Suncorp Stadium

STRUCTURAL STEEL SCORES WITH ITS COST AND CONSTRUCTION ADVANTAGES

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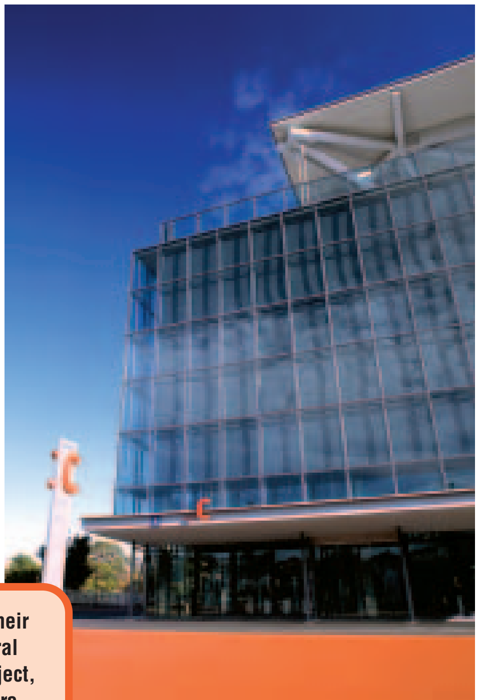
Located on the site of the former Lang Park development, just a short distance from Brisbane's CBD, this world-class stadium integrates with its surroundings and existing transport infrastructure, and with its modern facilities has transformed the comfort of spectators for Rugby League, Rugby Union and Soccer matches.

The inner city site, the presence of the retained western grandstand, some poor soil site conditions, and major drainage and electrical services under the site all presented challenges for the engineers and builders.

The other major challenge was the Queensland Government's time frame for the project – a short two years.

Multiplex and Watpac formed the Lang Park Redevelopment Joint Venture (LPRJV). From experience on Stadium Australia and the Gabba, the joint venture partners were keen to use structural steel.

The design of the roof and grandstand structures used innovative engineering features to reduce the weight and cost of the structural steelwork, and facilitated rapid and safe erection of the roof.



In recognition of their innovative structural design on this project, Structural Engineers, Arup were awarded the 2003 ASI Qld Engineering Steel Design Award.

They knew steel framing could deliver cost and construction advantages so they worked closely with the design team, Arup and Partners, the structural engineers, in conjunction with HOK Sport + Venue + Event and PDT Architects, to consider the suitability of individual elements of the project for steel framed construction.

THE GRANDSTANDS

The majority of the grandstands are steel framed, taking advantage of the significant repetition and potential time advantage and safety benefits available from unpropped construction in these areas.

The composite steel and concrete three tiered grandstand structure on the southern, eastern and northern sides of the field creates a seamless new stadium.

A spectacular steel framed roof covers the grandstands and spans up to 180 metres between supports.

The grandstand buildings consist of a three tiered bowl made up of structural steel frames at 7.6 metre centres that support precast, prestressed voided planks that act integrally with steel beams and precast, prestressed seating plats. The lower tier matches the geometry of the old western stand.

The grandstands are laterally stabilised by frame action and longitudinally stabilised with a combination of frame action and stair core walls. Corner buildings support the majority of the vertical loads arising from the new roof and all the lateral loads from the roof.

The mid and upper tiers of the grandstands cantilever up to eight metres beyond the column and raking strut supports, with the cantilevers formed from fabricated steel box beams. These box beams were designed for straightforward fabrication by minimising internal stiffening and simplifying welds between the box sides and flanges. They were also designed for practical erection with simple bolted connections.

Mark Finney of Beenleigh Steel who fabricated and erected the grandstand steelwork said that: "Because of their size, we arranged for the OneSteel 300PLUS® 1000 and 1200WB floor beams to be cambered during manufacture."

Because the grandstands are made up largely from prefabricated steel and precast concrete components, strategies needed to be adopted to facilitate efficient and reliable connections between different materials and trades.

These strategies included:

- use of post drilled fixings in lieu of cast-in fixings wherever structurally possible
- incorporation of oversized and slotted holes in steel connections wherever structurally possible
- rationalisation of the individual grandstand structures to allow the same standard components to be used for south, east and north grandstands despite subtle geometric differences between these areas
- the provision of generous bearing widths and packing allowances at the precast concrete to steel interfaces.

Great teamwork led to the efficient detailing of the structural steel components – saving both time and money.

THE ROOF

Arup and Partners, in conjunction with HOK Sport + Venue + Event and PDT Architects, developed an innovative roof design and method of erection.

The result is a massive 23,000 square metre roof which required more innovative thinking to reduce costs and enhance safety during construction.

The steel clad roof is virtually flat with minimum drainage falls and no structure projecting above the roof skin. It extends over 75 percent of the grandstands and over the corners with overhangs along the rear of the grandstands. Sightlines for 'highballs' have been maintained from all seats.

The roof structure provides weather protection for approximately 75 percent of the expanded 52,500 seat capacity stadium, and also houses all of the sports lighting (which allowed the original lighting towers to be removed). The stadium's horizontal roof plane diminishes the scale of the building while enclosing noise and light inside.

Once designed, the roof structure went to Cad Tech SA for steel detailing. Mark Kelly of Cad Tech said that: "we created a virtual prototype which could be rendered and rotated.

This technology gave us the ability to create a pre-assembly virtual prototype of the actual assembly fit-up of the structure, enabling us to iron out the glitches, saving both time and money."

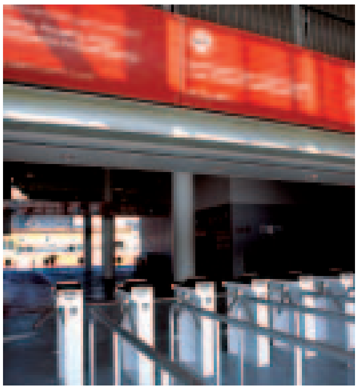
The precise location and cross sectional geometry of the main roof trusses were selected to allow the trusses to be assembled on the lower tier of the grandstand and lifted vertically into their final position without impacting on the construction of the middle tier.

The main visual feature of the roof is the supporting tubular steel trusses, approximately 10 metres in depth, intersecting at the corners where they are supported by pairs of inclined struts.

Sean McMonagle of Sun Engineering, fabricators on the roof structures said, that: "The complex nodal point connections were fabricated and welded in the workshop as separate units to reduce the on site construction and welding times of the nodes and trusses.

Fabrication both in the workshop and on site was enhanced by the use of 3D modelling, automated pipe profiling and laser positioning technology.

A simple yet effective purlin splice detail was developed to allow the roof purlins to be installed as simple spans, then spliced using purpose designed lap



members to provide continuity. This detail allowed rafters to be spaced at 15.2 metres using off-the-shelf steel purlins, working at maximum efficiency. The detail also allowed rapid erection of the roofing using pre-assembled panels."

FIRE ENGINEERING

Whether or not passive fire protection needed to be applied to the steel members was an important factor in determining which areas of the structure would be best constructed in steel.

By applying fire safety engineering design principles, the majority of the structural steelwork could be constructed without applied passive fire protection, thereby providing a structural solution with excellent economy, ease of construction and aesthetics.

CLIENT
Queensland Government

ARCHITECT
HOK Sport + Venue + Event and PDT Architects

BUILDING CONTRACTOR
(Joint Venture) Multiplex & Watpac

STRUCTURAL ENGINEER
Arup

STEEL FABRICATORS
GRANDSTAND: Beenleigh Steel Fabrication

ROOF STEEL: Sun Engineering

STEEL DETAILER
Online Drafting Services and Cadtech SA

MAIN COATINGS SUPPLIER
International Protective Coatings

PHOTOGRAPHY
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