MEINHARDT FACADE TECHNOLOGY

# Sydney Adventist Hospital

## Façade Concept Design Report

Australia Beijing Dubai Hong Kong India Manila Shanghai Singapore

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# 1. INTRODUCTION

## 1.1 Development Proposal

It is proposed that a Part 3A Project Application for the Master Plan of the proposed upgrade and extensions to the Sydney Adventist Hospital shall be submitted to the Department of Planning (DoP) by Sydney Adventist Hospital Ltd.

Image 1 : Aerial image of the Sydney Adventist Hospital, Lot 621 Wahroonga Sydney

The Master Plan for the Sydney Adventist Hospital upgrade and extension as prepared by Morris Bray Architects comprises three development stages designated as Stage 1, Stage 2 and Stage 3 which are in turn broken down into separate phases as the individual stages are commenced.

**Stage 1A** development consists of the following works:

- An expansion of the Clinical Services Building;
- A new multi storey Carpark structure to the north of the existing and proposed Clinical Services Building;
- A new 'on-ground' Carpark to the north of the multi-storey Carpark building;
- A temporary 'on-ground' Carpark on the existing 'paddock' to the northeast of the Hospital Precinct;
- New on-ground' Carparks to the west and southwest of the existing Beattie Building;
- New whole of site static fire fighting water supply tanks and Oxygen Tank.

**Stage 1B** development consists of the following works:

- Construction of the Clinical Service Building expansion.

**Stage 2** development consists of the following works:

- A new Concourse Building located between the existing San Clinic Building and the Clinical Services Building [CSB];
- A new arrival podium to the north of the existing SAN Clinic, existing Clinical Services Buildings and the extension to the CSB undertaken as part of the Stage 1 development;
- A new entry road from Fox Valley Road; and
- Construction of the Facility of Nursing.

**Stage 3** development consists of the following works:

- Relocation of the Museum;
- Construction of the Shannon Ward Building; and
- Construction of the multi-storey Shannon Carpark building.

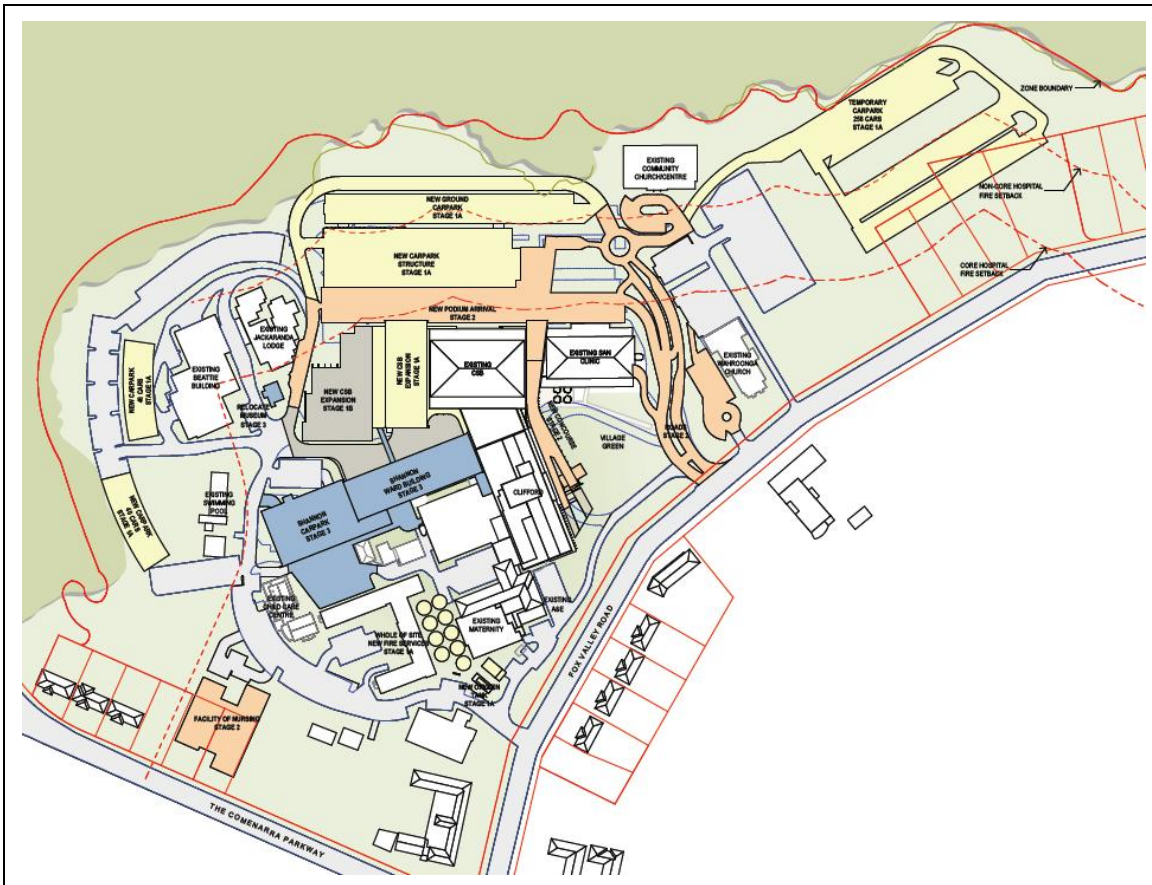



Image 2 : Overall Staging plan (Yellow – Stage 1A; Grey – Stage 1B; Orange – Stage 2; Blue – Stage 3)

## 1.2 Aim of this Report

This concept design report outlines the proposed façade systems for the Sydney Adventist Hospital upgrade and extension based on the Master Plan prepared by Morris Bray Architects.

The report focuses on the conceptual design of the initial Stage 1A - CSB Extension with the intention that the façade systems described herein are to be considered as templates for the future extension and redevelopment works.

As such, it is anticipated that individual façade concept design reports shall be prepared for each stage of the project to address specific design issues as the stages are initiated.

## 1.3 Stage 1A – Introduction

### 1.3.1 CSB Expansion – Surgical Precinct

Stage 1A of the development is an 11 level extension to the Clinical Services Building (CSB) and will accommodate new surgical facilities, operating theatres and surgical wards to increase the level of care for patients of the existing hospital whilst employing numerous green initiatives.

Image 3 : Conceptual Image of completed Stage 1A and 1B

### 1.3.2 Multi Level Car Park

A new Multi Level Carpark providing spaces for both hospital visitors and staff parking with the new parking structure over 5 Levels with two flanking surface car parks, one between the CSB building and the Multi Level Carpark and the other to the north of the Multi Deck Carpark.
The car park between the CSB building and the Multilevel Carpark will be finished in preparation for the Arrival Podium in Stage 2.

The Multilevel Carpark will be open deck and naturally ventilated.

Considerations and recommendations for the proposed system designs, material selection, performance recommendations (covering thermal, glare, acoustic and structural), and construction methodology are addressed in this report.

# 2. FAÇADE DESIGN CONSIDERATIONS

## 2.1 Aesthetic Considerations

The present architectural concept for Sydney Adventist Hospital is to have a façade that will implement clever climate control technology to hear and cool the interior of the building, as well as maximise the use of sunshading devices. It is anticipated that the façade will also maximise the amount of light entering the building without compromising the building's energy efficiency.

The following series of factors need to be considered in the design of the façade for this project:

(a) Solar / Thermal Performance

Solar Radiation angle and intensity changes with orientation, angle, the time of the year, time of the day, and of course weather conditions.

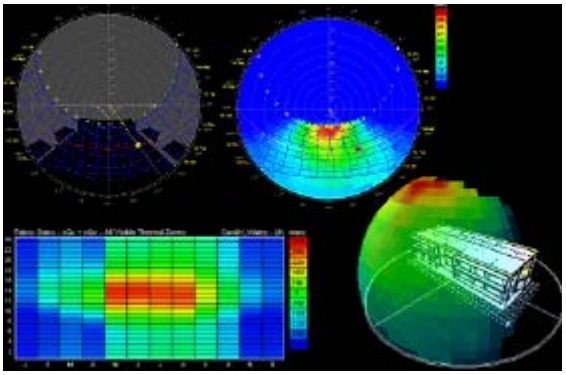


Image 4 : Example of solar radiation intensity over the course of a day. This peaks just after midday on the North Elevation.

In order to prevent excessive solar radiation from passing through the glazing the following options are available, either alone or together in a range of combinations:

- Solar controlled glass
- Overhangs or sunshades– directly reduce solar radiation on the North Elevation.
- Recesses, angled glazing or external sunshades on East and West Elevations
- Internal Blinds – provide shading and glare control but no reduction in A/C load

As there are minimal overhangs on the façade, sun shading devices will be used to provide solar control.
On the east and west façades, relatively large (600mm deep) vertical fins shall be connected to the curtain wall externally and conventional blinds shall be used internally for direct early morning and late afternoon sunlight.
The north elevation shall incorporate horizontal and vertical blades across vision areas to reduce solar penetration during peak summer months and increase it during cooler winter months.

(b) Natural Ventilation to Rooms

A common complaint in building facades is that they suffer from a “fish bowl effect” where occupants feel enclosed in glass. This is of particular concern for this project and other health care facilities, where tenants have little or no mobility or access to external areas. In view of this, it is common that natural ventilation is integrated into each room to avoid any feeling of claustrophobia.

Whilst E/M engineers tend to resist the provision of natural ventilation to buildings in Australia, this needs to be considered within the larger context of the following:

- What occupants want in terms of flexibility and control of their own comfort
- Health benefits associated with breathing fresh air and not reconditioned air
- Control of odours – venting of rooms for cleaning fluids and chemicals
- Opportunities to reduce A/C loads when outside conditions are appropriate.

(c) Acoustic Considerations

For medical and health care developments, the ingress of external noise needs to be minimized. Typically we would expect a specified noise criteria, NC rating of 30 for hospital rooms, as slightly higher for living spaces NC 35 to NC 40.

In addition to external noise mitigation, the noise from adjacent rooms and between floors also needs to be addressed in the façade design, please refer to Image 5 and Image 6 for examples of acoustic separation details between rooms.

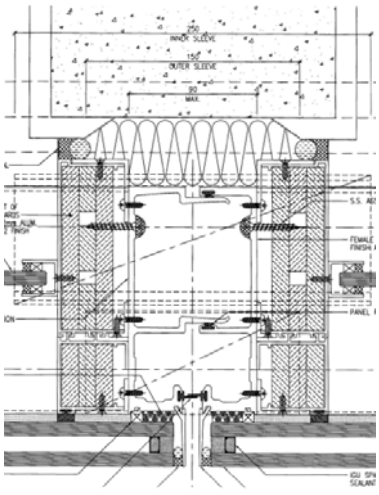


Image 5 : A high degree of acoustic separation is provided by adding additional thermal insulation to the full height of the mullion.

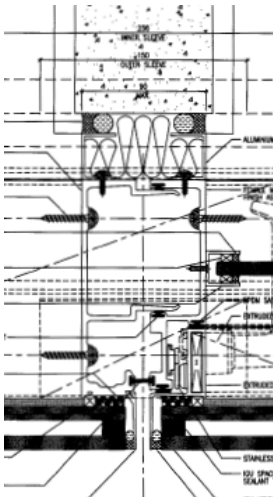


Image 6 : Typical acoustic separation at an internal wall closure provides sufficient separation within an apartment but is unlikely to be adequate between adjoining apartments.

(d) Safety Glazing

Safety glass is required in the critical areas of buildings where risk of impact is likely to occur. The use of tempered glass is preferred because it does not shard when it breaks.

The diagram below shows the critical locations (shaded) for both internal and external glazing where safety glass is required.

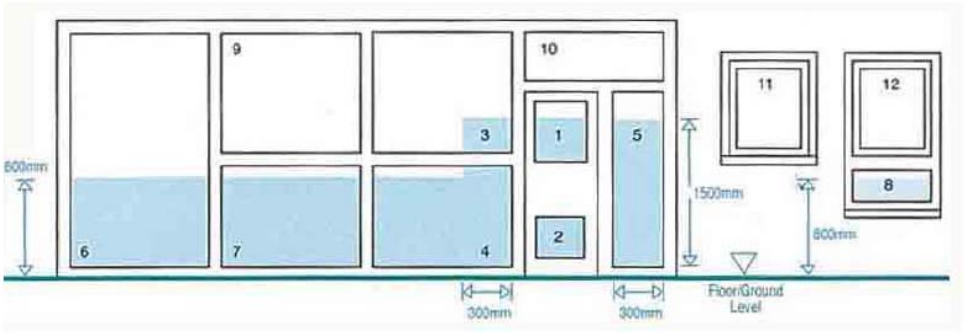



Image 7 : Locations where safety glass is required.

Safety glass can be either fully toughened glass (the type that breaks into small cubes) or laminated glass which has two layers of glass either side of a plastic film (interlayer).

Toughened glass can fail due to spontaneous breakage caused by the expansion of nickel sulphide, an impurity inherent in the raw materials that produces glass. In view of this we do not recommend toughened glass in any location where failure could be dangerous (skylights, overhead glazing and glazing above entry points for instance).

Image 8 : Examples of spontaneous breakage of tempered glass due to nickel sulphide inclusions

To protect the building owners against tempered glass breakage due to nickel sulphide inclusions and to provide a level of confidence where fully tempered glass must be used, 100% heat soak testing must be carried out which should eliminate breakage risk to acceptable limits.

Although heat soaking does not entirely eliminate spontaneous breakage, it will significantly reduce the risk of field breakage after building completion to an acceptable degree. MFT recommends all fully tempered glass must be heat soaked tested.

(e) Wind Loading

Wind loads will be calculated in accordance with AS1170. Part 2, with low level shielding from surrounding buildings.

The floor to floor height and glass modulation are reasonable, so we do not envisage wind loading having a significant impact on the cost of the façade. Glass will be typically 6/12/6mm HS Insulating Glass Units (IGU's) and mullions will be around 120mm deep, based on single anchorage points each floor.

(f) Maintenance

The majority of maintenance for this building may be achieved through the use of abseiling. The design of the abseiling strategy does not form part of this report.

## 2.2 Performance Requirements

The design of the facade systems should be in accordance with the following performance perimeters.

**Table 1: Performance Requirements**

| Performance Parameter | | Requirements |
|---|---|---|
| 1 | Design Life | Facade elements to be designed for:<br><br>20 years serviceable life, with reasonable routine maintenance,<br><br>50 years design life for facade structure (Framing, brackets and fixings, Excl. Structural silicone) |
| 2 | Wind Loads | Design to AS1170 Part 2<br>Design for a minimum 50 year return period. |
| 3 | Dead Loads | Design to AS1170 Part 1 |
| 4 | Earthquake Loads | Design to AS1170 Part 1 |
| 5 | Maintenance Loads | Glass and Glazing systems to withstand maintenance point load perpendicular to glass surface; |
| 6 | Thermal Movement | System to accommodate:<br><br>Ambient Temperature Range 0° C to 50°C<br>Surface Temperature Range -10°C to 80°C |
| 7 | Light and Heat Transfer | Refer to Section 2 for glass types schedule and glass performance requirements. |
| 8 | Fixing to Structure | Design fixings to resist all loads both individually and in combination.<br><br>Use cast-in inserts for primary curtain wall fixing method (Hot dipped galvanised steel). |
| 9 | Deflection Limits | Serviceability deflection limits:<br><br>Glass – Span/90 or <20<br>Aluminium Framing – Span/240<br>Aluminium /Composite Panels – Span/90 or <20 |
| 10 | Structure Tolerances | Slab edge (on plan) ± 25mm<br>Slab level ± 10mm<br>Cast in inserts ±10mm. |

| Performance Parameter | Requirements |
|---|---|
| 11 Fabrication Tolerances | Glass – to AS1288 2006<br>Framing members – cut to ± 1mm<br>Dimensions to overall panel ±2mm |
| 12 Installation Tolerances | Curtain Walls panels ± 3mm (in plan) relative to adjacent panel.<br>Overall facade plan ± 5mm (in/out) from nominal plane position |
| 13 Building Movement | Design curtain wall and to accommodate the following structural movements;<br><br>Vertical differential deflection (floor to floor)<br>Horizontal differential movement (floor to floor)<br>Horizontal movement (long term shrinkage)<br>Column shortening<br>Building sway<br><br>Where curtain walling is continuous over more than one floor, provide a horizontal stack joint to accommodate vertical building movement. |
| 14 Cast-in Inserts | Design to resist worst load combinations. For proprietary inserts, design to manufacturers requirements. For fabricated inserts, design to a factory of safety minimum 3.0. |
| 15 Weathertightness | The façade shall not leak if tested in accordance with AS/NZS 4284. Use pressure equalized / drained joint design for all cladding elements and interfaces. |
| 16 Acoustic Performance | In accordance with the Project Brief. |
| 17 Building Maintenance | The façade is to include eye-bolts for the window washing intermittent stabilization tie-back system. This needs to be coordinated with the BMU contractor and installed in accordance with AS1891. |
| 18 Ease of Glass Replacement | Each glass panel to be capable of replacement in isolation. |
| 19 Fire / Smoke Separation | All floors to be separated in accordance with BCA. |
| 20 Structural Silicone | Where structural silicone is used on vertical glass edges, design mullion to accept vertical glazing beads in the future if required. |

# 3. FAÇADE SYSTEMS

## 3.1 Introduction

A number of different façade systems have been proposed for each façade area (see the descriptions in Table 2). This section will discuss the different methods of façade fabrication and installation that is to be adopted for each façade type.

### 3.1.1 Curtain Wall Systems

Two methods of fabricating and installing the curtain wall façades have been reviewed for consideration:

- Stick System
- Unitised System

Choice of curtain wall systems is never straightforward. Main factors of consideration would be based on:

- Cost;
- Appearance;
- Timescale; and
- Access Limitations.

Generally, costs would increase with complexity, therefore increasing the number of non-standard items in a curtain wall system will increase cost, not only due to the cost of additional material but also due to additional design, work and time required to integrate the non-standard component(s) within the system.

The importance of the overall aesthetic quality of a building appearance will depend upon the desired image that the building is to project. A building facade may be designed to compliment, or contrast with the surrounding built environment. The Sydney Adventist Hospital expansion will inject livelihood into Sydney's Upper North Shore, and therefore there is a necessity to employ high quality façade materials that will increase the developments aesthetic appeal whilst not compromising the developments overall green rating.

Time-scale is an important consideration. Thus factory assembled curtain wall systems would be preferred over site installed and glazed curtain wall systems. Curtain wall systems involving factory pre-assembly must be well planned and managed so that units are available for installation when construction of the façade is to start. The units must also not be manufactured too early or delivered too soon otherwise additional storage costs can incur.

Other factors that are important include the availability of access. Erection of temporary construction access to facilitate installation of curtain walls can be an added cost to the overall project cost, which often is also reflected in the cost of curtain wall systems.

Curtain walls have been in use for many years and are globally recognised as the industry standard. Refer to Figure 5 and Figure 6 for photographs depicting such projects.

Figure 1 : 400 George Street Brisbane, Curtain wall (during construction)

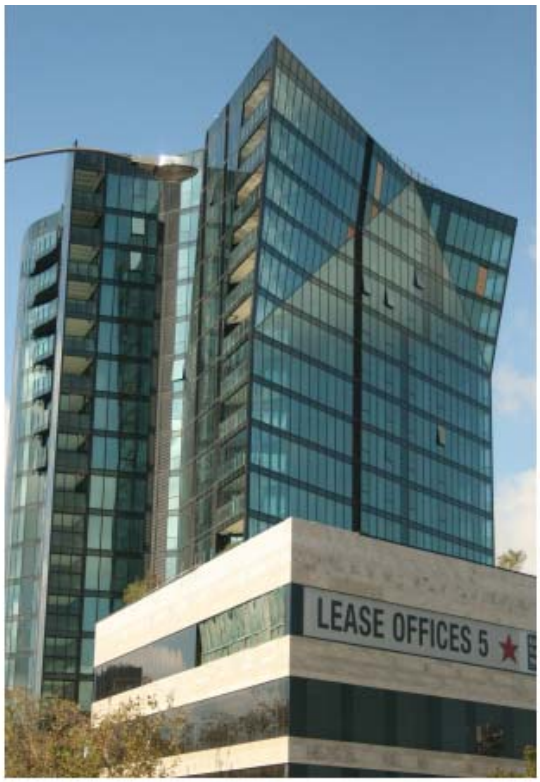



Figure 2 : One East Melbourne, Curtain wall

(a) Stick System Approach

The oldest curtain wall type is the stick built system. In the stick system, the curtain wall frame, comprising mullions and transoms, and glazing panels are installed and assembled together with various hardware components such as anchors, connectors setting blocks pressure plates, gaskets, capping etc, piece by piece on site. The site-assembled stick system has the advantages that erection can start quickly. But it also carries the major disadvantage that the subsequent installation speed will be significantly slower when compared with factory-assembled unitised units. This system is fully reliant on site installation workmanship to achieve the desired quality and weather tightness.

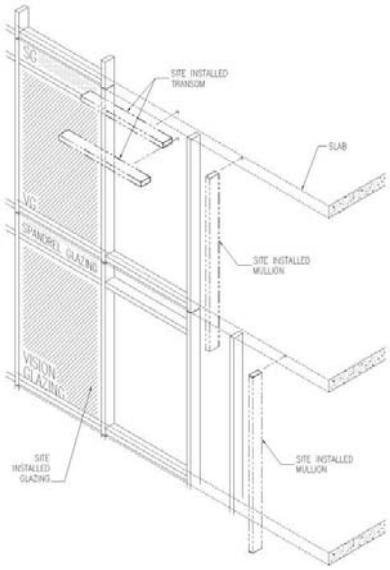



Figure 3 : Schematic showing stick system installation

Figure 4 : 4 Way joint for a stick curtain wall system

Key considerations:

- Site sealing is required and cannot be carried out during the summer days due to temperature. Glazing clips are usually required which will distort the glass in the façade.
- Mullions will be smaller (narrower)
- Exterior access is required in the form of scaffolding or gondolas slowing erection and causing safety risks
- Large movements will be difficult if not impossible to accommodate.

(b) Unitised Approach

In the unitised system, the curtain wall is composed of sizeable storey-height units that are assembled and fully glazed in the factory, shipped to the site and erected on the building. Vertical mullions and horizontal transoms of the modules are mated together. Where required, modules of such curtain walls can be also constructed up to two stories tall and every module or unit may incorporate numerous panels and glazing units.

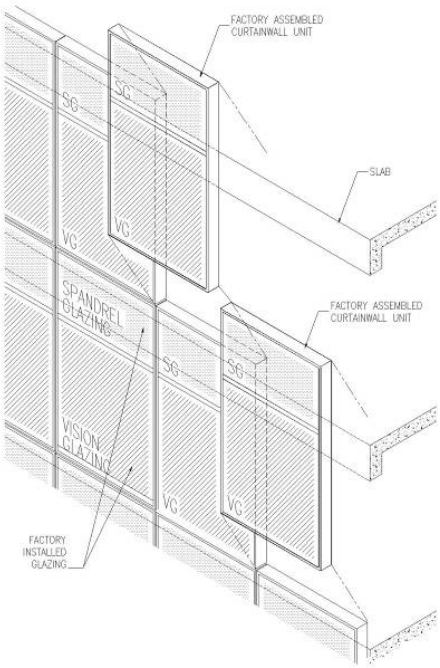
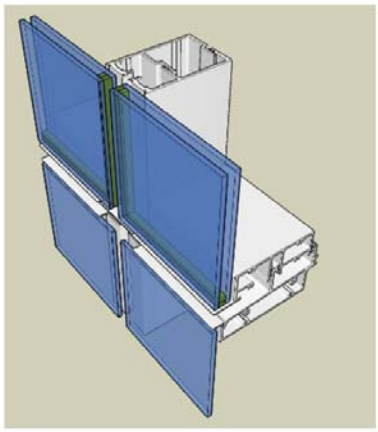


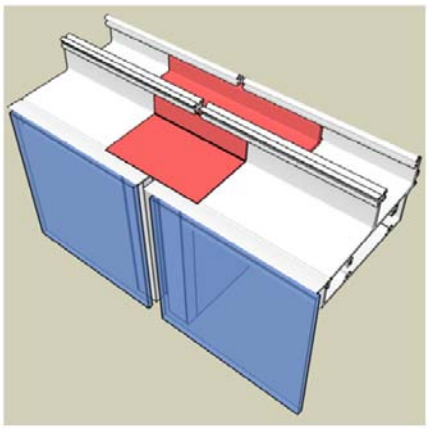

Figure 5 : Schematic showing minimised system installation

Key considerations:

- Site sealing can be replaced by sealing in a controlled environment
- External access is not required for curtain wall panel installation
- Better quality control in fabrication
- Rapid installation is possible
- Mullions will be wider to allow for building movements



Rendering of a 4-way stack joint for a unitized curtain wall



Rendering indicating the gutter splice of the unitized system

Figure 6 : Rendered images of curtain wall detail

The unitised system offers the advantage of construction speed; minimal site works; and better quality control from fully factory fabricated modular components. Fabrication costs for the stick system may be cheaper (up to 15%), however, due to the scale of the project, these will be far outweighed by the cost savings made by reduced construction time if a unitised system is employed.

(c) Curtain Wall Bracket Fixings

Curtain wall anchorage to the floor slab can be achieved by the following methods:

- Face of slab fixing
- Top of slab fixing

Both top and face fixings can be considered.

Top of slab fixing:

Generally, top fixing allows for easier and speedy installation, as all brackets are accessible directly and safely from the building interior. Cladding zone may be slightly reduced with fixing the bracket to the top of the slab, as opposed with face fixing, where the entire bracket shall be placed within the cladding zone. If there is no suspended floor, A top fixed embed will have to be recessed in the slab in order that the bolts and connecting plates are not exposed. This will cause an increased in construction cost due to boxing out and detailing of reinforcement.

Figure 7 : Curtain wall bracket (top of slab fixing)

Face of slab fixing:

For this solution, the bracket is placed and fixed outward from the slab edge. Drop-in brackets will ensure quick and safe installation. The bracket shall be designed to grip the mullions from the sides, thus the cladding zone can be minimized. By the nature of this fixing type, it does not affect floor finish or internal lining design, therefore floor build up can be reduced to minimum. Standard brackets can be used even at non-typical slab locations, such as in the proximity of columns.

Figure 8 : Curtain wall bracket (slab face fixing)

Figure 9 : Installation of unitized curtain wall

### 3.1.2 Aluminium Cladding

Aluminium cladding is proposed for some of the non-glazed areas of facades as per the Architect's design intent. The advantages of aluminium cladding are, it is both durable and relatively easy to maintain, and it is also versatile for creating the desired contemporary building appearance. Cladding can be designed to cover the projected canopies, ceiling soffits, encasement of glass displays, building sunshades, column finishing, architectural trims, entrance portals, architraves and balcony slab edge facing to achieve consistent and completeness in appearance.

Commonly, aluminium cladding is either minimum 3mm thick solid aluminium sheets with PVF2 or Kynar powder coated finish, or minimum 4mm thick composite aluminium panels that consist of polyurethane resin bonded in between two thin aluminium sheets. Solid aluminium sheets would generally be recommended for higher strength, and longer durability, higher workability and availability of non-standard colours, but if cost is a consideration, the less expensive composite aluminium panels are recommended. Fire rating considerations must be given for selection of composite aluminium panels by different manufacturers. All composite panels should be class '0' rated to BS476.

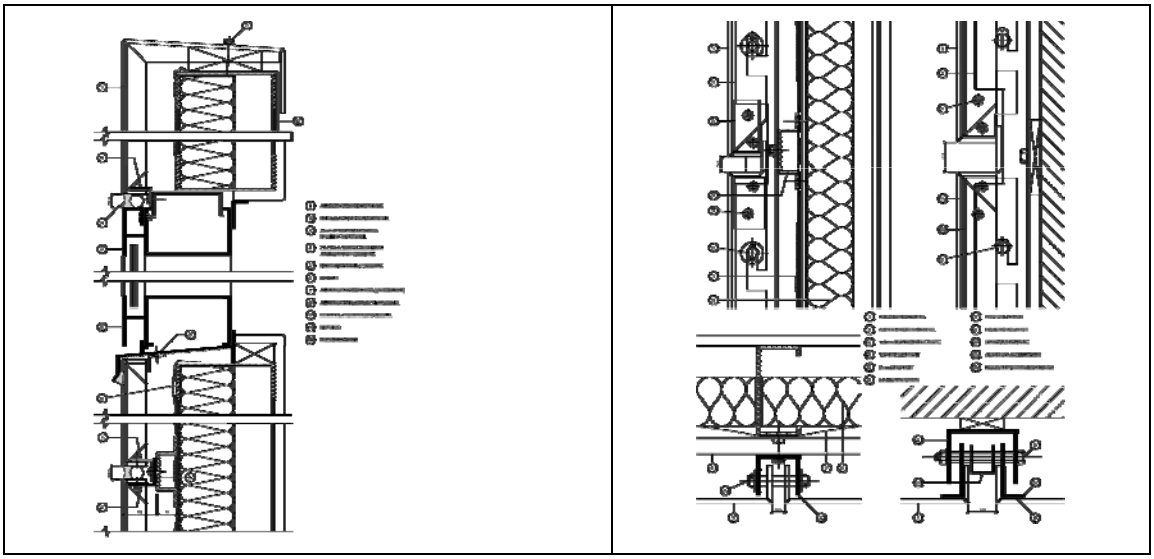


Figure 10 : Aluminium cladding systems – Unitized CW (left) and Cassette (right)

### 3.1.3 Sunshades

Sunshades are typically integrated into the curtain wall system. They can be prefixed in the factory or on the ground at site prior to lifting. Alternatively they can be installed off a working gantry after the curtain wall is installed.

Sunshading devices are aluminium framed wherever possible to reduce weight and reduce risks of long-term corrosion, however steel or stainless steel framing may be utilised for larger shading devices or higher loading conditions. The framing is most commonly fixed into the mullions of the curtain wall to avoid water proofing issues.

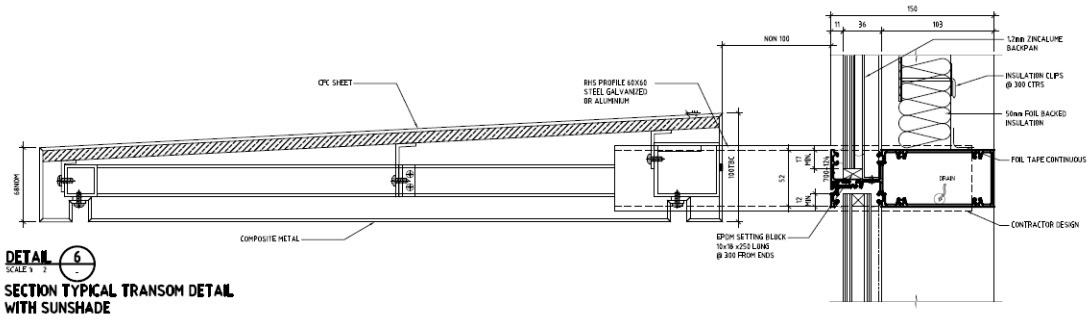



Figure 11 : Typical section through steel framed, aluminium clad sunshade

Cladding to sunshades is typically aluminium or composite aluminium sheet for durability and maintenance considerations. Plywood or - for protection against moisture damage - compressed fibre cement (CFC) sheet can be used as a backing on horizontal sunshades to resist maintenance loads imposed by cleaning crews stepping on the upper surface.

Colours depend on application and architectural intent, but it is not uncommon to utilise lighter colours on horizontal sunshades to create a “light shelf” effect to supplement lighting to internal spaces. Bird protection must also be addressed for horizontal sunshades with flatter profiles.

### 3.1.4 Louvres

Louvres are specified between the exposed columns on the north elevation entry, around the Level 6 plant areas and at roof level. The louvre profiles will vary, depending on aesthetic intent, shading criteria, required weather-tightness, air flow and acoustic criteria. Architectural grilles are often installed in front of working louvres to achieve a specific appearance. This will particularly be the case for Level 6 where the vertical louvres will only provide minimal weather protection to plant areas.

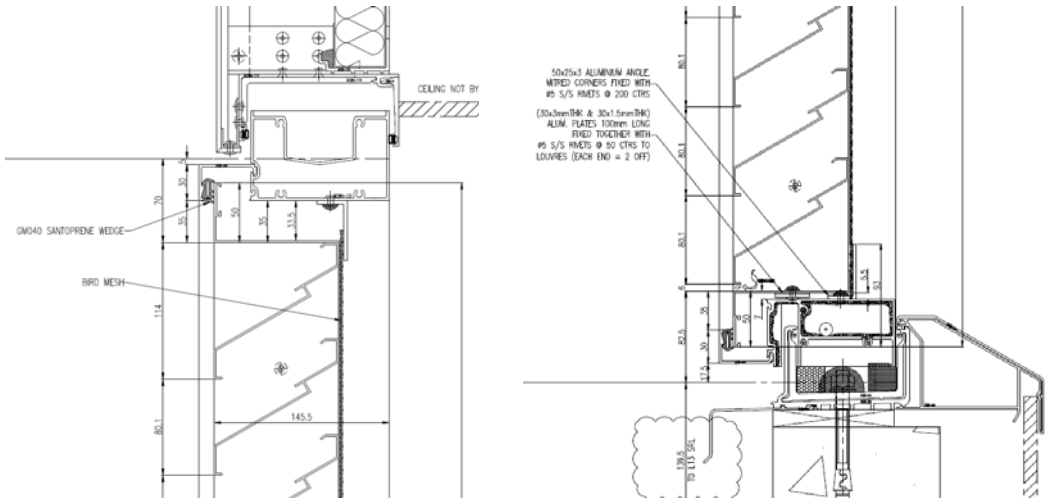



Figure 12 : Louvre head and sill details

### 3.1.5 Precast Concrete

Precast concrete facades can be used as both a cladding element or, if considered early in the design process, as a structural element. They provide durable and high quality finishes to the external façade with excellent quality control over forms and can be erected relatively quickly. They also provide excellent thermal and acoustic barriers for sensitive applications. The disadvantages include limited design flexibility, weight of panels during transport and handling, need for accurate setout on site and careful consideration of joints.

Precast cladding panels are typically designed to transfer load to each floor level via brackets or hook-on type connections and are restrained by panels or other structural elements through dowelled connections or other bracket systems. Panels with penetrations for windows, doors or other significant openings may need to be temporarily reinforced with ties or strongbacks during transportation.

Joints require special consideration and may be one of three types: open-drained, face-sealed or compression sealed. MFT typically recommends a combination of open drained and compression sealed to provide maximum weather-tightness. Horizontal joints are addressed via a shiplap joint with a compressible seal and air-seal to the rear, while vertical joints are resolved with an expansion chamber and baffle to the centre of the joint and an air-seal to the rear.

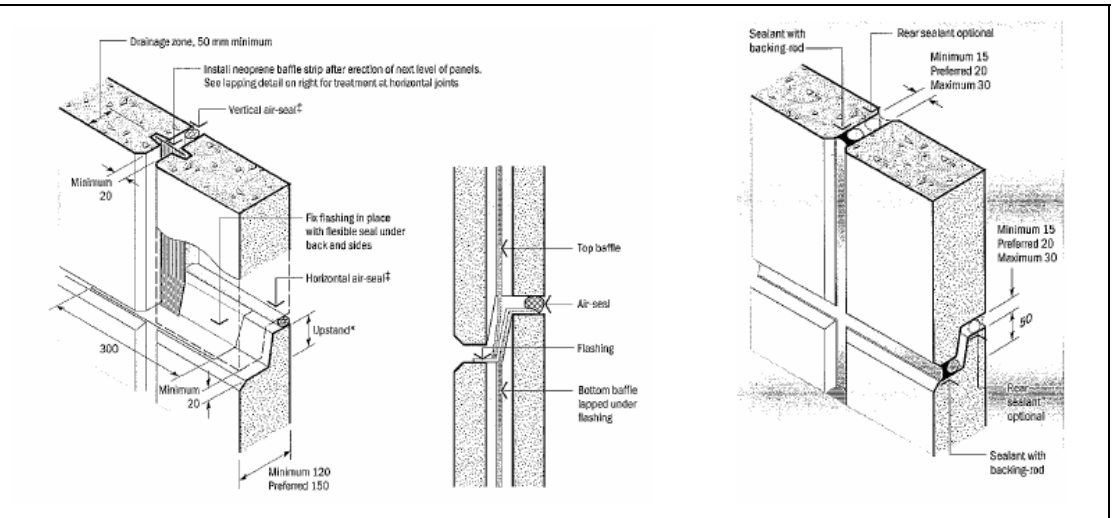



Figure 13 : Open-Drained Joint and Face Sealed Joint

Several profiles and features may be cast into the surface of panels and a variety of finishes may be achieved including off-form, polished or water-washed (exposed aggregate). A water-tight surface sealant is typically applied over these finishes and may be supplemented by an anti-graffiti coating to publicly accessible areas.

### 3.2 Proposed Façade Systems

The Sydney Adventist Hospital upgrade and extension is encompassed by a number of façade types. The façade systems for Stage 1A are listed in Table 2.

As discussed in the Introduction to this report, these façade systems shall provide a template for the project as a whole and may be referenced in future stages. Please refer to Section 3.3 for façade system details.

**Table 2: Façade Systems**

| Façade System | Description |
|---|---|
| System 1 | Horizontal aluminium louvre panels on steel frame to Roof Level plant rooms. |
| System 2 | Unitised pressure equalized aluminium curtain wall system with staggered mullions, clear vision glazing and 4 colour aluminium cladding panels |
| System 3 | Vertical & horizontal sunshades fixed to System 2 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| System 4 | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels. |
| System 5 | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and aluminium cladding panels |
| System 6 | Vertical & horizontal sunshades fixed to System 5 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| System 7 | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels |
| System 8 | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and 2 colour aluminium cladding panels |
| System 9 | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels to cantilevered corners |
| System 10 | Vertical aluminium louvre panels on steel frame to Level 6 plant rooms. |
| System 11 | Aluminium panel cladding fixed to a steel subframe with punched clear vision windows and integrated soffit to underside of Level 5 recess. |
| System 12 | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and aluminium cladding panels recessed under Level 5 |
| System 13 | Horizontal aluminium louvre panels between exposed structural columns |
| System 14 | Vertical sunshades fixed to System 12 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| System 15 | Unitised pressure equalized aluminium curtain wall system with full height clear vision glazing |
| System 16 | Precast concrete panels with punched clear vision windows |
| System 17 | Pressure equalized aluminium strip window system with fixed vision glass |
| System 18 | Painted render on concrete or block wall substrate |
| System 19 | Unitised pressure equalized aluminium curtain wall system with full height clear vision glazing to Link Bridge |
| System 20 | Vertical & horizontal sunshades fixed to System 19 through the vertical mullions with aluminium framing and composite aluminium cladding. |

Reference is made to Figure 1 - 4 showing the locations of the various façade types.

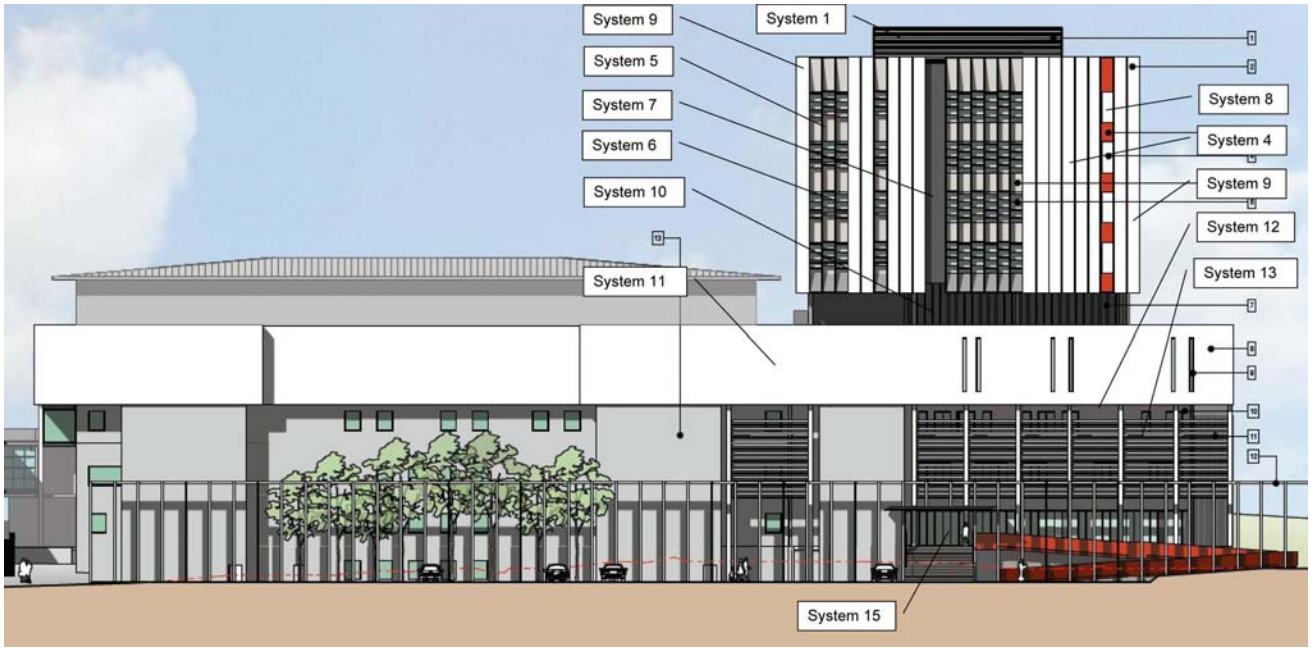



Figure 14 :North Façade.

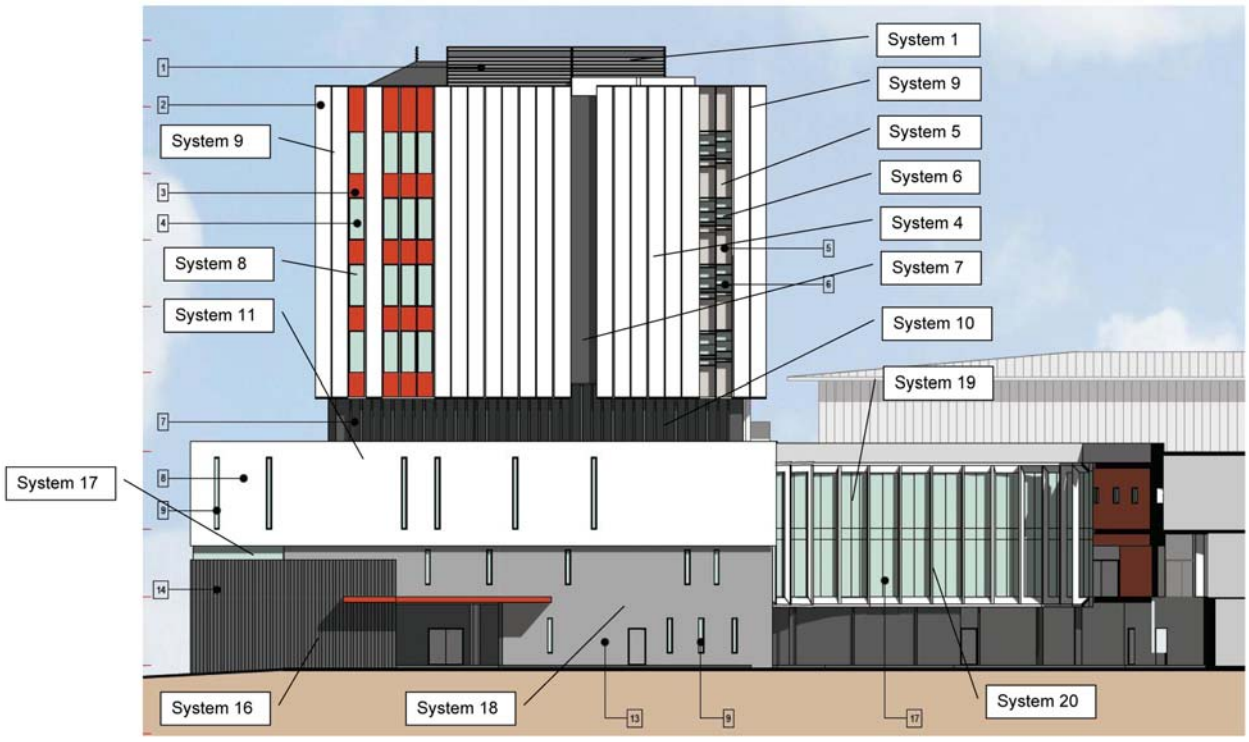



Figure 15 :South Façade.

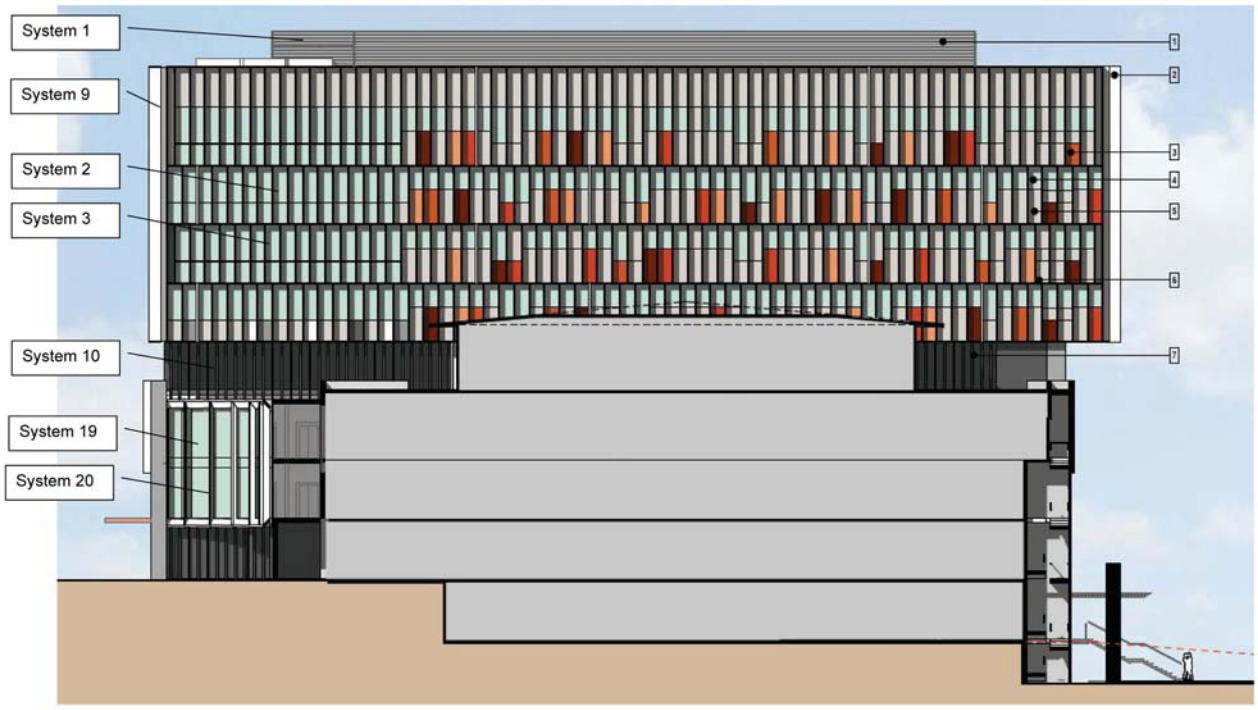



Figure 16 :East Façade.


Figure 17 :West Façade.

### 3.3 Façade System Specifications

| Façade System 1 | Description |
|---|---|
| Description / Design intent: | Horizontal aluminium louvre panels on steel frame to Roof Level plant rooms. |
| Indicative location (s): | Roof Level Plant Rooms |
| Typical module size: | TBA |
| Joint / sealing type: | Open |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm |
| **Frame** | |
| Frame material: | Steel |
| Frame finish: | Two pack paint system. |
| Frame colour: | To architects approval. |
| Frame size: | Square hollow sections. |
| External bead projection: | N/A |
| **Louvres** | |
| Material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | To match curtain wall. |
| Typical panel size: | TBA |
| Fixing method: | Concealed. |

| Façade System 2 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with staggered mullions, clear vision glazing and 4 colour aluminium cladding panels |
| Indicative location (s): | West Façade Level 7 – 10 |
| | East Façade Level 7 – 10 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |
| **Spandrel Panel** | |
| Spandrel Type 1 | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 3 | Description |
|---|---|
| Description / Design intent: | Vertical & horizontal sunshades fixed to System 2 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| Indicative location (s): | West Façade Level 7 – 10 |
| | East Façade Level 7 – 10 |
| Typical module size: | 975 x 3800 (TBC) to suit curtain wall panels |
| Joint / sealing type: | Silicone sealed |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| **Sunshade** | |
| Finish: | Powder coated to architects approval. |
| Colour: | To be confirmed. |
| Fixing method: | Concealed. |

| Façade System 4 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels. |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Cladding Panel** | |
| Panel Type | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Cladding Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 5 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and aluminium cladding panels |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |
| **Spandrel Panel 1** | |
| Spandrel Type 1 | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |
| **Spandrel Panel 2** | |
| Spandrel Type 2 | Inclined Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 6 | Description |
|---|---|
| Description / Design intent: | Vertical & horizontal sunshades fixed to System 5 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical module size: | 975 x 3800 (TBC) to suit curtain wall panels |
| Joint / sealing type: | Silicone sealed |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| **Sunshade** | |
| Finish: | Powder coated to architects approval. |
| Colour: | To be confirmed. |
| Fixing method: | Concealed. |

| Façade System 7 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels. |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Cladding Panel** | |
| Panel Type | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Cladding Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 8 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and 2 colour aluminium cladding panels |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |
| **Spandrel Panel** | |
| Spandrel Type 1 | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 9 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with aluminium cladding panels to cantilevered corners |
| Indicative location (s): | North Façade Level 7 – 10 |
| | South Façade Level 7 – 10 |
| Typical panel size: | 900 x 3800 (TBC) |
| | 1200 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Cladding Panel** | |
| Panel Type | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Cladding Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 10 | Description |
|---|---|
| Description / Design intent: | Vertical aluminium louvre panels on steel frame to Level 6 plant rooms. |
| Indicative location (s): | Level 6 Plant Rooms |
| Typical module size: | TBA |
| Joint / sealing type: | Open |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm |
| **Frame** | |
| Frame material: | Steel |
| Frame finish: | Two pack paint system. |
| Frame colour: | To architects approval. |
| Frame size: | Square hollow sections. |
| External bead projection: | N/A |
| **Louvres** | |
| Material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | To match curtain wall. |
| Typical panel size: | TBA |
| Fixing method: | Concealed. |

| Façade System 11 | Description |
|---|---|
| Description / Design intent: | Aluminium panel cladding fixed to a steel subframe with punched clear vision windows and integrated soffit to underside of Level 5 recess. |
| Indicative location (s): | North Façade – Level 5 |
| | South Façade – Level 5 |
| | West Façade – Level 5 |
| Typical module size: | TBA |
| Joint / sealing type: | Silicone sealed. |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm. |
| **Frame** | |
| Frame material: | Steel. |
| Frame finish: | Galvanised. |
| Frame colour: | N/A. |
| Frame size: | Nominal 100mm wide x 200mm deep |
| **Cladding Panel** | |
| Panel Type: | Composite Aluminium Panel. |
| Typical panel size: | TBA |
| Glazing method: | Concealed fixing - hook on system. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | N/A |
| Panel Type: | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 12 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with clear vision glazing and aluminium cladding panels recessed under Level 5 |
| Indicative location (s): | North Façade Level 3 & 4 |
| | West Façade Level 3 & 4 |
| Typical panel size: | 1200 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 600 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |
| **Spandrel Panel** | |
| Spandrel Type 1 | Composite Aluminium Panel. |
| Typical panel size: | 975 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |
| **Spandrel Panel** | |
| Spandrel Type 2 | Composite Aluminium Panel. |
| Typical panel size: | 600 x 800 |
| Fixing method: | Horizontally and vertically mechanically fixed to aluminium frame. |
| Makeup: | 4mm thick composite aluminium panel with stiffeners where required and insulation within cavity to achieve thermal and acoustic ratings. |
| **Spandrel Performance** | |
| Shading coefficient: | N/A |
| Total R Value: | 2.8 |
| Visible reflectance: | <15% |
| Rw : | 47 |
| Panel Type | Equivalent to 4 mm thick Alpolic / Alucobond. |

| Façade System 13 | Description |
|---|---|
| Description / Design intent: | Horizontal aluminium louvre panels between exposed structural columns |
| Indicative location (s): | North Façade Level 3 & 4 |
| Typical module size: | 2000 x 3800 (TBA) |
| Joint / sealing type: | Open |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm |
| **Frame** | |
| Frame material: | Steel |
| Frame finish: | Two pack paint system. |
| Frame colour: | To architects approval. |
| Frame size: | Square hollow sections. |
| External bead projection: | N/A |
| **Louvres** | |
| Material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | To match steel framing |
| Typical panel size: | TBA |
| Fixing method: | Concealed. |

| Façade System 14 | Description |
|---|---|
| Description / Design intent: | Vertical sunshades fixed to System 12 and 15 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| Indicative location (s): | West Façade Level 2 - 4 |
| Typical module size: | 1200 x 3800 (TBC) to suit curtain wall panels |
| Joint / sealing type: | Silicone sealed |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| **Sunshade** | |
| Finish: | Powder coated to architects approval. |
| Colour: | To be confirmed. |
| Fixing method: | Concealed. |

| Façade System 15 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with full height clear vision glazing |
| Indicative location (s): | North Façade Level 2 |
| | West Façade Level 2 |
| Typical panel size: | 975 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 9.52mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |

| Façade System 16 | Description |
|---|---|
| Description / Design intent: | Precast concrete panels with punched clear vision windows |
| Indicative location (s): | West Façade Level 2 - 4 |
| | South Façade Level 3 & 4 |
| Typical panel size: | TBC |
| Joint / sealing type: | Vertical - Pressure equalized baffled joint with rear air seal. |
| | Horizontal - Pressure equalized drained shiplap joint with pressure seal. |
| Joint width: | Vertical Nominal 20mm / Horizontal Nominal 20 mm. |
| **Precast Panel** | |
| Panel material: | Precast Concrete |
| Panel finish: | TBA |
| Panel colour: | To architects approval. |
| Panel size: | TBA |
| Weather Seal: | TBA |
| **Glazing Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | TBA |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |

| Façade System 17 | Description |
|---|---|
| Description / Design intent: | Pressure equalized aluminium strip window system with fixed vision glass |
| Indicative location (s): | West Façade – Level 4 |
| | South Façade – Level 4 |
| Typical module size: | TBA |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 150mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass Type 1** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | TBA |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 8mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |

| Façade System 18 | Description |
|---|---|
| Description / Design intent: | Painted render on concrete or block wall substrate |
| Indicative location (s): | South Façade Level 3 & 4 |
| Typical panel size: | N/A |
| Joint / sealing type: | Square tooled expansion joint |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm. |
| **Render** | |
| Render material: | Cementitious Render |
| Render finish: | TBA |
| Render colour: | To architects approval. |
| Weather Seal: | TBA |

| Façade System 19 | Description |
|---|---|
| Description / Design intent: | Unitised pressure equalized aluminium curtain wall system with full height clear vision glazing to Link Bridge |
| Indicative location (s): | South Façade Level 4 & 5 |
| Typical panel size: | 1800 x 3800 (TBC) |
| Joint / sealing type: | Pressure equalized drained joint. |
| Joint width: | Vertical Nominal 15mm / Horizontal Nominal 20 mm. |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| Frame size: | Nominal 85mm wide x 200mm deep |
| External bead projection: | N/A. |
| **Vision Glass** | |
| Vision glass type: | Insulated Glass Unit. |
| Typical glass panel size: | 975 x 3000 |
| Glazing method: | Horizontally and vertically structurally glazed to aluminium frame. |
| IGU makeup: | 8mm thick HS panel + 12mm thick airspace + 9.52mm thick HS panel |
| **Glass Performance** | |
| Shading coefficient: | TBA |
| U-value: | TBA |
| Visible transmittance: | TBA |
| Visible reflectance: | TBA |
| Rw : | TBA |
| Panel Type: | TBA |

| Façade System 20 | Description |
|---|---|
| Description / Design intent: | Vertical & horizontal sunshades fixed to System 19 through the vertical mullions with aluminium framing and composite aluminium cladding. |
| Indicative location (s): | South Façade Level 4 & 5 |
| Typical module size: | 1800 x 3800 (TBC) to suit curtain wall panels |
| Joint / sealing type: | Silicone sealed |
| Joint width: | Vertical Nominal 10mm / Horizontal Nominal 10 mm |
| **Frame** | |
| Frame material: | Aluminium. |
| Frame finish: | Powder Coat. |
| Frame colour: | To architects approval. |
| **Sunshade** | |
| Finish: | Powder coated to architects approval. |
| Colour: | To be confirmed. |
| Fixing method: | Concealed. |