Marina Footbridge

Challenged by cyclones? - Answer: Precast!

Few places on Earth are more exposed to cyclones than Exmouth in WA's remote northwest corner, one thousand kilometres from Perth. The area holds the Australian wind speed record of 267 km/h, about the same as the top speed of a V8 Supercar – a frightening thought!

This was a larger part of the challenge for the design of a new $4.8m cyclone resistant footbridge spanning 90 metres recently constructed over the main channel at Exmouth. The bridge provides easy access to the newly developed marina district, now becoming a tourist destination. Due to its spectacular setting and daring construction, the slender new bridge is already a local attraction in this fast-growing area.

The project has some very interesting features with its cyclone resistant and highly detailed precast and structural steel components embodying elegance and strength. The basic structure is a steel arch of 90-metres span, fabricated in two sections then lowered from each abutment into position until they meet in the centre.

The arch was trial assembled in its fabrication yard then transported 1,000 kilometres to the site from Perth.

Precast manufacturer
Delta Corporation

Architect
Landcorp

Engineer
BG&E Consulting

Builder
Bocol Constructions

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Meanwhile, precast manufacturer Delta Corporation was completing the precast decking units that would provide essential structural stability against cyclonic wind uplift as well as forming the 1.8 metre wide footway. Precast deck units, apart from aesthetic considerations, were selected for the steel arch structure to provide sufficient mass to stabilise the structure against wind uplift prior to the grouting-in of stressing cables that perform this task in the completed structure.

The lifting of the steel arch involved a large mobile crane at each end, with a third crane providing a platform for workers to join the two bridge sections together. The bridge segments were held by temporary cables during this operation. As soon as the arch was joined, the 300mm thick precast decking units were sequentially placed – each being bolted to the steelwork and the previous unit using a steel bracket with a box-out to conceal the fixing. Next, prestressing strand was threaded through each edge of the deck and grouted to enhance resistance to the cyclonic wind uplift forces.

The precast decking units are cleverly designed with rounded edges to shed wind loads assessed at a maximum design wind speed of 99m/sec at the apex of the arch. Exposure classification of the precast concrete was designed to AS3600 Classification 1. Each of the 15 total decking units is 6m long x 3m wide x 300mm thick cast off steel moulds using 50 MPa concrete. Each deck unit was lifted complete with bollards attached for the final balustrades to obviate the need for temporary railings and assist the speed of construction. Careful detailing of the precast units permitted the inclusion of embedded steel UB spreaders that support 250 x 250 x 9mm SHS steel suspender stanchions that hang the deck from the overhead arch hanger cables. The precast units also contain embedded lighting conduits threaded through the steel stanchion assembly, all being fully concealed in a very constricted space. This aesthetically pleasing outcome was a testament to the design skill of the consultants and the co-operative approach of the precaster and provides a good example of the benefits of early engagement with the precaster in the design process.

A special feature of the highly detailed precast deck units was the clever design of the ramps and landings required for wheelchair access. These were contained within the precast thickness so as to hide the ramp profile in the side view. No in-situ topping was required to the deck units.