Bridge eliminates accident blackspot

The new bridge carrying Roberts Road over the Hume Highway and railway tracks at Chullora, Sydney, was opened in August 1998, three months ahead of schedule. The $15 million bridge is the centrepiece of a $55 million upgrade at the intersection of Roberts Road, Centenary Drive and the Hume Highway.

The upgrade, which includes widening of the Hume Highway, removes a notorious accident blackspot and traffic bottleneck. This intersection was responsible for up to 40 traffic accidents every year. Many of these occurred at peak hour and often involved many vehicles, dramatically affecting traffic flow and causing frustrating delays.
The upgrade also improves access to the Homebush Olympic site.

The new Roberts Road bridge.

The Challenge

The project posed a significant challenge for the Designer, RTA Technology. The bridge had to be constructed over two railway tracks without interruption to trains and around the many service utilities at the site, whilst keeping the considerable traffic flowing along the Hume Highway and Roberts Road. Railway track possession was very limited. The lift over the railway tracks required the maximum reach and capacity of a large crane, for which there was only one suitable position on site.

The Solution

The final design solution adopted, after much interaction amongst the various authorities involved, is a very elegant bridge which appears to 'duck and weave' effortlessly past all the obstacles in its path.

The bridge has two lanes in each direction and is on a 240 metre vertical curve with approach grades of +7% and -7%. The horizontal alignment comprises reverse curves of 240 metre radii at each end with a straight horizontal alignment in the middle. Carriageway widths vary from 8.6 to 9.8 metres between kerbs and the median skews across the bridge centreline to maintain horizontal sight distance.

The superstructure comprises four composite steel trough girders with a reinforced concrete deck spanning over six continuous spans of approximately 30, 38.3, 29.4, 39.7, 31.6 and 25 metres. The girders are supported on pot bearings.

"The steel girders provided an ideal solution at this difficult site. Steel had the advantage of being able to be fabricated closely to the required vertical and horizontal geometry, whilst minimising the structural depth over large spans. The complex geometry and varying skews throughout could be catered for very well with steel," said Salah Assi, lead design engineer for RTA Technology.

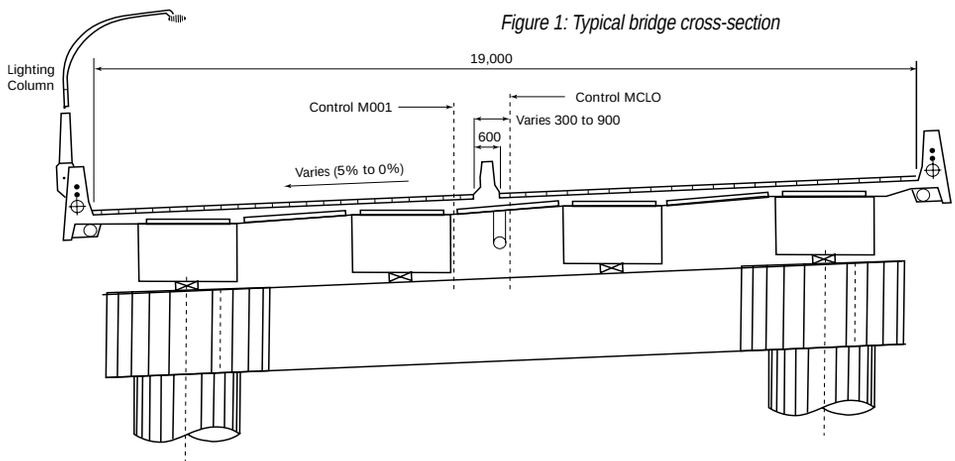
Reinforced concrete piers and reinforced earth abutments are constructed with varying skews. The location and skew angles are controlled by clearance requirements for existing and final intersection layout, railway tracks, utilities and other structures.

Aesthetics

The aesthetics of the bridge were considered very carefully by the RTA engineers and their architect because of the high visibility of the structure.

The curved steel trough girders with a deck cantilever of constant width follow the alignment of the structure strictly, thus

Figure 1: Typical bridge cross-section



enhancing its appearance. The green painted steelwork with a distinctive yellow stripe, mimics the livery of the historic NSW 38-class steam locomotive 3801, in recognition of the area's rich rail heritage. Nearby are the Chullora railway workshops, where many locomotives were built in the past, and the Enfield Marshalling Yards. The railway theme is also reflected on the bridge piers which are modelled on steam engine crankshafts and in the landscaping which incorporates locomotive wheel and axle motifs.

The shallow depth of the superstructure, combined with the above treatments, has resulted in an interesting and aesthetically appealing landmark.

Fabrication and Erection

To maximise economy, trough girders have a constant depth of approximately 1400 mm and bottom flanges 2250 mm wide with thicknesses varying between 16 and 25 mm and are stiffened longitudinally with 200x20 mm plates. Top flanges are typically 500 to 600 mm wide. Vertical webs, 16 mm thick with 200x20 mm plate stiffeners, have been used throughout. Steel is Grade 350 and 350L15 to AS 3678 for the top flanges and longitudinal stiffeners.

Erection of the girders was undertaken at night to minimise the impact on trains and traffic. The girders were delivered pre-painted to the site in segments of up to 40 metres in length and erected span by span from the northern abutment. After lifting in position each segment was temporarily braced and aligned then fully butt welded to the previously erected segments. The butt welds were ground and smoothed and then painted over.

Curved girders with paintwork reflecting rail heritage.

A new state-of-the-art specification for the fabrication and erection of the trough girders was prepared for this project by the RTA in conjunction with industry, including OneSteel.

"The new specification has been written to facilitate fabrication, by clearly outlining requirements, and to reduce costs by eliminating unnecessary over-specification and over-welding," said Ray Wedgwood, RTA's Chief Bridge Engineer. "Ultimately this yields cost savings to both the RTA and the Australian fabrication industry. The combination of this new specification and properly trained and experienced fabricators should ensure that the right quality is built in from the start." He added, "The success of the fabrication and erection of the steel girders for this project confirms the suitability of the choice of steel.

Bridge pier cross head modelled on steam engine crankshaft.

The work was done within a tight work program and came in under budget and within time, to the specified quality."

Surface Protection

The coating for the steel girders consists of a solvent borne ethyl silicate inorganic zinc primer, one Micaceous Iron Oxide epoxy coating build coat and two finishing coats of polyurethane.

Deck Construction

The reinforced concrete deck was formed with precast concrete formwork panels between the girders' top flanges. Conventional plywood formwork supported on steel brackets was used for the cantilevers. This system was adopted for maximum flexibility to cater for the complex geometry and varying deck cross-falls.

Conclusion

The fabrication and erection of the trough girders ahead of time and under budget is a clear indication that the painstaking, thorough review of the specification by the RTA is producing results which will benefit both the community and industry, and establishes a new benchmark for cost-effective fabrication.

The timely and successful construction of this project is a tribute to the close co-operation of RTA personnel, the fabricator and the contractor; always a key factor in projects of this type.

The end result is an aesthetically pleasing bridge in a handsomely landscaped site, which captures and highlights the rail heritage of the area.

Client:	RTA-NSW
Designer:	RTA Technology
Architect:	RTA Technology
Fabricator:	Adua Constructions Pty Ltd.
Contractor:	Abignano Pty. Ltd.