

World Cup winners

Post-tensioned steel technology

Since the Olympics, Stadium Australia now the Telstra Stadium, has been in transitional mode. The AU\$80 million post-Olympics reconfiguration includes two new suspended permanent roofs above the northern and southern ends of the stadium.

This involved the use of a lightweight roof utilising a 114 metre truss with a post-tensioned and grouted bottom steel chord.

Several of Australia's leading engineering and construction companies joined forces to deliver a world first in stadium roof design and implementation. The team was working to meet the deadline for the Rugby World Cup and this year's Bledisloe Cup,

Conceived, designed and engineered by Australian company, Bigspace, the new north and south roof sections utilise patented post-tensioned steel technology to span the 114 metre distance between the stadium's two main arches.

Bigspace founder Murray Ellen said that: "Our advanced planning and construction methodology ensured the stadium remained operational, preserving the revenue stream to the stadium owners during the construction period that included the NRL Grand Final, an AFL Semi Final, the largest AFL home and away crowd for the year (Sydney Swans vs. Collingwood) and a host of other NRL and AFL matches."

The new roof has continued with the original hyperbolic paraboloid



design conceived by the original stadium designers, Bligh Lobb Sports Architecture with the new structural design being described as 'an evolution of the original'.

The 98 tonne main trusses were assembled outside the stadium end walls at ground level. Six kilometres of stressing strand was installed and stressed by specialist contractors under the instruction of Bigspace. Stress testing prior to lifting ensured the structure was 'load tested' prior to installation, and provided the mechanism to validate software modelling. The trusses were grouted after lifting.

The inherent strength of the structure was put to the test during construction



when Sydney experienced wind speeds well in excess of 100km/h.

Close co-operation between Bigspace, Multiplex, their structural consultants and original stadium engineers Sinclair Knight Merz and specialist fabrication company, Ahrens Engineering ensured the Bigspace design integrated safely with the existing structure.

Erection of the main trusses by Impact Rigging and Brambles utilised one 400t crane and one 800t crane, which were on site for a single week during the Royal Sydney Easter show. The remainder of the assembly was carried out with smaller

cranes, chosen for their ability to reach inside the stadium rather than their capacity to lift large weights. The 10 x 10 metre



roof panels, complete with polycarbonate sheeting, were then assembled outside the stadium and lifted into place.

The post-tensioned steel solution resulted in significant reductions in overall weight when compared to conventional designs, a critical issue impacting on both the original stadium and the assembly process. The approximate 30% reduction in structural steel delivered significant benefits all round. Major assembly works carried out at ground level rather than insitu helped to keep costs of the project in line with budget and an extremely tight construction programme.

The combined talents and professionalism of all parties involved in the final phase of Telstra Stadium's development have delivered to the world - as it focuses on the Rugby World Cup finals - a showcase of Australia's expertise in post-tensioned steel technology, engineering and construction.

Client: Stadium Australia Trust (responsible entity – James Fielding Funds Management)
Builder: Multiplex
Structural Consultants: Sinclair Knight Merz
Specialist Designers and Engineers: Bigspace
Fabricators: Ahrens Engineering
Steel Detailers: CAD TECH