TASS Engineering (Pty) Ltd

Mpumalanga International Fresh Produce Market

THE PROJECT BRIEF

CLIENT: MPUMALANGA ECONOMIC GROWTH AGENCY

ARCHITECTS: ORBIC ARCHITECTS

MAIN CONTRACTOR: ENZA CONSTRUCTION

ORBIC architects

MIFPM PROJECT BRIEF

The Mpumalanga International Fresh Produce Market is perfectly located within the luscious Lowveld as catalyst to stimulate growth in the agricultural sector, create a significant number of job opportunities, create scope for the establishment of downstream business and act as an important tool to fight food insecurity.

The design of this modern facility addresses the needs of the modern food industry and is designed to operate more effectively and efficiently than existing, traditional fresh produce markets. The entire project consists of 17 buildings; each playing an integral part of the market operations. In order to achieve the design requirements, improvements were made to the physical infrastructure layout, the building structures and in turn affecting the operations and management of this ‘market of the future’.

MIFPM MARKET BUILDING ROOF DESIGN PHILOSOPHY

True to the saying: “Form follows function”, the design of the main market building has been designed to accommodate the most flexible market operations according to the current requirements, but also for possible future alterations and expansion to these operations.

Three dimensional tri-angular tubular arch trusses spanning 220m in length with two rows of support columns spaced at 68m in between, grants the operator the required flexibility to position cold rooms, racking and set out the most productive operational equipment layouts. The side end supports for these trusses in the form of supporting concrete portal frames were integrated in the design of the building to accommodate mechanical equipment and forms the support structure for the insulated panel envelope of the building that houses insulated sectional doors that open onto the side platforms. Translucent modular sheeting to the southern sides of these concrete portal gables allow for natural light to enter the building without excessive heat transmission. The roof sheeting consists of a sandwich panel of 135mm insulated material with sheeting to the top and bottom to maximize temperature control within the building.

The market layout was designed to accommodate for future expansion by extruding the roof design to the back. Current gridline numbering runs numeric from the top to bottom to ease and consolidate future design extensions with the current design. Sail material roofing at the back of the building connects lightly with the back end gable that will also allow flexibility for future expansion.

THE PROJECT OVERVIEW

MPUMALANGA INTERNATIONAL FRESH PRODUCE MARKET

PROJECT OVERVIEW

STRUCTURAL STEELWORK

Project Completed: 2023

Steelwork Completed: December 2021

Tonnage: 1537 ton

Profiles used: Predominantly Circular Hollow Sections

PROJECT OVERVIEW

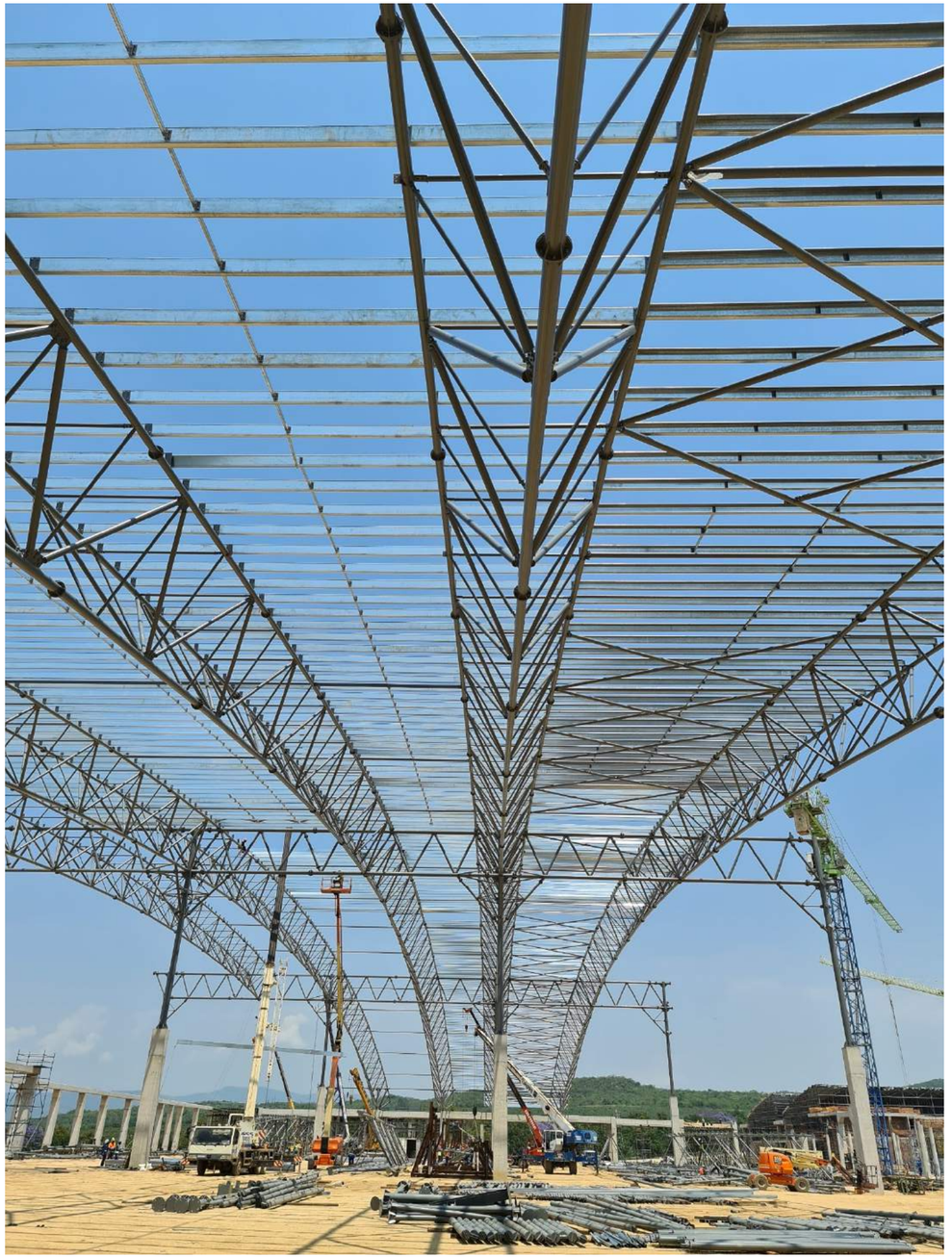
STRUCTURAL STEELWORK

Structural Engineer: P Design CC

Steelwork Contractor: TASS Engineering (Pty)Ltd

Steel Detailer: 3DStruct

Steel Merchant/s: Macsteel / Allied Steelrode / BSI



PROJECT OVERVIEW

METAL CLADDING AND ROOFING

Project Completed: 2023

Cladding Completed: June 2023

Cladding Material Used: SAFLOK / WIDEDEK

Manufactured by SAFAL

Cladding Profile: SAFLOK / WIDEDEK

Cladding Area Coverage: 30,000m2

Cladding Tonnage: 222 ton

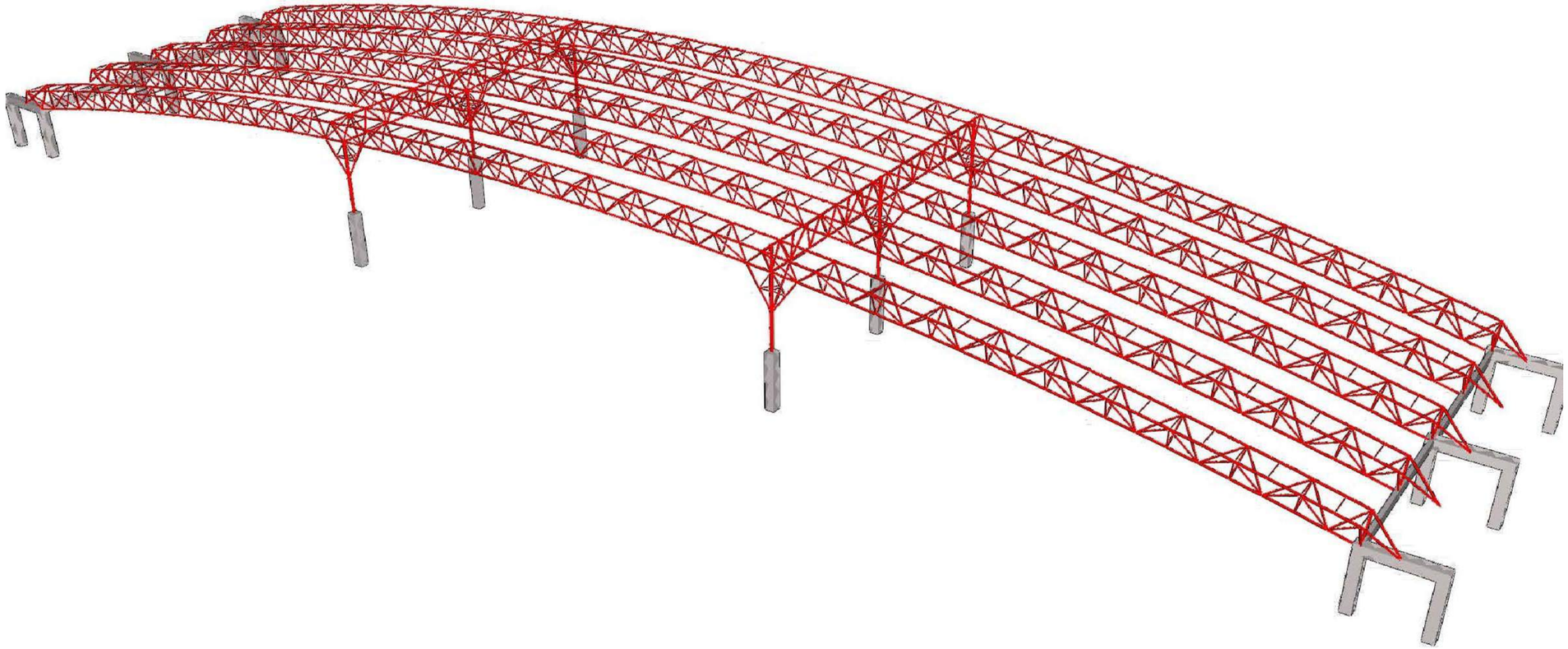
STRUCTURAL FRAMING

STRUCTURAL ENGINEER: P DESIGN CC

STEELWORK CONTRACTOR: TASS ENGINEERING P/L

STEEL DETAILER: 3DSTRUCT

MIFPM Roof Structure



The Mpumalanga International Fresh Produce Market steelwork roof covers an approximate 29,000m2 floor area, 220m x 135m.
The main roof support structural system consists of a three span, three dimensional tri-angular tubular arch truss.
The three spans are 70m each resulting in maximum usable floor space below with minimal support columns.
The trusses are spaced at alternating centres of 13m and 10m.
Central round hollow section column supports are placed every 26m with transfer trusses picking up intermediate trusses between column supports.

At the roof centre and at the highest point of the roof arch the floor to purlin height is 23,5m. Particular attention was given to the central support columns and the intersecting connection detail to support both the two dimensional transfer trusses and tr-angular roof trusses. At the roof side end support the lateral shear forces where transmitted onto supporting concrete portal frames.

In order to facilitate transport of the roof steelwork from the Johannesburg manufacturing workshop to the site in Mbombela the tri-angular tubular arch trusses were designed to be bolted together.

The two roof gables structure provided support to approximately 2200m2 of side wall gable cladding at each end.
Two dimensional tubular pipe trusses were used to support the up to 16m high gable ends.
The steelwork roof was designed to support a 200mm thick insulated roof covering as well as making allowance for future solar power panels configuration.

METAL CLADDING/ ROOFING

CLADDING MANUFACTURER: SAFAL

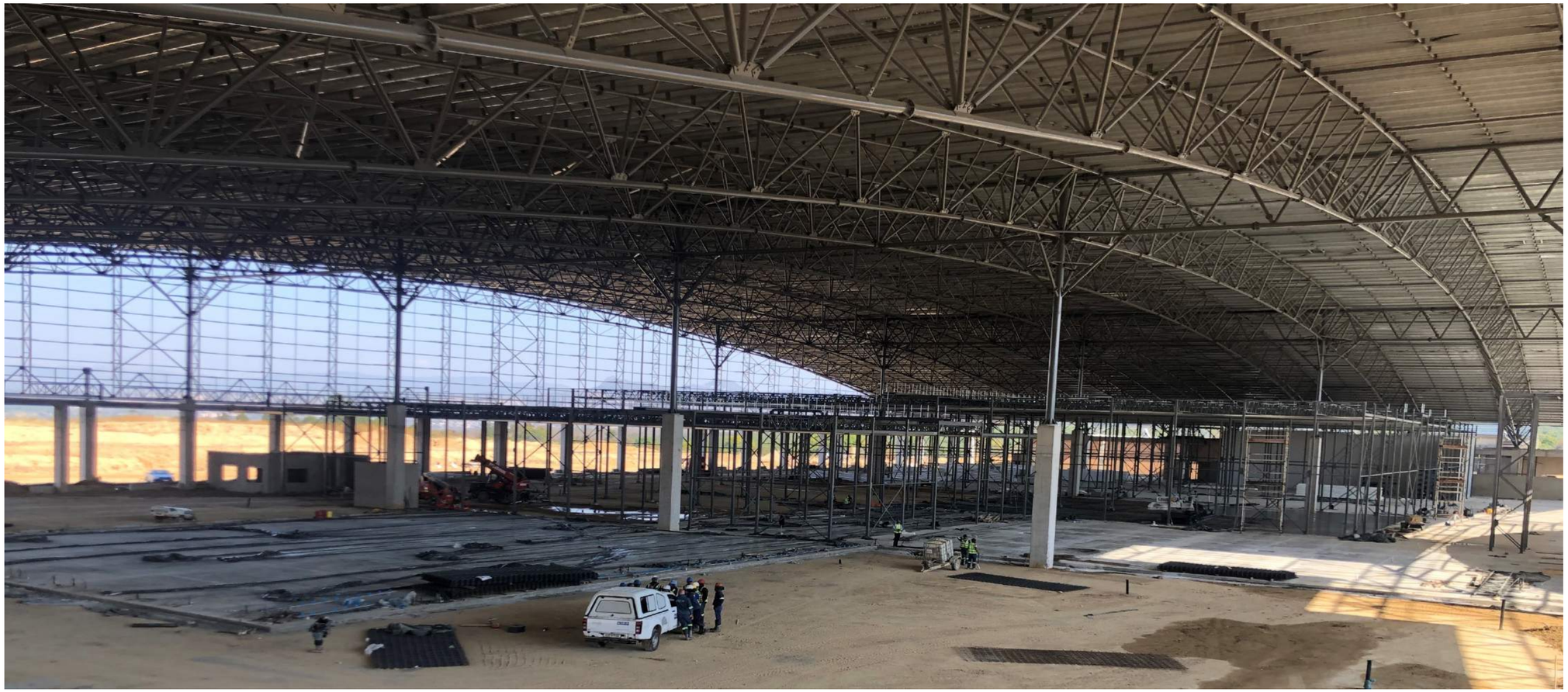
CLADDING ROLL FORMER / PROFILER: SAFINTRA

CLADDING/ ROOFING SUPPLIER: SAFINTRA

CLADDING/ ROOFING CONTRACTOR: T5Projects

MIFPM Roof Sheeting and Cladding

The required climatic conditions within the completed building envelope dictated the roofing system to be used comprising a two layer sandwich configuration of 0,47 Widedek ceiling sheets , a 135mm Starlite Insulation blanket and 0,53 SAFLOK external weather sheeting.



The roof is split into three equal segments for sheeting separated by gutters with the 68m long SAFLOK roof sheets being rolled on site and pushed up a scaffold ramp onto the roof.

The area of the roof is approximately 30,000m2 with a side cladding area of 6,200m2.

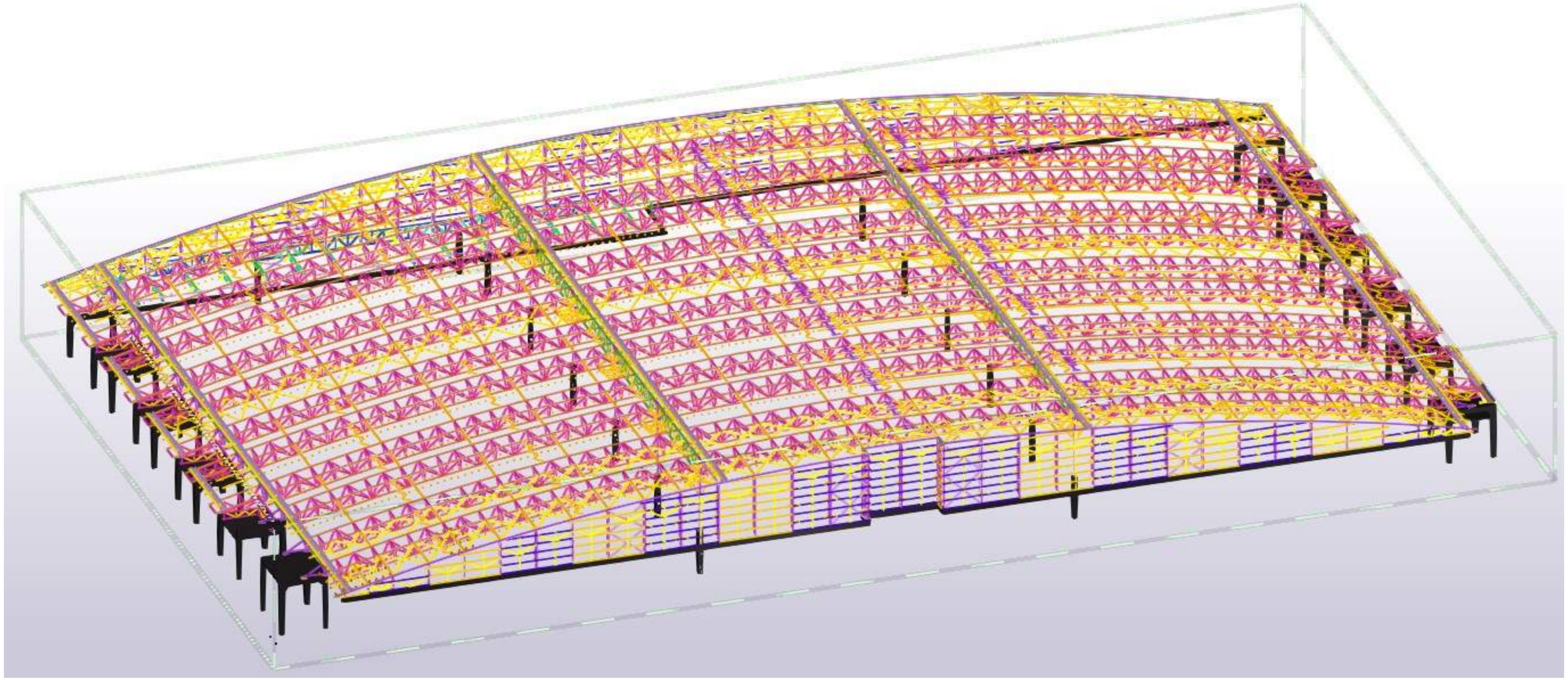
The sides of the building are clad with 0,47 Widedek sheets with a 50mm layer of Lambdaboard for insulation.

The Widedek ceiling sheets were installed in various lengths lapped over the purlins since they do not form part of the weather envelope.

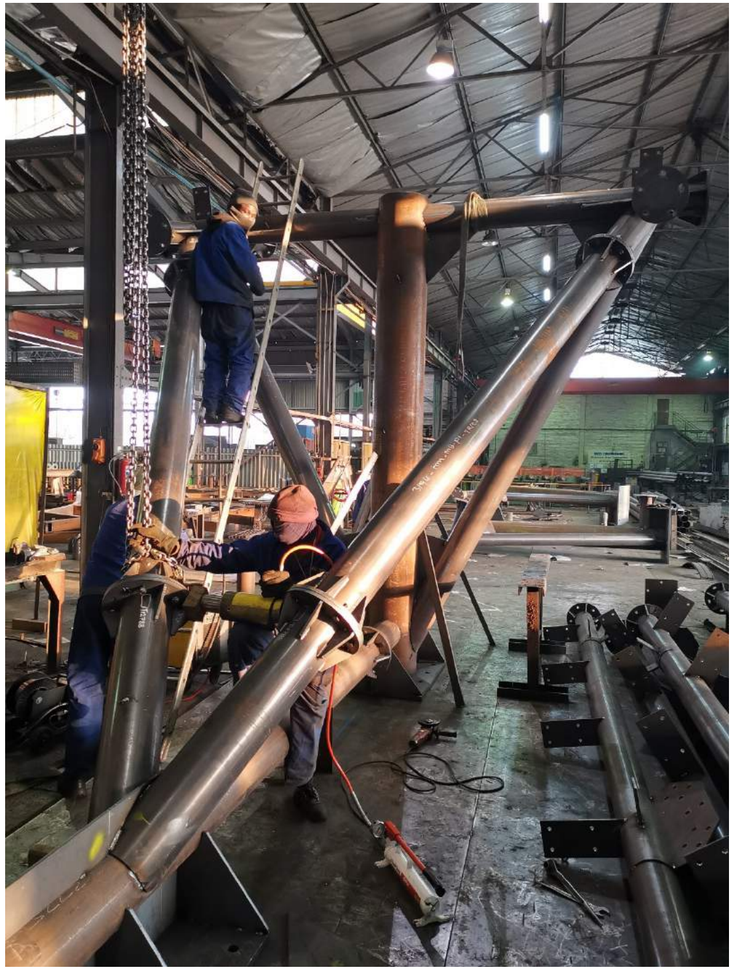
FABRICATION

STEELWORK CONTRACTOR: TASS ENGINEERING (PTY) LTD

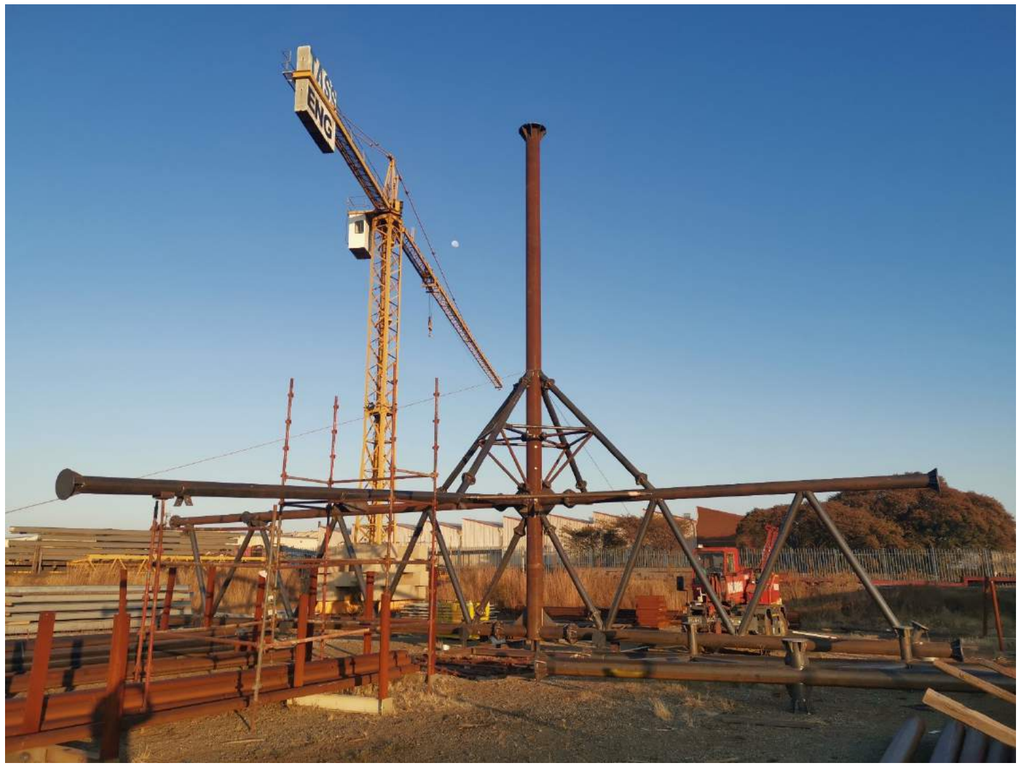
From the very outset it was realized that to manufacture a roof of this size with the Main Structural members being 3,6m. toblerone trusses of welded construction and then deliver them to Nelspruit was going to be an extremely expensive transport exercise and would not make economic sense and thus the decision to make the entire structure piece small was taken very early during the tender preparation phase.



The idea of manufacturing 33 number similar toblerone trusses each being 70m. long and 3,6m. in size made up of piece small components required some innovative thinking with respect to how one would make suitable jigs to ensure that all the components would fit together correctly when it came to assembling them on site.
A huge amount of time was dedicated to this challenge during the detailing process and the design and detailing of the jigs was integral to that process.



Doubler plates were introduced at all the toblerone truss connections to strengthen the walls of the truss chords against buckling but more importantly , from a fabrication point of view , it simplified the jigging of the chord members by enabling the connections to be fully fabricated in simplified jigs separate from the chords then added to the chords in a single line jig setup.
Since the roof profile had such a large radius it was also decided , and agreed , to fabricate the trusses with segmented chords and the splice locations were carefully chosen to limit the number of different connection configurations in the truss segments.



The roof consists of 11 trusses in its length , 3 truss spans over its width and 7 truss segments in each span which amounts to 231 truss segments all told.
As such it was extremely important to ensure quite early in the fabrication process that when assembled the full trusses would provide the correct dimensional profile to accurately fit into the roof on site.

Similarly the configuration of the support column / girder / truss intersection was incredibly complicated and the trial assembly of this section of the roof at the workshop was seen as being critical to the success of the Project.

ERECTION / CONSTRUCTION / INSTALLATION

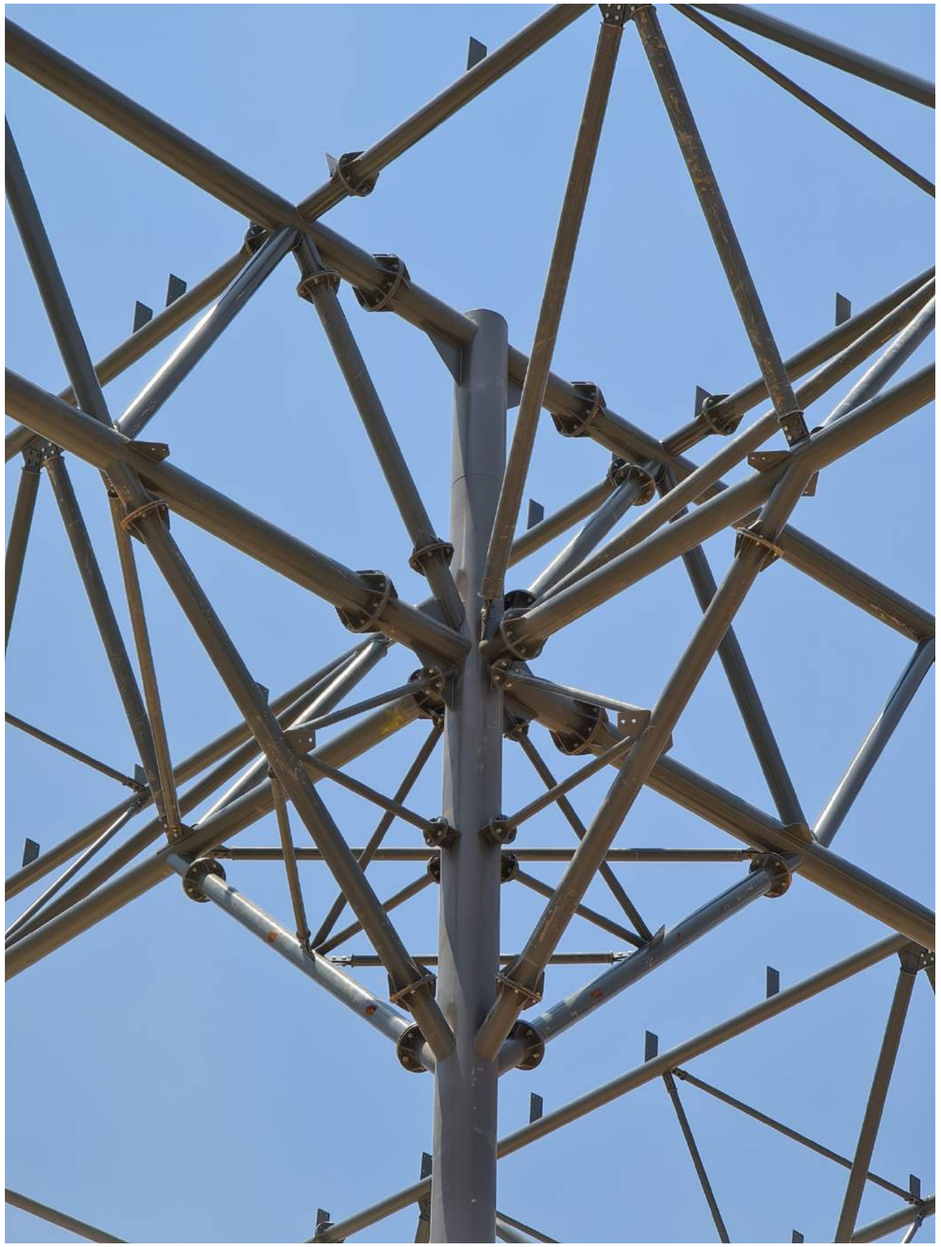
CONTRACTOR: GSE CONSTRUCTION / CTK TRADING

Assembly of the toblerone trusses on the site necessitated the provision of a number of assembly frames which had to be set out , lined and levelled to ensure the accurate assembly of each truss before hoisting.

A major concern throughout the installation phase of the Project was that the holding down bolts at the two concrete abutments of the roof would talk to each other such that 210 meters of roof truss would fit snugly between the steel buttress frames once they were mounted on them.

Even though accurate surveys were provided by the Main Contractor and we had allowed some tolerance in the buttress frames base plate holes it was not a given that with such a long length of steelwork we would end up with a perfect fit.

As it turned out the building works were fit for purpose and the Main Contractor could be commended for a job well done.



Talk about complicated intersections.

The trial assembly at the workshops proved invaluable to the installation on site.

At 70 meters long tandem lifting was the order of the day.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CHALLENGES AND SOLUTIONS

The main challenge on this Project was the shear size of the roof structure and it’s structural framing system requiring a major consideration of how to transport it to the site 330 km’s away from the fabrication shop.

This was overcome by detailing it as piece small allowing the transport loads to be maximised which then added further challenges as to how to fabricate it like a meccano set while ensuring all the pieces went together seamlessly.

These challenges were overcome by careful consideration of the jigging systems that would be used for the fabrication of the components and then trial assembling the major structural components and interfaces between them.

THE BENEFITS OF STEEL IN THIS APPLICATION

Structural Steel is the only construction material that could have been used to achieve such large scale open spaces under roof that were integral to the Architects vision for this development.
8 No internal columns for a 30,000m2 roof coverage is unprecedented.

With its high strength to weight characteristics and the ability to assemble such light weight elements of steel in a structural configuration that would enable such large span structures to be designed, makes it the ideal material.

The use of tubular sections further enhances the visual appeal of the roof structure let alone them being the most structurally competent sections.

WHAT WE'RE PROUD OF

We envisaged a MECCANO set and made it work in this magnificent roof structure.