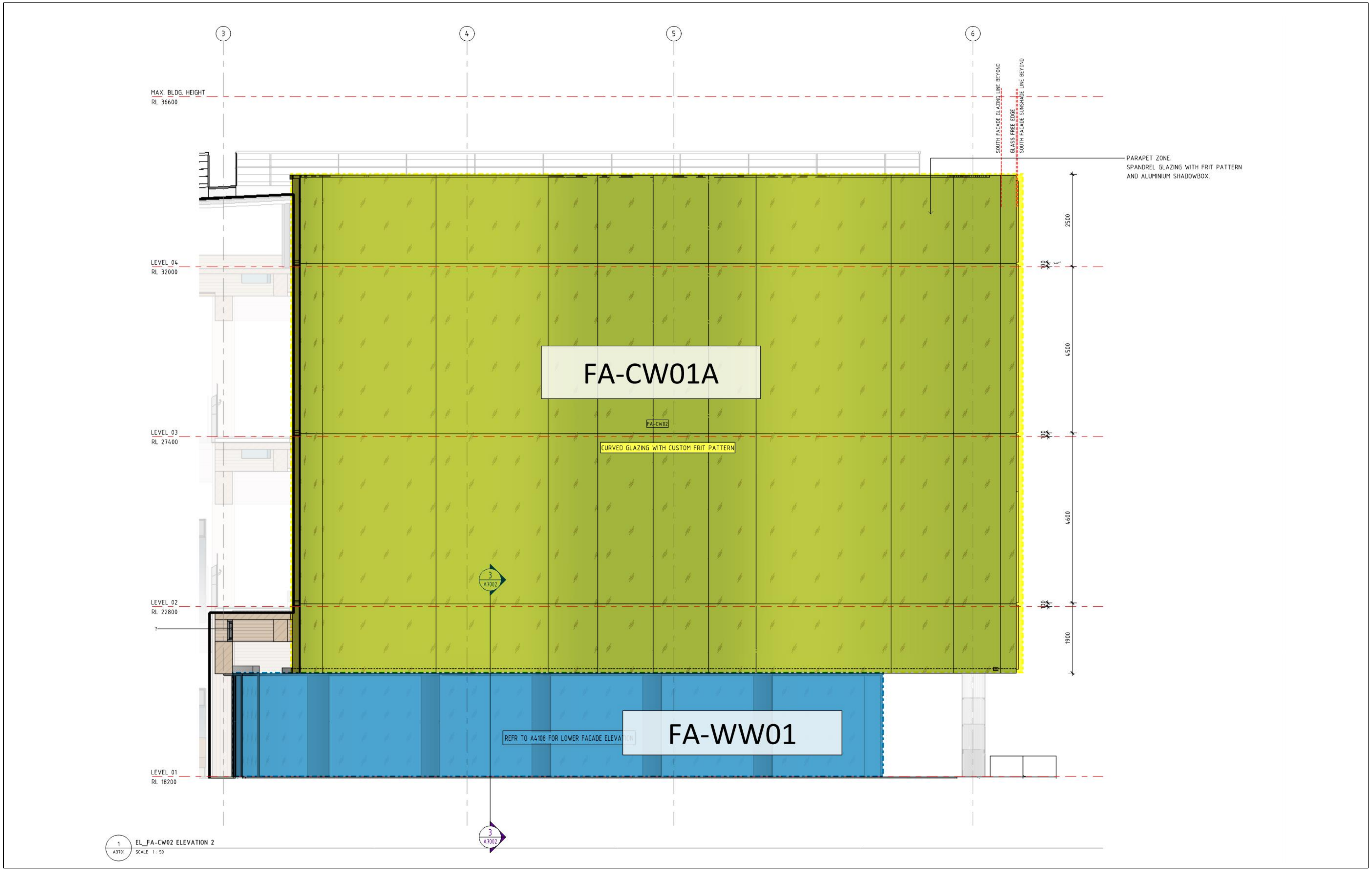
West Elevation



Curved Façade – South



Curved Façade West



3.0 Criteria and Assumptions

The design of the Building Envelope for the UON CCC development will be required to satisfy several design parameters and project specific requirements. The sections following include discussion of general requirements for façade systems that have been informed by the following project documents:

3.1 Importance

3.1.1 Building

The BCA NCC defines Importance Level 3 as considered to be buildings that as a whole may contain large numbers of people. BCA NCC Section B requires the following design event for safety under Importance Level 3 classification:

- 1:1000 annual probability of exceedance for Region A2 wind loading
- 1:1100 annual probability of exceedance for earthquake

AS1170.0 in Table F1 defines Importance Level 3 as structures that as a whole may contain people in crowds or contents of high value to the community or pose risks to people in crowds. Table F2 for Importance Level 3 and 50 year Design Working Life indicates the following:

- 1:25 annual probability of exceedance wind loading, ULS
- 1:1000 annual probability of exceedance earthquake, ULS

3.1.2 Component

All façade system elements and components that are associated with occupant, maintenance or other personnel safety, are proposed to be designed, tested and installed for the associated performance for Building Importance indicated above.

3.1.3 Design Working Life

AS1170.0 defines the Design Working Life the period of time during which a structure or structural element, that when designed, is assumed to perform for its intended purpose with expected maintenance but without major structural repair being necessary. Table F2 in AS1170.2, for a 50 year Design Working Life indicates alignment with the BCA NCC wind and seismic loading annual probabilities of exceedance noted above. A 50 year Design Work Life is proposed for all façade elements and components with a structural safety function.

3.1.4 Redundancy and Robustness

AS1170.0 defines Structural Robustness as the ability of a structure to withstand events like fire, explosion, impact or consequences of human errors, without being damaged to an extent disproportionate to the original cause. This is predominantly associated with building structures, however is to be considered for materials and components used in façade systems, where appropriate. The following are proposed, refer to following sections for discussion.

- Glass – internal locations to meet AS1288. Monolithic or laminated toughened glass not to be used unless approved
- Glass – external vertical locations to meet AS1288. Monolithic heat strengthened used where within design requirements. No impact performance

3.2 Durability

All façade components and materials are to achieve required Design Life with reasonable maintenance up to and following service life period. Most components are to be accepted by the Building Owner as requiring regular access for cleaning, maintenance and replacement within the Design Life duration. Components that cannot be accessed and replaced without entire facade system dismantling are recommended to reach design life without maintenance, for example support anchors to concrete. Elements that can be maintained and replaced with some façade system dismantling are to be accepted by the Building Owner, for example cladding sub-framing and metallic air barrier sheeting.

3.2.1 Corrosivity Environment

The external corrosivity macro-environment at the Central Coast Campus location is indicated in AS2312 to be Class C3 Medium with approx. 25µm to 50µm loss of mild steel per year. A more aggressive industrial macro-environment or micro-environment due to pollutants and chemicals is assumed not to be present.

The proposed façade systems include vertically oriented cavities that are not generally exposed to the beneficial washing of rainwater, thereby allowing collection of chemicals and contaminants. All cavities are to promote drainage and are not to include prolonged surface wetness. Materials and components within these cavities are to be assessed for elevated corrosivity category, Class C4 High with approx. 50µm to 80µm.

Façade system materials and components are to be assessed and design to meet performance associated with the following:

- Exposed to external environment air, rainwater and condensation, i.e. rain screen materials and components with good drainage – Class C3
- Exposed to external environment air and condensation, but mostly protected from rainwater, i.e. materials and components between rain screen and air barrier with good drainage – Class C4
- Exposed to internal conditioned environment air, with minor exposure during construction, i.e. materials and components behind air barrier and protected during construction – Class C2

3.2.2 Service Life

ISO15686 defines the Service Life as the period of time after installation during which a building or parts meets to exceeds the performance requirements. Façade materials and components can be categorized as follows.

- Replaceable – Building Management following correct maintenance will not preclude the need for component replacement during Design Working Life duration
- Permanent and maintainable – Building Management is to follow correct maintenance for the component to reach Design Working Life duration without replacement
- Permanent and non-maintainable – Building Management cannot access the component, the component reaches Design Working Life duration without maintenance. However the component will require maintenance or replacement at some point after Design Working Life duration.

Predicted Service Life durations for typical façade materials and components are:

- Anodized or powder coated aluminium extrusion finish, permanent and maintainable – 25 years
- Anodized or powder coated aluminium sheet finish, permanent and maintainable – 25 years
- Structural silicone, replaceable – 35 years
- External gaskets and seals, replaceable – 25 years
- Internal gaskets and seals, replaceable – 35 years
- Aluminium framing, brackets and stainless steel fasteners, permanent and non-maintainable – Design Working Life
- Glass, replaceable – 35 years
- Metallic air barrier sheet, permanent and maintainable – 25 years

3.2.3 Anodized Aluminium

Anodized aluminium extrusions and sheet are recommended to meet the high quality standard of AAMA612 or the lesser AAMA611, however local anodizing contractors generally do not have quality testing capability to ensure compliance with these standards and instead produce anodized aluminium in accordance with AS1231. Exposed aluminium is to achieve 25µm average coating thickness (AA25).

The aluminium anodized coating is susceptible to damage through transportation, installation and facility operation. Repair of the coating is difficult and for this reason anodized finish is not recommended.

3.2.4 Powder Coated Aluminium

Powder coated aluminium extrusions and sheet are recommended to use Dulux, Interpon or similar approved powder that meets AAMA2605 quality for external applications and AAMA2604 for internal applications. The higher AAMA2605 quality provides increased durability for coating integrity and colour fastness, however is more costly than the lesser AAMA2604 and AAMA2603. PVDF liquid applied paint meeting AAMA2605 is typically proposed as alternative to static applied dry powder. AAMA2604 quality finish provides a reasonable performance, further information can be provided if necessary.

AAMA2604 quality powder coating has been adopted.

3.2.5 Air Barrier

Metallic air barrier sheet material used in cladding systems and unitized glazing system non-vision zones is typically galvanized or electrogalvanized zinc coated steel. The Service Life of 1.5mm thick steel sheet with 55µm coating to AS4680 is noted in AS2312.2-2014 as 26 to 78 years for C3 corrosivity category and 78 to >100 years for C2 corrosivity category. It is likely during the Design Working Life of sheet in drained cavities will need to be maintained, which will require removal of external cladding for access. The Building Owner is to allow for long term maintenance activities associated with inspection of cladding cavities, removal of cladding and repair or replacement of air barrier sheeting.

Alternative to a metallic air barrier sheet is air permeable or non-permeable sarking wrap. Such products provide the same function as metallic sheeting however are not specifically required under AS4200.2 to be tested for Ultimate Limit State wind pressures. Where proprietary cladding systems have been chamber weather tested, the use of pliable wrap has been upgraded to rigid board air barrier at higher wind pressures. Wrap products are susceptible to tearing and taped joints opening.

The use of wrap products is not recommended unless required for breathable wall system and condensation management. Fully sealed metallic air barrier sheeting is recommended.

Façade systems proposed for the project are mostly factory fabricated and do not include sarking or site applied metallic sheet air barrier.

3.2.6 External Steelwork

All steelwork external to façade system air barrier must be stainless steel where inaccessible. Coated mild steel can be used where inspection and maintenance is achieved and where Australian Standard requirements for detailing are followed.

3.2.7 Post-fixed and Cast-in

All post-fixed anchors and cast in channels are to be stainless steel where positioned external to façade system air barriers or where inaccessible.

3.3 Warranty

The warranty period provided for façade materials, fabrication and installation quality is a legal agreement between supplier and purchaser. Façade systems are expected to comprise standard materials and processes that have a history of successful use in Australia. If necessary Inhabit can review proposed warranty periods and compare to that provided on other similar projects, the below are typically available with standard procurement of facades:

- General quality and weatherproofing, 10 years
- Glass and IGU, 10 years
- Laminated Glass, 5 years from supplier increased to 10 years by Façade Contractor
- Aluminium powder coating and anodizing, 15 to 25 years depending on quality level adopted
- Sealant and gasket, 10 years
- Hardware 1 to 5 years, depending on component
- Galvanized steel coating, 15 years

3.4 Aesthetic

3.4.1 Visual Mock-Up

The project will include a benchmarking process of products whereby visual quality is inspected and approved or rejected by the project Architect and Building Owner or their representative. A full-size visual mock-up (VMU) of critical façade systems is to be adopted for the appreciation of materials and finishes. The VMU is to be assembled in Newcastle on the development site. The VMU is intended to be a hold point for façade procurement and provide the opportunity to modify or change materials and finishes within cost plan and budget allowances.

Façade systems to be included as VMU are to be agreed with the Architect and Client prior to tendering of the façade packages. Refer to the Façade Performance Schedule document for full details of VMU and PMU (Performance Mock-Up) requirements.

Façade systems that are not included in the VMU process are to be approved via visual inspection of sample submission. All samples are to include sufficient numbers to represent the expected range of colour and surface finish variation, for example anodized aluminium samples are to be submitted as bookends of production.

3.4.2 Glass Visual Distortion

All glass to be used on the project will exhibit varying degrees of visual distortion, which will be checked during factory production against accepted Australian and International standards. The purpose of VMU and sample approval is to set the visual benchmark for the project that can be used as comparison against supplied product if necessary. The following are typical sources of visual distortion and expectation for mitigation:

- Anisotropy quench pattern from heat treating process, with rainbow appearing stripes and patches – this is unavoidable however can be controlled to a degree with production checking. Partial factory checking proposed to be adopted.
- Pink/red and violet external reflected appearance of low emissivity coating – selection of neutral coloured glass product as visual benchmark. Proposed to be adopted where possible.
- Roller wave of heat-treated glass, with external surface appearing wavy – use rectangular panels with long dimension oriented vertically so that the visual effect is less noticeable. Proposed to be adopted where possible.
- IGU pillowing from differential air pressure from factory to site, with external appearance appearing bowed – this is unavoidable however can be limited with more costly positioning of thicker lite as outer lite. Not proposed to be adopted.
- IGU double reflection, typically from internal view – cannot be avoided, however can be limited with more costly body tinted glass. Not proposed to be adopted.
- Production tolerance from floating process, cutting, laminating and heat treating can introduce edge warp and panel bowing – cannot be avoided. Australian and ASTM standards to be adopted.
- Laminated glass with concentric circles (Newton's rings) – this is very uncommon and not a consideration.
- Edge and corner distortion from curving process – this is unavoidable but can be controlled with adjustment to furnace roller distribution. There is no curved glass on the project so not a consideration.
- Acute viewing angle can exacerbate some of the above visual effects, whereby the distortion is compressed into a shorter view width – cannot be avoided.

The project Architect is to inspect VMU glass and approve for an agreed visual quality benchmark.

3.4.3 Ceramic Frit

Non-vision opaque glass panels are typically achieved with 100% coverage ceramic frit paint applied to internal glass surfaces. The process of applying the paint is either by silk screening or digital printer. Quality standards for ceramic frit allow small pin holes which are typically not visible from the outside, however can be highly visible and a visual defect when viewed from the inside with incident sunlight on external surfaces.

100% ceramic paint coated glass is not recommended for panels viewable from internal spaces. All ceramic coated panels are anticipated to include solid backing such that the painted surface is not visible.

3.4.4 Aluminium Extrusion

The production of aluminium extrusions can result in surface irregularities. Extrusions typically show draw lines that can be due to die plate wear and also extrusion design, they cannot be removed completely however a powder coated surface finish will hide die lines more effectively than an anodized surface finish.

The Visual Mock-Up (VMU) and sample approval procedure will be a benchmark for accepted visual appearance and defects.

3.4.5 Aluminium Sheet

The production of aluminium sheet can result in surface material inconsistencies. Aluminium sheet must be of quality suitable for an anodized finish so that the material visual inconsistency is not exacerbated by the finish. A powder coated finish for aluminium sheet can be applied to most alloys and is limited to lesser degree for availability and size.

Fabrication of aluminium sheet panels with stiffeners and mechanical fixings can exhibit surface undulations which are more noticeable with gloss surface finishes. Panel flatness will be checked in the factory against industry standards, however may still result in noticeable surface flatness.

The Visual Mock-Up (VMU) and sample approval procedure will create a benchmark for accepted visual appearance and defects.

3.4.6 Oil Canning

Metallic cladding panels or visual back pans are susceptible to surface flatness variability with the use of support sub-framing and poor perimeter detailing. Large format cladding panels with poor allowance of thermal expansion and contraction have risk of unacceptable visual distortion that may not be present during VMU and sample approval processes. Facade detailing is to sufficiently allow for movement to minimize occurrence of visual distortion, some residual distortion may be present particularly with high gloss finishes.

3.4.7 Hail Damage

Light weight cladding materials are susceptible to hail impact indentations and surface coating deterioration. Testing has been carried out on steel and aluminium cladding products, showing that thinner aluminium material results in increased degree of more damage. However 3mm solid aluminium coil coated aluminium cladding is preferred for its increased environmental durability. Hail damage is expected over the building life and will need to involve panel replacement in order to avoid further finish deterioration.

3.4.8 Self-Cleaning

All horizontal surfaces will collect dirt over time and are washed by rainfall, however build-up and staining can occur where and adjacent to locations where water can pond and not wash the surface clear. All surfaces are to be sloped such that self-cleaning cleaning from water runoff is promoted and maintenance requirements are reduced.

Locations where façade systems are sheltered from rainwater washing and are difficult to access will exhibit more dirt collection over time and are to be avoided if possible or access methodologies and frequencies approved by the Building Owner.

3.4.9 Wildlife

The Building Envelope static openings such as mechanical ventilation louvres are to include powder coated stainless steel mesh for the prevention of bird and vermin infestation. Other locations that promote bird nesting should be avoided and where required, alternative options considered such as bird of prey handling or the use of ultrasound speakers.

Sulphur Crested Cockatoos are known to quickly damage exposed cladding joint sealants. Exposed sealants on or adjacent to horizontal surfaces are not recommended and alternative details with cover strips of the silicone sealant used to protect from wildlife damage.

3.5 Spares

Storing spare façade system components and materials on or off site following practical completion is typically seen as difficult due to space limitation, however is beneficial to the Building Owner if successfully implemented. Due to both local and international construction industry supply lines generally adopting international production, having a store of spare components and materials allows faster replacement and avoids reliance on long lead time supply.

3.5.1 Hardware

Hardware and components of hardware assemblies are usually supplied with short warranty periods due to expected wear and tear. Whilst some hardware suppliers have local representatives, their stock inventories may vary from time to time. The following are typical hardware components that should be considered for approx. 10no. complete sets. Components that typically experience higher likelihood of damage should be confirmed by Facilities Managers and included.

- Automatic and manual hinge door – handle, lock, actuator
- Frameless pivot door – handle, lock
- Automatic entry door – floor guide

3.5.2 Glass Panel

Vision and non-vision glazed has usually been processed to include coatings that are not readily available locally. Whilst panels are typically large and varying in size, allowing for supply and storage of approx. 0.5% of all vision and non-vision panels types is recommended. The composition is to be determined from glass cutting list and to be proportionally representative of glass sizes.

3.5.3 Cladding Panel

Similarly, allowing for supply and storage of approx. 0.5% of all cladding system panels types is recommended. However some cladding products, for example aluminium, can usually be locally sourced at short notice for temporary supply whilst waiting for matched product supply. The composition is to be determined from material cutting list and is to be proportionally representative of sizes.

3.5.4 Extruded Aluminium

Extrusions that are the most susceptible to damage, for example transoms, sills, thresholds, blind pelmets and the like, should be considered for supply and storge of sufficient lengths to produce 50m^2 of façade and approx. 50m of extrusions.

3.6 Loading

3.6.1 Wind

All façade systems are to be design in accordance with AS1170.0 and AS1170.2 with cladding pressures derived by the Façade Contractor from the standard or from wind tunnel testing carried out by a Wind Consultant. Refer to the section below for discussion associated with wind effects.

3.6.2 Live

All façade systems are to be design in accordance with AS1170.0 and AS1170.1 for live loading applied to façade elements.

All horizontal ledges or steps are to be designed for a minimum 1.1kN vertical loading and 0.5kN accidental lateral loading.

All balustrades protecting a fall of more than 1m are to be designed for the C5 classification loading. All facades forming part of the building envelope but are not adjacent to emergency egress are to be designed for the C1/C2 classification loading.

3.6.3 Seismic

All façade systems are to be designed in accordance with AS1170.0 and AS1170.4 for seismic loading. Façade systems are mostly light weight and are not expected to present issues for resistance of seismic loading.

3.6.4 Movement

All façade systems and interaction with building structural are to be such that there are no detrimental effects of building displacement and rotation regarding façade systems. Façade systems are to be standard with no special or complex design scenarios that require custom research and development procedures to resolve.

Façade systems are to be of modulation and size, with system movement joints at regular centres such that movement can be accommodated with typical design approaches and do not require complex analysis to resolve for building structure or thermal movement.

3.6.5 Temperature

Façade systems exposed to direct solar heat can reach temperatures in excess of 100°C, for example shadow boxes and skylights. These high temperatures are known to reduce structural performance of materials. The following are to be assessed for a range of exposed ambient and surface temperatures:

- Polyvinyl Butyral (PVB) interlayer
- Ceramic coated glass

3.7 Wind

3.7.1 Cladding Pressure

Preliminary cladding wind pressures have been assessed in accordance with AS1170.2 with the following maximum values. Further reduction may be possible be considering location on the building and internal wind pressure coefficients.

- Ultimate Limit Stage (ULS) pressure at building corners: +1960Pa and -1700Pa
- Serviceability Limit State (SLS) pressure at building corners: +1275Pa and -1100Pa
- Water infiltration test pressure at 30% of positive SLS for AS2047 laboratory testing: +385Pa
- Water infiltration test pressure at 60% of positive SLS for AS4284 laboratory testing: +765Pa

3.7.2 Mechanical Ventilation

All mechanical ventilation louvres and internal ducts are to be full sealed and designed for external wind pressure such that they do not form a dominant opening in the Building Envelope.

3.7.3 Resonance

Light weight attachments to the façade such as vertical aluminium sunshade fins and horizontal aluminium sunshade hoods are susceptible to wind excitation that can lead to component failure. A Wind Consultant is to consider resonance and provide further advice for screening and deep sunshade elements. The Wind Consultant will be required to work with the certifying engineer for relevant façade systems, in carrying out dynamic analysis of façade attachments for the verification of their structural adequacy.

3.7.4 Fatigue

All façade components that are exposed to repeated fluctuation in wind loading must be assessed for fatigue. The Wind Consultant will be required to work with the certifying engineer for relevant facade systems, in determining equivalent static loading and cycle numbers for fatigue assessment.

3.7.5 Hail Impact

Hail impact that results in glass panel breakage may subsequently allow external wind pressure to be applied to internal spaced at and near the location of glass failure. The likelihood of such an event is to be accepted by the Building Owner and the minimum requirements of BCA NCC and Australian Standards with no hail impact performance to be adopted.

3.8 Water Penetration

The BCA NCC under FP1.4 requires a Roof or External Wall, including openings around windows and doors, must prevent the penetration of water that could cause:

- Unhealthy or dangerous conditions, or loss of amenity for occupants
- Undue dampness or deterioration of building elements

The BCA NCC states there are no Deemed-to-Satisfy provisions to demonstrate compliance with FP1.4, a Performance Solution is required to demonstrate the performance requirement of FP1.4 is met to the satisfaction of the Building Certifier. The project FP1.4 Consultant is to confirm compliance requirements for relevant façade systems.

3.8.1 Laboratory Test

The following façade systems are proposed to be laboratory tested for weatherproofing:

- Unitized window wall – AS4284 with 60% SLS cyclic water penetration
- Operable hinge doors – AS2047 with 30% static water penetration
- Proprietary cladding system – AS4284 with 60% cyclic water penetration

BCA NCC only requires water penetration performance of glazing systems to meet the AS2407 30% SLS positive wind pressure. Possible verification method indicated in BCA NCC FV1 for cladding systems includes cyclic water testing to AS4284, however only for “low risk” scenarios with low wind pressure. The cladding systems for the project are anticipated to be high risk and therefore outside of the BCA NCC verification method, however as this is counterintuitive the full AS4284 testing including cyclic water testing is required by some Building Certifiers for cladding systems.

Alternatively the Building Owner is to confirm that the minimum requirements of BCA NCC are accepted, meaning water penetration through façade systems will be more frequent and requiring maintenance. Considering that the typical approach to water ingress defect rectification by a local Façade Contractor is to check that Bureau of Meteorology recorded wind speeds are higher than agreed project requirements, we recommend that facade system water ingress testing is as high as reasonably practical.

3.8.2 Site Test

All façade systems are proposed to undertake site hose water testing in accordance with AAMA501.2, with the initial 25m^2 of installed façade tested. Subsequent to a successful initial test continue testing 25m^2 for every 250m^2 of façade system installed.

All façade systems initial gutter and sub-sill installation are to be flood tested. Subsequent to a successful initial test continue testing 10% of the installed façade system.

Balcony terrace membranes at critical façade system interface junctions are to be flood tested. Subsequent to a successful initial test continue testing 10% of the installed façade system and membrane.

3.8.3 Condensation

The BCA NCC has no explicit requirement for condensation control for non-Class 2 buildings. Internal space relative humidity levels and ventilation are assumed to be controlled such that condensation risk at the internal façade line is minimal. Typical locations where condensation may occur with the Gosford climate conditions are as follows:

- Winter months where external surface temperatures are low
- thermal bridging through façade framing at sunshade fin and hood bracket locations
- thermal bridging through structure at terraces and the like
- poor ventilation to spaces with high relative humidity, for example kitchens.
- shower facilities
- façade vision panels, however these are exposed to ventilation and evaporation
- façade non-vision panels where access is restricted to internal surfaces but moisture migration through internal walls occurs.

The project Mechanical Consultant is to ensure that internal relative humidity control and ventilation is to be designed such that condensation at the façade line is minimized.

Internal spaces that are no conditioned are to be assessed by the project ESD and Mechanical Consultants for sufficient natural ventilation. Materials in these environments are to be selected to accommodate repeated wetting and drying.

3.8.4 Vertical Termination Height

AS4654.2 requires a vertical height from membrane at external surface to internal surface, related to project Ultimate Limit State wind speeds. The following approximate wind speed and associated vertical termination height has been calculated in accordance with AS1170 and AS4654:

- 47m/s wind speed
- 70mm vertical termination height

An alternative solution can be used instead of the AS4654.2 vertical termination height, where the project Hydraulic and Civil Consultants are to confirm the vertical height difference at which, external drainage and overflow are such that water will not reach the façade.

3.8.5 Enclosed Façade

Locations where internal walls are built behind external façade systems make access for inspection and repair of water ingress defect difficult. This project and typical education building design include this to a significant extent. Façade systems are preferred to be chamber tested without the reliance on site applied sealant, so that site applied sealant is a "belts and braced approach", and extensive site hose testing carried out to verify system installation. Maximizing the use of unitized aluminium framed façade panels is recommended due to performance reliability instead of site stick build steel framed wall with multiple trade contractors involved in achieving system performance. The ability to inspect cavities between external façade and internal wall must be included.

3.8.6 Entry Threshold

Entry doors that require DDA compliant thresholds do not meet water ingress requirements of FP1.4. Positioning entry door locations with good shelter and protection from rain and water is recommended. The use of external grated drains, external finishes on pedestals and internal drained floor mats should be used to mitigate water ingress at entry locations. The project Hydraulic Consultant is to confirm requirements to prevent water reaching the façade. The Building Owner is to confirm acceptance of water ingress at exposed locations.

3.8.7 Membrane

Liquid applied or torch on membranes at Roof Level, terraces and the like, are not included in this report.

All concrete, blockwork or similar external wall systems, including those with external rainscreen cladding systems, should include membrane product and damage protection to prevent moisture transmission through the wall to internal spaces.

3.8.8 Cavity Baffle

Cladding and glazing systems positioned on the outside of concrete, steel framed or other similar walls require metallic flashing to close off the cavity at regular vertical and horizontal spacing, and at corners. This baffle flashing is required to promote drainage of the cavity to the outside and to prevent cavity wind pressure differentials.

3.8.9 Inward Opening

Aluminium framed hinged doors are typically adopted for maintenance only access, however are recommended to be inward opening instead of outward opening where wind can catch the door leaf and pull personnel outwards. Inward opening doors and seals are however limited in the water penetration performance and are to be agreed with Building Owner.

3.9 Access and Mobility

3.9.1 Threshold

AS1428.1 requires thresholds to have maximum 3mm vertical step at abutment of surfaces, or 5mm with 1:1 slope. Ramp gradient of 1:8 is permitted up to vertical height change of 35mm in front of door thresholds. Where external trench grates are used to control rain and water, the grate must include maximum 8mm wide continuous slot or maximum 13mm wide non-continuous slot. The project Access and Mobility Consultant is to confirm locations and requirements. The project Hydraulic and Civil Consultants are to confirm suitability of external trench grates for keeping all water away from façade systems and thresholds.

3.9.2 Door Automation

Doors present along the continuous accessible path generally require operating force not to exceed 20N. Manually operated doors in façade systems typically do to achieve this requirement and typically require actuators and automatic hardware. Sliding doors typically include automatic operators at the head, hinge doors to typically include actuator arms at the head, and pivot doors typically include actuators in the floor or at the head.

Façade weather performance of these systems cannot be achieved and requires alternative solution. The project Hydraulic and Civil Consultants are to confirm that no water will reach door locations.

3.9.3 Visual Marking

Visual marking indicators of glazing are required where glass is present along the continuous accessible path. AS1428.1 includes requirements for marking height above Finished-Floor-Level (FFL), band height and level of contrasting luminance against surrounding finishes. The project Access Consultant is to confirm locations requiring marking. The project Architect is to confirm marking appearance and colour for meeting contrast luminance requirements.

3.9.4 Handle

All door hardware handles must meet AS1428.1 dimensional requirements for use and entrapment.

3.9.5 Handrail

Handrails are typically not supplied by the Façade Contractor and can present a water ingress warranty problem. Handrails are assumed to be attached to stand alone internal balustrade systems and not connected to façade systems.

3.10 Fire

3.10.1 Slab Edge

The project includes curtain wall façade systems with fully sealed smoke flashing capable of accommodating 200°C and fire rated insulation at horizontal and vertical interface junctions between curtain wall and adjacent walls and building elements. All internal junctions between façade and compartment walls are assumed to be achieved within the internal wall design.

The project Fire Consultant is to confirm build-up, location and extent of façade treatment required.

The Building Certifier is to confirm that the fire rated extent of internal compartment boundaries is to the inside façade of the façade system only and does not extend to the outside of the façade system.

3.10.2 BCA NCC Section C

All façade materials are to be compliant with BCA NCC Section C with material testing to AS1530.1 required for materials that fall outside of BCA NCC Section C deemed to satisfy allowances. Typical materials requiring AS1530.1 testing are as follows:

- mineral wool insulation
- glass fibre reinforced concrete (GRC)
- air barrier membrane and joint taping product

3.10.3 Partition Wall

Internal partition walls that form boundary of fire compartments will need to be sealed to the inside surface of façade systems. The interface detail at these locations is anticipated to require deflection allowance with aluminium channel, fire insulation and fire sealant. The project Fire Consultant is to confirm build-up, location and extent required. The Fire Consultant is to confirm that the fire rated extent of internal compartment boundaries is to the inside façade of the façade system only and does not extend to the outside of the façade system.

3.10.4 Egress

Façade systems comprising aluminium and glazing have limited inherent fire rating performance. Where located at fire egress pathways, facade detailing should be such that complex protection measures are avoided and alterative materials are used to achieve performance.

3.10.5 Cladding Cavity

Cladding systems that introduce a continuous drained cavity over several levels is assumed to require horizontal cavity baffles to bridge across the cavity between the inner wall (typically air barrier sheeting or concrete) and inside of external cladding, in order to prevent chimney effect. The Fire Consultant is to confirm the extent and location of cavity baffles and their requirement to be a fire rated material.

3.10.6 Fire Rated Glazing

No fire rated glazing is proposed for the project.

3.10.7 Bushfire

The project does not appear to be located within bushfire hazard zoning. The project Fire Consultant is to confirm.

3.11 Acoustic

3.11.1 Wind

All buildings in wind make noise, however façade attachments can increase the risk of tonal wind generated noise (whistling) that can occur with FA-CW01a sunshade elements. Façade components with sharp corners, narrow gaps, small and punched perforations are typical risk sources.

Wind tunnel testing is the preferred approach to reduce the likelihood of whistling however cannot remove the risk. Real world conditions cannot be replicated in laboratory testing.

The project Acoustic Consultant is to review external façade elements for tonal wind generated noise and provide advice on acceptability for both indoor and outdoor spaces. A testing regime for wind induced tonal noise is to be included in the Acoustic report.

3.12 Solar and Light

3.12.1 Daylight Penetration

Internal daylight penetration is an important performance objective for façade glazing product and geometry, internal finish properties and space layout. Lack of daylight is known to be the main contributor to Sick Building Syndrome. The project ESD Consultant is to confirm visible light transmission (VLT) maximum levels for façade glazing products.

3.12.2 Internal Glare Discomfort

Internal spaces in the building generally include a mix of patient rooms, staff work rooms, circulation corridors, occupant lounge, back of house medial operations spaces, meeting rooms and offices spaces. Pathology laboratory testing spaces and Medical Imaging are included on Level 04 and 02. These spaces, with direct solar light incident on work surfaces may create discomfort due to high contrast levels between viewing surfaces and surrounding light levels. Laboratory workstations due to sensitivity of samples and light conditions, typically cannot allow direct incident light on work surfaces. Internal blinds are assumed to be an acceptable method to limit incoming light levels as needed for occupant work activities.

The project ESD Consultant is to confirm visible light transmission (VLT) maximum levels for façade glazing products and verify with the Building Owner and User Groups the expected occupant operation of internal venetian and roller blinds for control of internal glare.

Blind products should be considered, if required, to include both sheer and black out materials, and perimeter track guides so that no gaps are present between blind and façade framing.

3.12.3 Reflected Heat

Sunlight comprises the visible light wavelengths of ROYGBIV and the non-visible light wavelengths of Radio, Micro, Infrared, Ultraviolet, X-ray and Gamma-ray. Modern low emissivity coated glass products have been developed to transmit most of the visible spectrum whilst reflecting or absorbing most of the non-visible spectrum, thereby limiting the transmission of wavelengths that heat up internal spaces and reduce the energy load of building mechanical systems.

The heating effect of sunlight is reflected from performance glass products into adjacent external spaces, creating, contributing to Heat Island Effect where non-absorbing hard surfaces increase ambient temperatures. Approximately 75% of the Building Envelope is glazing, however the project is understood not to have any performance objectives to reduce the contribution to surrounding ambient heat.

3.12.4 Thermal Fracture

Annealed glass product can be susceptible to thermal fracture from differential solar heating and shading, internal reflective blinds, glass edge defects and poor frame selection. Façade systems and glass temper are selected to minimum fracture risk.

3.12.5 Thermal Comfort

The proposed internal space layout includes several rooms, narrow corridors, link bridge and circulation space that will be subject to incident solar energy. The spaces are assumed to be assessed for acceptable thermal comfort levels by the project ESD and Mechanical Consultants, they are to confirm maximum required Solar Heat Gain performance of glazing products and acceptable façade detailing for insulation and that minimized dynamic solar heat gain.

3.13 Building Energy

The project ESD Consultant report indicates the following façade system performance requirements:

- External wall glazing – U_w value 3.0 W/m^{2}K, $SHGC_w$ 0.5
- External wall solid cladding – U_w value 0.5 W/m^{2}K (R value 2.0 m^{2}K/W)

3.13.1 Solar Shading

Varying solar shading elements are proposed on the project, with intent to provide visual articulation through shape and materiality, and also to function as shading devices to minimize direct solar shading. Due to the daily solar path from East to West and annual change in angle of incidence from high in Summer to low in Winter, the following are generally effective in reducing incident solar energy to occupied spaced:

- North Elevation – horizontal sun hoods at vision head and through vision height
- East and West Elevations – vertical sun fins with orientation pointing to the South
- South Elevation – vertical sun fins as per East and West Elevations, however due to the lower solar energy early morning and late afternoon these have limited total effect.

The project proposes to use vertical and horizontal shading elements generally on all elevations. Significant shading on all elevations is provided with non-vision opaque façade panels that prevent incident solar energy. Optimization of shading extent and orientation may be possible if within building aesthetic parameters.

3.13.2 Solar Heat Gain

The most effective method of reducing solar heat gain to occupied spaces is the use of external shading devices. Glass products with low emissivity performance coating technology have been developed to reduce transmission of solar wavelengths associated with heat whilst allowing higher levels of visible light wavelengths.

Reliance on performance coated glass may be more cost effective for construction budgets in comparison with external shading devices, however they do not present best cost benefit when ongoing building operating costs are included.

3.13.3 Dynamic Solar Heat Gain

BCA NCC Section J, AFRC/NFRC testing and assessment protocols include static solar performance, they do not include dynamic effects of solar heat gain whereby incident solar energy is contained within façade cavities and radiate to internal space. Twin skin façade systems such as shadow boxes, from experimental data, are shown to exhibit higher effective solar heat gains than the with compliant assessment pathway. The ESD and Mechanical Consultants are to review and include allowance for dynamic solar heat gain if necessary.

3.14 Environmental Sustainability

3.14.1 Embodied Carbon

Construction material supply, fabrication and installation require energy which with current technology involves the use of fossil fuels resulting in carbon emissions. Life cycle assessment of materials and processes will become more common in the coming years with industry intent to reduce embodied carbon.

From 2023 onwards a 5 star rated building within the Greenstar framework must follow the Climate Positive Pathway which includes Upfront Carbon Emissions to be reduced by 20%. A Greenstar registered project will need to undertake life cycle assessment of materials and processes to achieve this target. BCA NCC minimum requirements do not yet include requirements for embodied carbon and life cycle assessment.

The majority of embodied carbon within base build construction is within concrete and steel structural framing. Aluminium and glass production is energy intensive, their use in facade systems involves carbon emissions that should be considered for reduction where possible. The project ESD Consultant is to confirm project requirements.

3.14.2 Procurement Limitations

A large proportion of façade materials and components used in the Australian Construction industry originate from China and surrounding South-East Asian countries. Supply lines and regulatory frameworks are not currently equipped to respond to embodied carbon accounting principles. Imposing limitations and requirements on typical supply pathways comes with risk of non-compliance and difficulty in implementation project requirements. Credits relying on embodied carbon reduction of façade systems must be considered carefully and in conjunction with the project Main Contractor and Façade Contractors.

3.14.3 Volatile Organic Compounds

Greenstar credit requirements typically include limits to Volatile Organic Compounds (VOC) for site applied internal paint, adhesive and sealant, for example waterproof membrane and silicone or polyurethane sealant that are part of facade system installation. The project ESD Consultant is to confirm material and component requirements and their compliancy certification.

3.14.4 Changing Climate

The project ESD Consultant is to confirm Climate Change Resilience and Heat resilience requirements for the project.

3.15 Structure Interface

3.15.1 Plan Tolerance

Window wall façade systems with sub-head and sub-sill connected to concrete typically require 10mm gap at back of sub-sill in recess, where plan position is not critical. However due to likely internal spatial limits the window wall is anticipated to be required to install at precise location, meaning a large tolerance allowance of +/-25mm at concrete recess step is recommended.

This tolerance is to be confirmed by the project Structural Consultant and Formwork/Concrete Placement Sub-contractor.

3.15.2 Relative Level Tolerance

Construction of concrete horizontal structure can result in variable relative level (RL) due to post tensioning balancing uplift, formwork back propping removal timing and presence of loading bay and construction person lifts that interrupting back propping and increase local loading. RL tolerance to be achieved typically is +/-10 to +/-15mm and is to be confirmed by the project Structural Consultant and Formwork/Concrete Placement Sub-contractor.

3.15.3 Precast

The project does not include the use of precast concrete.

3.15.4 Cast in Connection

Cast in channels and ferrules are beneficial where concrete reinforcement is congested, they prevent the need for reinforcement identification, site measure and custom connection development. However, they are susceptible to accidental position adjustment following correct setting out. Where accidental adjustment has occurred, connections typically require redesign and modification. Templating of connection groups is recommended such that relative position between fasteners can achieve tight tolerances.

3.15.5 Post Tension Live End

Horizontal concrete structural design typically includes post tensioned concrete with the presence at slab and beam edges of grouted pocket and steel blocks at live ends. Coordination between façade system connection to concrete and position of live ends can be problematic and requires consideration. The use to window wall with nominally 100mm to 150mm deep anchor zones at approximately 600mm centres is anticipated to provide good spatial allowance for post tensioning anchorages to be shifted as required.

3.16 Movement

3.16.1 Thermal Expansion and Contraction

Aluminium framed systems proposed for the project include regularly spaced joints that allow for thermal movement due to differences between installed temperature and maximum or minimum ambient and surface temperatures.

3.16.2 Moisture

Façade systems and materials are selected such that moisture swelling is not a critical consideration.

3.16.3 Structure Movement

The project Structural Engineer is to confirm maximum differential structural movement applied to façade systems. Unitized aluminium framed systems can typically accommodate +/-10mm to +/-15mm differential vertical movement between successive levels and height/500 inter-storey drift. Ceramic tile cladding façade systems typically require strictly limited structural movement. The following data is to be provided for coordination with the Façade Contractor:

- Maximum differential deflection occurring between levels at all locations and at all levels
- Short term initial stress deflection, assuming post tensioned concrete structure
- Short term Dead Load deflection
- Short term Superimposed Dead Load and Live Load deflection
- Long term total deflection
- Incremental deflection
- Column shortening
- Foundation settlement
- Short and long term initial stress longitudinal shorting, assuming post tensioned concrete structure

3.16.4 Façade and Structure Interaction

Expected building movement and façade systems proposed are such that a complex iterative façade/structure interaction assessment is not anticipated to be required.

3.17 Human Impact

There are no specific project requirements stipulated for the requirement of glass post breakage performance. The minimum requirements of the BCA NCC and Australian Standards are understood to be accepted, refer to discussion below regarding residual risk to Building Owner associate with glass selection.

3.17.1 Toughened Glass

Australian Standard AS1288 allows the use of toughened glass in locations where there is risk of accidental human impact. Toughened glass when broken will fracture into small dice sized pieces which is deemed to be safer for human occupants compared with other glass tempers where fracturing results in large shards. Most glass however is produced with Nickel Sulphide (NiS) particles that present a higher risk of spontaneous breakage compared with other glass tempers. AS1288 includes provision for testing (Heat Soak Testing) toughened glass to minimize the risk of spontaneous breakage, however it must be noted that the risk is not removed and variables is equipment calibration, glass stacking and process duration have been more recently shown to cast doubt over published risk reduction. Inhabit do not recommend the use of toughened glass in any scenario where a low residual risk is required by the Building Owner. The alternative to toughened glass is heat strengthened laminated glass whilst meeting AS1288 human impact requirements adds cost to glazing systems, however is recommended.

3.17.2 Doors

AS1288 required doors and glass adjacent to doors to be Grade A safety glass. Heat strengthened laminated glass is recommended, with for both inner and outer lites of IGU where accessible. The additional thickness of glass can be problematic for glazing pockets, the use of reduced edge spacer is typically adopted to accommodate.

3.17.3 Terrace

Locations where façade separates internal to external, for example terrace, balcony or Ground Level spaces, and glazing that can be mistaken for opening through the façade with vertical drop of 1m or less, must be Grade A safety glass. Heat strengthened laminated glass is recommended, with for both inner and outer lites of IGU. The additional thickness of glass can be problematic for glazing pockets, the use of reduced edge spacer is typically adopted to accommodate.

3.17.4 Balustrade

All balustrades are recommended to comprise heat treated laminated glass, toughened laminated or toughened monolithic glass is not to be used. Where IGU is used for external visual consistency to adjacent façade systems, the inner lite is to be heat treated laminated.

3.18 Accidental Impact

Glass is a brittle material that when impacted is susceptible to fracture. Typical everyday human activities not education facility operations related are assumed to fall within AS1288 human impact classifications with subsequent residual risk to occupants which has been deemed by the BCA NCC to be acceptable.

Accidental impact due to activities that are education facility operations related have increased likelihood of glass breakage and higher risk of occupant injury. The project Architect and User Groups are to identify locations where space function is such that accidental impact is elevated. Such areas are proposed to comprise heat treated laminated glass for accessible surfaces, with hard body and soft body impact testing undertaken in accordance with CWCT methodologies.

3.18.1 Low Level Glazing

Glass that is present at low level, within approx. 1.5m from finished floor level, is assumed to be protected by bump rails and bollards that prevent the accidental impact. Locations where protection is not provided and impact risk is sufficient, are to be confirmed by the project Architect.

3.18.2 Maintenance

All internal surfaces need to be accessed and maintained. Maintenance activities usually increase the risk of accidental impact due to operation of equipment. Impacts are anticipated to be minor in nature, require the use of heat treated laminated glass and require design for redundancy.

3.19 Security

3.19.1 Vandalism

Cladding systems that are accessible to the public are not proposed to include anti-graffiti coatings and are to be over painted in situ as necessary. The presence of light weight cladding systems in these zones is susceptible to denting and damage, and may require repair or replacement.

3.19.2 Attack

Building security requirements are anticipated not to require intruder attack rated glazing and not require cladding systems resistance to attack and vandal damage, for façade systems that are accessible by the public and campus visitors. The project Security Consultant is to confirm requirements.

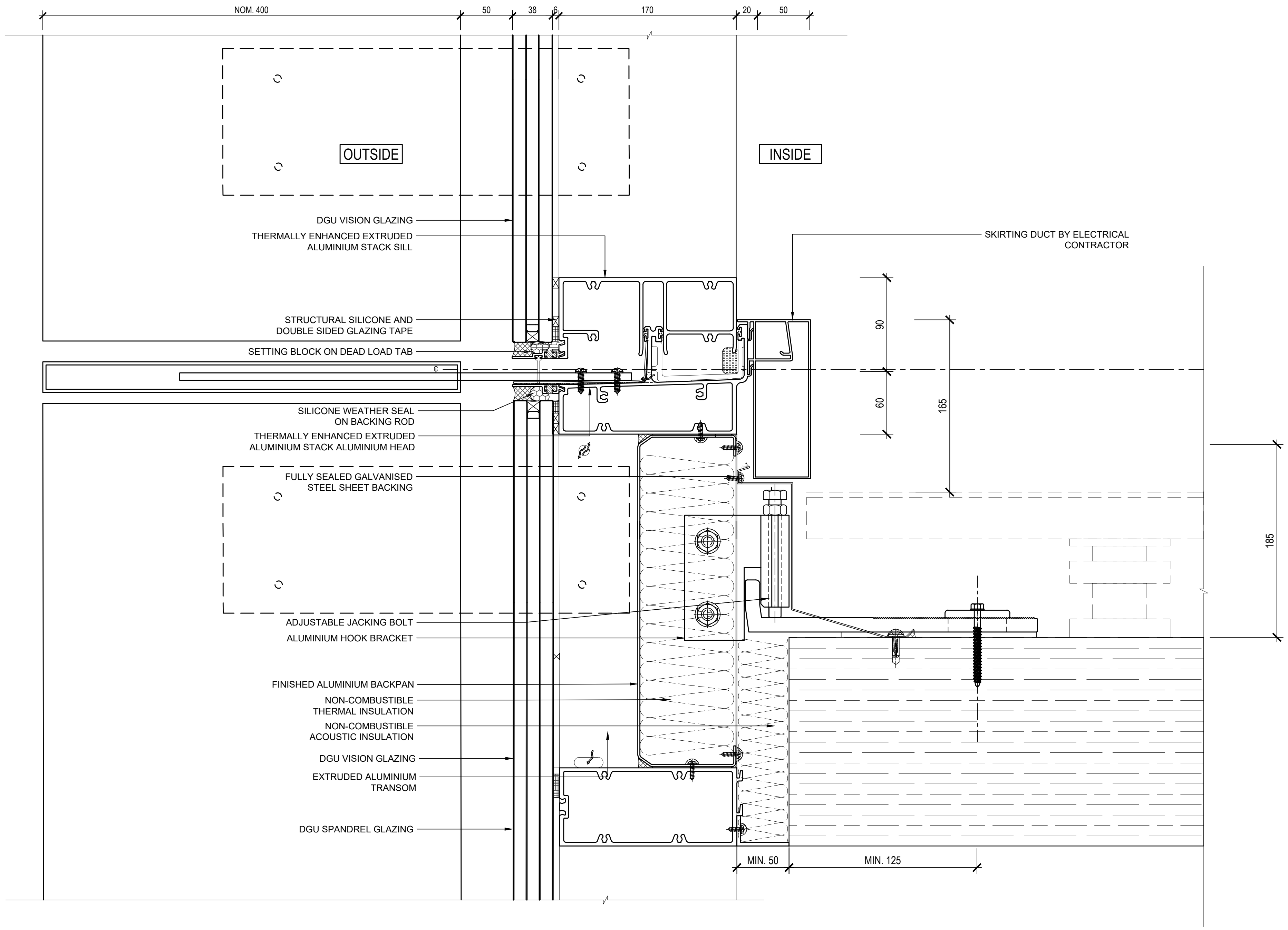
3.19.3 Blast

No façade system performance under blast loading is required for the project. The project Security Consultant is to confirm requirements.

3.19.4 Terrorism

No façade system performance under loading associated with terrorist activity is required for the project. The project Security Consultant is to confirm requirements.

A.1 Façade Design Intent Details



SECTION 01
SCALE- 1:5

CONNECTION TO HORIZONTAL ALUMINIUM PLATE AND SUNSHADE FROM TYPICAL FLOOR STRUCTURE

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE	Drawn: TA	Design: INH.	Approved: PB	Date: 24.04.2023	Scale at A3: 1:5
	Architect: LYONS					
Title		Drawing No.: 17251-DWG-FC4100				Rev.: 00

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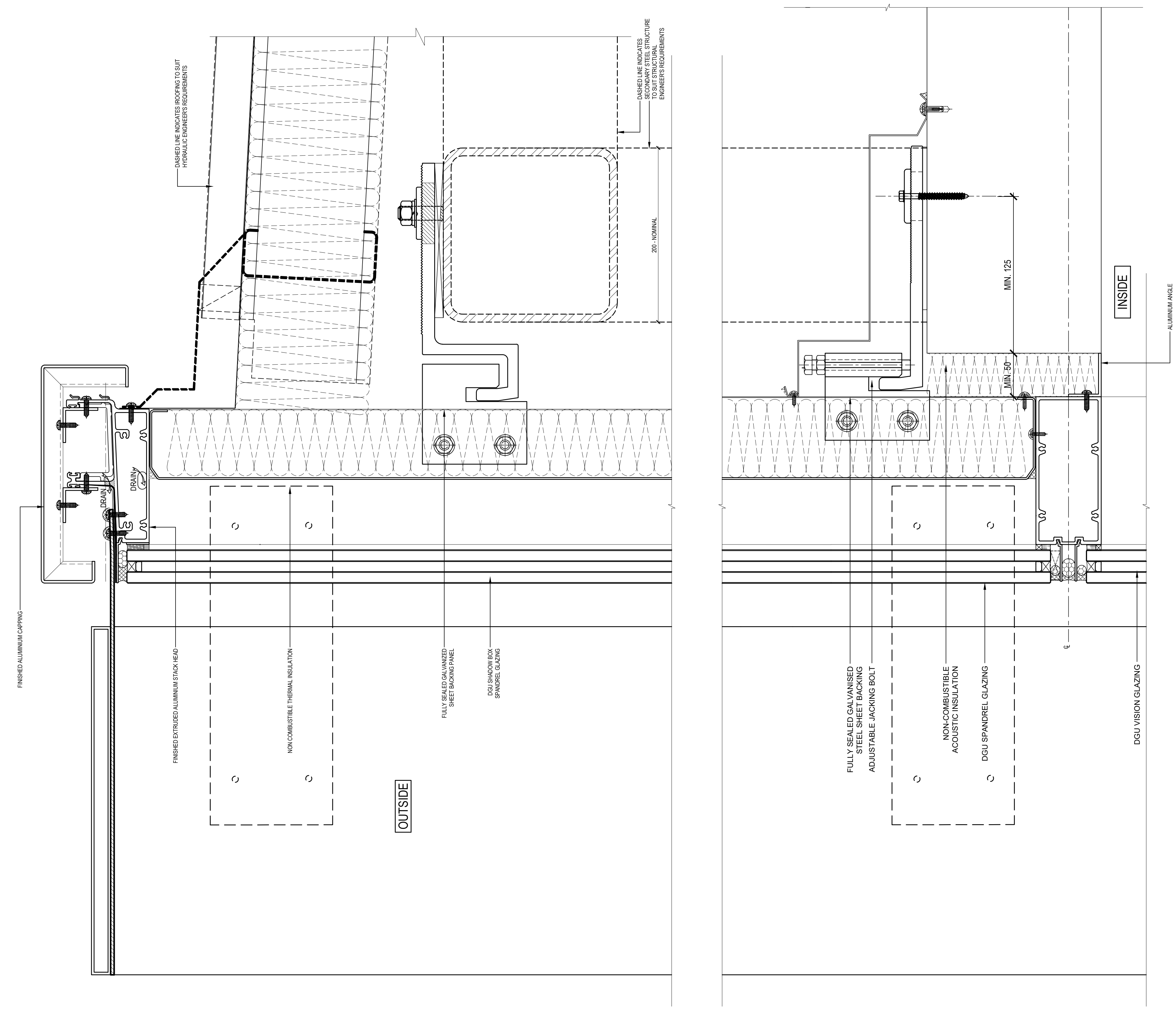

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SECTION
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TYPICAL CONNECTION AT GUTTER

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE Architect: LYONS	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0
Title		Drawing No.: XXXX-DWG-FC4101				Rev.: #N/A

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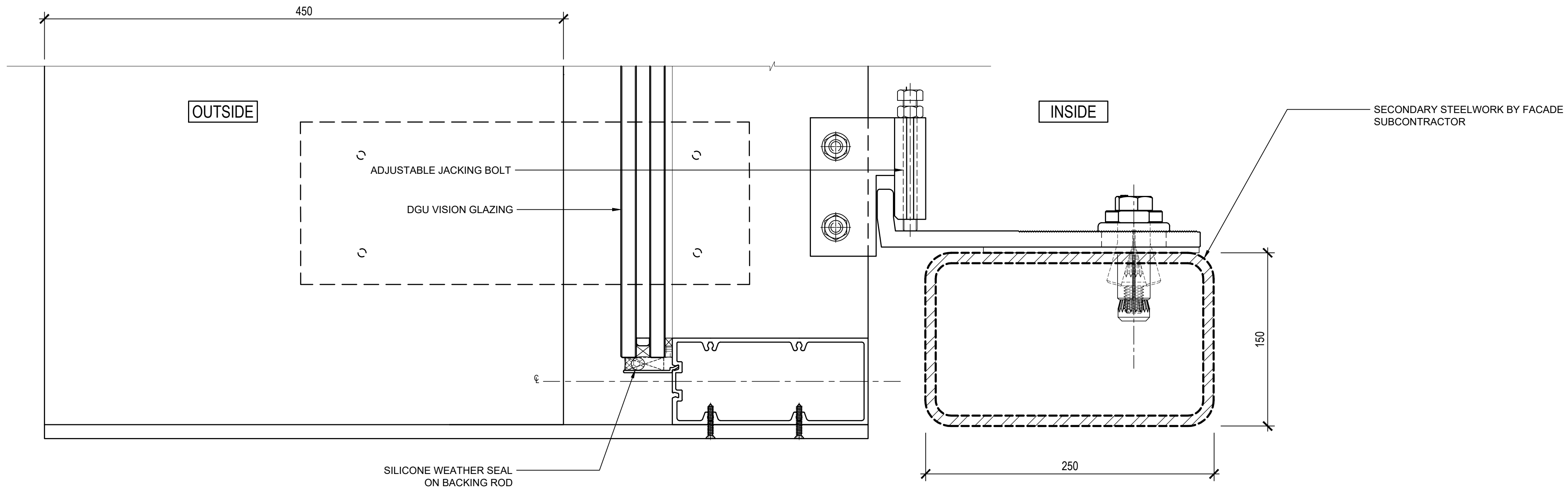

SECTION 01 / -
SCALE- 1:5
CONNECTION TO WIND BEAM AT CANTILEVER

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE / Architect: LYONS	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0
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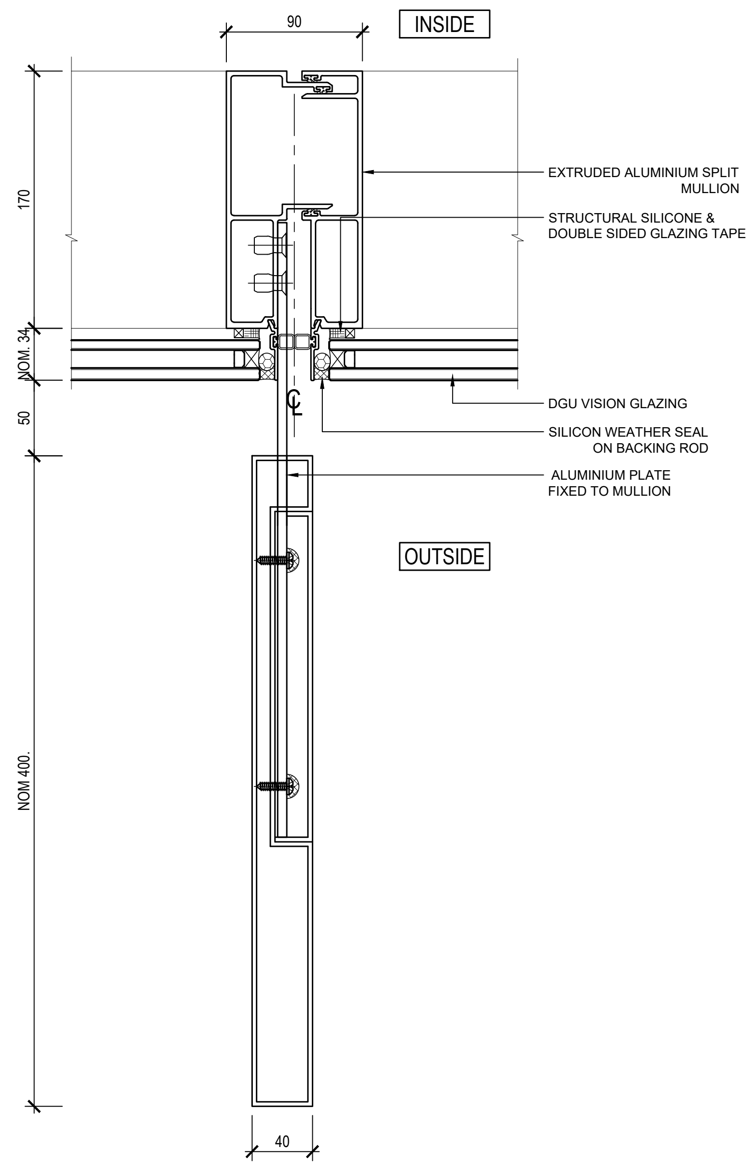

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TYPICAL MULLION DETAIL
WITH FIN CONNECTION

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Project UON CCC	Client UNIVERSITY OF NEWCASTLE / Architect LYONS	Drawn #N/A	Design Initials	Approved Initials	Date #N/A	Scale at A3 0
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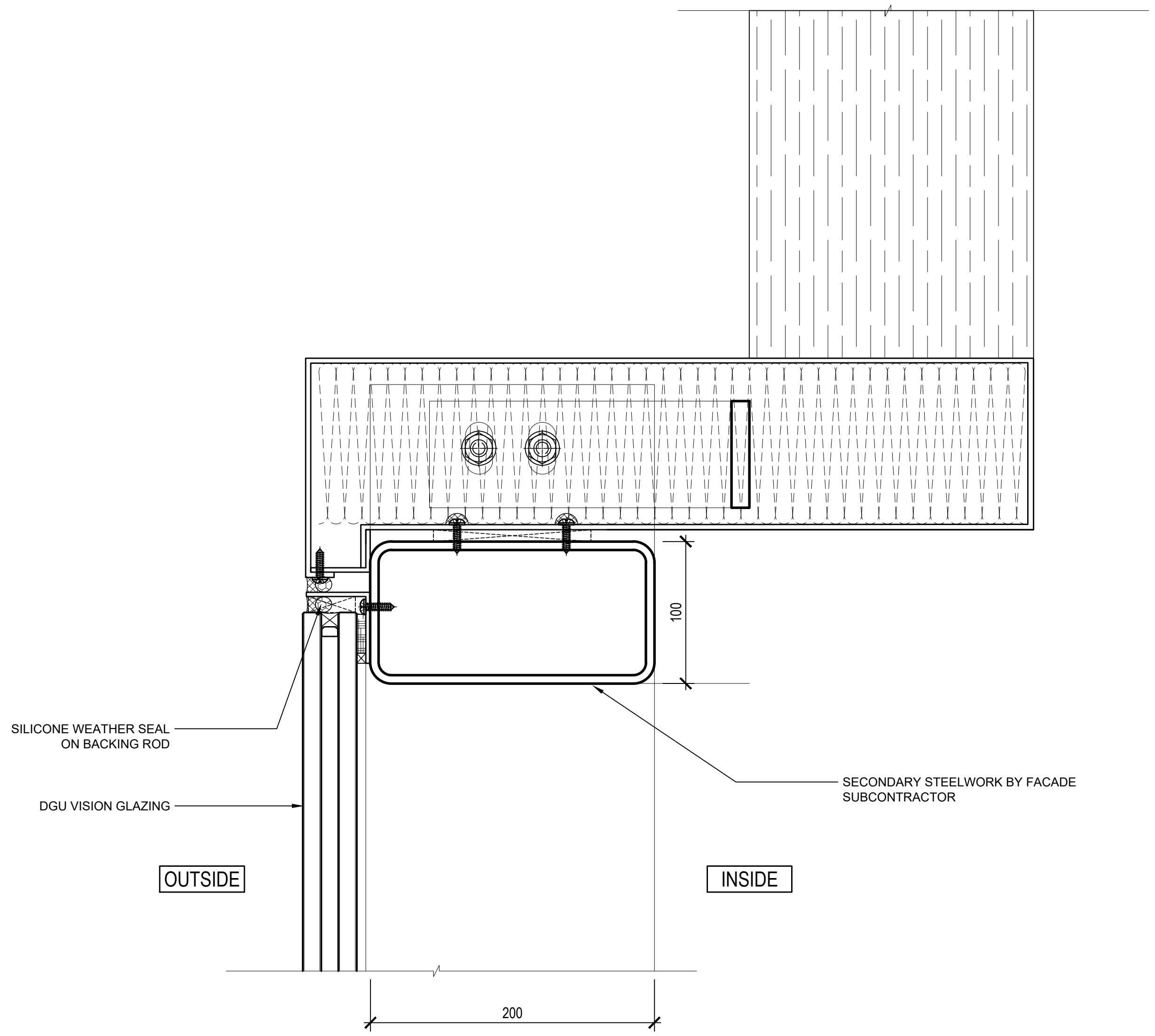

SECTION 01
SCALE- 1:5

CONNECTION TO BASE
STRUCTURE

Rev	Date	By	Description

Rev	Date	By	Description

Project UON CCC	Client UNIVERSITY OF NEWCASTLE Architect LYONS	Drawn TA	Design INH.	Approved PB	Date 24.04.2023	Scale at A3 1:5
Title		Drawing No. 17251-DWG-FC4100				Rev. 00

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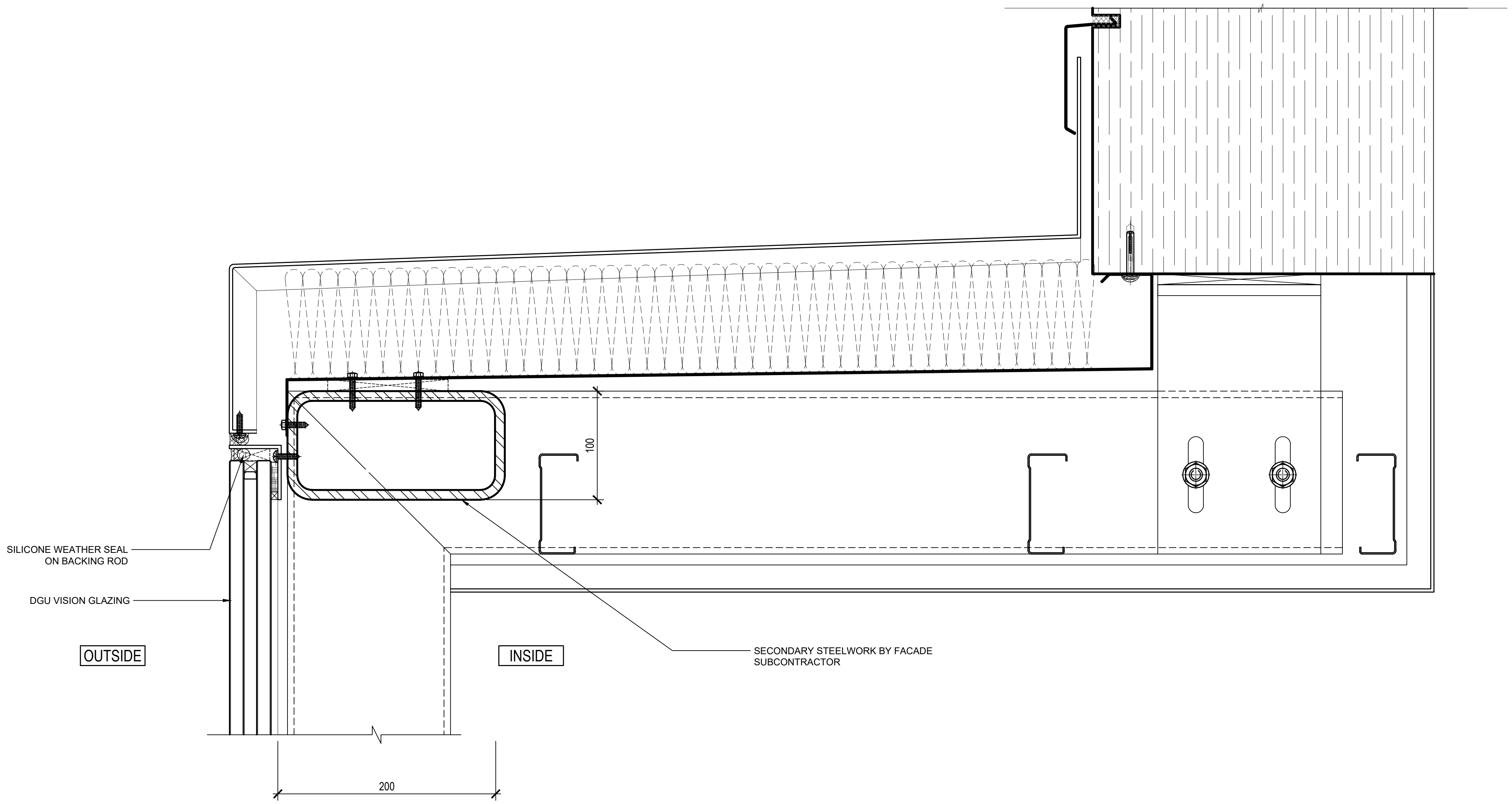

SECTION 01 -
SCALE- 1:5

CONNECTION TO BASE STRUCTURE

Rev	Date	By	Description	Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0	Inhabit Australasia Pty Ltd.
	Architect: LYONS						
Title		Drawing No. XXXX-DWG-FC4201				Rev. #N/A	NOT FOR CONSTRUCTION

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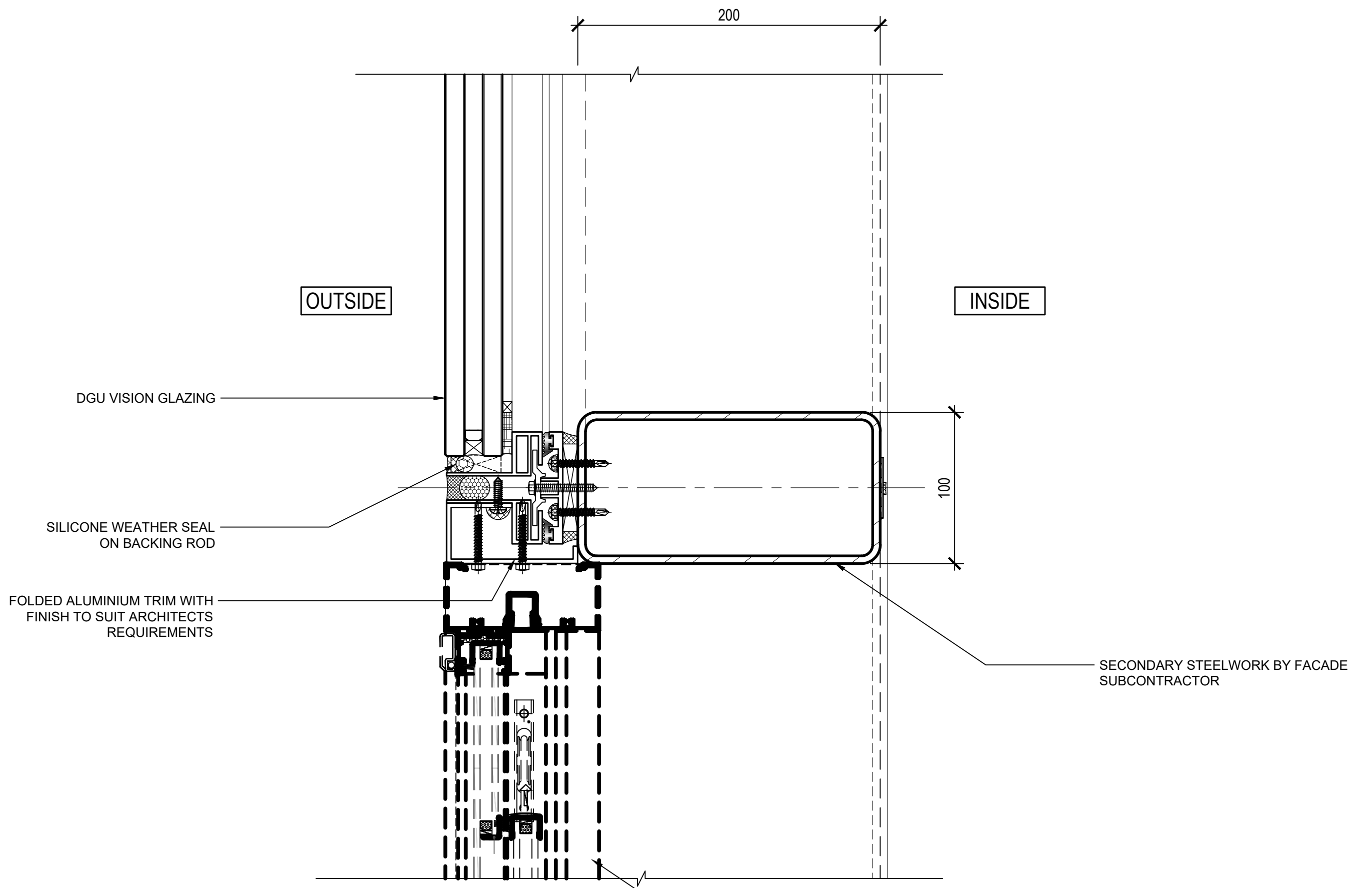

SECTION 01 -
SCALE- 1:5

VERTICAL SECTION DETAIL THROUGH SERVERY WINDOW HEAD INTERFACE WITH CASSETTE GLAZED SYSTEM

Rev	Date	By	Description	Rev	Date	By	Description

Project	Client	Drawn	Design	Approved	Date	Scale at A3
UON CCC	UNIVERSITY OF NEWCASTLE	TA	INH.	PB	24.04.2023	1:5
	Architect LYONS					
Title		Drawing No. 17251-DWG-FC4100				Rev. 00

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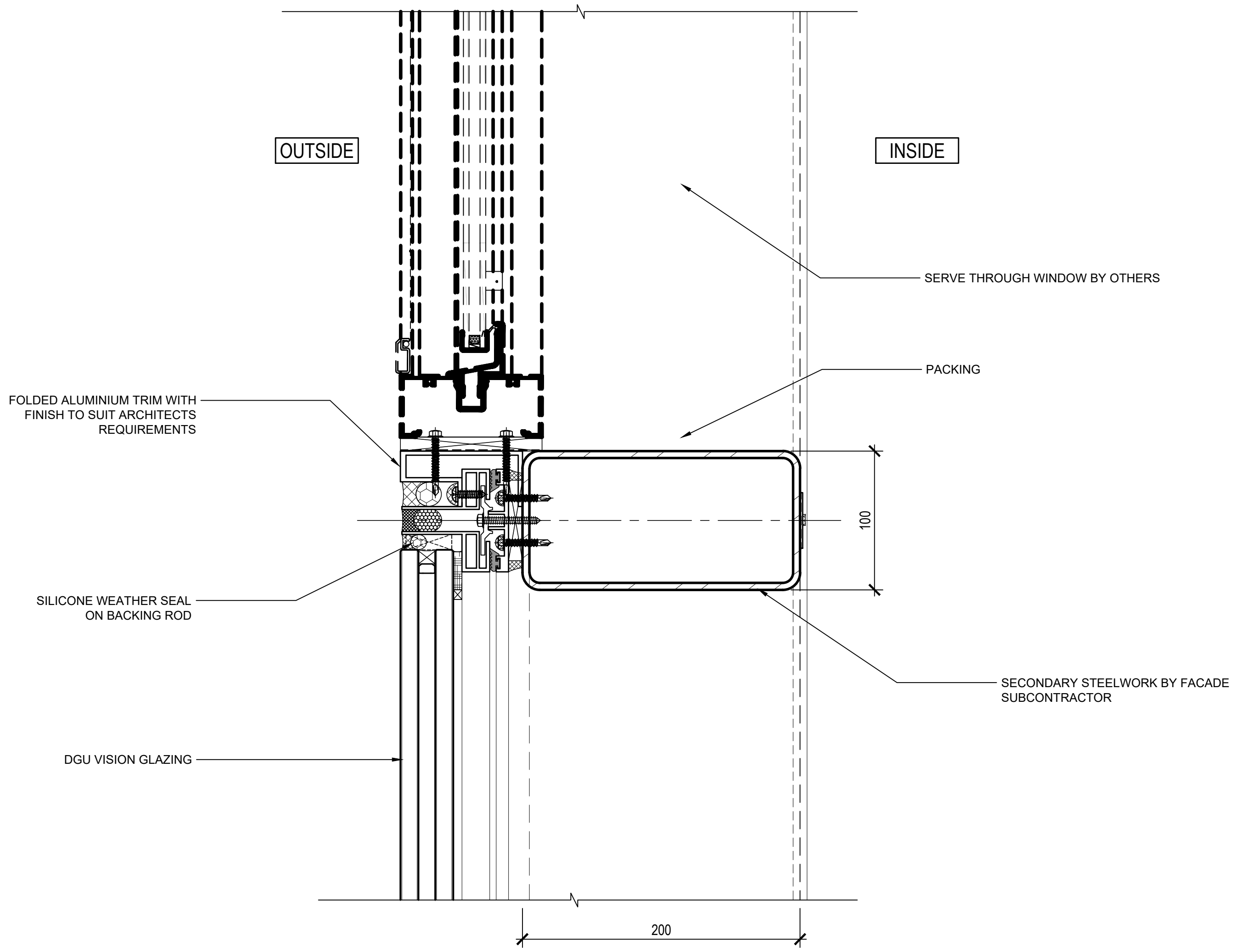

SECTION 01
SCALE- 1:5

VERTICAL SECTION DETAIL THROUGH SERVERY WINDOW SILL INTERFACE WITH CASSETTE GLAZED SYSTEM

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE Architect: LYONS	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0
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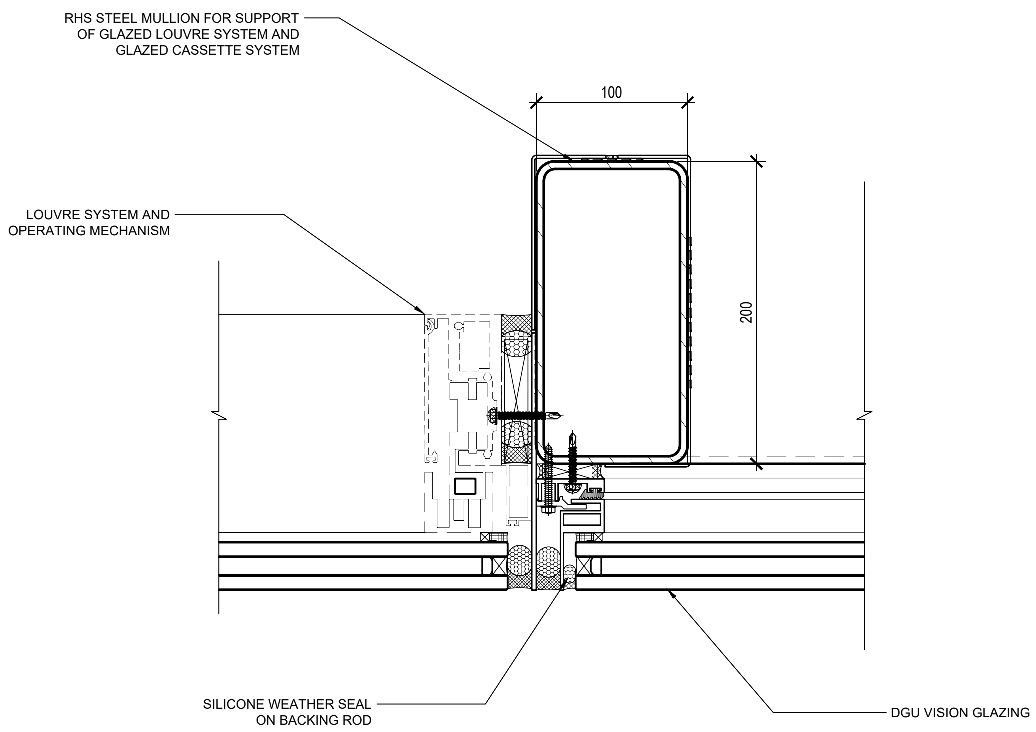

DETAIL 5
SCALE- 1:5
PLAN DETAIL THROUGH GLAZED LOUVRE SYSTEM

Rev	Date	By	Description	Rev	Date	By	Description

Project	Client	Drawn	Design	Approved	Date	Scale at A3
UON CCC	UNIVERSITY OF NEWCASTLE Architect LYONS	TA	INH.	PB	24.04.2023	1:5
Title		Drawing No. 17251-DWG-FC4100				Rev. 00

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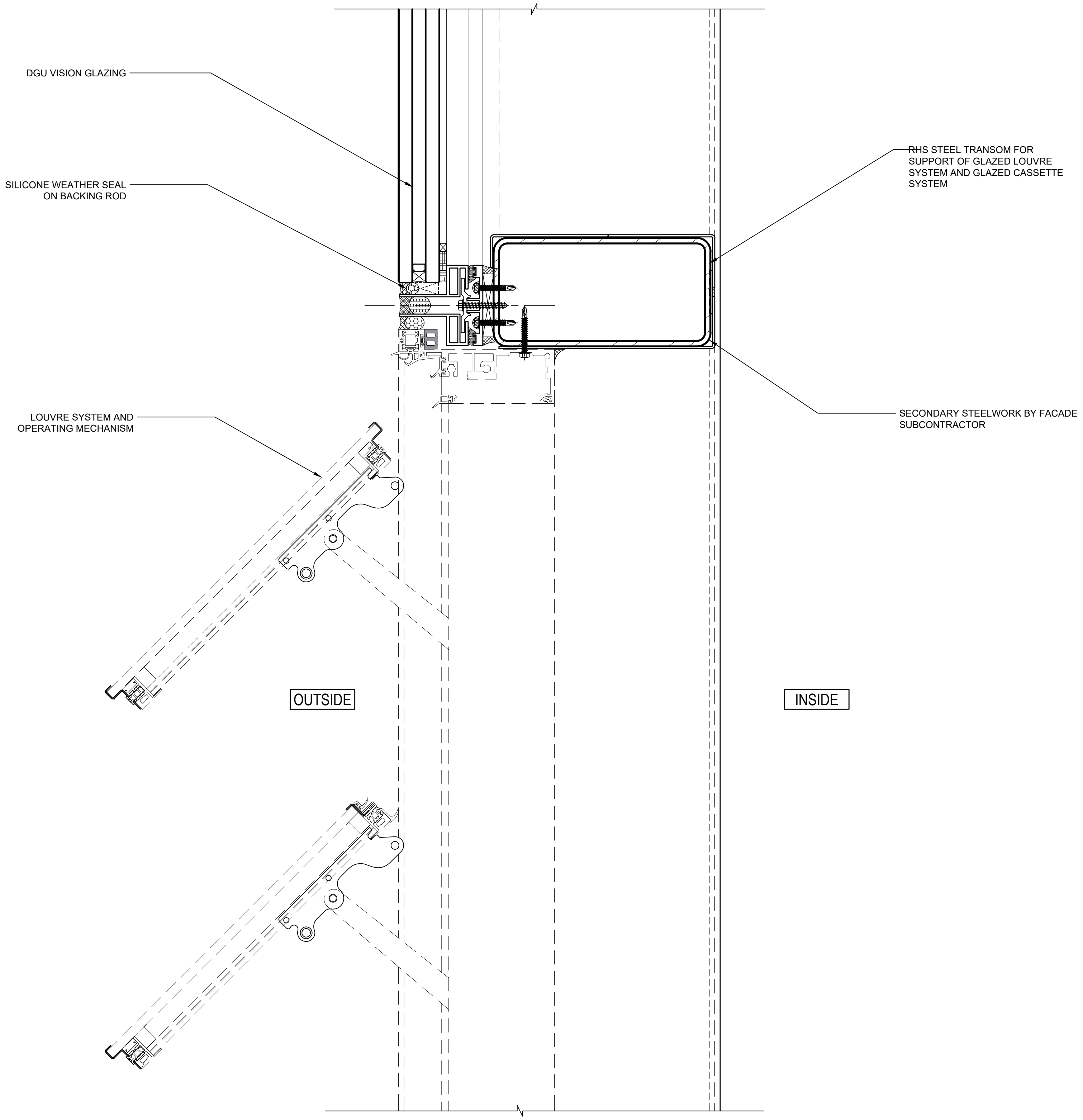

SECTION 01 -
SCALE- 1:5
CONNECTION TO GLAZED LOUVRE SYSTEM AT TOP

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE; Architect: LYONS	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0
Title		Drawing No.: XXXX-DWG-FC4401				Rev.: #N/A

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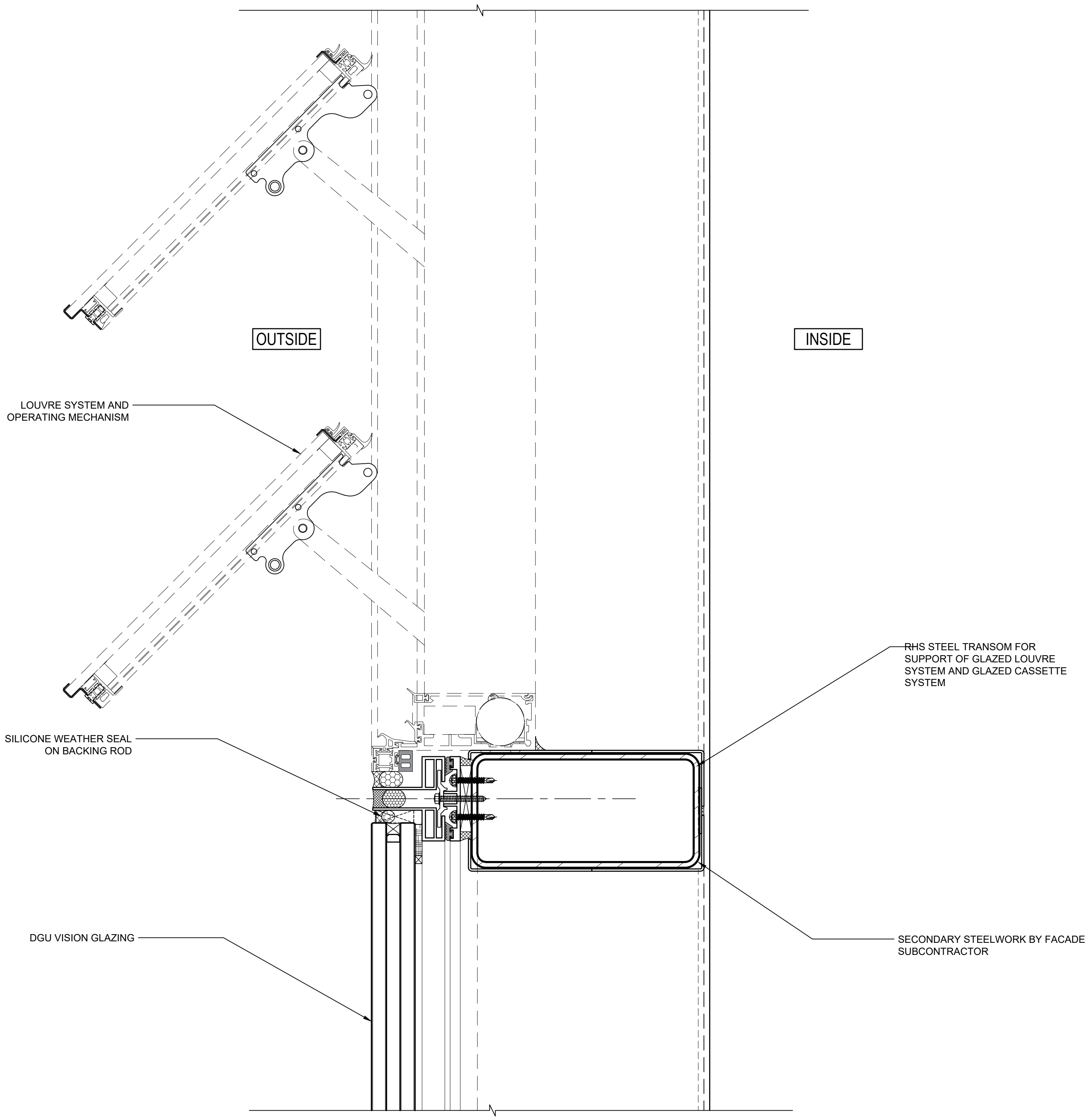

SECTION 01 -
SCALE- 1:5

CONNECTION TO GLAZED
LOUVRE SYSTEM
AT BOTTOM

Rev	Date	By	Description

Rev	Date	By	Description

Project: UON CCC	Client: UNIVERSITY OF NEWCASTLE; Architect: LYONS	Drawn: #N/A	Design: Initials	Approved: Initials	Date: #N/A	Scale at A3: 0
Title		Drawing No.: XXXX-DWG-FC4402				Rev.: #N/A

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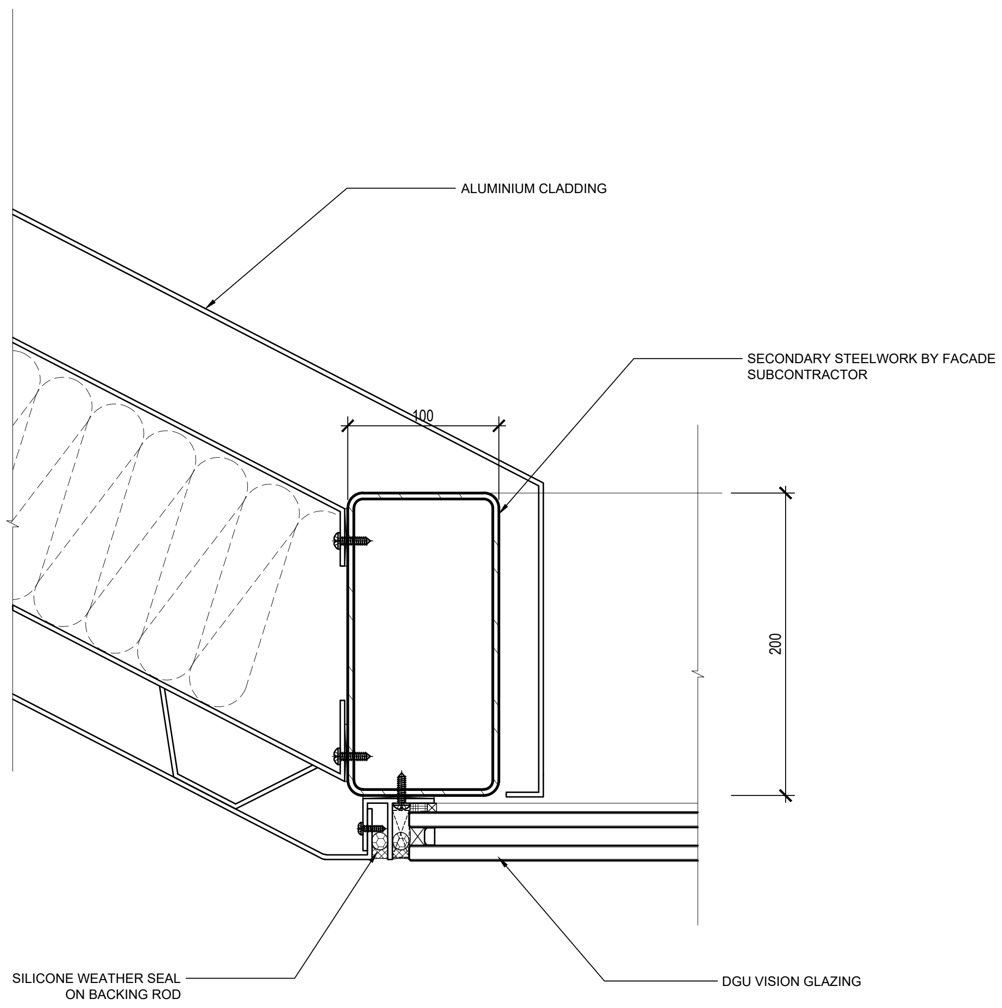

PLAN 01
SCALE- 1:5
GROUND FLOOR
AT STEEL MULLION

Rev	Date	By	Description

Rev	Date	By	Description

Project	Client UNIVERSITY OF NEWCASTLE	Drawn	Design	Approved	Date	Scale at A3	Inhabit Australasia Pty Ltd.
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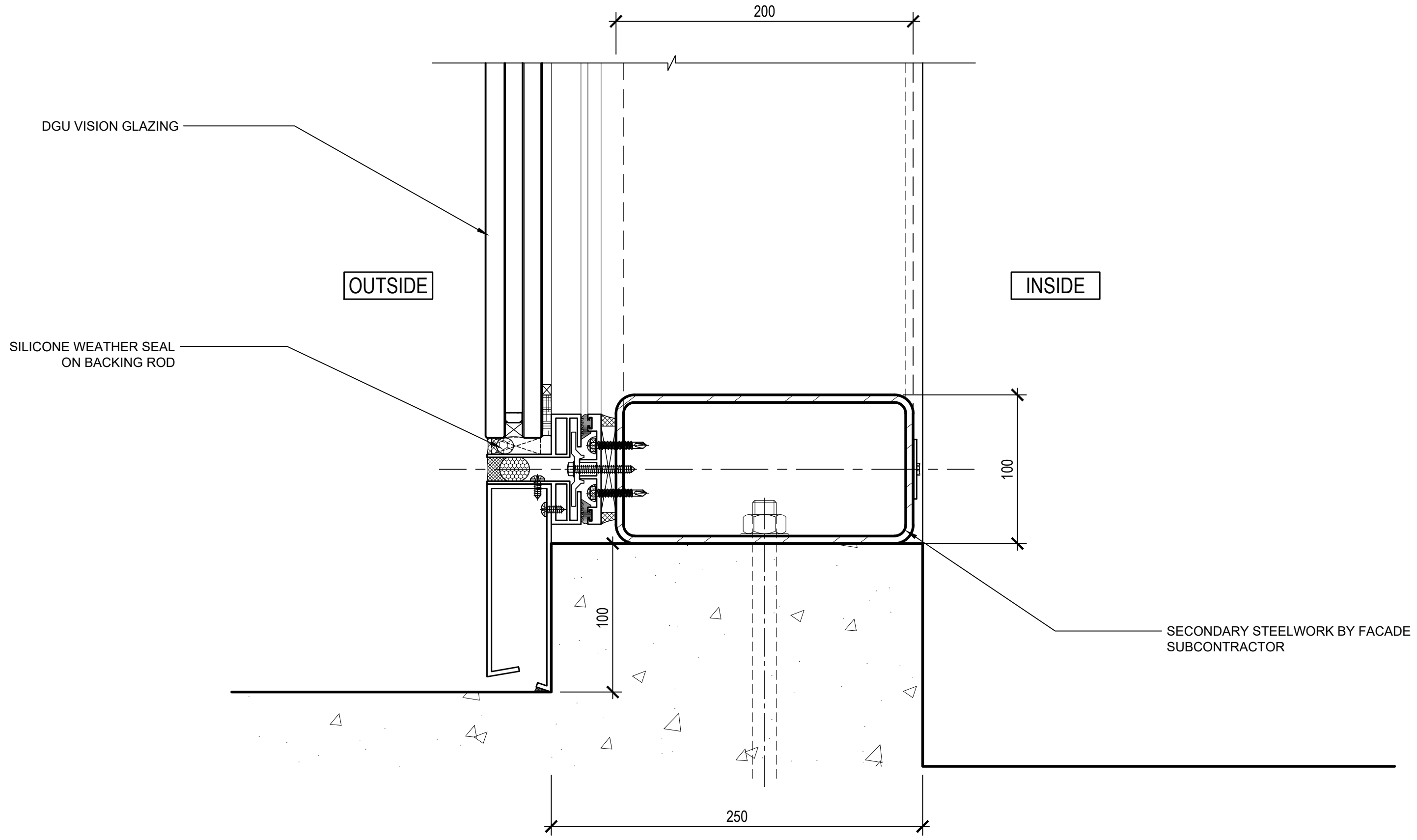
Title		Drawing No. 17251-DWG-FC4100				Rev. 00	NOT FOR CONSTRUCTION



SECTION 01
-
SCALE- 1:5

CONNECTION TO BASE
AT CONCRETE SLAB

Rev	Date	By	Description

Rev	Date	By	Description

Project	Client	Drawn	Design	Approved	Date	Scale at A3
UON CCC	UNIVERSITY OF NEWCASTLE	#N/A	Initials	Initials	#N/A	0
	Architect LYONS					
Title		Drawing No. XXXX-DWG-FC4501				Rev. #N/A

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