SOUTHERN AFRICAN INSTITUTE
OF STEEL CONSTRUCTION

Steel Awards 2023

KMH Architects | LEAF Structures

Hasso Plattner d-school Afrika

THE PROJECT BRIEF

CLIENT: University of Cape Town

ARCHITECTS: KMH Architects

MAIN CONTRACTOR: Haw & Inglis

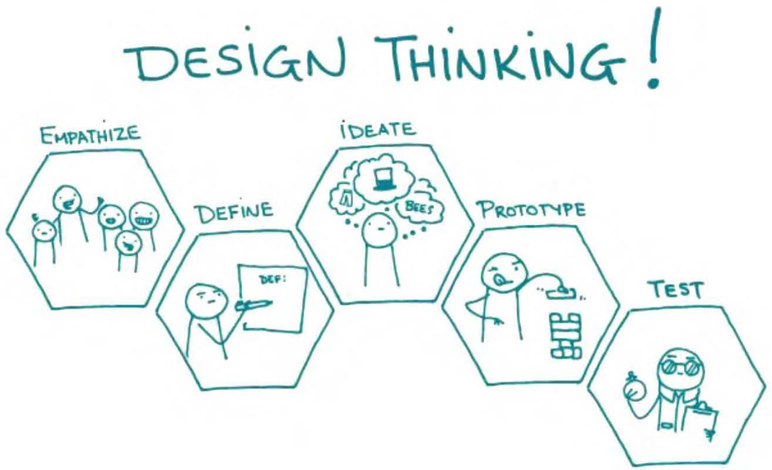
HASSO PLATTNER d-school AFRIKA

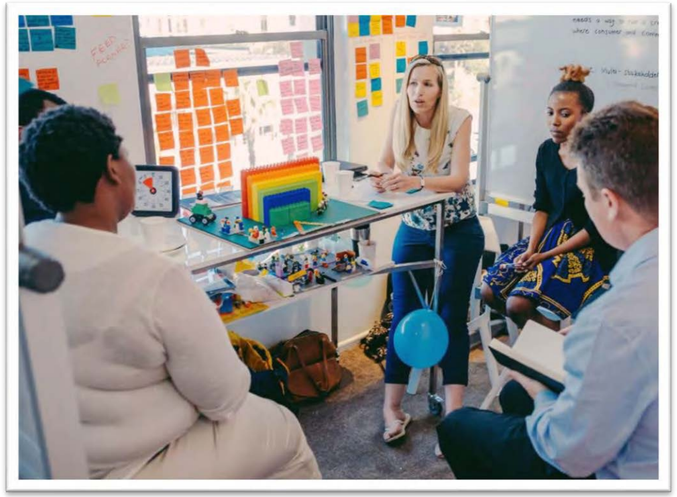
The d-school Afrika's objective *is to train individuals in the practice of design thinking, as an enabler of innovation and new outcomes, to meet users' needs in complex socio-political and economic contexts.*

Key concepts included; sustainability, integration with the contextual fabric of the university while also signifying a unique function, spaces and materiality that communicate a different kind of learning environment and seeing collaboration and co-making happening

The client aspirations for the new building were visionary

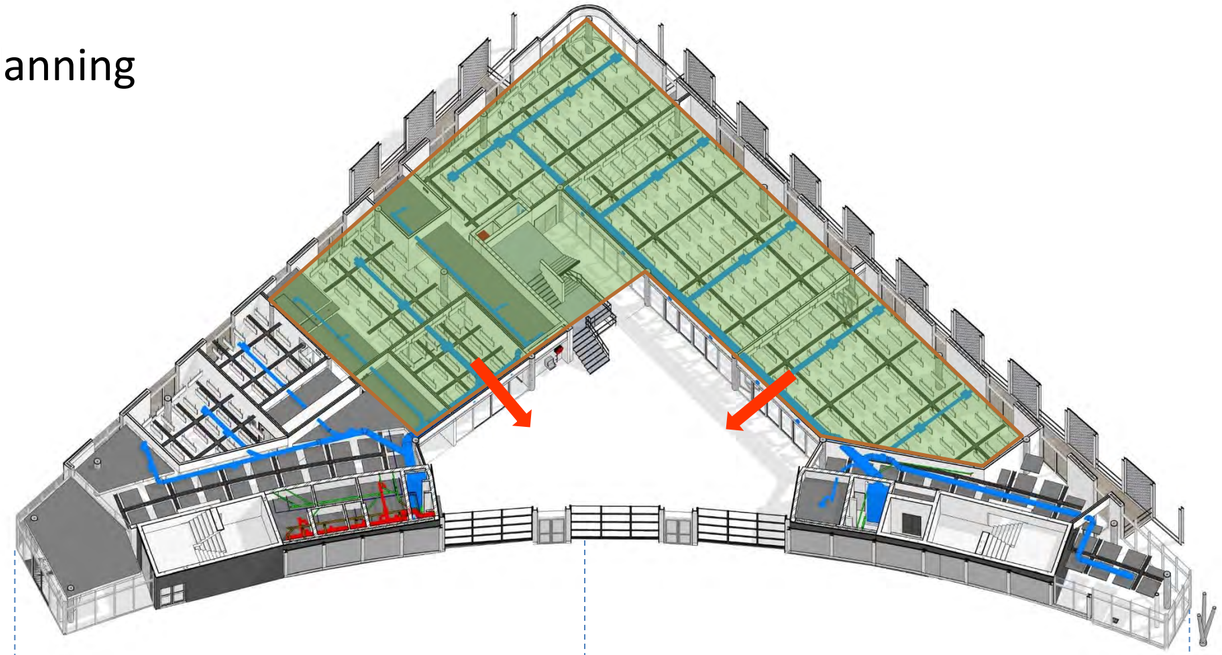
- The new d-school was to become a "destination"
- To be synonymous with the teaching of our future generation the mindset in the practice of innovation, design-led and creative thinking.
- Aligned to this vision the building should achieve a GBCSA 6 Star certification in the Public & Education Building category.



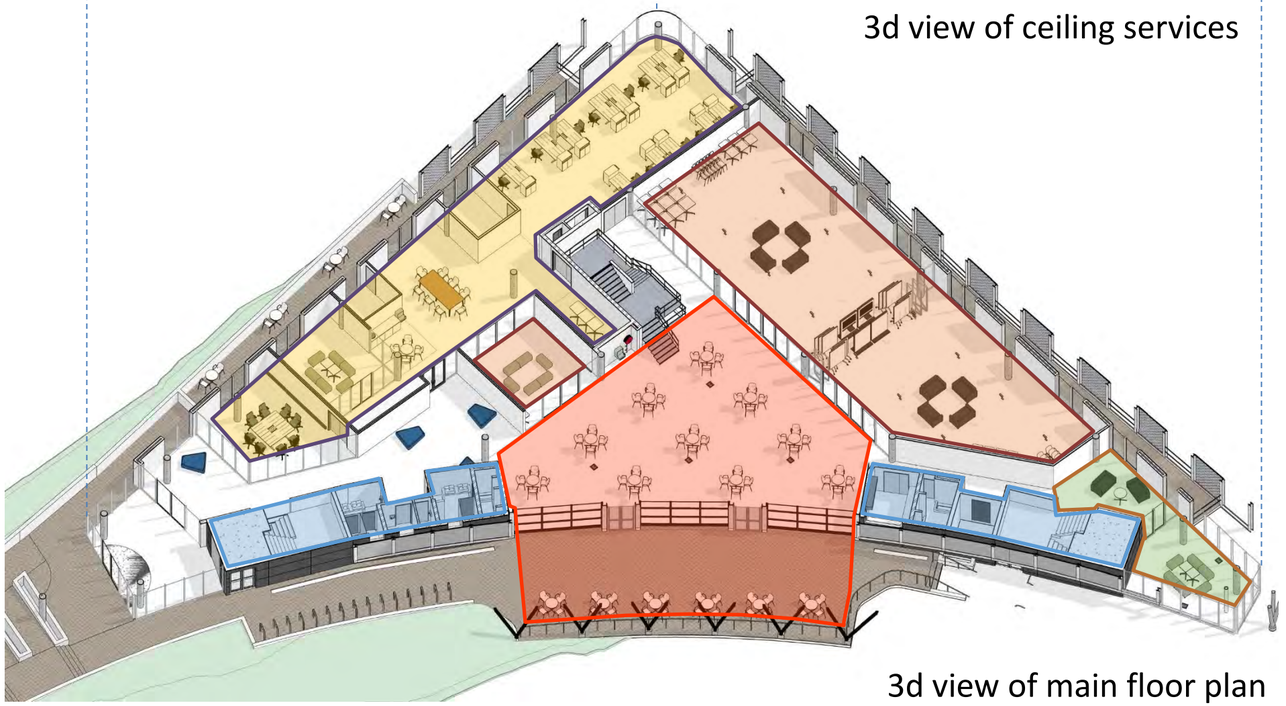


KMH ARCHITECTS

Planning



3d view of ceiling services



3d view of main floor plan

Maximum spatial flexibility was required to easily re-purpose spaces in the future as the school's programmes evolve. To achieve this, fixed structural elements and services form a spine along the southern edge allowing for large span orthogonal space along the northern and western sides. All services, including power, are suspended from the soffits to provide unconstrained floors.

Conceptually the central space in the school functions as a "town square" for the design thinking community, being both the nexus for events and also the place outsiders can enter, be welcomed and start to engage in the design thinking mindset. The façade threshold, comprised of large sectional glass doors, can be fully opened or closed to make this space public or more private as required.

The teaching and learning studios are grouped around the central space. Each studio can be used independently or opened to the central space. Unless the blinds are drawn the activity in the studios is visible to those in the central space, maximizing engagement. Studios are large, rectangular spaces with flat floors and all furniture on wheels. Acoustics are managed through vertical baffles allowing the majority of the concrete soffit to be exposed for optimal radiant comfort through the TABS solution

The staff space is open plan utilizing agile furniture solutions, deliberately challenging traditional academic closed cellular environments. The staff and coaches' spaces are consciously planned adjacent to the main entrance with shared break-out spaces to encourage interaction between students, faculty and coaches.

Teaching and learning design thinking can be a high intensity activity in the studios. At each end of the building there are softer reflection spaces, provided with warmer finishes and calming acoustics. These are the spaces for ideation, reflection and recovery. They celebrate views out and visually connect to the landscaping surround the building.

Design & Sustainability

- Passive façade design incorporating shading elements and performance glass to maximise natural light and minimize solar heat gain
- PV array generates electricity to reduce reliance on mains electricity
- Actuated high levels windows in the atrium to flush the building at night
- Fritted performance glass to reduced solar heat gain and glare whilst providing natural light into the studios
- A thermally activated building structure (TABS) replaces traditional HVAC to provide radiant cooling

- Electric vehicles parking spaces and charging points & cyclist facilities
- Rainwater capture and storage for re-use for toilet flushing and irrigation

KMH ARCHITECTS

STOP
STOP

THE PROJECT OVERVIEW

PROJECT OVERVIEW

STRUCTURAL STEELWORK

Project Completed: October 2022

Steelwork Completed: January 2022

Tonnage –

1. Free Form Steelwork: 29,600kg
2. Atrium Supports, Tree Columns and Eyebrow: 20,950kg

Profiles used: Rectangular and round hollow sections and W-frame sections.

PROJECT OVERVIEW

STRUCTURAL STEELWORK

Structural Engineer: LEAF Structures

Steelwork Contractor: Anchor Steel Projects and Novum Structures

Steel Detailer: MNT Drafting CC and Novum Structures

Steel Merchant/s: Various

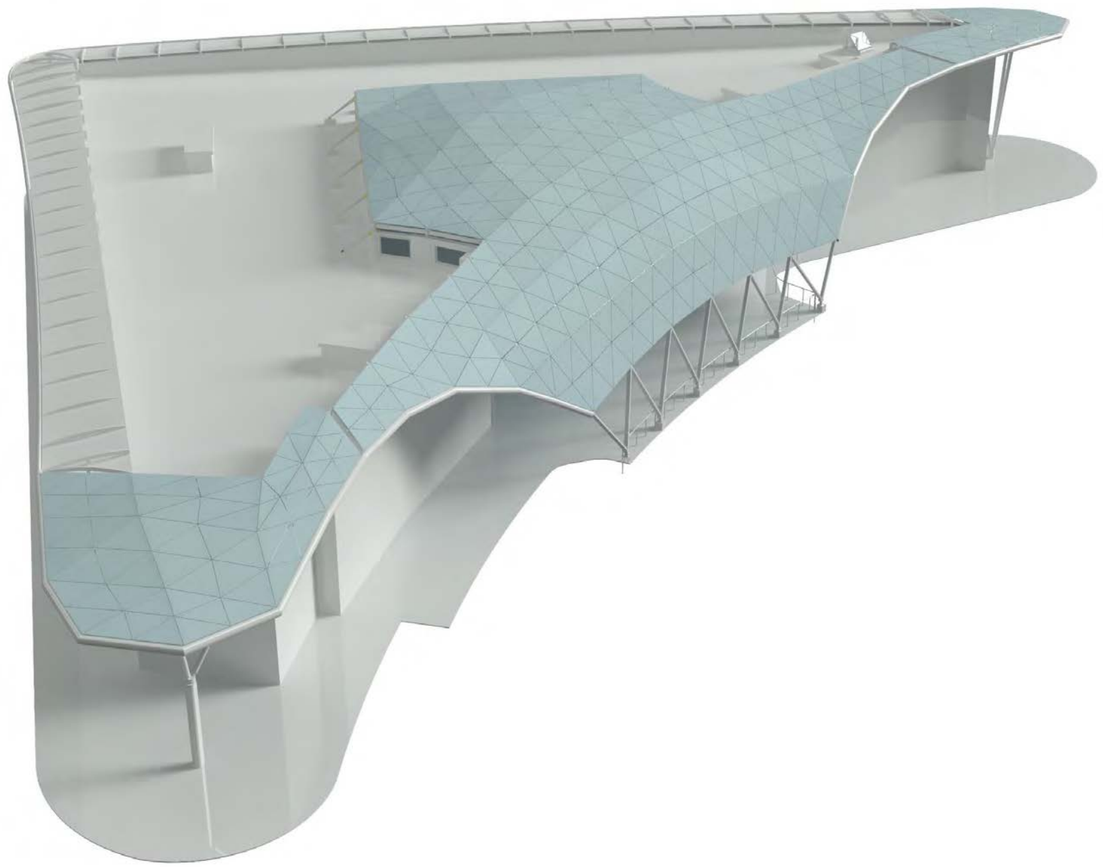
STRUCTURAL FRAMING

STRUCTURAL ENGINEER: LEAF Structures

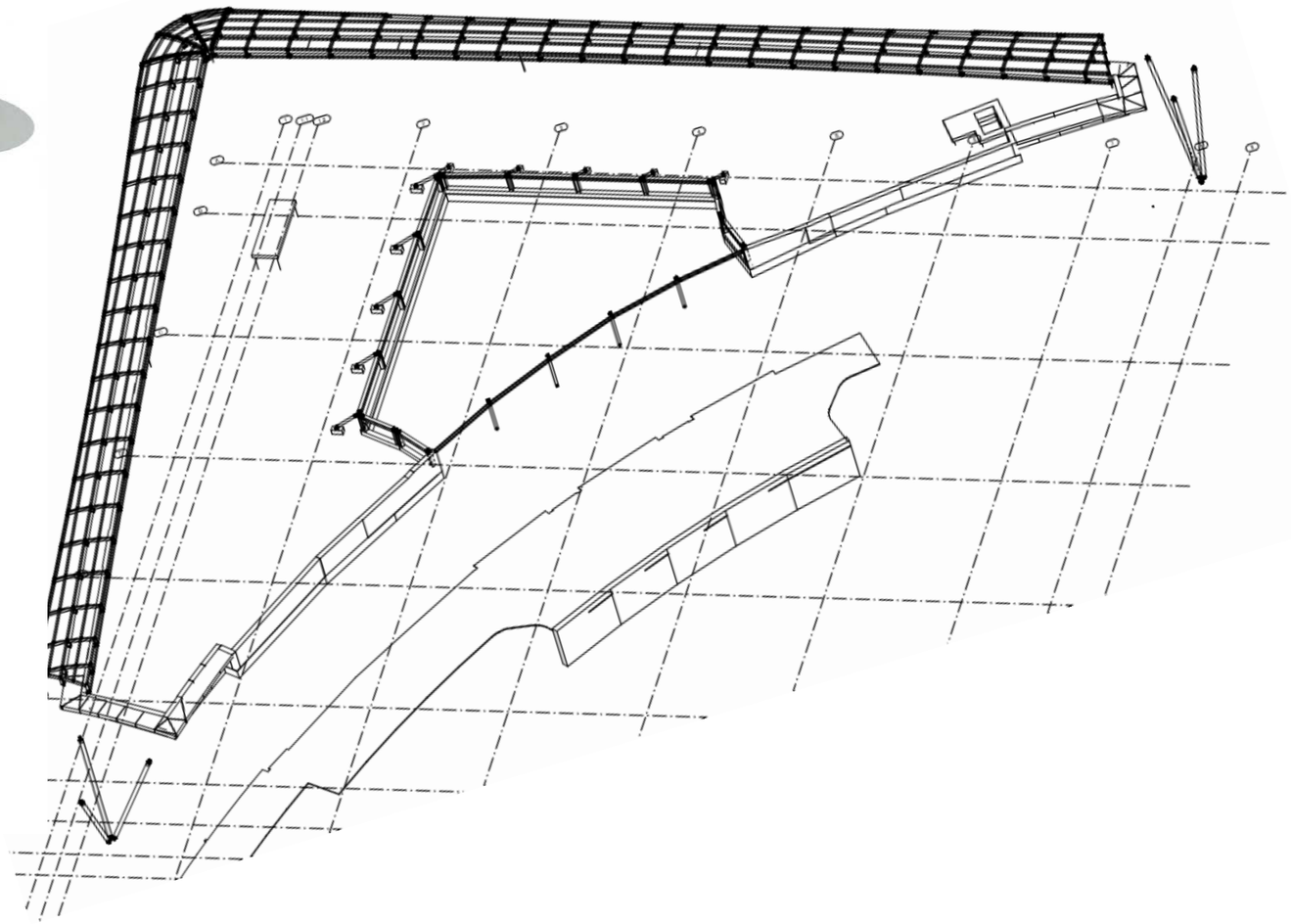
STEELWORK CONTRACTOR: Anchor Steel Project and Novum Structures

STEEL DETAILER: MNT Drafting and Novum Structures

Structural Steelwork Design - Overview

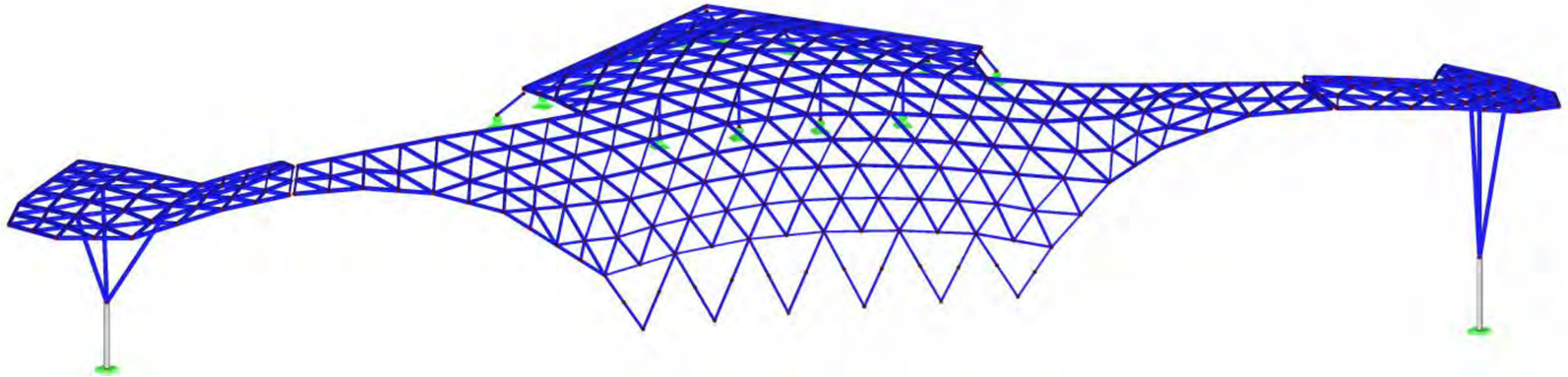


Overall Isometric View – Glass and Steelwork

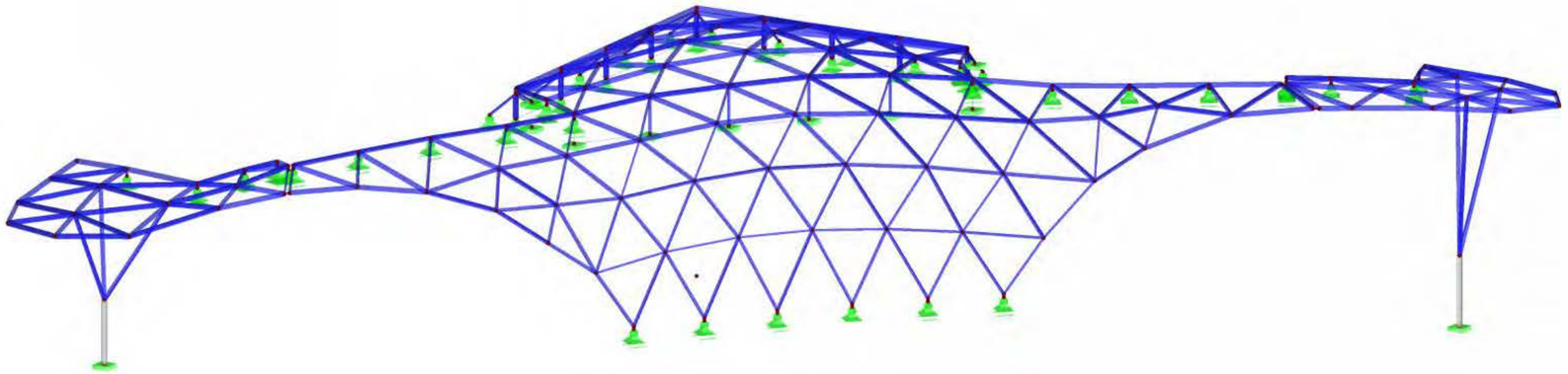


Overall Isometric View – Eyebrow and Atrium Framing Steelwork Only

Structural Steelwork Design – Grid Optimization



Initial Geometry:
Full free form structural grid.
Max. grid up to 2240mm.

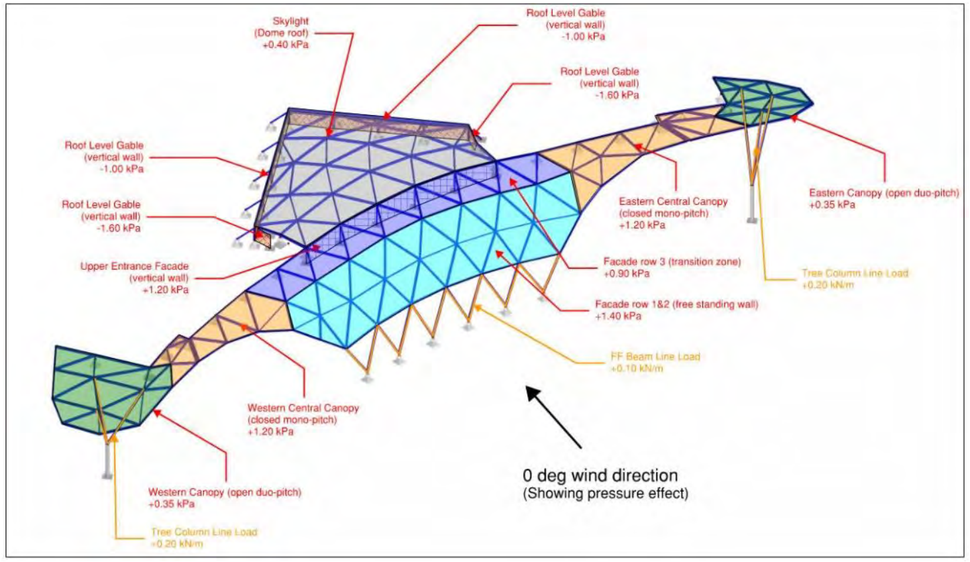


Optimized Geometry:
Sparse free form structural grid.
Max. grid up to 5000mm

The optimized geometry resulted in a 20% reduction of embodies carbon for the steelwork + glazing.

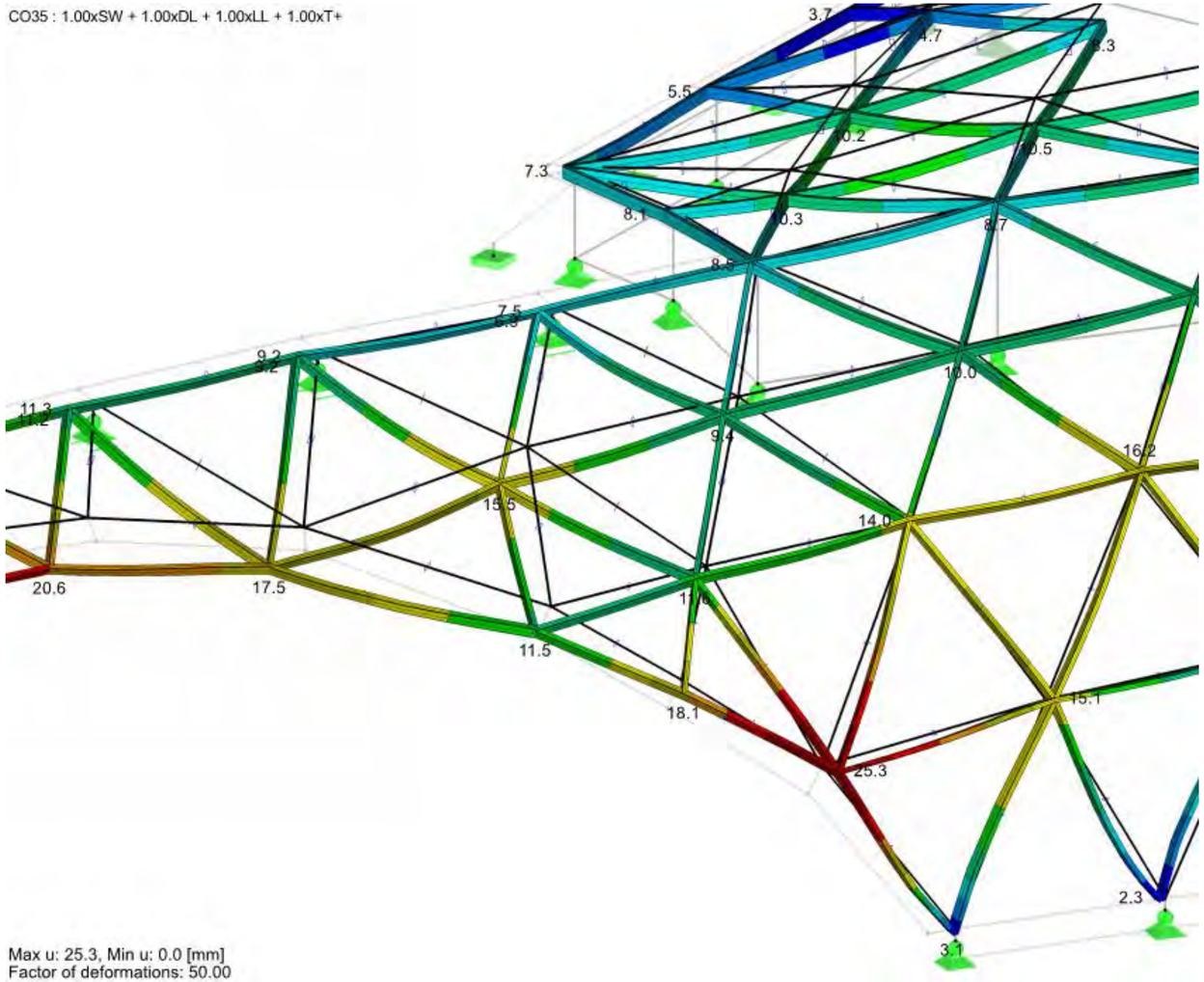
Building emission	CO2 emissions (kg)		
	Manufacturing	transportation	Total emissions
Initial Geometry	256 756	12 849	269 605
Optimized Geometry	321 943	15 911	337 854
		% Difference	20%

Structural Steelwork Design – Structural Calculations

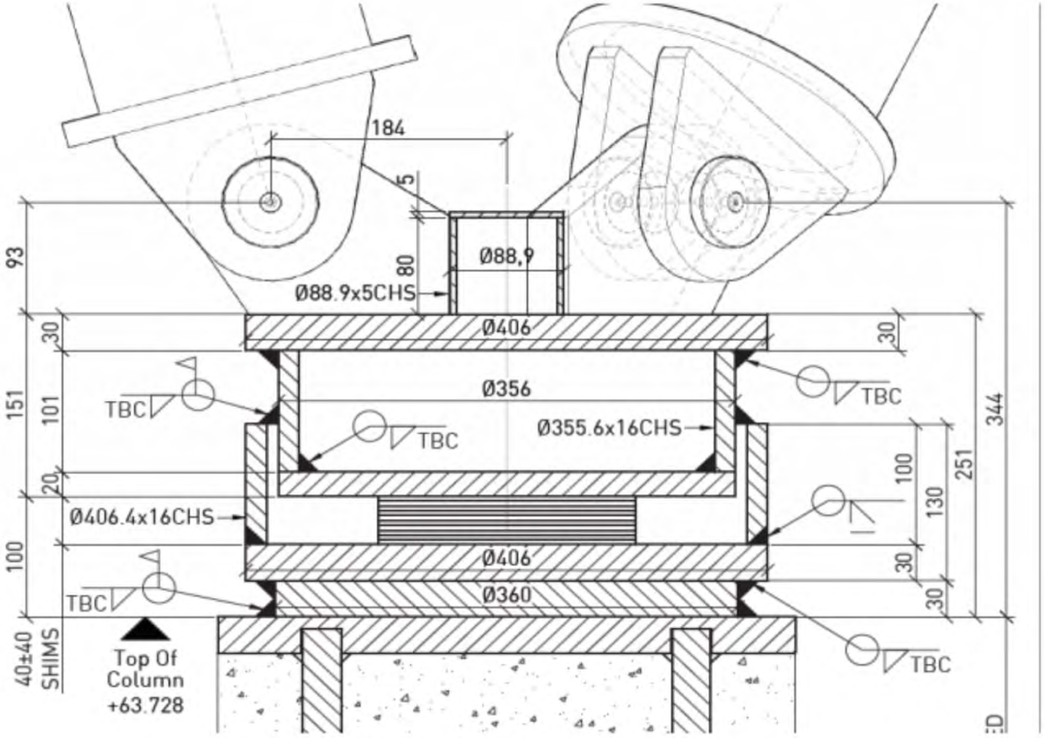


Gridshell structure divided into three section and analysis based on site specific loading

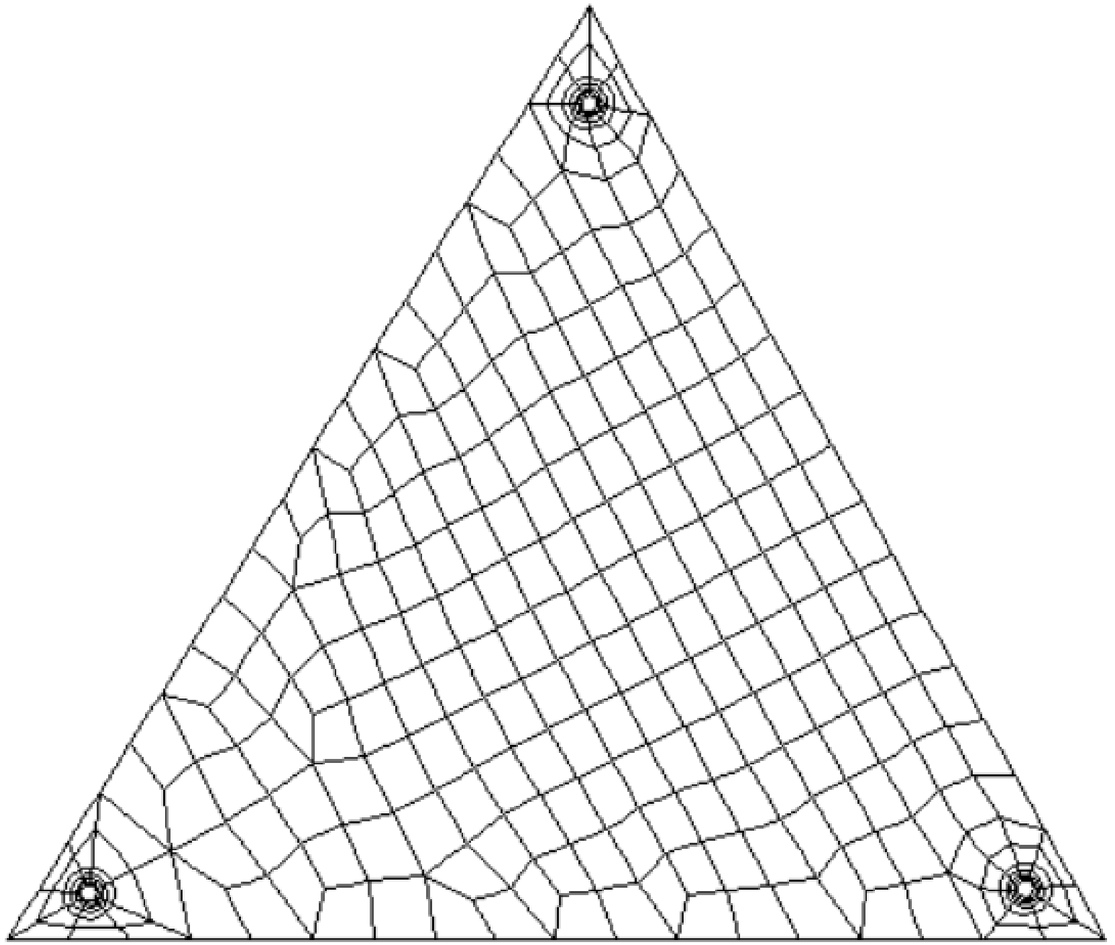
Structural Steelwork Design – Structural Calculations



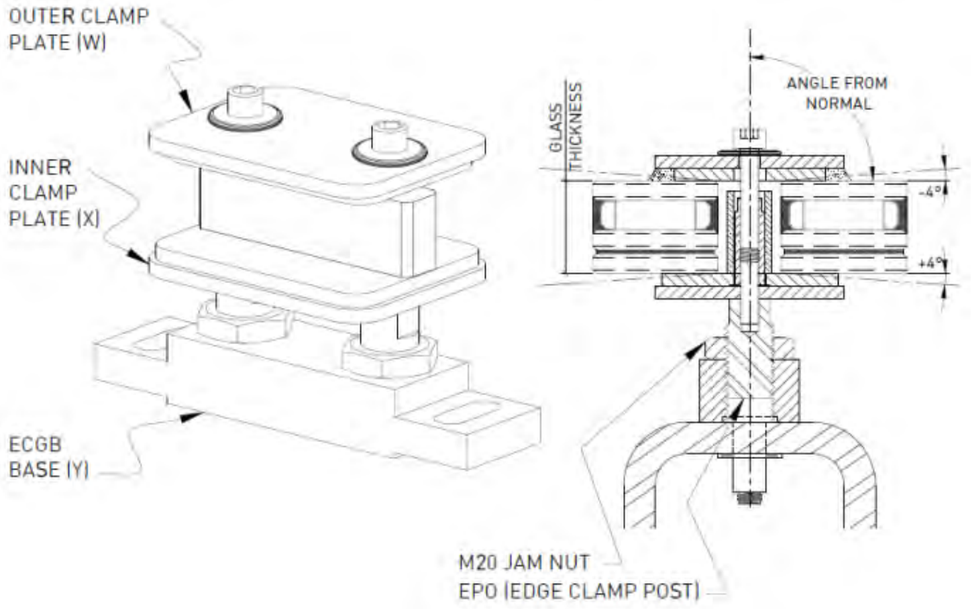
Local and global stress and deflections were calculated the steelwork was detailed accordingly.

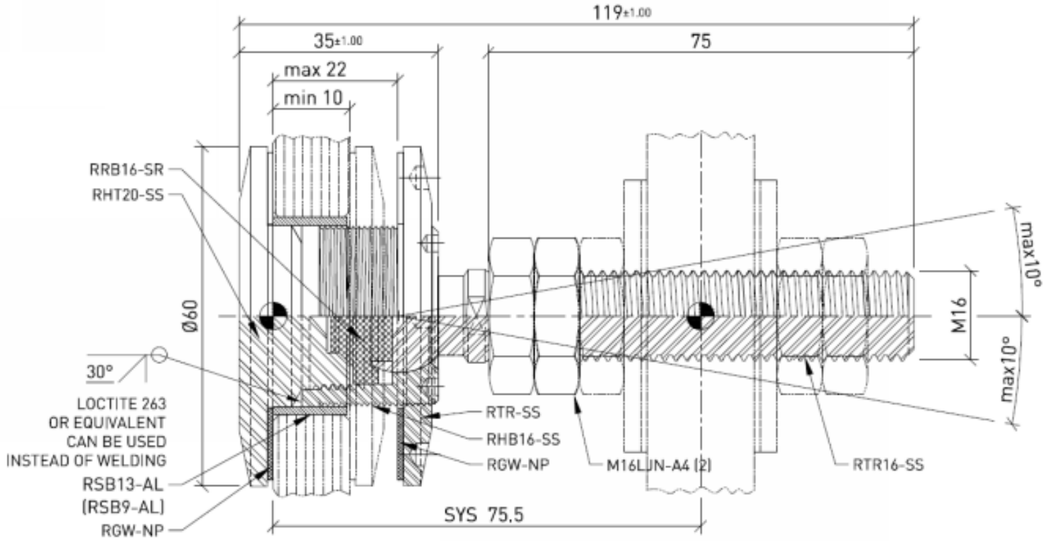


Structural Glass Design

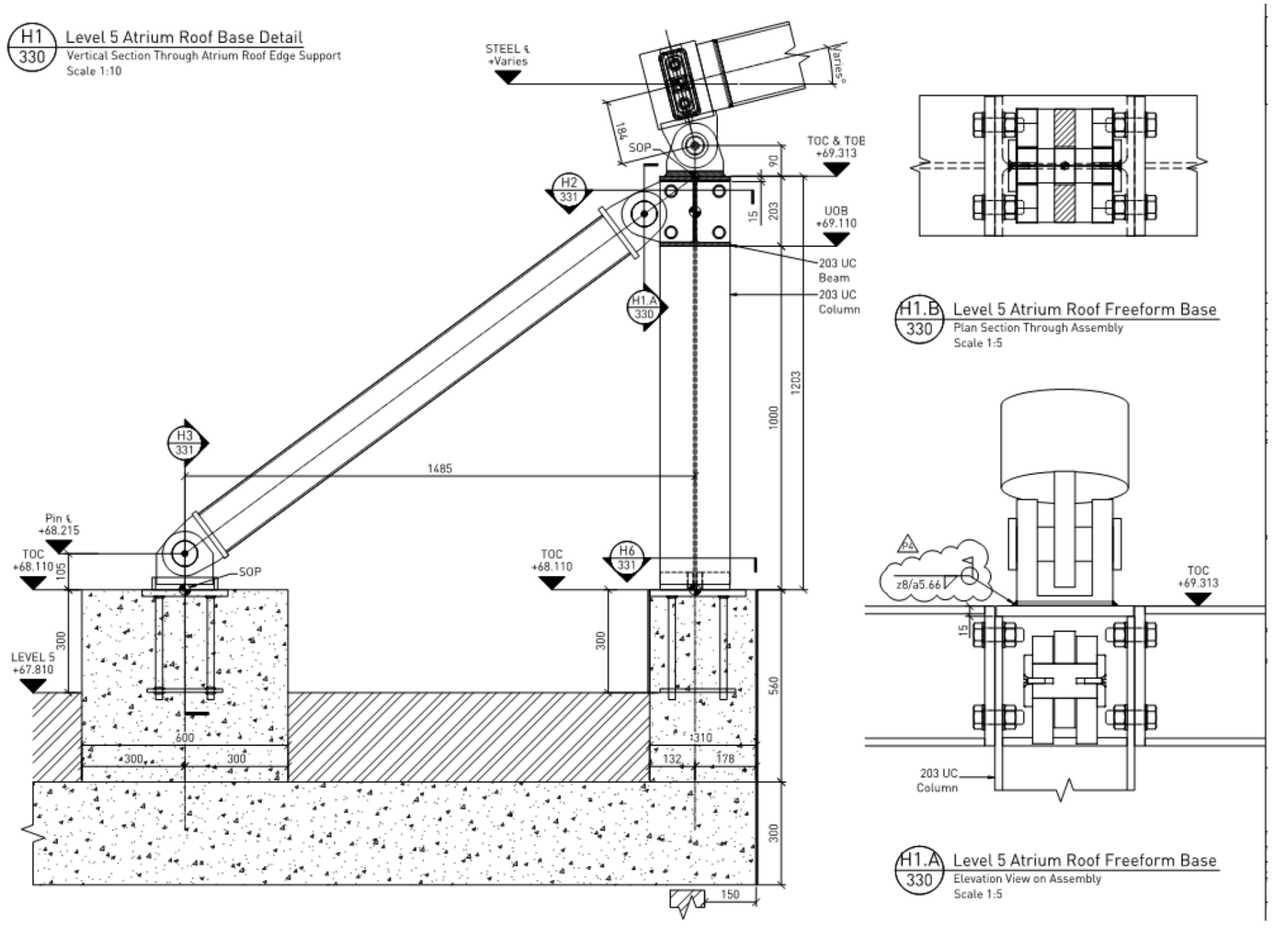


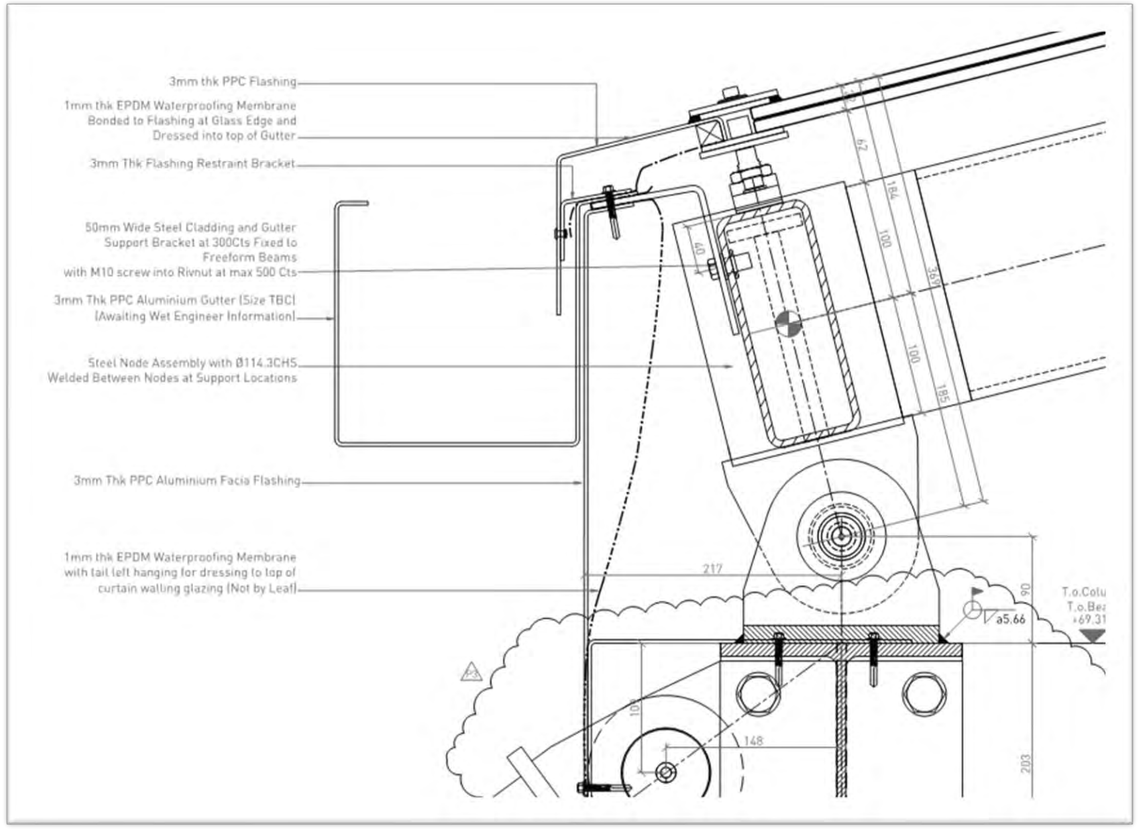
Non-linear FE analysis





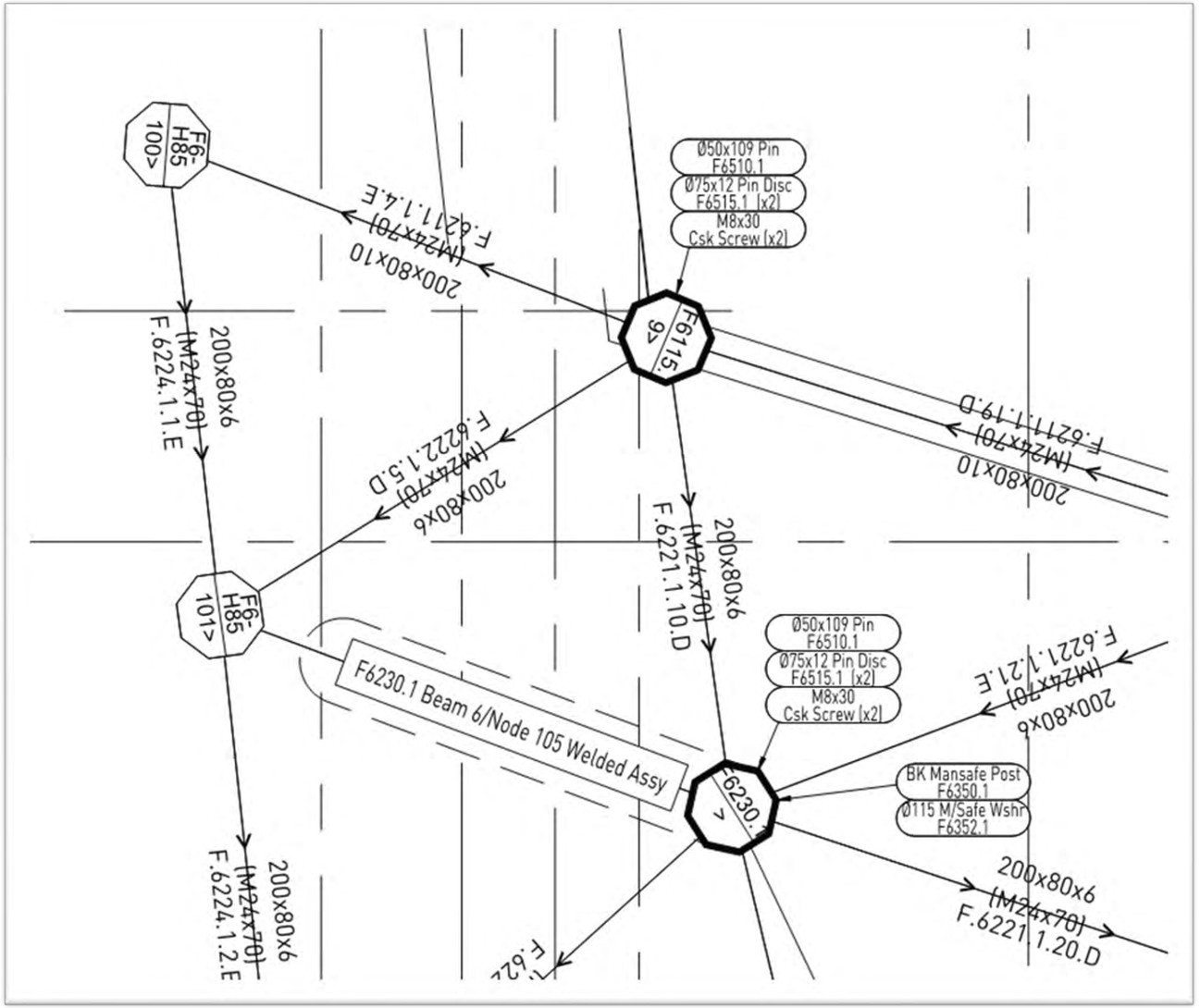
Structural Steelwork Detailing

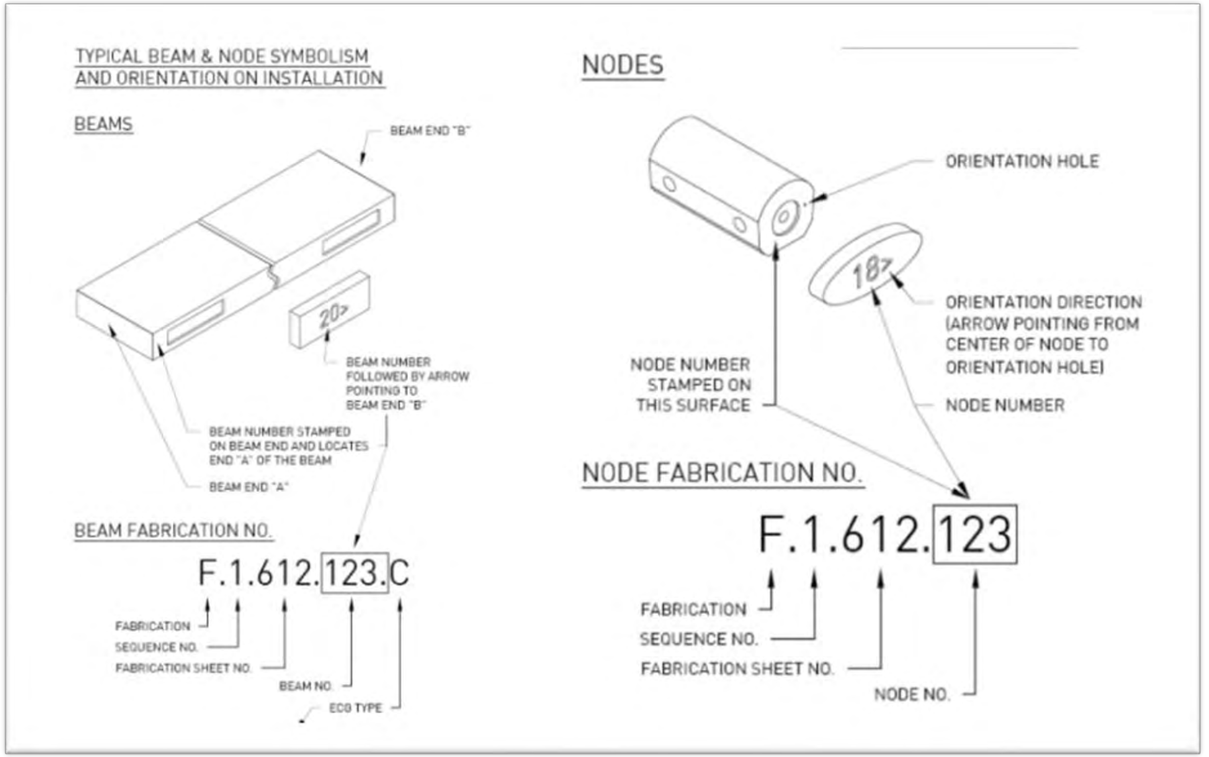




Detailing required for the submittal drawings – including steel detailing and interface details with the concrete and cladding

Structural Steelwork Detailing



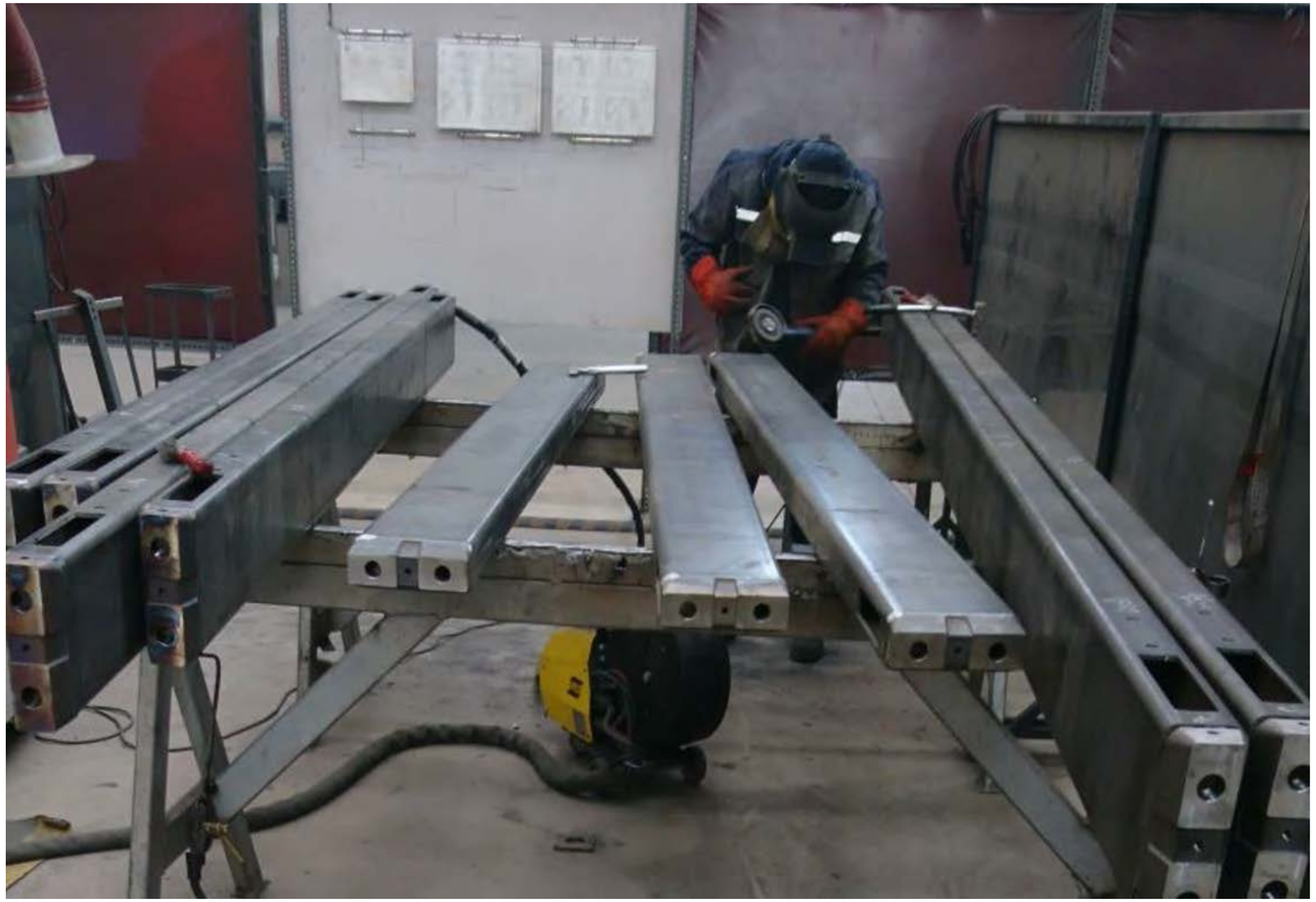


Detailing required for installation

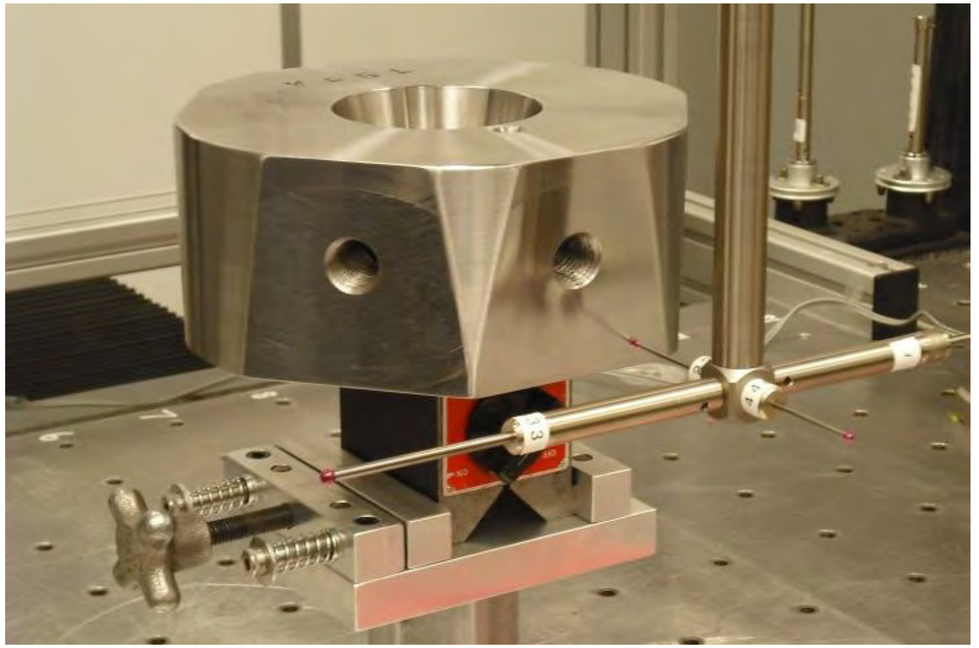
FABRICATION

STEELWORK CONTRACTOR: Anchor Steel Projects and Novum Structures

Steelwork Fabrication

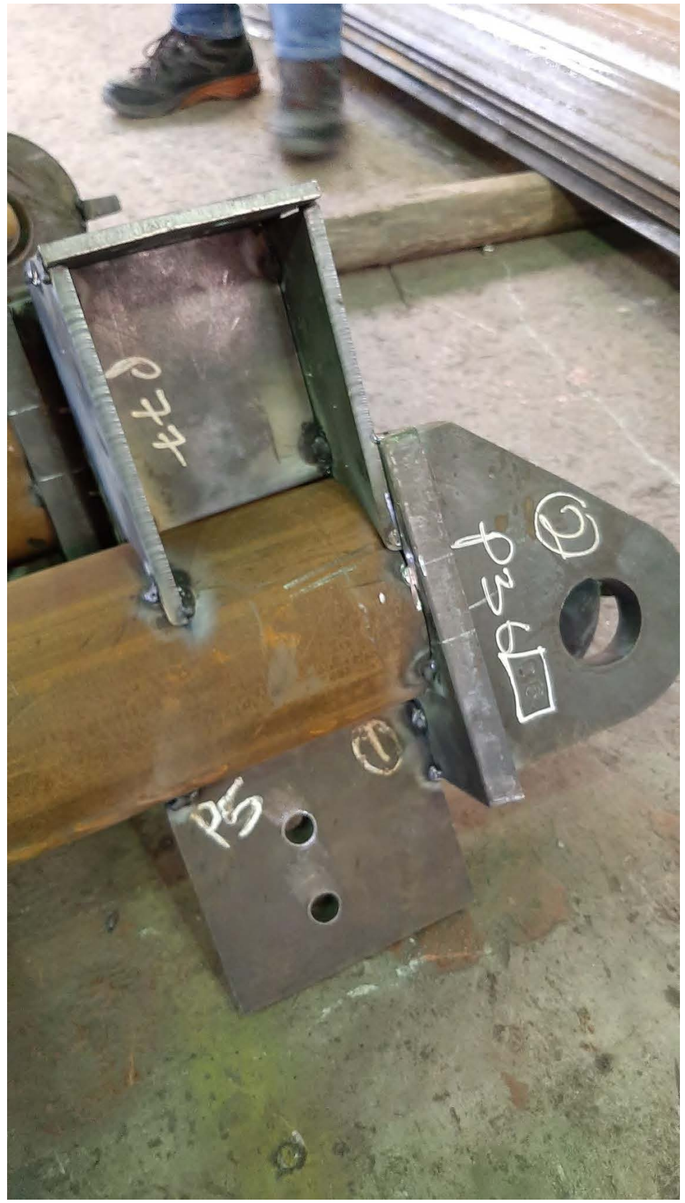


Beam fabrication



Node fabrication

Steelwork Fabrication



Fabrication of Atrium Support Steelwork

Steelwork Fabrication

Steelwork Interface Checks

Free Form Beam Practice Assembly

ERECTION / CONSTRUCTION / INSTALLATION

CONTRACTOR: LEAF Structures and Anchor Steel Projects

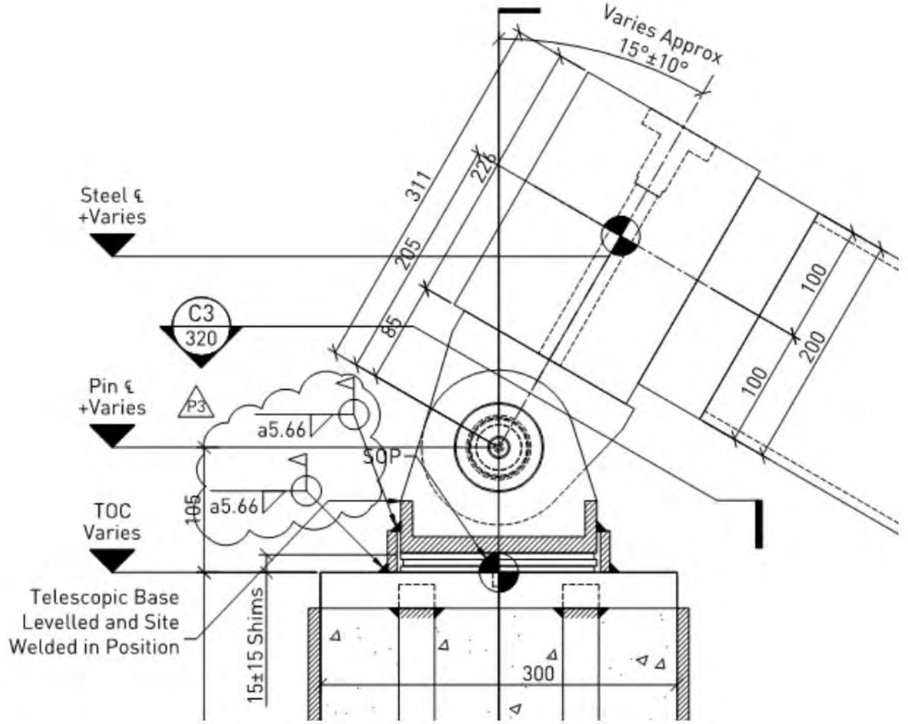
Steelwork Erection

Eyebrow Steelwork Installation

Steelwork Erection

Atrium Steelwork Installation

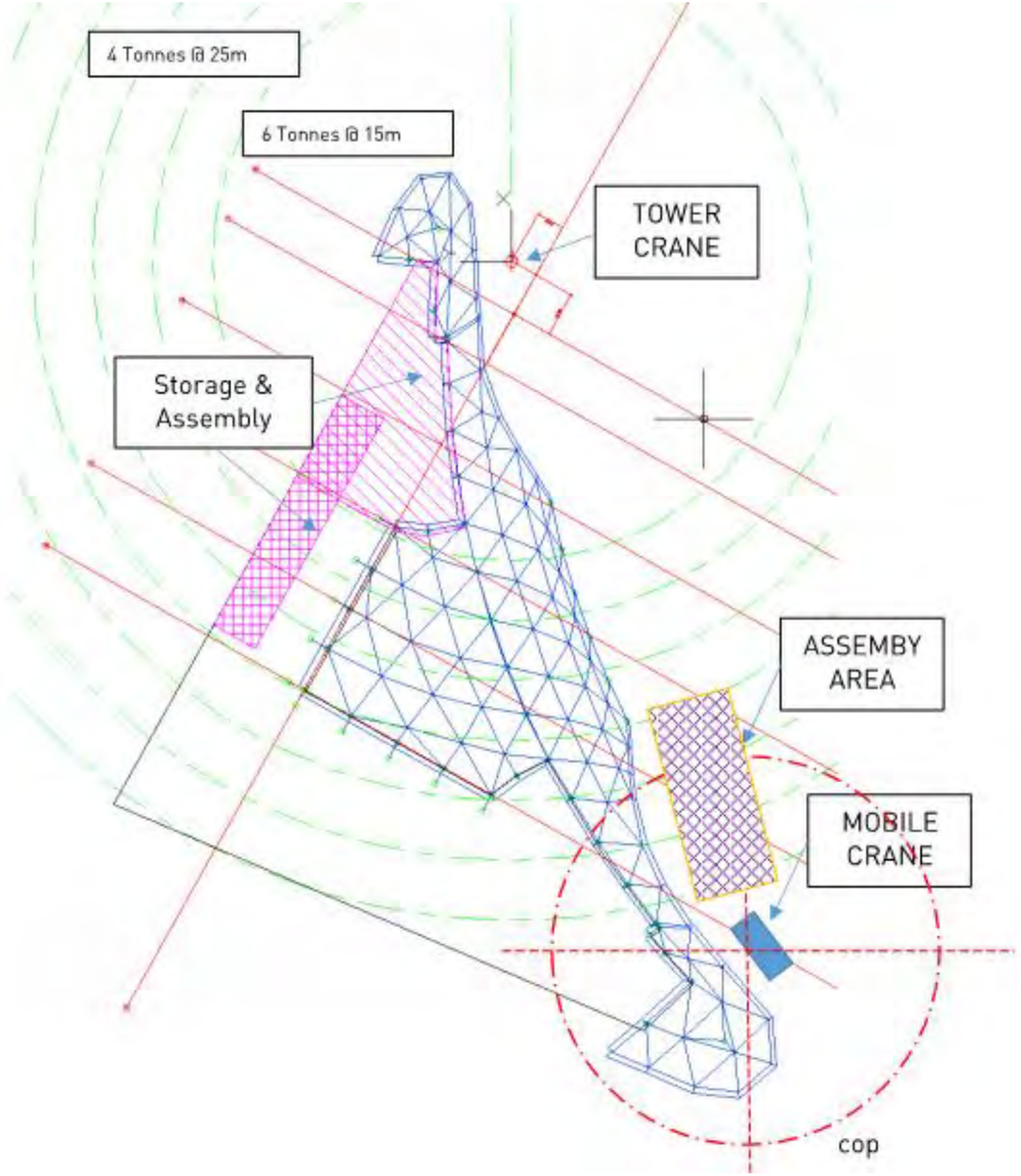
Steelwork Erection

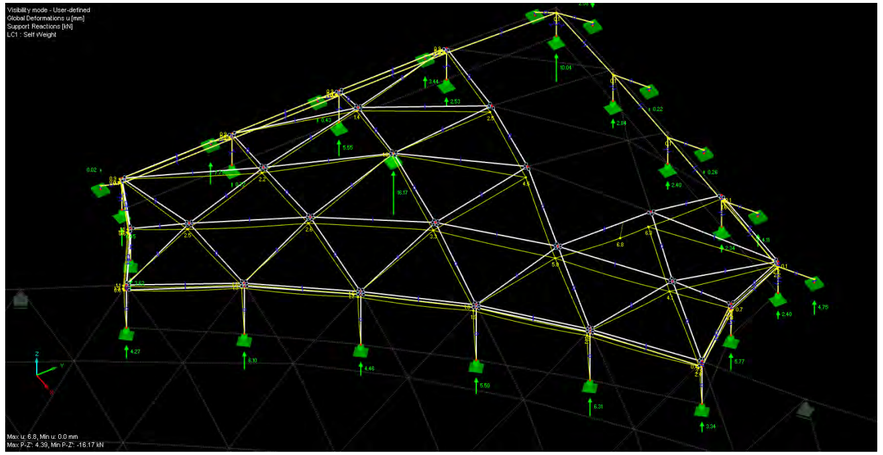


Support Node no.	Member Type	Elevation TOC (Z value)			Shim thickness (mm)	Required Pin Elevation
		Drawings	Actual (survey)	Difference	15	105
9	Roof column base	68,583	68,583	0	15	68,688
10	Roof column base	68,883	68,870	-13	28	68,988
11	Roof column base	69,044	69,034	-10	25	69,149
12	Roof column base	69,114	69,098	-16	31	69,219
13	Roof column base	69,071	69,081	10	5	69,176
14	Roof column base	69,073	69,081	8	7	69,178

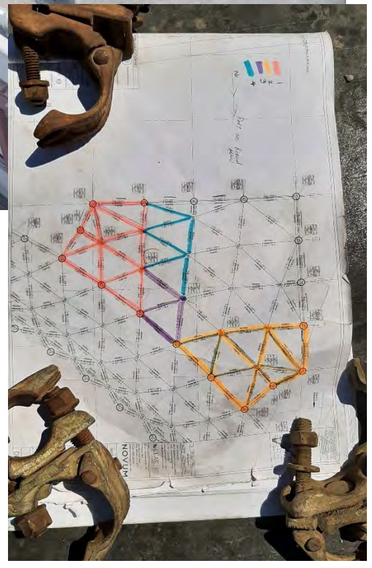
Ensuring accuracy between the main concrete structure and the gridshell

Steelwork Erection





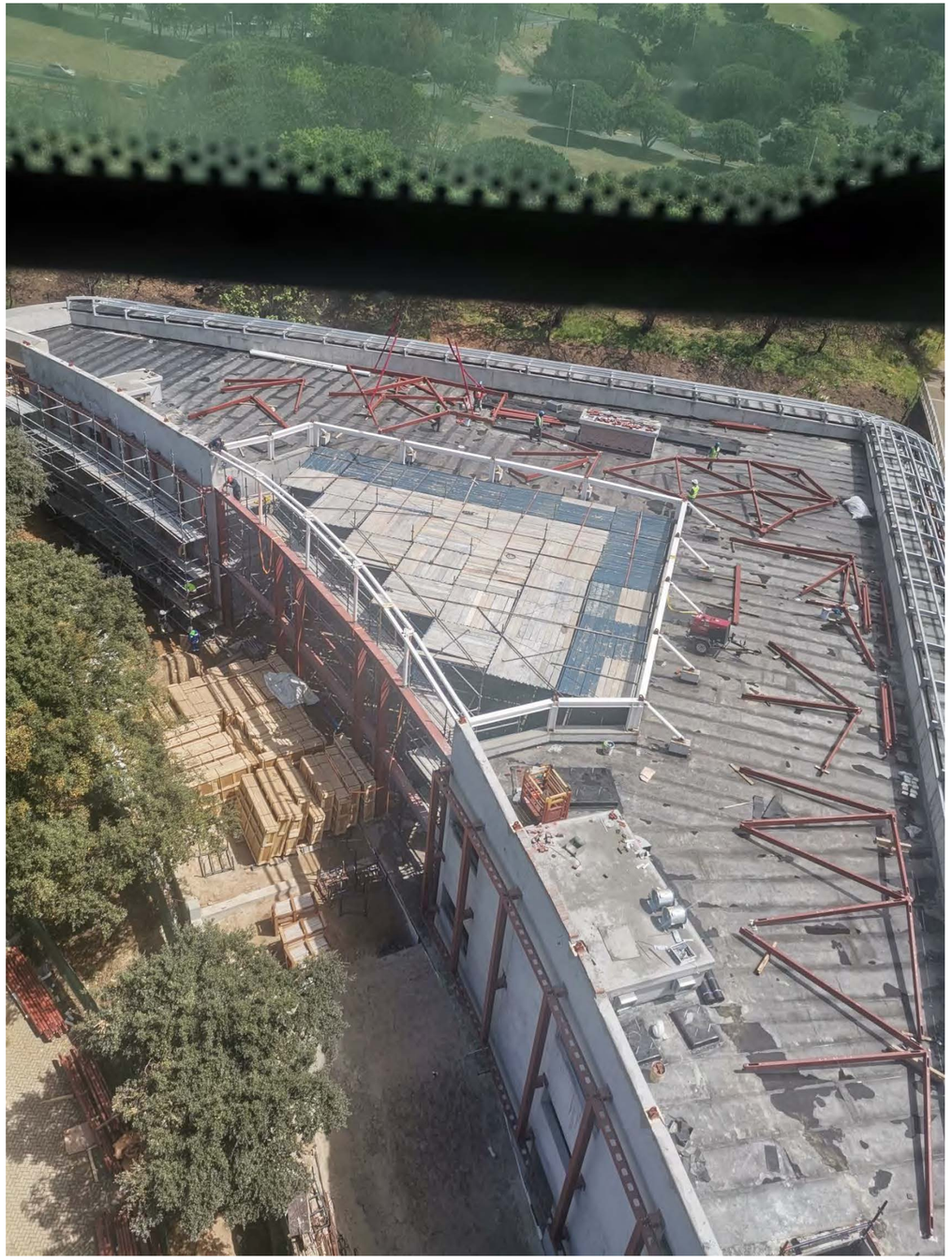
Steelwork Erection



CHALLENGES AND SOLUTIONS

Challenges and Solutions

Congested site, trees and COVID 19….



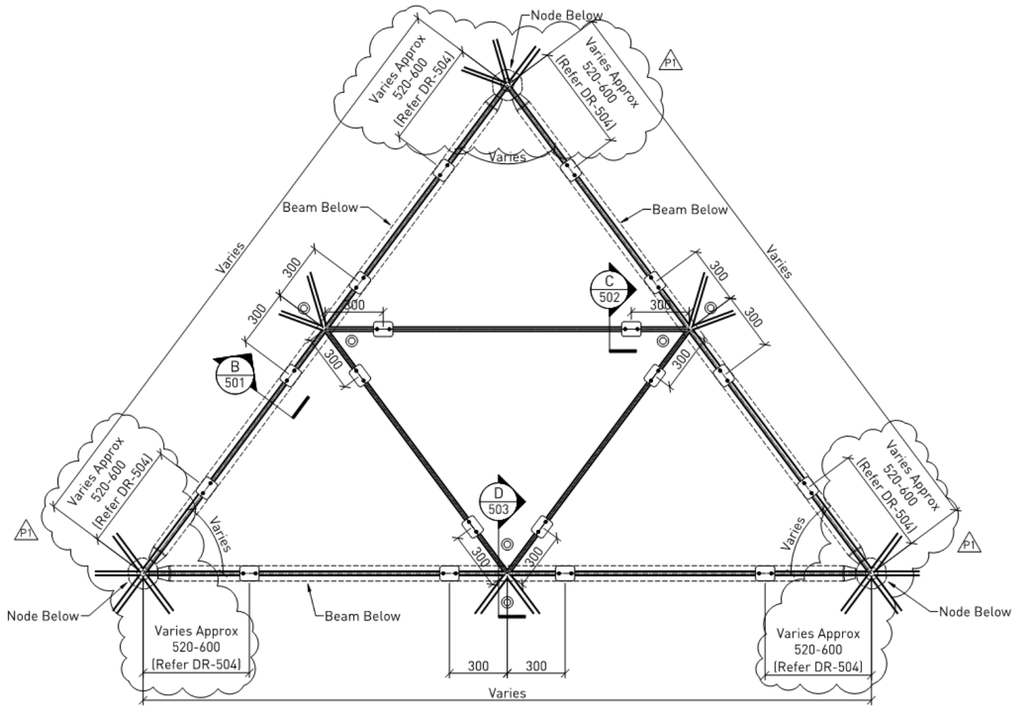
Challenges and Solutions

Bull Nose Wrapping Around the Structure

Challenges and Solutions

Bull Nose Wrapping Around the Structure

Challenges and Solutions



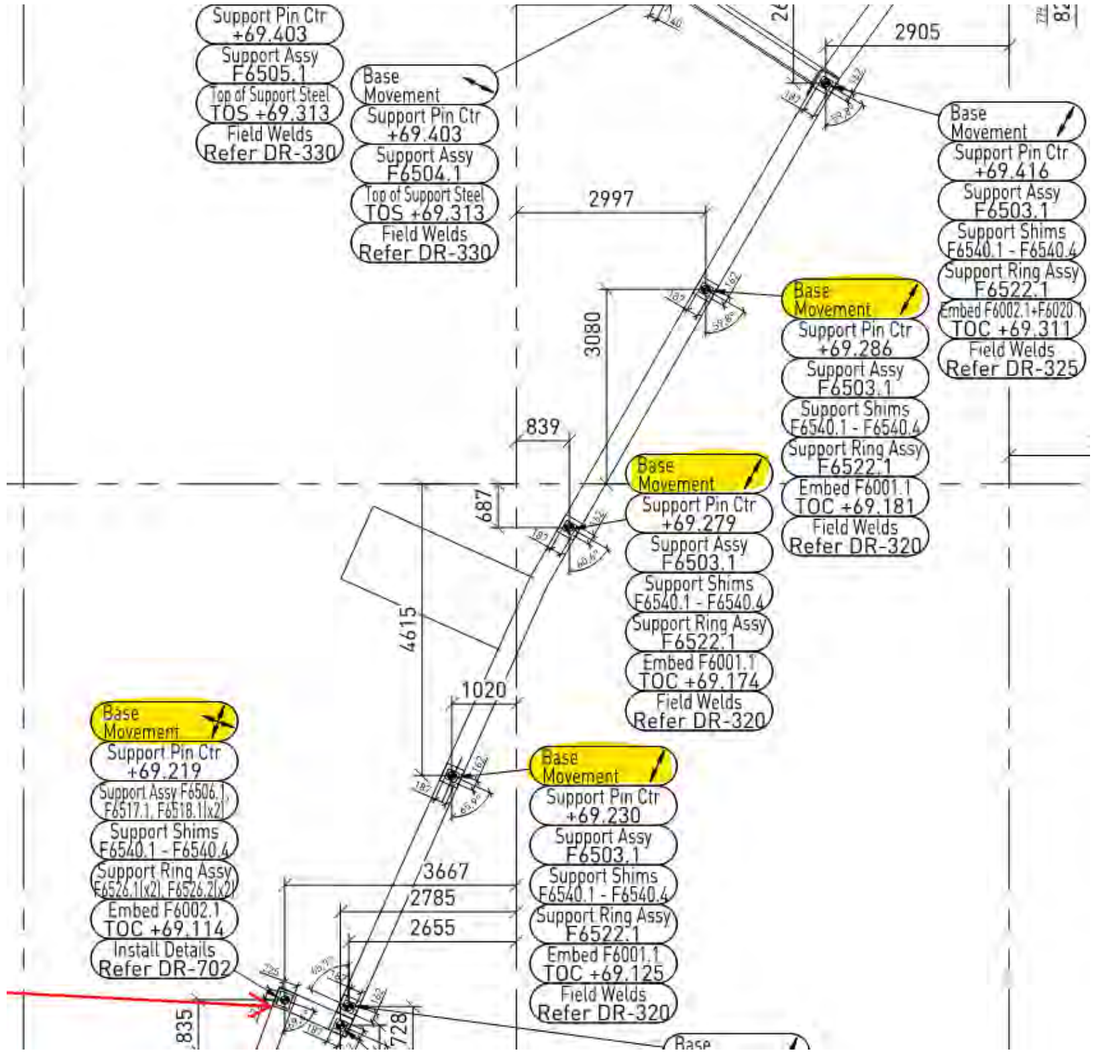
Large Structural Grid – 4 glass panels per 1 structural grid

THE BENEFITS OF STEEL IN THIS APPLICATION

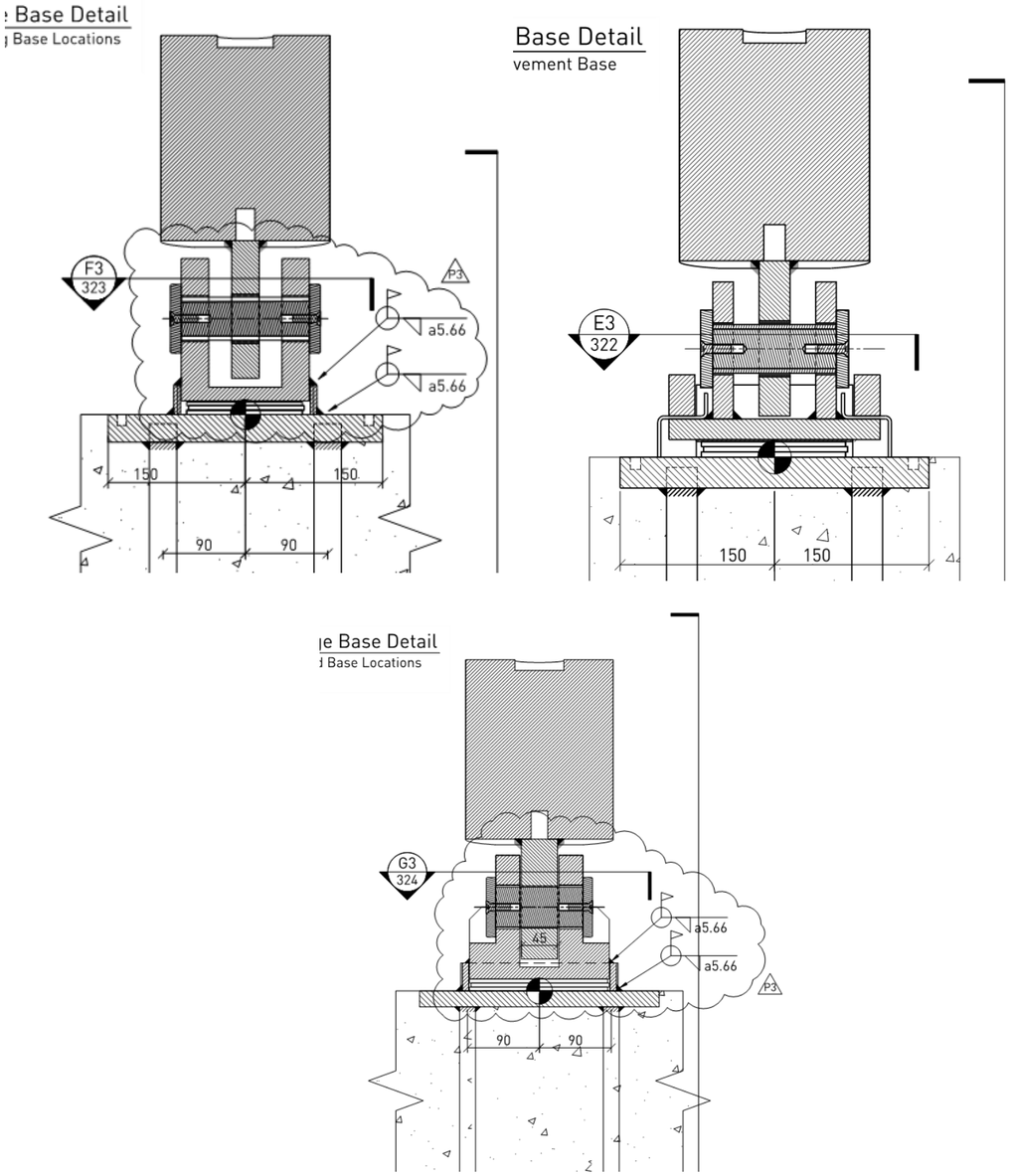
Benefits of Steel In This Application

Tight installation, various scopes and high degree of tolerance required

Benefits of Steel In This Application

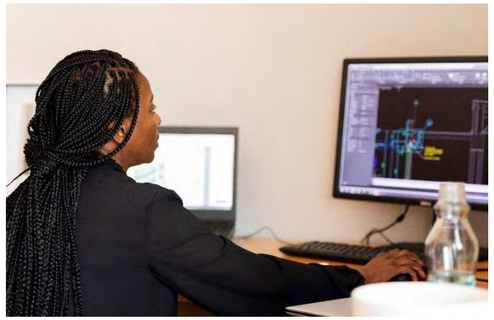


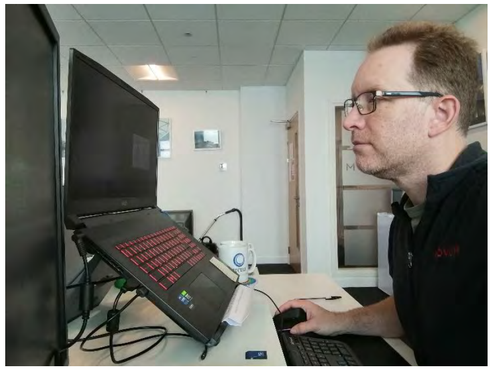
Ability to accommodate temperature movements



WHAT WE'RE PROUD OF

What We're Proud Of



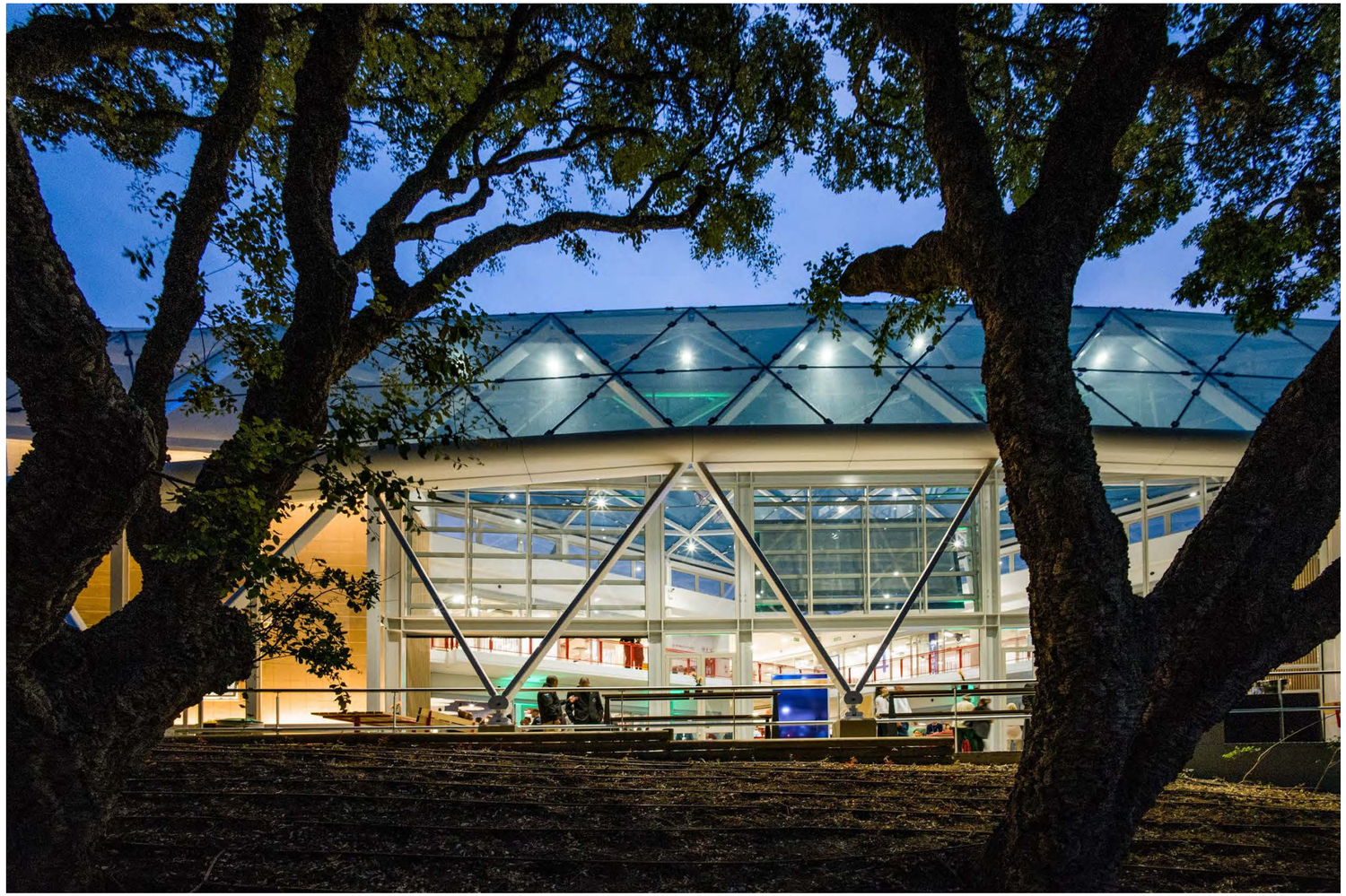


The hundreds of people who made this project possible.

What We're Proud Of

A beautiful, functional structure,

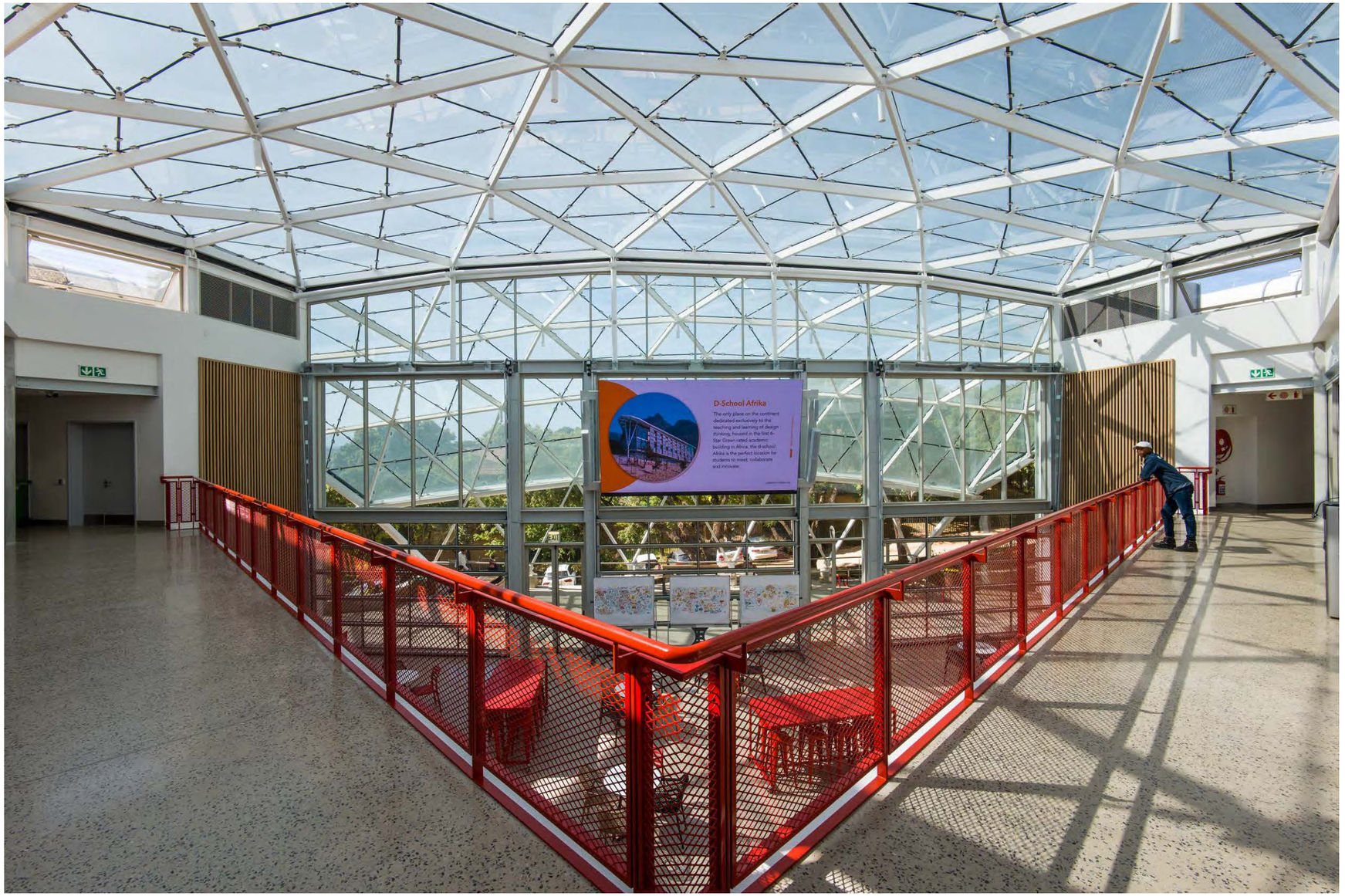
What We’re Proud Of



which celebrates it’s surrounding and create space for collaborations.

What We're Proud Of

What We're Proud Of



Creating a space where the building geometry is expressed and celebrated.