Re-engineering delivers efficiencies in the use of steel

Qantas Sydney Distribution Centre

The Qantas Sydney Distribution Centre has been constructed for Qantas Airways Limited by A W Edwards for the purpose of storage and distribution of aircraft parts. The building is steel framed with precast and metal exterior cladding. Open plan office areas have been incorporated into the large mezzanine area at the eastern end of the building and in several areas on the ground floor of the warehouse.

In mid 2003 this large warehouse project was tendered as a fully designed and documented project. The architectural design had been competed by Melbourne based architects, Architectus while the structural and services design components had been completed by Maunsell. Following the initial tender phase, the project was postponed (due, primarily, to the effect of the SARS Virus on the airline industry) and was re-tendered approximately 12 months later. The bulk earthworks and piling works were completed under a separate contract.

During the second phase of tendering, which occurred during April and May 2004, cost-saving options were sought by Blue Visions Management in an effort to reduce the impact of general cost escalation in the building industry from the time of the original tender.

In response to this, A W Edwards offered a Design and Construct alternative tender for the structural elements, which was prepared in conjunction with Fozzard's Consulting Engineers. A range of other savings were also offered at that time, including revised finishes to the precast panels and a rationalised Mechanical Services system. The major cost savings revolved around a re-engineered structural design, which involved an alternative approach to several of the original concepts.

The process of re-engineering and value management started before the contract was awarded, enabling the project to be delivered within the budget expectations of the client. Actual construction work commenced in mid November 2004, following a detailed design development and documentation phase.

Michael Musarra of A W Edwards said that the "value management processes were implemented by the entire project team and fostered throughout construction by Qantas Airways, Blue Visions Management, Fozzard's Consulting Engineers and A W Edwards. Through their expertise in steel design, and liaison with A W Edwards, Fozzard's developed an efficient and practical structural design under a Design and Construct arrangement for both the structural steel frame and the concrete elements of the building. This re-engineered design delivered substantial cost savings, enabling the project to go ahead."

"The large open spaces within the warehouse have been achieved with efficiently designed structural steel elements. The façade is highlighted by the use of exposed Zincalume® downpipes and a range of textures applied to the precast cladding. A carefully considered combination of both horizontal and vertical metal cladding to the upper areas of the façade has created a sense of proportion and balance to the large complex," Michael said. Metal cladding was also used to create draft curtains in the warehouse and for sprinkler zone separation.

Above: Mezzanine flooring system comprising fielders CF210 profile spanning 6.5m between welded steel beams with service penetrations.

Originally designed with approximately 850 tonnes of steel, approximately 550 tonnes of structural steel went into the re–engineered main building with a further 80 tonnes of purlins. The purlins and girts were supplied by BlueScope Lysaght. Internally lapped Z20015 purlins were used with Z20019 and Z20024 in end spans and local pressure areas.

Allan Fozzard of Fozzard's Consulting Engineers developed the final structural design solution for the project. He said that "the architectural specifications called for large, clear spans with few internal columns within the warehouse and loading dock areas. To reach these specifications welded beams and fabricated trusses were used efficiently. The cantilevered eaves detailing was realised by the use of fabricated outrigger frames bolted to the roofing rafters, achieving the architectural aesthetic criteria."

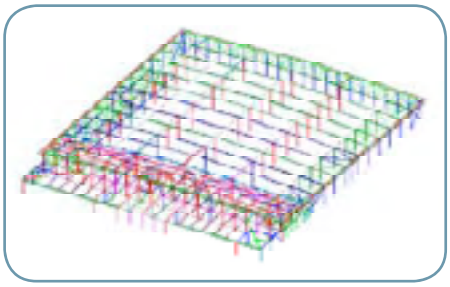
"Steel enabled the large un-interrupted spans to be achieved, which would not be possible with other construction methods."

Michael Musarra commented that, "the extremely high floor tolerance criteria was satisfied by the use of conventionally reinforced concrete slabs spanning between CFA concrete piles constructed under a separate early works contract. The original slab design was based upon a post-tensioned concept with a series of beams. Super flat floor finishes were of paramount importance in the critical narrow

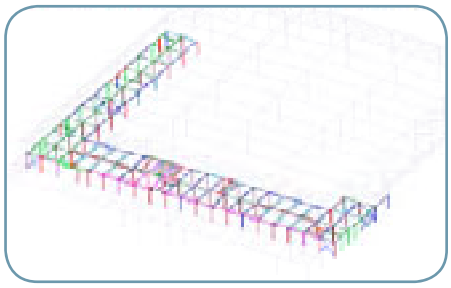
aisle racking areas, which are approximately 13 meters in height. These were necessary to meet the requirements of the materials handling equipment contractor Siemens and A W Edwards engaged De Martin & Gasparini to supply and place the concrete.

Building dimensions

Located on a 30,000 square metre site the main warehouse building is approximately 155 meters long by 130 metres wide. The overall height to the ridge is 13.8 metres. All the cladding and roofing was supplied by Stramit, with approximately 20,000 square metres of Stramit Speed Deck Ultra roofing used on the project. The roofing and cladding was installed by MGW Roofing (Newcastle). Directional winds and wind terrain categories around site had to be taken into account in engineering the roof as Mascot is exposed and subject to relatively high winds.



Microstran design model of full building.



Microstran design model of Mezzanine structure.

An internal mezzanine was included between 10 and 13 metres wide, which runs around the perimeter at a height of 6 metres, creating an aggregated area of 3,822 square metres.

Allan said that, "on the Design and Construct tender, significant cost reductions were made on the steelwork, precast concrete and concrete. Rafter number and sizes were reduced significantly, as were the numbers of columns and transfer beams and no members were increased from the original design."

"The mezzanine floor was originally documented with a standard steel deck system with close centred steel beams. By spanning 6.5 metres in lieu of the original design at 3.25 or 3.3 metres the number of floor beams was reduced by a half and equivalent saving made on the concrete quantities," Allan concluded. The decking, imported from New Zealand in roll-formed sheets, was Fielders CF210 profile.

Realising the steelwork

The steel detailing, fabrication and erection were carried out by Southern Cross Rigging and Constructions from Australian steel supplied by OneSteel Distribution, Horan Steel and Southern Steel. The project was detailed using Tekla Structures software (Xsteel) as the 3D modelling package.

The structural steel was erected by utilising 50 tonne and 25 tonne mobile cranes. Boom lifts were used extensively for bolting and welding where required.

Michael said that, "steel enabled the large un-interrupted spans to be achieved, which would not be possible with other construction methods. Time was saved by the off-site fabrication of the structural steel and precast elements. By using a Sydney based steel fabricator we minimised transport issues and achieved timely procurement and site delivery. The overall steel erection process was completed in approximately 14 weeks. We erected the first structural steel column at the beginning of February 2005 and were virtually at building handover stage at the beginning of November 2005. Such efficiencies could not have been achieved without the extensive use of steel throughout the building and the value added to the processes by the entire project team."

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The steel frame spans are 26 metres and bay widths generally of 10 metres. The rafter sections were generally OneSteel 300Plus® 460UB67 with internal columns sized at grade C350 250x250x6.0 square hollow sections (SHS).

Mezzanine beams were spanning 10 metres to 20 metres. These were sized at 530UB92 to 700WB115 (10 metre span internal and edge beams) to 1200WB249 at 20 metre spans. The rafter-to-column connections were by cap plates. Internally the steel was protected by zinc phosphate and all the external exposed elements were galvanised by Industrial Galvanizers.

The new Qantas Sydney Distribution Centre, with its state-of-the-art materials handling equipment installed by Siemens, was completed in mid November and is set to provide improved efficiencies.

Project Team

Owner: Qantas Airways Limited
Project Manger: Blue Visions Management
Architect: Architectus (Melbourne)
Structural Engineer: Fozzard's Consulting Engineers
Building Contractor: A W Edwards
Steelwork Contractor: Southern Cross Rigging and Constructions
Steel Detailer: Southern Cross Rigging and Constructions
High Bay Racking and Materials Handling Equipment: Siemens
Building Services: Maunsell
Cladding Supplier: Stramit Building Products