Nomination: Arup (Structural Engineers)

Malvern Park Shopping Centre
(Steel Canopy Feature Roof)

THE PROJECT BRIEF

CLIENT: GEPF/ PIC

ARCHITECTS: TCRPV Architects

MAIN CONTRACTOR: WBHO

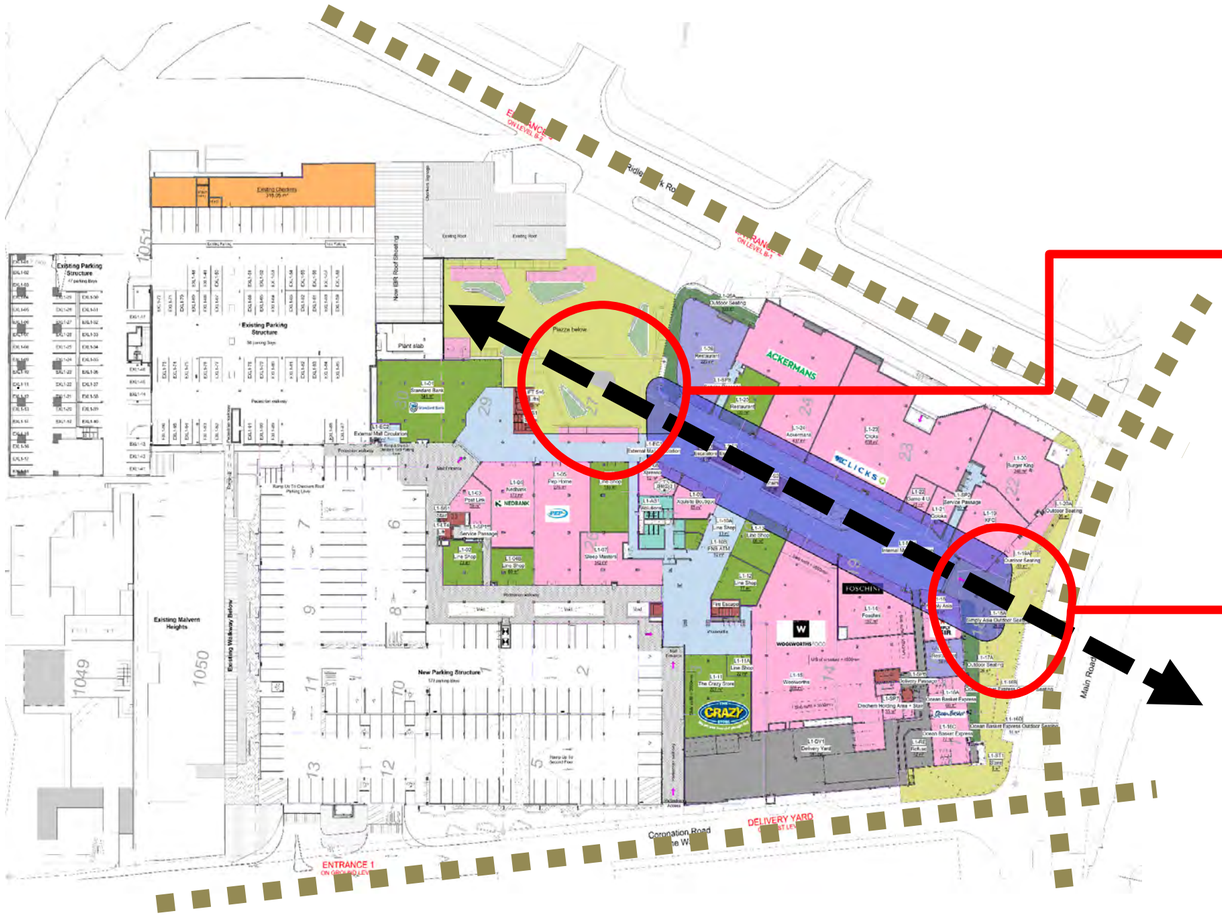
CLIENTS BRIEF / KEY DESIGN APPROACH

The current mixed-use development necessitated a comprehensive overhaul.

Key objectives of the redesign included:

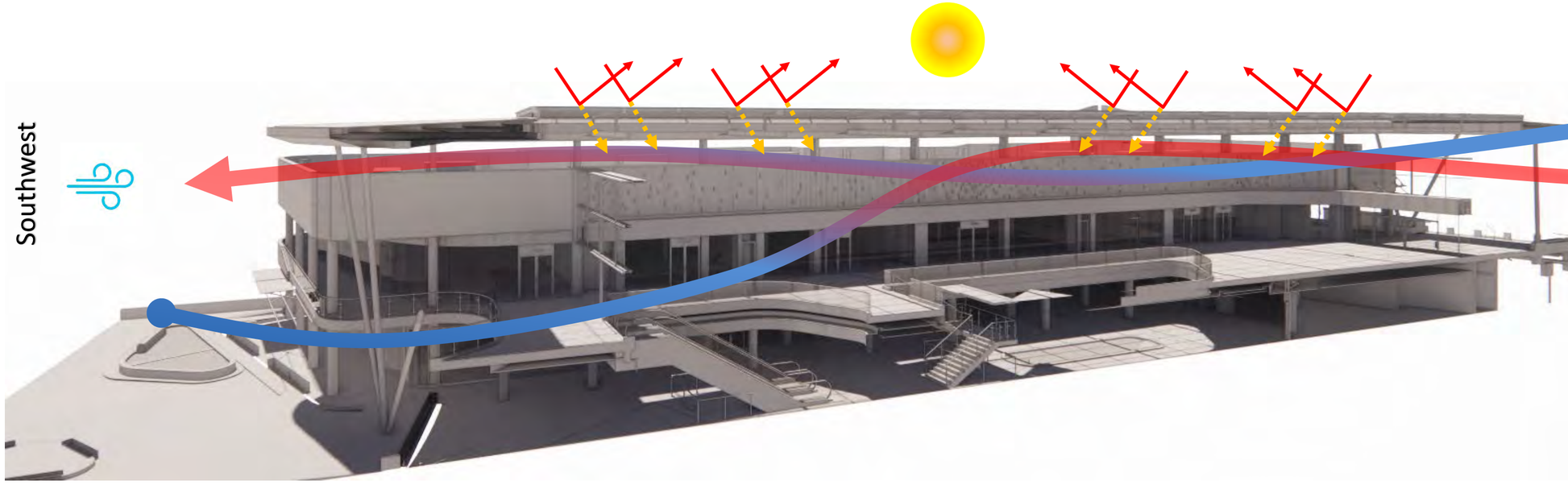
- Enhancing accessibility for vehicular and pedestrian traffic
- Expanding the Gross Lettable Area by 5000m^2
- Fostering a positive impact on the community through upgraded retail offerings and inspiring architectural design

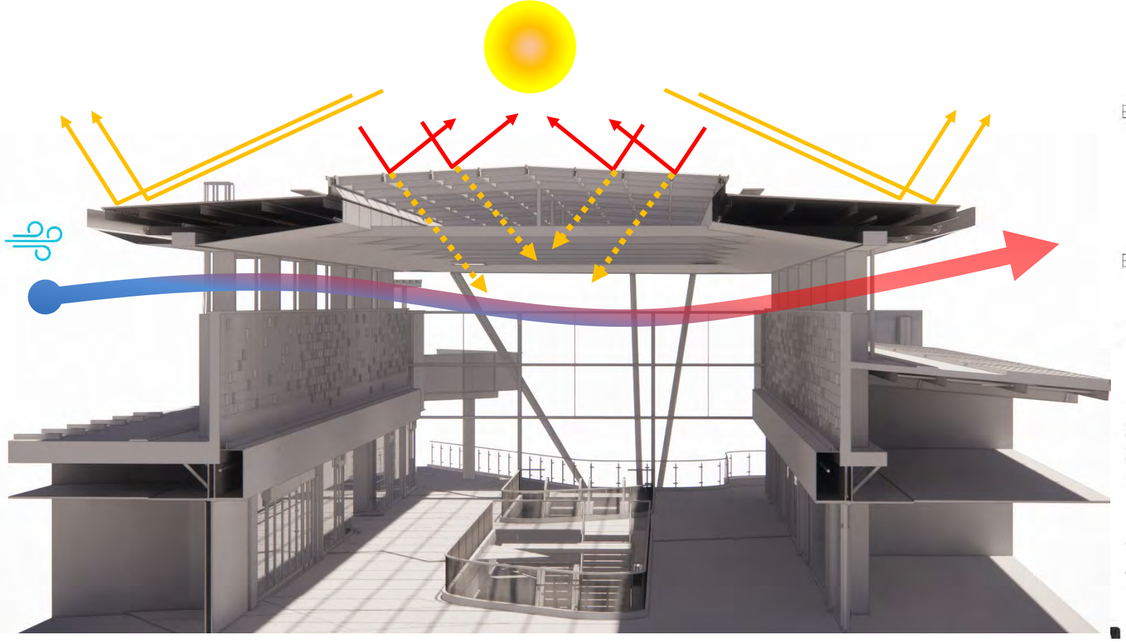
CLIENTS BRIEF / KEY DESIGN APPROACH

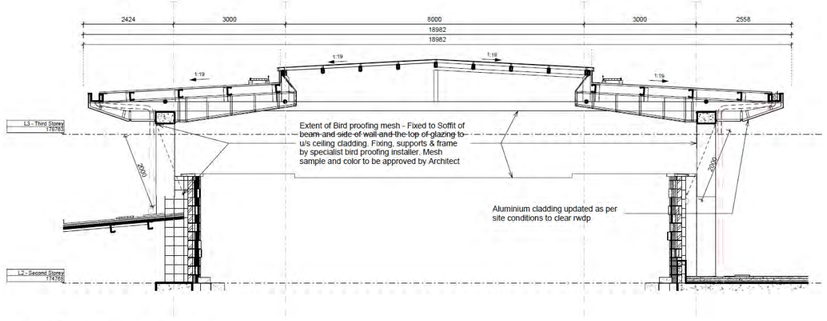



Steel canopy roof: Piazza

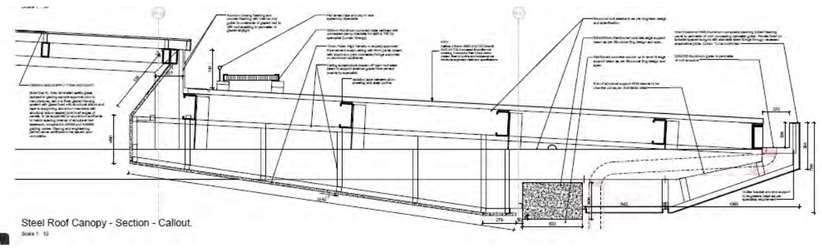

Steel canopy roof: Main Entrance



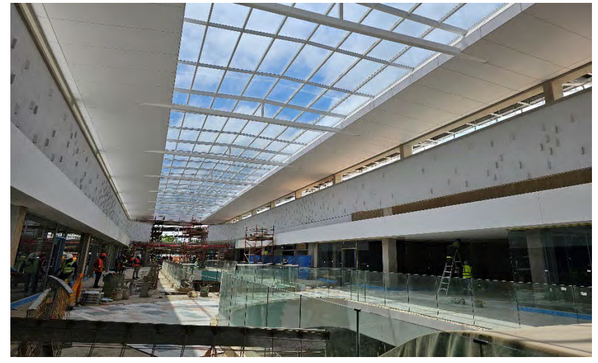




Steel Roof Canopy - Section.
Scale 1 : 50



Steel Roof Canopy - Section - Callout.



THE PROJECT OVERVIEW

PROJECT **OVERVIEW**

STRUCTURAL STEELWORK

Project Completed: **30 April 2024 (in progress)**

Steelwork Completed: **7 March 2024**

Tonnage: **42 tonnes (27 kg/m^2)**

Profiles used: **CHS, RHS, PFC, UB, CFLC, T-sections, angles**

PROJECT **OVERVIEW**

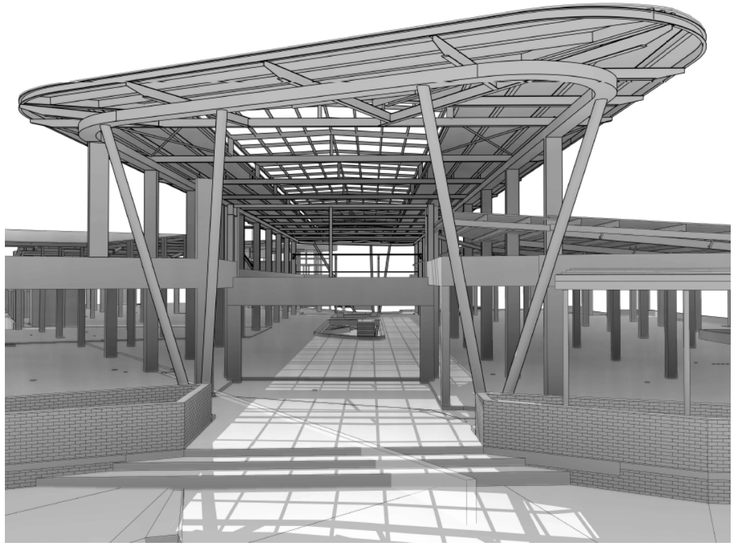
STRUCTURAL STEELWORK

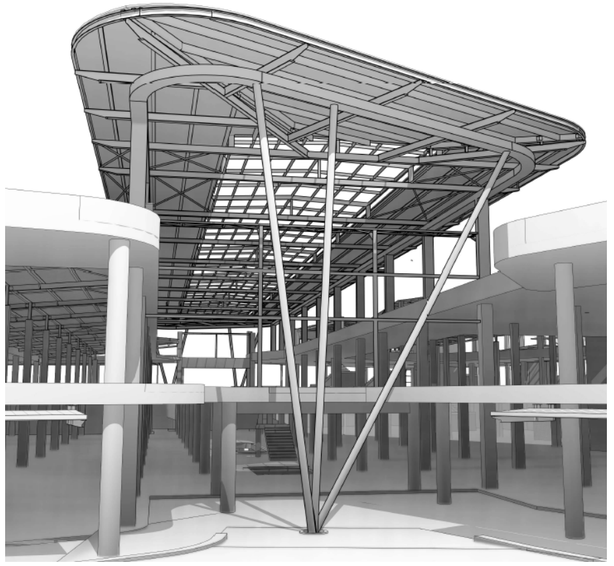
Structural Engineer: **Arup**

Steelwork Contractor: **Avellini Bros**

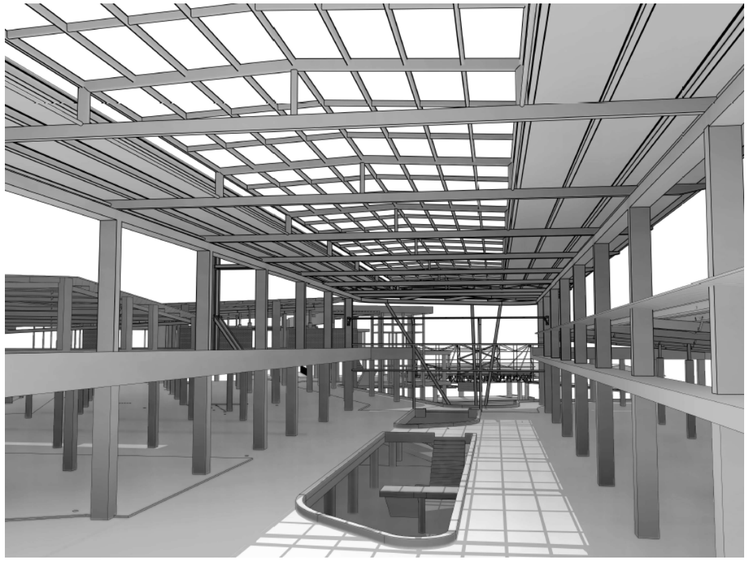
Steel Detailer: **Structech 3D Modelling**

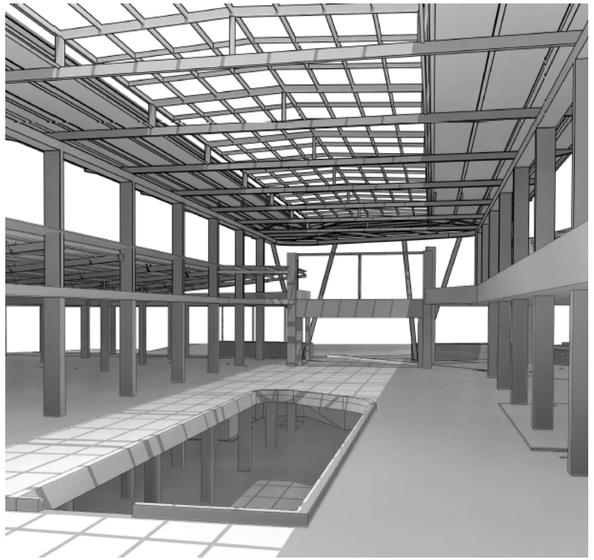
Steel Merchants: **Garsin Steel Tube and Pipe, Tubecon**





PROJECT **OVERVIEW**





METAL CLADDING AND ROOFING

Project Completed: **30 April 2024**

Cladding Completed: **7 March 2024**

Cladding Material Used: **[Type A] Al-Zinc coated steel, [Type B] Lam. Safety Glass**

Cladding Profile: **[A] Safintra 0.53mm Saflok 700, [B] 10.38mm Lam. Safety Glass**

Cladding Area Coverage: **[A] 960 m^2, [B] 590 m^2 , Total = 1550 m^2**

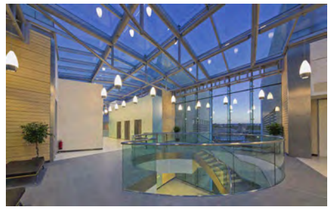
Cladding Tonnage: **[A] 4.2t, [B] 17.45t**

STRUCTURAL FRAMING

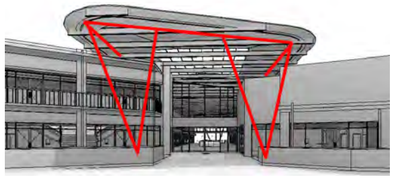
STRUCTURAL ENGINEER: Arup

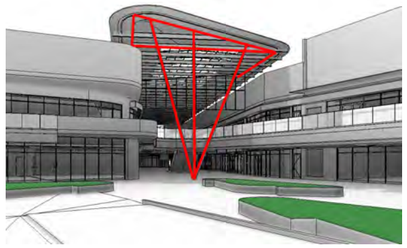
STEELWORK CONTRACTOR: Avellini Bros

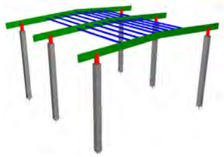
STEEL DETAILER: Structech 3D Modelling

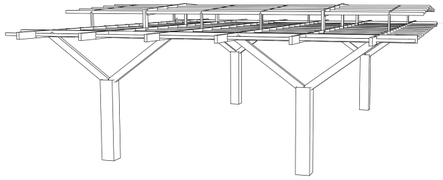


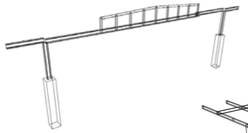
Concept

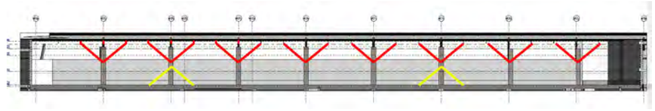


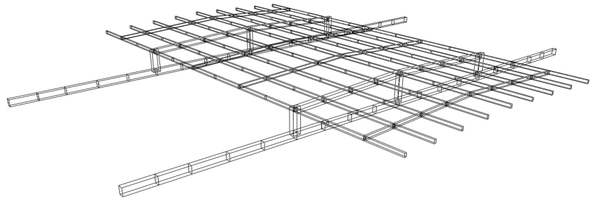




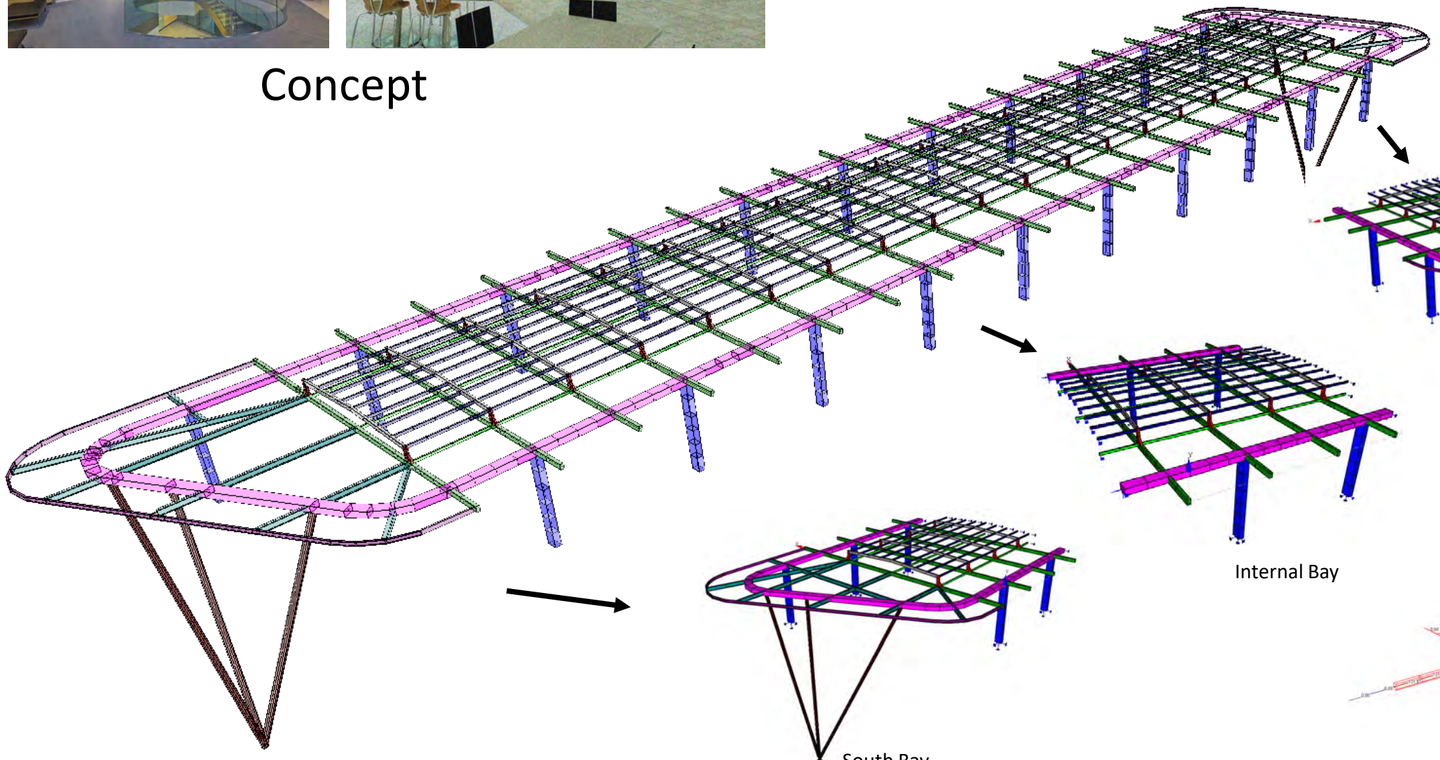








Scheme Design

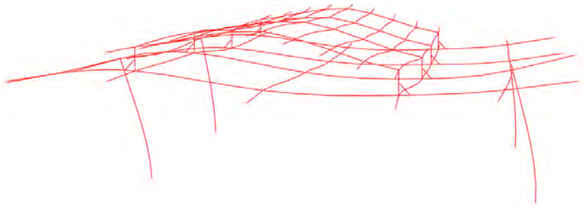


North Bay

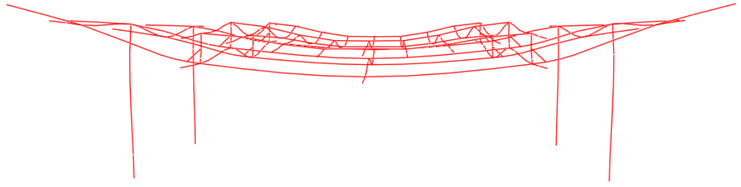
Internal Bay

South Bay

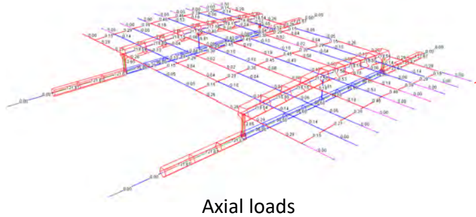
Detailed Design



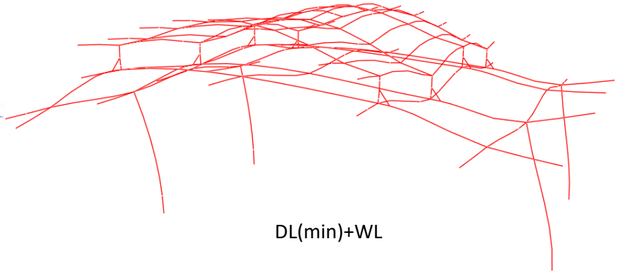
DLO



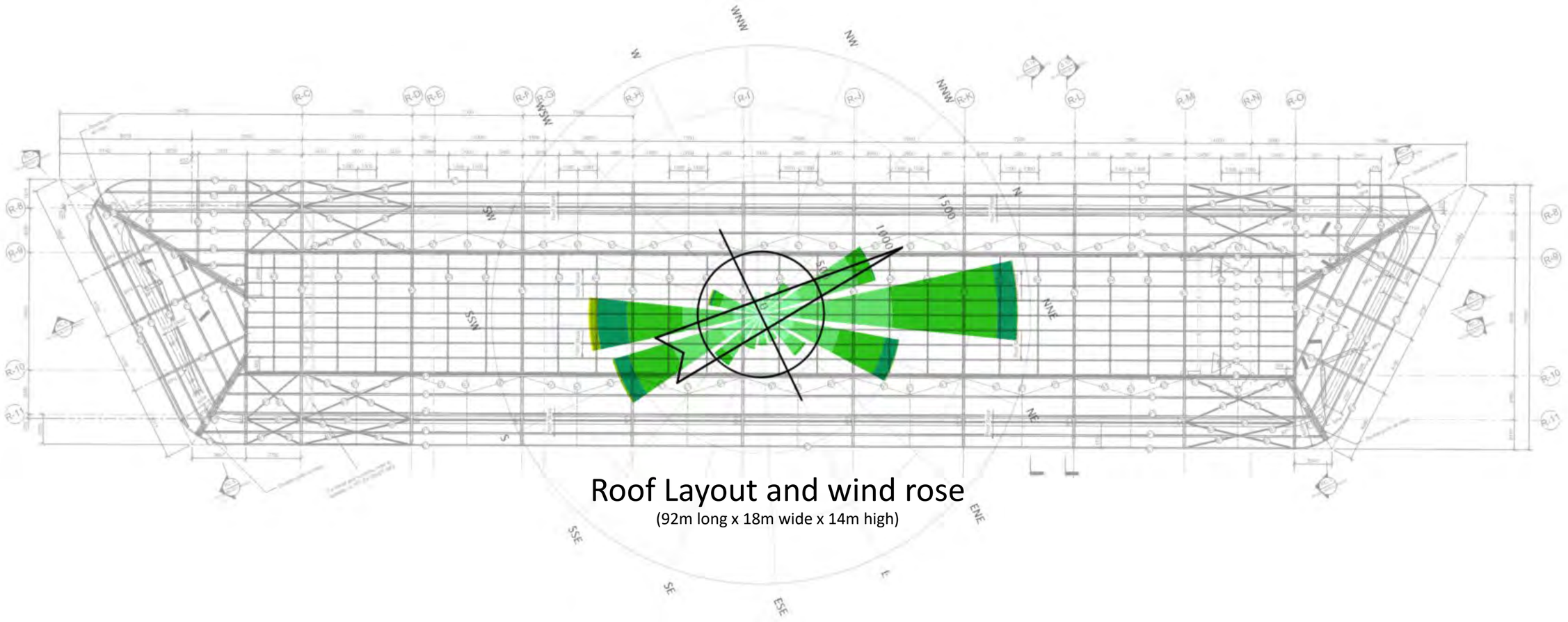
DL+LL



Axial loads

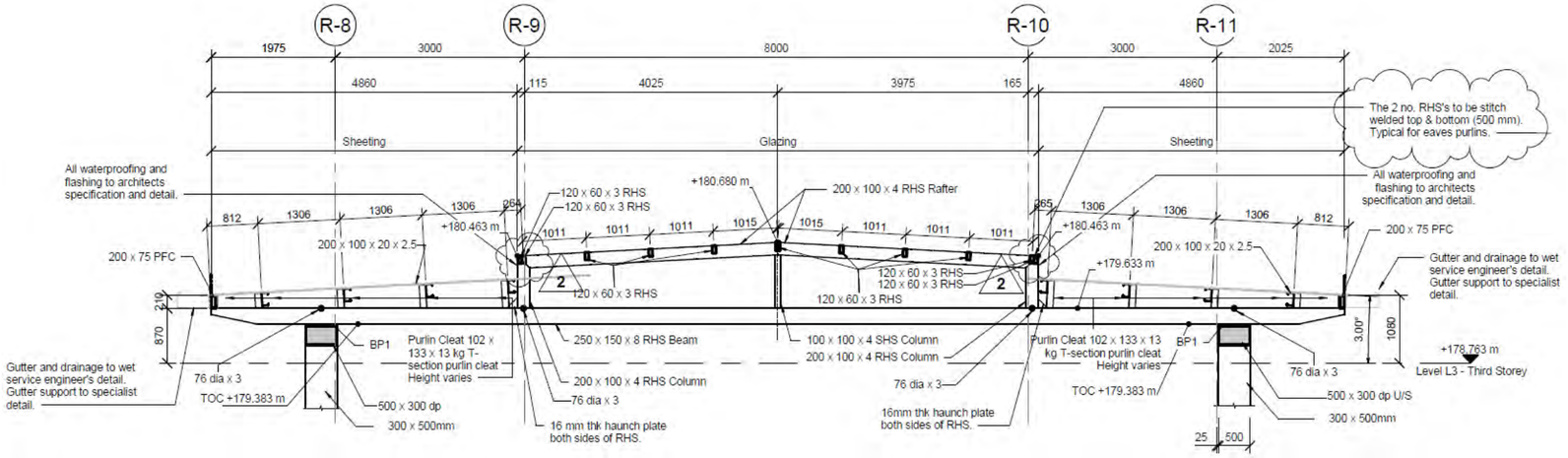


DL(min)+WL

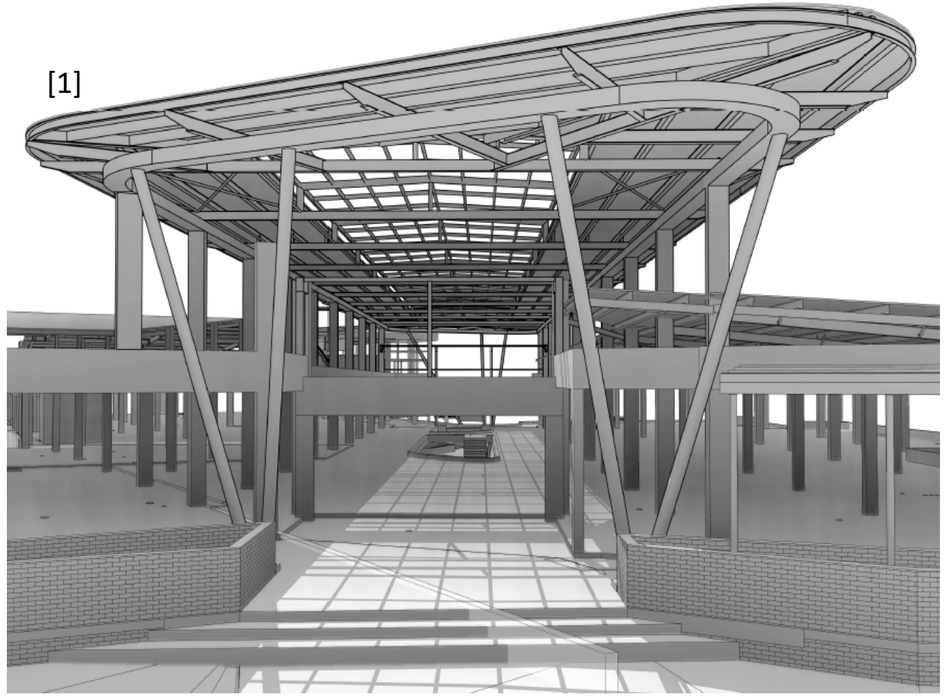


Roof Layout and wind rose

(92m long x 18m wide x 14m high)



Typical Section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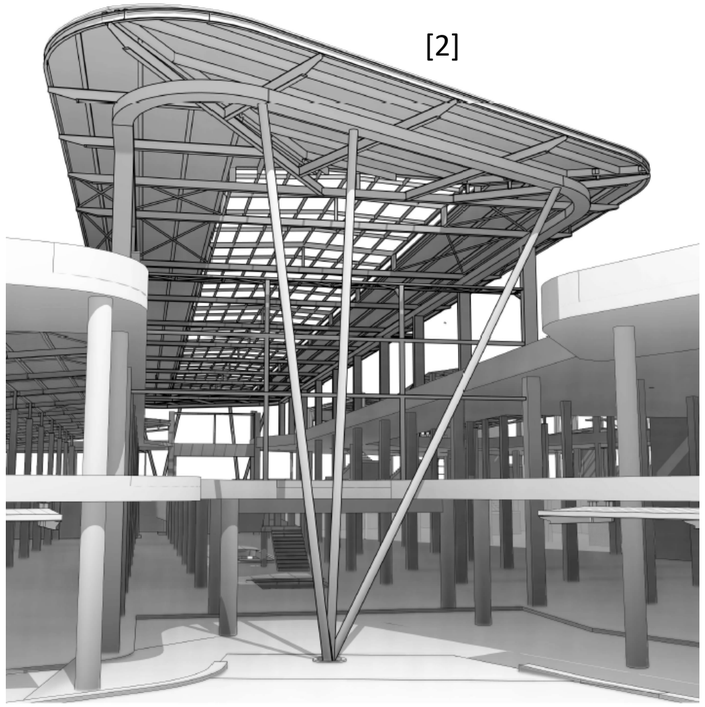
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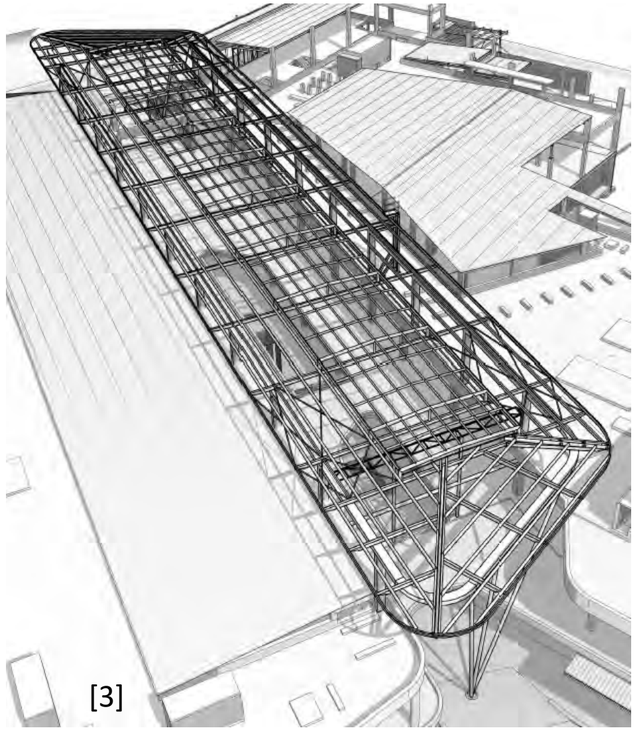
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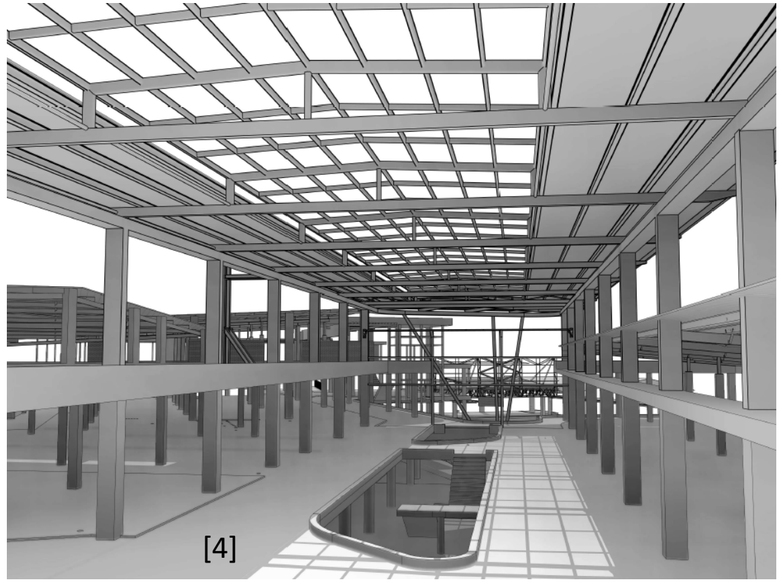
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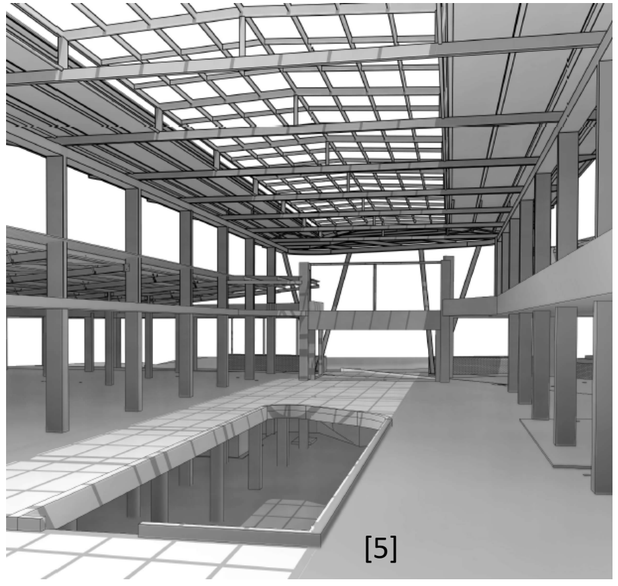
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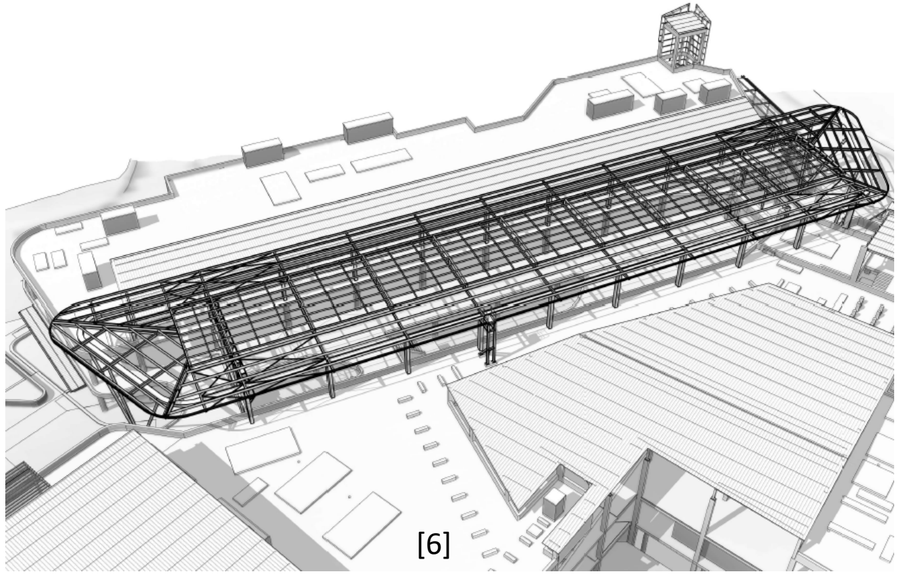
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Structural Renders

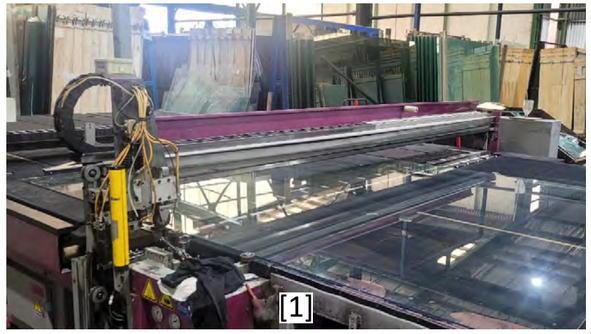
METAL CLADDING/ ROOFING

CLADDING MANUFACTURER: Viva Composite

CLADDING ROLL FORMER / PROFILER: City Glass & Aluminium

CLADDING/ ROOFING SUPPLIER: City Glass & Aluminium

CLADDING/ ROOFING CONTRACTOR: City Glass & Aluminium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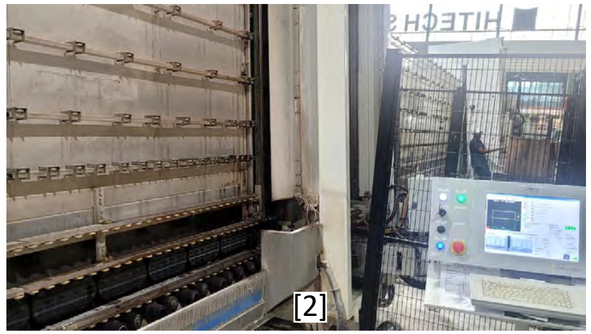
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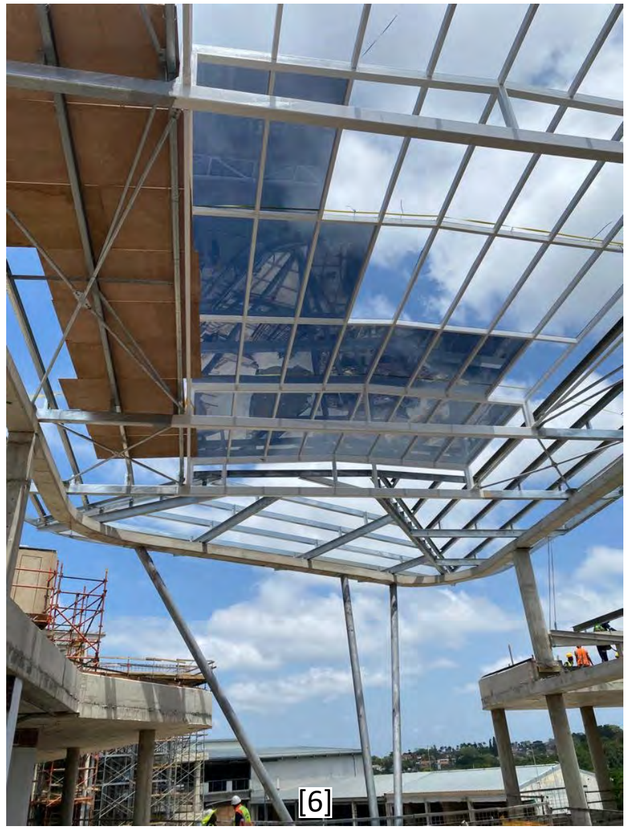
Processing and machine polishing of 10.38mm lam. performance glass for skylight


[3]


[4]


[5]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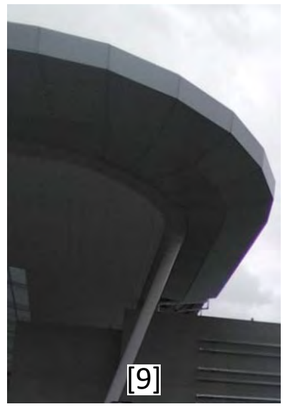
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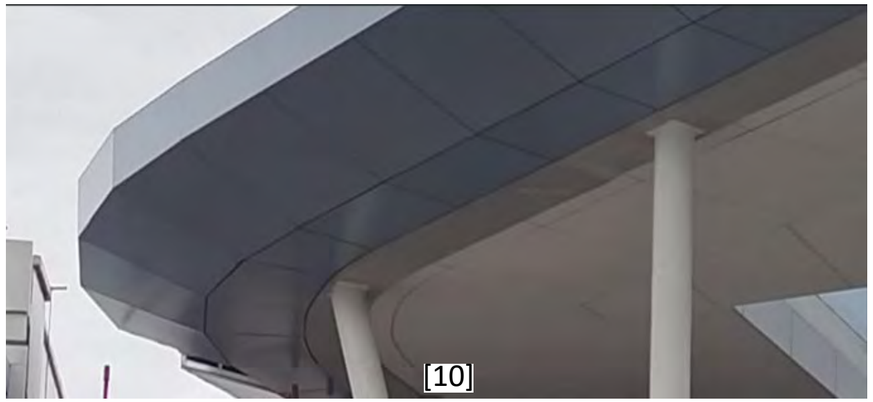
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Fabrication of aluminium composite panels for exposed ceiling closure

CHALLENGES FACED:

1. Installing glass that weighs 26kg per sqm at height posed a significant handling and installation challenge.
2. Shaping the ACP cladding to the radius corners

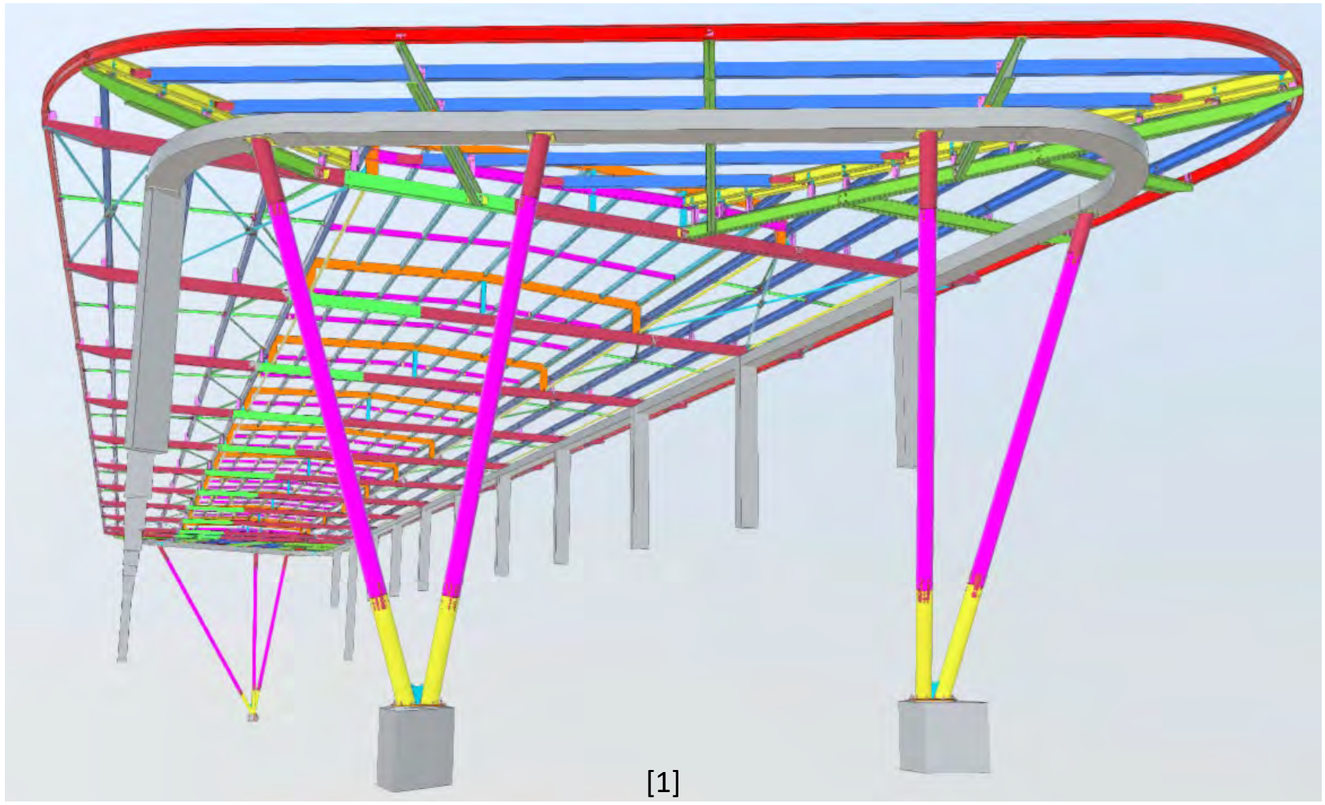
ACCOMPLISHMENTS:

1. Finishing ahead of programme for the glass roof with minimal glass breakages.
2. Achieving a clean faceted finish to the ACP cladding corners of the roof.

DETAILING & FABRICATION

STEELWORK DETAILER: Structech 3D Modelling

STEELWORK CONTRACTOR: Avellini Bros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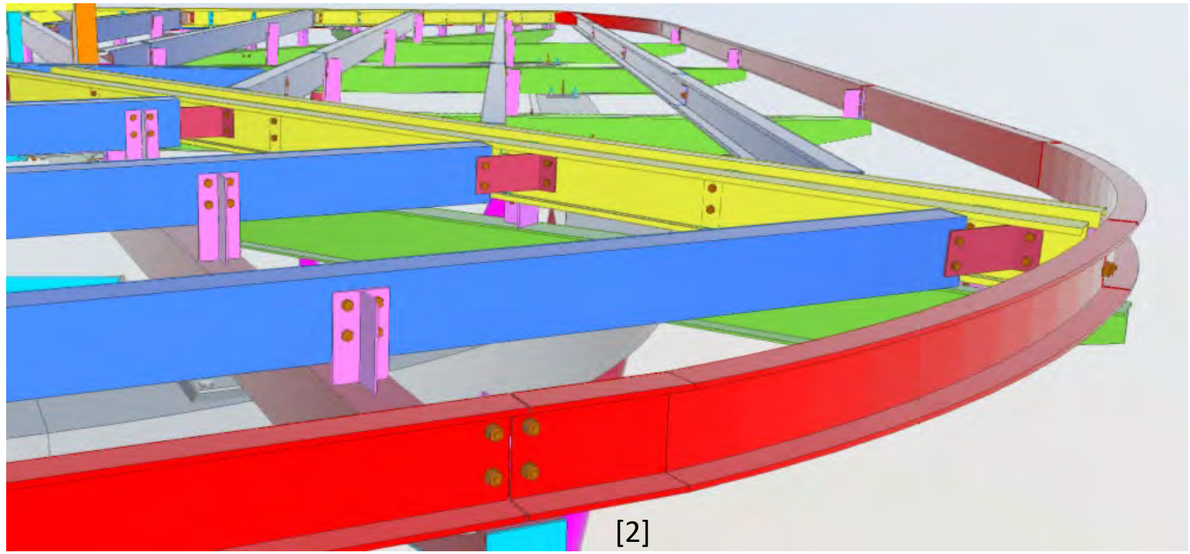
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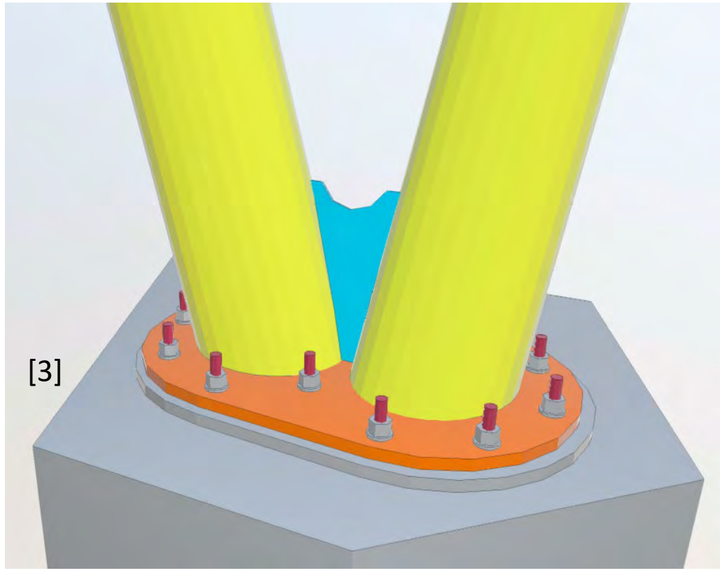
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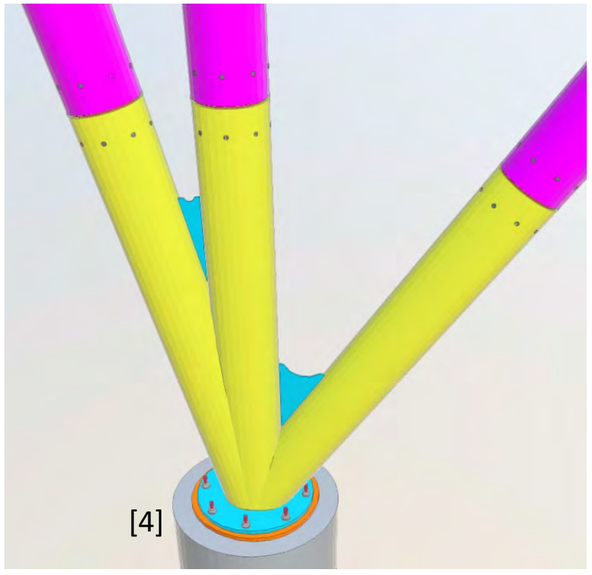
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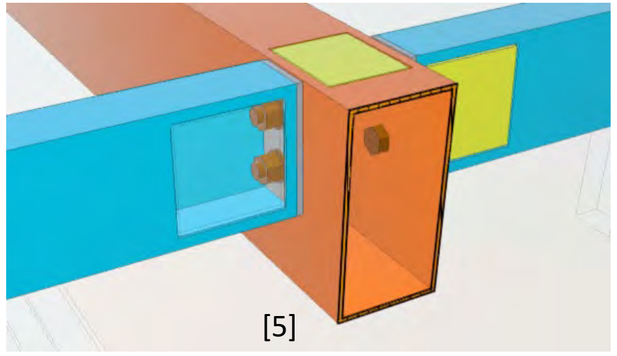
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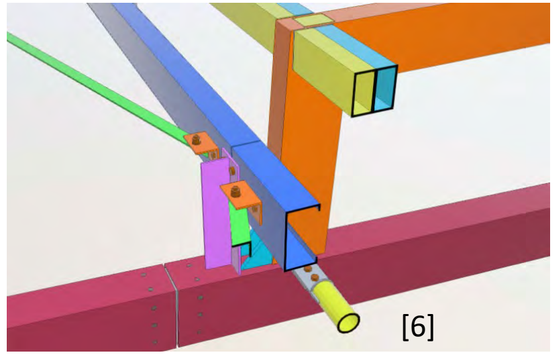
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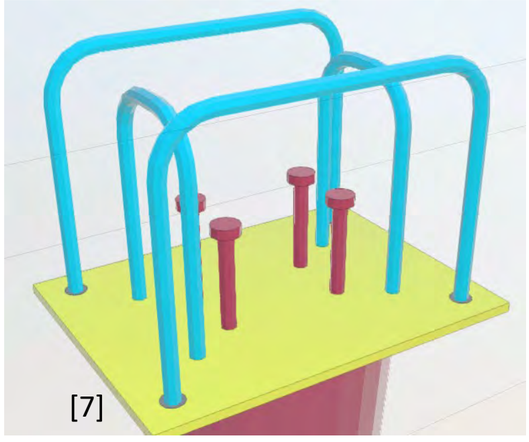
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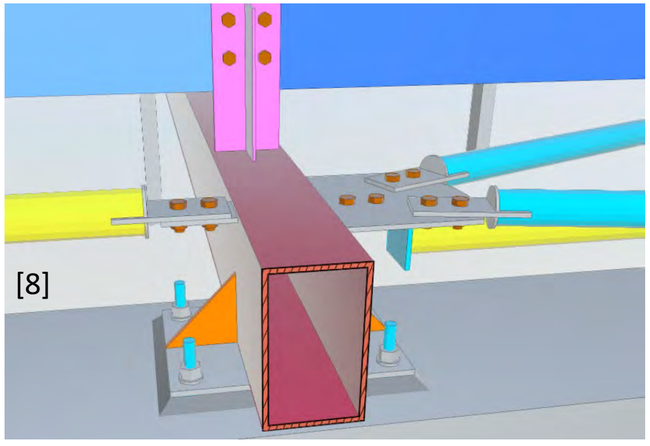
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ERECTION/ CONSTRUCTION/ INSTALLATION

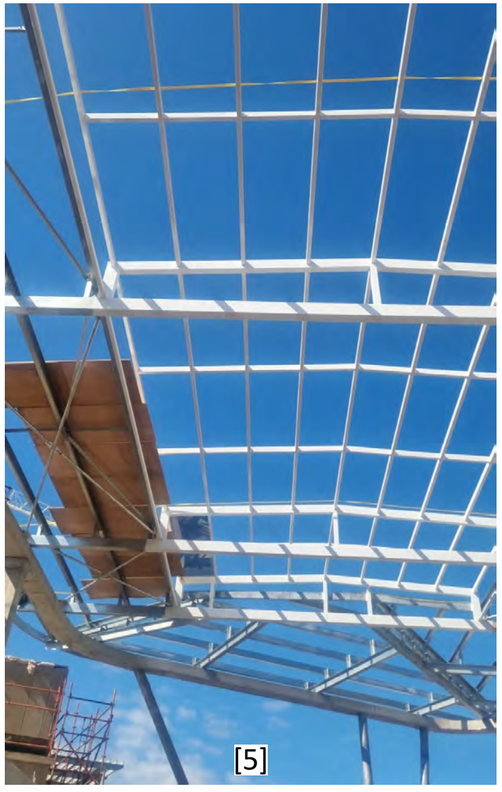
CONTRACTOR: WBHO

[1]


[2]


[3]

[4]


[5]

[6]

The following challenges were observed during installation:

1. Access

Meticulous planning was required with the Structural Engineers to understand correct installation of the roof. The tower crane and spider cranes were used in conjunction to increase productibity, and suspended slabs below were back propped to accommodate mobile spider cranes.

2. Low Tolerance

All steelwork was hot dip galvinised and as such, cast in bolts were installed with little tolerance to achieve the necessary alignment with the bottom chord of the trusses to avoid any on site modifications. In addition to this, it was imperative that the reinforcement concrete ring beam was cast accurately, as this would receive the steelwork. The concrete elements were monitored for deflections and surveyed prior to receiving the steelwork.

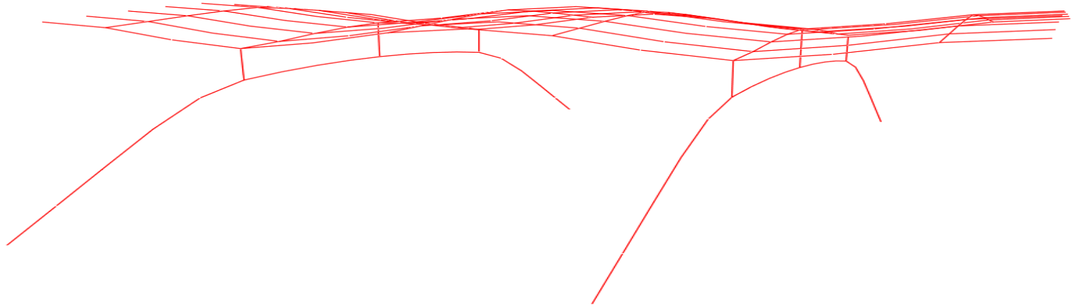
3. Sequence of Installation

The roof was installed from the northern entrance side towards the southern side, which assisted all other critical path trades to follow below.

CHALLENGES AND SOLUTIONS

WIND LOADS (MANAGING UPLIFT)

In addressing the dominant uplift wind load case, we strategically managed gross area of glazing (skylight) and sheeting on the roof to beneficially use the dead weight of the glazing to manage the overall uplift of the roof.



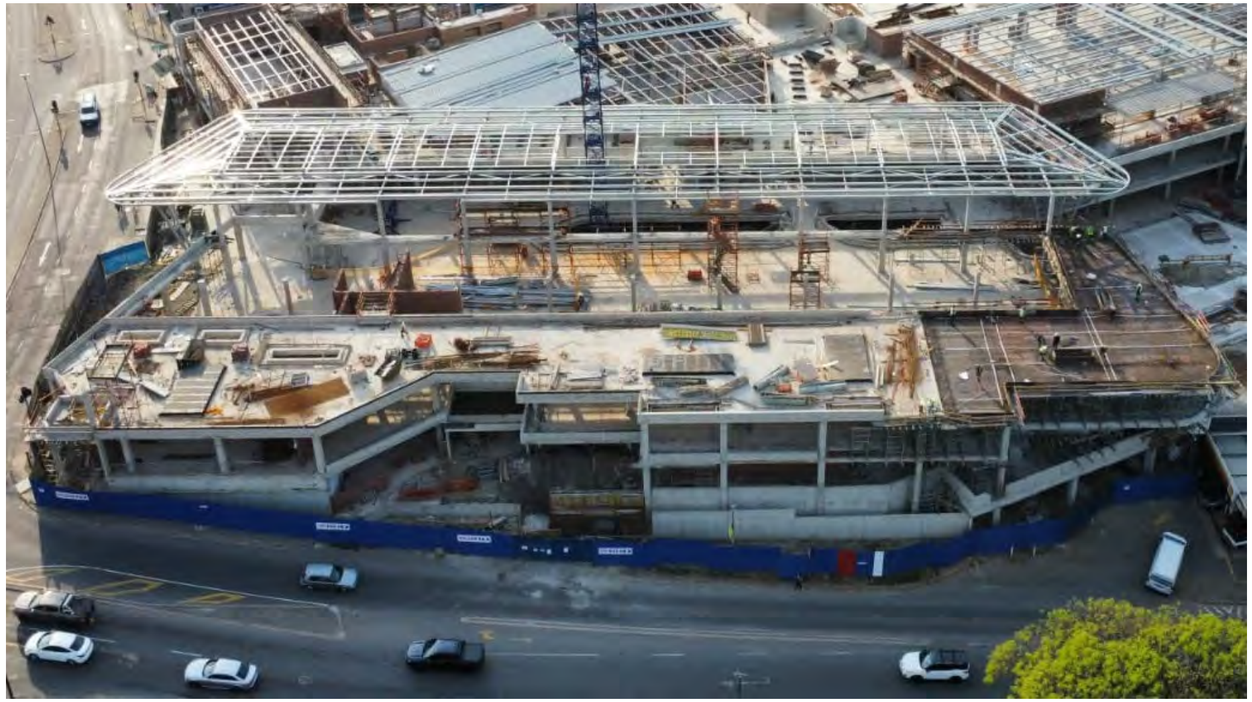
RAKING COLUMNS

CHS feature columns on the Northern and Southern side were designed as raking in two directions. Setting out was successfully achieved with meticulous planning.

SUSTAINABILITY

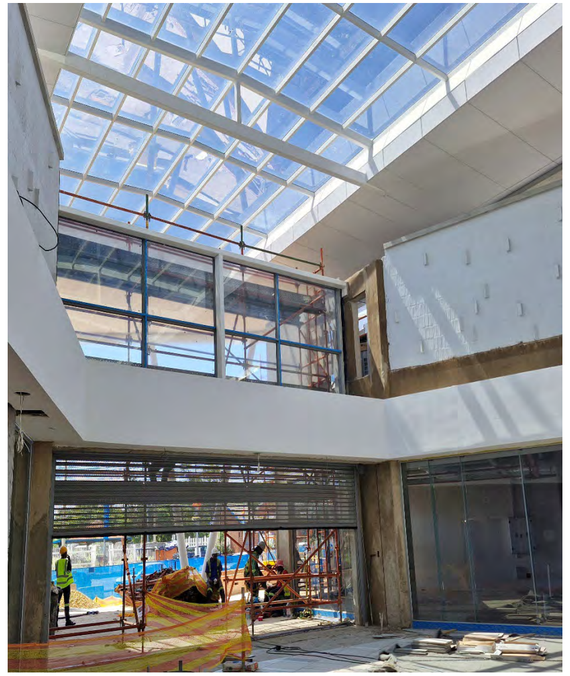
In terms of embodied carbon, our roof achieved a “B” SCORS rating of 191 kgCO2e/m^2 GIA through lean structural design, emphasizing sustainability and minimising carbon emissions. In addition to this, the roof is fully demountable through bolted connections.

THE BENEFITS OF STEEL IN THIS APPLICATION



THE BENEFITS OF STEEL IN THIS APPLICATION

- Steel was the material of choice from the beginning of the design process.
- Its strength , durability , flexibility allows designers to create both elegant and efficient design.
- The long spans with slender profiles with the intricate geometry can prove to be difficult and sometimes impossible with other materials.



WHAT WE'RE PROUD OF

WHAT ARE WE MOST PROUD OFF

Elegance of Design: The steel roof structure exudes elegance, captivating with its graceful lines and sleek appearance.

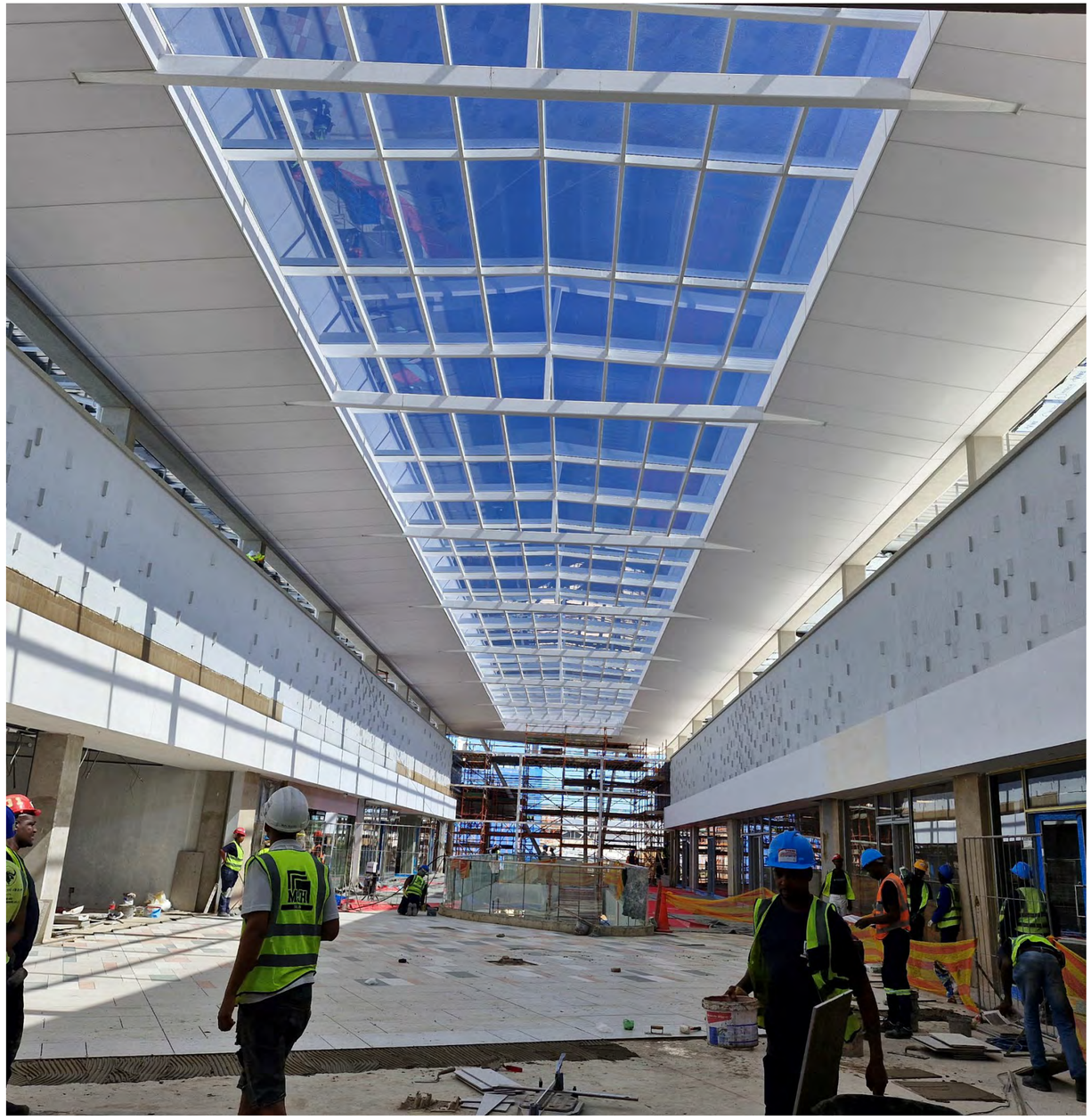
Lightness Appeal: The roof's lightweight construction adds to its allure, imparting a sense of airiness and modernity.

Volume Enhancement: By skillfully framing the space, the roof creates a heightened sense of volume, contributing to an expansive and inviting atmosphere.

Proportion Mastery: The careful selection and use of steel elements ensure harmonious proportions, enhancing the aesthetic appeal and structural integrity of the design.

Unintrusive Presence: Despite being the largest element, the roof seamlessly integrates into the space, exerting strength without overpowering, thus maintaining a balanced and unobtrusive presence.

Before (3D Render)



After (Site)