This case study was written at the time when OneSteel was part of BHP. In that context, in some instances within this case study, reference may be made to BHP.

Shuttle Expressway Favour

It's hard to imagine, but peak hour may become the preferred time to travel for commuters when Adelaide's new 22 kilometre Southern Expressway is completed.

This unique expressway will operate one-way only and will carry north-bound morning traffic towards Adelaide and south-bound evening traffic out of Adelaide in an efficient and free-flowing manner. .

Construction will be carried out over a number of stages. Stage One is complete and stretches 6 kilometres between Bedford Park and Reynella and will eventually become the eastern side of a dual carriageway. Its design had to consider both initial requirements for reversible traffic flow and the final requirements for future two-way traffic flow. The two sets of conditions led to some unusual bridging criteria requiring specific design solutions that would suit both expressway configurations.

Easily modified steel chosen

The underbridges that carry the expressway over Sturt River and Marion Road will only require widening in the future. However, the overbridges that carry Majors Road and Seacombe Road over the expressway, required different spans and posed the biggest design challenge.

Construction of the overbridges to span the full width of the future expressway would have required spans of over 40 metres, with structural depths of up to 2 metres. Such a deep super-structure would have created difficulties with grade separation problems at the cross-roads as well as having a very "heavy" appearance. In addition, more money would have been spent initially for bridging not required for many years and future options would have been restricted.

To overcome these problems careful consideration was given to the design and construction methods chosen to allow future width expansion. The structural systems evaluated included composite prestressed concrete beams and steel beams with a deck slab cast in place. However, the change in design moments resulting from pier position modification would create significant problems for the prestressed concrete beam option because prestressing profiles cannot be altered.

Other structural options such as voided prestressed concrete slabs or prestressed concrete box girders (which would have to be cast in place) were also considered unsuitable because of difficulties in extending them in the future as well as high initial cost.

The solution was to adopt a composite steel I-beam and concrete deck option which could be easily modified in the future. Its advantage is its ease in future strengthening and modification should the ultimate configuration change. For example, if a dedicated bus lane was required in the future. This solution also allowed the existing services to be connected to the bridges with minimum disruption.

Fabrication

Fabrication of the bridge beams was relatively straight forward. BHP Welded Beams were supplied to a specified length and camber in conjunction with Tubemakers Steel. Fabrication was minimal with bearing stiffeners, few bracing beams, bearing plates and studs welded in the workshop.

Construction

The assembly of the bridge superstructures on site were quick and straightforward, with the steel girders being erected using light cranes, resulting in minimal disruption to local traffic.

All bridges were designed with no intermediate permanent bracing. Bracing of the critical top flange during construction was done using temporary ties above the deck and temporary props between the beams. Conventional formwork was used throughout for the construction of the deck slab.

Each bridge has been brightly painted in different colours. The varying colours, chosen by landscape architects, EDAW Pty Ltd, emphasise the difference between each bridge while providing an attractive and unifying visual theme.

Majors Road bridge

s Steel Flexibility

The Majors Road overbridge spans 26 metres. Beams are 1000 WB 258 300PLUS® at 1750 mm centres topped with a 175 mm reinforced concrete deck.

Seacombe Road overbridge spans 25 metres. Beams are 1000 WB 258 300PLUS® at 2150 mm centres topped with a 175 mm reinforced concrete deck.

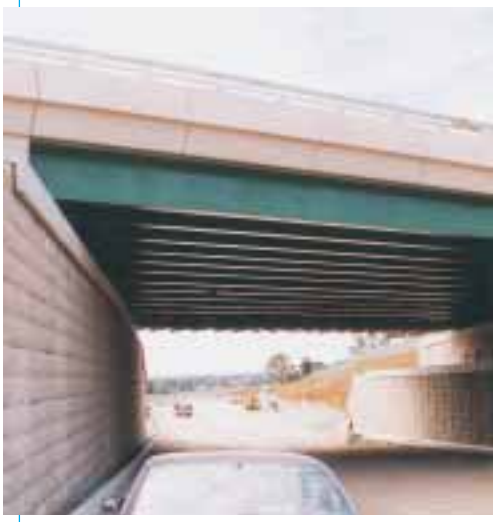
Sturt River underbridge is a single span of 22 metres. Beams are 1000 WB 215 300PLUS® at 2110 mm centres topped with a 175 mm reinforced concrete deck. Integral abutments have been used with longitudinal movements accommodated by flexing of the piles. Walkway lighting under the bridge was improved by painting the walls bright yellow.

With the Marion Road bridge, a two span layout was adopted with reinforced soil abutments and spans of 29 and 30 metres. Beams are 1200 WB 392 300PLUS® at 1980 mm centres topped with a 175 mm reinforced concrete deck slab. The central pier was designed to resemble a series of windows, of varying sizes giving it a lighter, transparent effect. The pattern will suit both the initial width and the future widened configuration.

Conclusion

This project is an excellent example of how innovative concepts can be used to overcome traffic problems by staging at minimum cost whilst leaving options open for the future. The bridge designs will cater very well for any future widening requirements of the express-way and highlight steel's flexibility in structural applications, particularly BHP's range of low cost 'off the shelf' plate girders.

Client:	Department of Transport, South Australia
Design Engineers:	Dare Sutton Clarke, Rust PPK, Connell Wagner
Project Manager:	Maunsell Pty Ltd
Construction Contractor:	McMahon, with York Civil
Architect:	EDAW Pty Ltd
Fabricator:	Samaras Structural Engineers
Distributor:	Tubemakers Steel
Painter:	Troisi Steel



Top left: Seacombe Road bridge

Left: Marion Road bridge

Above: Formwork under the Seacombe Road bridge