Tall order met with rational rollout

Synnex Highbay Warehouse, Lidcombe NSW

The supply of structural steel sections for a new IT distribution centre in western Sydney high enough to contain an eight storey building is being kept to program through deft planning and handling.

Over 570 tonnes of structural steel is being used on the 3000sqm high bay storage building developed to house automated computer systems to store and retrieve items from 24-metre high racks. The over 100 metre long building comprises 13 portal frames approximately 28 metres high and wide to accommodate the tall storage racks.

According to the project's structural engineers at Opus International Consultants, **Pushpa Ratnayake** and **Chris Hackney**, functional constraints precluded internal columns so each frame had to be designed as an individual portal frame made entirely of custom fabricated 1000WB322 sections.

All told, that represents over a kilometre of steel length in the portal frames alone.

"We analysed the steel frames as a combination of simple 2D and more complex 3D frames using Microstran," Chris said.

"Various load combinations were considered to obtain the critical design action envelope. The final design was subjected to an internal design review and verification process in accordance with the Opus in-house quality system.

"Various stages of construction were reviewed to comply with the current Safety in Design legislation and the constraints were communicated to the builder."

The facility's reinforced concrete floor slab was designed for high racking loads equivalent to a uniform load of 29kPa with stringent deflection criteria (span/1000). The high bay slab also was required to support the cranes that would be used to erect the steelwork. The size, transportation and erection of the frame members all had to be considered in the design.

"In a project of this magnitude, it was very important that we worked closely with the steel detailer, fabricator and the erector during all phases of construction," he said.

"We had experienced staff on hand right through the construction period so that the site queries were responded promptly. Our design was flexible enough to accommodate some minor changes proposed by the fabricator to facilitate easier fabrication and erection.

"The high bay frames were secured into the pile caps using M36 holding down bolts. A bolt location template was cast into the slab at the base of each column to make sure the bolts were located precisely and multiple surveys were also carried out to achieve correct set out."

The structure was documented in 3D using Autodesk Revit software package in keeping with the current industry trend and the 3D Revit model was shared with the other consultants for architectural and services coordination. They said that the 3D model was particularly helpful in correctly modelling the complex geometries in order to avoid any clashes with the services and other structural elements.

Andrew Reynolds, Engineering and Projects Manager at the project's prime steel contractor, Copal Engineering said the job would have been impossible without the use of overhead cranes.

"The main challenge was the handling of the 1000WB and 500WC sections from the workshop, transportation, painting, right through to erection and fit-out work onsite," he said.

Twenty eight metre high elevated work platforms were required to access the tops of the columns and rafter connections onsite.

"The beams had to be unloaded and loaded onto trucks to go onsite but they also needed to be manoeuvred within the workshop and rolled over numerous times during welding to obtain correct welding positions," he said.

"We found that using a series of plate grabs to pick up the beams from their flanges when on their sides was the most safe and efficient handling method. Using overhead cranes with two hoists per crane rather than a single hoist also increased productivity as only one crane was needed to handle each member."

As project timeframes were reasonably tight and the site could have easily become congested by the sheer volume of steel required, he said the fabrication sequence was coordinated and back-planned from the target construction and erection program as a 'just in time' (JIT) sequence.

"We worked with our steel supplier to ensure we received each steel delivery only a few days ahead of our fabrication program and dispatched the completed members to the painters as soon as they had been inspected by the welding inspector and passed by NDT examination," Mr Reynolds said.

"Our in-house project engineers then coordinated with the painters and riggers to deliver the painted members to site in the required order to match the erection sequence approved by the structural engineer.

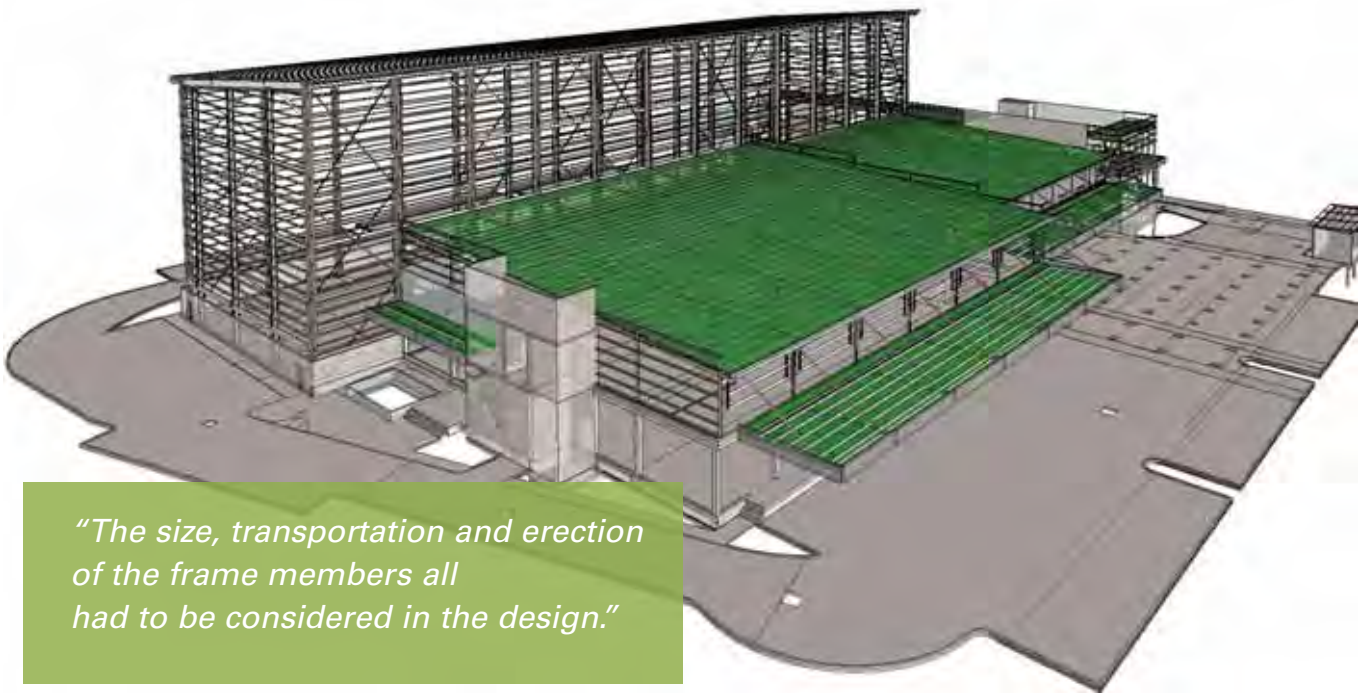
"We were able to work with the steel detailers and the structural engineer to propose some changes here and there to connections and details to make the fabrication and installation quicker and easier."

He said that the sheer number of weld runs required in the main connections presented some quality assurance challenges which were addressed with close interaction between workshop staff, welding inspectors and the NDT examiner to ensure good techniques and proper procedures were followed.

Due to the number of full penetration butt weld runs required in each complete joint and the number of holes in each splice plate, Copal had to procure additional welding machines and magnetic-based drills in order to get through the volume of welding and holing that was required on each main member.

Project Team

Client: Synnex Australia
Architect: MGA Architects, Sydney
Builder: Kane Constructions
Building Erection: Asset Cranes & Rigging
Structural Engineer: Opus International Consultants
Steel Fabricator: Copal Engineering
Steel Detailing: Hawkesbury Drafting
ASI Steel Distributor: CMC Coil Steels
ASI Steel Manufacturers: BlueScope Steel, OneSteel



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